The National Forestry Accounting Plan of France including the Forest Reference Level (FRL) for the 2021-2025 and 2026-2030 periods

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1 GENERAL INTRODUCTION

In accordance with Regulation (EU) 2018/841 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (LULUCF) under the 2030 climate and energy policy framework, the Member States of the European Union account for emissions and removals from managed forest land for the commitment periods 2021-2025 and 2026-2030 on the basis of a Forest Reference Level (FRL). The Member States submit to the European Commission before 31 December 2018 for the 2021-2025 period and before 30 June 2023 for the 2026-2030 period, their National Forestry Accounting Plans (NFAP) containing a proposed FRL.

During the two commitment periods, a comparison of total emissions and removals from managed forest land as estimated in the national inventory and the FRL will be used to calculate an accounting net debit or accounting net credit, calculated for each commitment period. The elaboration of the NFAP, containing the proposed FRL, must comply with certain rules and criteria, set out in Article 8 and Annex IV of Regulation 2018/841.

This document has been drawn up on the basis of the provisions contained in Regulation 2018/841 and on the basis of the recommendations of the "guidelines on the development and reporting of forest reference levels in accordance with (EU) Regulation 2018/841" (Forsell, et al. 2018) drawn up for the European Commission.

For this exercise, carried out in November-December 2018, the proposed forest reference level (FRL) was calculated for the two periods, 2021-2025 and 2026-2030, for the European part of France, namely Metropolitan France as well as the 5 overseas departments and regions (DROM): Guadeloupe, French Guiana, Martinique, Mayotte and La Réunion.

Since the FRL must be based on the pursuit of sustainable forest management practices, as documented over the period between 2000 and 2009, the FRL is a calculation derived from a theoretical projection intended only to assess the accounting credit or debit of emissions and removals from managed forest land. The FRL is an accounting instrument and is not a climate and/or forest policy. In particular, it is not a benchmark of management practices that it would be desirable to achieve.

In terms of climate policy, the reference texts in force are the act relating to the energy transition for green growth (LTECV) published in the Official Journal of 18 August 2015, and the 1st national low-carbon strategy (SNBC), approved by Decree No. 2015-1491 of 18 November 2015. The draft 2nd national low-carbon strategy (SNBC 2) was made public on 6 December 2018 and its adoption is planned for the second quarter of 2019.

In terms of forest policy, the reference texts in force are the Act for the future of agriculture, food and forests (LAAAF) of 13 October 2014 and the French national forest and wood programme 2016-2026, approved by Decree No. 2017-155 of 8 February 2017.

1.1 GENERAL DESCRIPTION OF THE FOREST REFERENCE LEVEL OF FRANCE

The FRL of the whole of France is presented in the table below:

FRL (tCO2e/year)	Metropolitan France	Overseas	Whole of France (Metropolitan and Overseas)
2021-2025	-58,467,881	172,700	-58,295,181
2026-2030	-60,298,556	172,700	-60,125,856

The results include all gases and pools. The FRLs are calculated from the modelling of a projection which estimates an increased sink during the period.

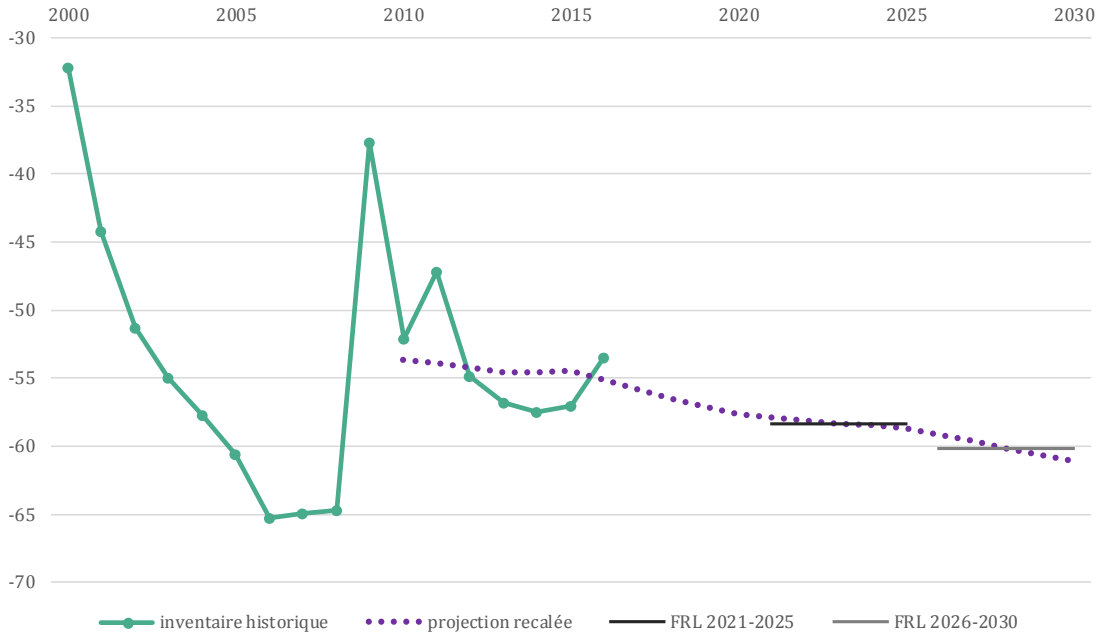


Figure 1 Presentation of the FRL as compared with the projection and the historical inventory, in MtCO2e

For information, the contribution of each overseas department and region is presented in the table below:

FRL (tCO2e/year)	French Guiana	Guadeloupe	Martinique	La Réunion	Mayotte
2021-2025	164,380	0	0	7,460	859
2026-2030	164,380	0	0	7,460	859

In line with the inventory, an estimate of neutrality of the forest carbon balance is applied: no forest sink is thus reported for overseas forests. Therefore, this calculation results in a particular situation where the overall carbon balance for overseas is a net source (see section 3.1.2).

For information, the FRL differs from the FMRL (see box below) reported under the Kyoto Protocol. Indeed, the estimated FMRL under the regulations regarding the LULUCF accounting rules for the 2013-2020 period is -45 615 kt CO2e. It was -67 410 kt CO2e in 2015, when it was subject to a technical correction of 21 795 kt CO2e.

Difference of approach between the FMRL and the FRL

The Forest Management Reference Level (FMRL) for France, as well as for many Member States of the European Union, was calculated by the Joint Research Centre (JRC). To establish it, the JRC used two approaches: a forest growth model based on the forest inventories of the Member States, and the gains-losses method of the IPCC based on historical data of forest characteristics. This FMRL of France, submitted in 2011, is available on the UNFCCC website[1]. Information on the calculation method and the parameters are in the 2011 Assessment Report (TAR[2]).

The FMRL is based on forest modelling data, different from the forest data used in the inventory. However, a postadjustment procedure has been used to align the historical FM with the FMRL. This approach is mentioned in the technical assessment report (TAR[3]) of the French FMRL (paragraphs 9 and 10) [4].

The FRL calculated here, on the other hand, uses a French model, developed by the IGN, the organisation responsible for forest inventories in France (see chapter 3).

1.2 CONSIDERATIONS ON THE CRITERIA AND GUIDELINES AS SET IN ANNEX IV-A OF REGULATION 2018/84

Annex IV-A of Regulation 2018/841 lays down the criteria and guidelines for determining FRLs:

1.2.1 Compatibility of the FRL with the objective of neutrality

"(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 scenario proposed for calculation of the forest reference level of France, based on the continuation, until 2030, of the sustainable forest management practices identified for the 2000-2009 period, may be regarded as compatible with the goal set by the Paris agreement to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases during the second half of this century. Indeed, with the forest management practices integrated in the scenario, the FRL projects an enhancement of the forest sink compared to currently observed levels. Forest management practices take into account wood harvesting policies and the renewal of old and poorly managed forests to avoid the phenomenon of declining sinks of ageing forests.

Between 2000 and 2009, sustainable forest management practices in France were integrated into the first climate policy instruments. In 2004, France adopted its first strategic climate plan, the 2004-2012 Climate Plan, in order to achieve the assigned objectives under the Kyoto Protocol. This plan consisted of different actions in all sectors of the economy, aimed at stabilising greenhouse gases emissions in 2010 at their 1990 level. It also provided for a fourfold reduction in emissions by 2050. Some actions were specifically aimed

[1] http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_france_2011.pdf

[2] http://unfccc.int/resource/docs/2011/tar/fra01.pdf

[3] http://unfccc.int/resource/docs/2011/tar/fra01.pdf

[4] *[Data and models] used for the construction of the FMRL are different from those used in the GHG inventory. (…) In order to make [FMRL] consistent with the historical data, a postadjustment/calibration was applied. Historical data from reporting on forest land remaining forest land under the Convention are used for post-calibration of the model results (…) by using the average of the period 2000 to 2008 from the 2010 national GHG inventory*. (paragraphs 9 and 10 of the TAR).

at forests, in particular the conservation and enhancement of forest carbon sinks, following the Marrakesh Agreements of the UNFCCC COP 7 in 2001.

The various forestry provisions of the 2004-2012 Climate Plan may be considered to have been included in the sustainable forest management practices used to elaborate the FRL, without this undermining the rule of elaborating FRL based on the continuation of the sustainable management practices as documented between 2000 and 2009.

Subsequently, after the 2000-2009 reference period, France committed itself, with the first low-carbon national strategy (SNBC 1) adopted in 2015, to reduce its GHG emissions by 75% by 2050 compared to 1990 (Factor 4).

The target of carbon neutrality by 2050, an ambitious reflection of the carbon neutrality target of the Paris Agreement, has been introduced more recently into French climate policy, in particular with the Climate Plan of 6 July 2017. The 2nd low-carbon national strategy[1] (SNBC 2), whose draft was made public on 6 December 2018, aims to achieve a target of carbon neutrality by 2050 within the national territory and provides details of the measures and actions envisaged by the Government for the ecological and solidarity transition required to achieve this target. This draft will be communicated to the environmental authority and will undergo a public consultation. Its adoption is planned for the second quarter of 2019.

The SNBC 2 seeks to improve the effectiveness of the forest-wood sector in order to achieve this target. Indeed, the latter is strategic because it meets the need to supply the economy with biosourced and renewable energy and products, and at the same time, contributes significantly to the carbon sinks of the land sector through carbon sequestration in forests and in wood products.
The forest management envisaged in the SNBC is more dynamic than the one envisaged in France's FRL, in order, in particular, to renew forest stands by making them more resilient to climate change, by bringing more biosourced materials into the economy taking advantage of the associated effects of temporary storage and substitution with more emitting materials and fossil fuels. It provides better preservation of soils carbon stocks. An increased afforestation and a reduction in deforestation in order to enhance the land sector sink are also considered.

The various guidelines of the new SNBC for forests are not integrated into the management practices used to elaborate the FRL because they are, by definition, subsequent to the 2009 date. All these guidelines however apply to current forestry guidelines.

1.2.2 Carbon stocks not taken into account

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

Calculation of the FRL of France is consistent with the calculation principles of the inventory, and only takes into account the various fluxes (gross production, mortality, harvesting, decomposition) to arrive at a net result. The mere presence of carbon stocks, for all carbon pools, is therefore not taken into consideration when calculating the FRL for France.

1 https://www.ecologique-solidaire.gouv.fr/france-publie-projet-strategie-nationale-bas-carbone-snbc

1.2.3 Robustness and credibility of the accounting system

"(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;"

The FRL is based on an accounting system consistent with the national inventory of France, whose robustness and credibility are assured by compliance with the 2006 IPCC Guidelines and various reviews by experts.

Emissions and removals resulting from the use of biomass are taken into account in an appropriate way by using the IGN harvest rates, adjusted to the wood harvesting statistics (Annual sector surveys, EAB), and by the calculation of a module dedicated to harvested wood products.

1.2.4 Taking into account harvested wood products

"(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;"

The pool of harvested wood products is taken into account in calculating the FRL of France. It is calculated by applying a first-order decay function and half-life values (IPCC, 2006), consistently with the calculations for wood harvesting used in the FRL.

The FRL for the whole of France is -58 295 181 tCO2e for the 2021-2025 period and -61 125 856 tCO2e for the 2026-2030 period, in which the pool of harvested wood products is -4 258 397 tCO2e for the 2021-2025 period and -4 439 480 tCO2e for the 2026-2030 period.

If instantaneous oxidation of the harvested wood products was assumed (if no carbon were temporarily stored in wood products), the FRL would be -54 036 784 tCO2e for the 2021-2025 period and -55 686 376 tCO2e for the 2026-2030 period.

1.2.5 Constant ratio between solid and energy use of forest biomass

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

For projection of the FRL, the following have been applied: (i) the average harvest rate observed for the reference period (excluding the effects of storms, i.e. 2003-2008) and (ii) the ratio of use between timber and industry wood (solid use) and energy wood (energy use) as observed for the reference period (2000-2009). The projection of wood products is calculated directly from the projection of total harvests, thus keeping a constant ratio between the solid use (wood products) (34%) and energy use (harvests remains) (66%).

1.2.6 Compatibility of the FRL with the biodiversity and sustainability objectives (Annex II)

"(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;"

The sustainable forest management practices between 2000 and 2009 are largely regulated by the forest policy act[1] published in 2001, making multi-functionality the fundamental principle of the forest policy. It is

1 Forest policy act No. 2001-602 of 9 July 2001

in line with the international framework of the recommendations on sustainable forest management, in particular with regard to the resolutions of the ministerial conferences on the protection of forests in Europe (MCPFE), a process now known under the name of Forest Europe. This act provided responses to the new expectations of society in relation to forests, in particular in terms of biodiversity, with the introduction into the Forest Code of the fundamental principles of the forest policy[1], and in particular, "the sustainable management of forests ensures their biological diversity, their productivity, their regenerative capacity, their vitality and their ability to satisfy, now and in the future, relevant economic, ecological and social functions, at the local, national and international levels". The forest policy act was developed in conjunction with the 1st forest strategy of the European Union, of 3 November 1998, and is in fact, fully compatible with it.
The first national strategy for biodiversity 2004-2010 is the implementation of the French commitment under the Convention on Biological Diversity (CBD), ratified by France in 1994 with the objective of "halting the loss of biodiversity by 2010", alongside all the European Union Member States. Each essential component of the biosphere was considered to achieve this objective: genes, species, habitats, ecosystems, and their inclusion into an ecological framework. The implementation of the strategy begun with the adoption in November 2005 of a first series of action plans, completed in 2006, by three other action plans including one on forests and another one on French overseas. The strategy contained several elements regarding forests, including, in particular, the objective of promoting the conservation and appropriate strengthening of biological diversity as an essential element of the sustainable management of forests at the national, regional and global levels.

The operational implementation of the forest policy act was carried out, in particular, by the national forest programme (PFN) 2006-2015. This document made the preservation of both remarkable and ordinary forest biodiversity, a key issue of the national forest policy. The PFN paid particular attention to forest ecosystems with high biological value, fragile habitats and forest stands with outstanding characteristics in terms of naturalness. For the overseas forests, the PFN, here too, made biological diversity a key issue. Even outside areas dedicated to protecting nature, the PFN has led to current forestry management guaranteeing the preservation of biological diversity.
All the provisions relating to sustainability and biological diversity contained in the forest policy act of 9 July 2001 and reincorporated in the PFN 2006-2015, as well as in the national biodiversity strategy 2004-2010, can be considered to be compatible with the associated European strategies of the time. All the associated measures can be considered to have been included in the sustainable forest management practices used to elaborate the FRL, without this undermining the rule of elaborating the FRL based on a continuation of the sustainable forest management practices as documented between 2000 and 2009.

After the forest policy act of 9 July 2001, the Act for the future of agriculture, food and forests (LAAAF) of 13 October 2014 became the new legislative reference framework for French forest policy. Following the PFN of 2006-2015, the national forest and wood programme (PNFB) defines French forestry strategy for the 2016-2026 period. This strategy recalls that forest biodiversity, whether classified as "ordinary" or "heritage", is a major asset for sustainable and effective forestry. The PNFB and regional forest and wood programmes (PRFBs, regional declinations of the PNFB) being deployed, propose actions to strengthen knowledge about biodiversity; the preservation of biodiversity in the forest and the preservation and rehabilitation of ecological forest continuity. More specifically, among the practices that promoted in the PRFBs, can be cited the example of leaving stumps and slashings on the spot; keeping dead wood in forest stands and/or on the ground; the creation of islets, networks and continuities of senescence; monitoring measures on the diversity of tree species in stands and/or per forest area. In the overseas departments and regions, new tools are developed using imaging analysis to maintain a high level of environmental monitoring and policing of forests. Restoration by afforestation of degraded sites is encouraged, while the protection of particularly sensitive forest ecosystems, such as mangroves, is reinforced.

1 Article 1 of the Forest framework act 2001-602

The PNFB has been built in conjunction with the new forestry strategy of the EU for forests and the forest sector, of 20 September 2013, and is fully compatible with it. In particular, the two documents share the same guiding principles, including that of sustainable forest management and their multifunctional role, reflected in Forest Europe principles.
After the first phase, 2004-2010, based on sectoral action plans, the new national strategy for biodiversity (SNB) 2011-2020 is now the programmatic reference text for the French biodiversity policy. This strategy, presented on 19 May 2011, is an application of the Aichi targets of the strategic plan of the Biological Diversity Convention, and sets out a greater commitment of the actors in all activity sectors, at all territorial levels, both in French mainland and overseas. The SNB has also been built in close interaction with the new European Union Biodiversity Strategy to 2020, following the communication of the European Commission of 3 May 2011.
The various provisions of the PNFB and the current SNB are not integrated into the management practices used to elaborate the FRL because they are, by definition, subsequent to 2009. All these guidelines however apply to current forestry guidelines.

1.2.7 Consistency with the national projections

"*(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;*"

From a methodological point of view, both the calculation of the projections used in the various strategic documents of the forest and climate policies, and the calculation of the FRL are based on the same scope as the national inventory of emissions and removals of greenhouse gases. As regards the calculation of the projected years, the technique used differs because the exercise has different objectives. On the one hand, the FRL is based on the Margot model of the IGN that models the evolution of the forest of Metropolitan France as of its status in 2010 and by continuing the practices observed in 2000-2009. On the other hand, the projections are not based on the results of a forestry model but only on the hypotheses of experts regarding the evolution of the forest.

The reference level is consistent with national projection work. Firstly, in terms of results, an increase in the sink of the land sector was also provided for in the "With Existing Measures" (WEM) scenario carried out in 2017. The latter increased from 36 MtCO2eq in 2015 to 59 MtCO2eq in 2035 for the whole of the sector (LULUCF)

The method used is also similar. Even if the Margot model used for the FRL was not used for the WEMscenario of these projections, data from similar activities were used (forest growth, volume of harvested wood, mortality, aboveground and belowground carbon stock, forest areas).

However, some differences naturally exist. Whereas the forest reference level envisages the continuation of current forestry practices, the WEM scenario provides for more dynamic forest management practices with an increase in the level of harvesting by 20 Mm^3 between 2015 and 2035.

A "With Additional Measures" (WAM) scenario was also produced in 2018 as part of the 2nd Low Carbon National Strategy (SNBC 2).

1.2.8 Consistency with the national inventory

"*(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 calculation of the FRL is based on the same methodological approaches (methods of gains and losses for the forest biomass estimates, application of the first-order decay method of the IPCC for harvested wood products, an assumption of stock in equilibrium for the other pools) and the same data sources (national forest inventory of the IGN, wood harvest data from statistical surveys and readjusted to the IGN overall harvest level) as the national inventory. This report, as well as all the documents and files provided as part of the submission of the national inventory of France, provides all the methodological information for guaranteeing transparency of the calculations and justifying their relevance.

Nevertheless, for the years from 2010 to 2016, there is a significant gap between the model applied for the FRL and the national inventory. In order to make the projection consistent with the national inventory, an adjustment has been made, in accordance with the recommendations of the methodological guide (Forsell, et al. 2018) (see section 4.2.1).

2 PREAMBLE FOR THE FOREST REFERENCE LEVEL

2.1 CARBON POOLS AND GREENHOUSE GASES INCLUDED IN THE FRL

2.1.1 Carbon pools

The calculation of the FRL of France, consistent with the national inventory, takes into account fluxes related to the following carbon pools, in forest land remaining forest land:

	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products
Metropolitan France	E	E	E	E (0)*	E (0)*	E
French Guiana	E (0)[1]	E (0)*	E (0)*	E (0)*	NE	NE
Guadeloupe	E (0)*	E (0)*	E (0)*	E (0)*	NE	NE
Martinique	E (0)*	E (0)*	E (0)*	E (0)*	NE	NE
La Réunion	E (0)*	E (0)*	E (0)*	E (0)*	NE	NE
Mayotte	E (0)*	E (0)*	E (0)*	E (0)*	NE	NE

E = Estimated; NE = Not estimated; E(0) = Estimated at zero

2.1.2 Greenhouse gases

The calculation of the FRL of France, consistent with the national inventory, estimates the following fluxes of greenhouse gases:

	Forest balance			Burning of wood harvest residues			Forest fires		
	CO_2	CH4	N2O	CO_2	CH4	N2O	CO_2	CH4	N2O
Metropolitan France	E	NE	NE	IE	E	E	E	E	E
French Guiana	E (0)*	NE	NE	IE	E	E	E	E	E
Guadeloupe	E (0)*	NE	NE	IE	E	E	E	E	E
Martinique	E (0)*	NE	NE	IE	E	E	E	E	E
La Réunion	E (0)*	NE	NE	IE	E	E	E	E	E
Mayotte	E (0)*	NE	NE	IE	E	E	E	E	E

E = Estimated; NE = Not estimated IE = Included elsewhere; E(0) = Estimated at zero

[1] A zero estimate means that the variation in stock of this pool is zero, and that the carbon gains and losses of (emission and sequestration fluxes) offset each other. This hypothesis is supported by scientific knowledge, and uncertainties about the current data (see Sections 3.1.1.5 and 3.1.2).

2.2 DEMONSTRATION OF THE CONSISTENCY BETWEEN THE POOLS INCLUDED IN THE FRL

The calculation of the FRL takes into account all the carbon pools in a consistent way:

- the above-ground biomass is modelled;
- the belowground biomass is calculated directly in proportion to this above-ground biomass;
- dead wood is assumed to be in equilibrium, in line with the mortality of the biomass – except for emissions from dead wood related exceptionally to decomposition, over several years, of windfall from storms;
- litter and soil are also assumed to be in equilibrium, consistent with the dead wood hypothesis and consistent with the national inventory;
- harvested wood products are directly projected according to the modelling of future wood harvests, in accordance with the guide.

2.3 DESCRIPTION OF THE LONG-TERM FOREST STRATEGY

2.3.1 General description of forests and forest management in France and the national policies adopted

2.3.1.1 Metropolitan France

With 10% of the EU forest area, Metropolitan France forest area ranks fourth behind Sweden, Finland and Spain. Regarding the volume of standing wood, it lies in third place with 2.5 billion m³ behind Germany (3.6 billion) and Sweden (2.9 billion). It currently covers 16.5 million hectares in Metropolitan France (i.e. 30% of the territory). Forests are thus a major element of our landscapes. In Metropolitan France, they are mainly located around the Mediterranean coastline, in the Landes forest area, in the east of the country and in the mountainous regions.

French forests have three important characteristics:

- they are diverse: they have a variety of ecosystems (humid, mountain, tropical forests). Mainly composed of broadleaf trees in Metropolitan France (two-thirds of the forest), conifers predominate in mountain areas and on poor soils.
- In Metropolitan France, ¾ of them belong to private owners. Although there are more than 3 million French owners, 2.2 million of them own less than one hectare, whereas approximately 380 000 own more than 4 hectares and total 76% of the private forest area. The 50,000 owners who own more than 25 hectares account for approximately 52% of the private forest area and provide ¾ of the sale of wood from private forests. Public forests (state, municipal) represent ¼ of the forest of Metropolitan France and play a particular role as regards general interest services and visitor access. They provide almost 40% of the wood harvest;
- it is in a capitalisation phase in the younger stands, not yet mature, but also structurally under-exploited, in particular in its least productive or less accessible part and in many stands that have reached the renewal stage. Thus, although the commercial harvest has been stable since the end of the 1980s, biological wood production in forests has increased during this same period. On average, over the 2005-2013 period, harvesting in Metropolitan France amounted to approximately 50% of net biological production (after deduction of stand mortality). However, there is a very different situation according to the regions, linked to the age of agricultural and rural abandonment, the relief, the type of ownership, the age of the stands and the species.

Following the Act for the future of agriculture, food and forests (LAAAF) of 13 October 2014 and the National forest and wood programme 2016-2026, approved by Decree No. 2017-155 of 8 February 2017, the national policy currently adopted to boost forest management is structured around 5 main focus areas:

- Promoting the grouping of forest owners (constitution of forestry economic and environmental interest groups, establishment of producer organisations, sharing of logging operations between private and public forests, etc.)
- Improving the sharing of information using digital technology (development of a computer exchange platform between the economic actors of the forest-wood sector: "The forest is moving" mechanism)
- Optimising the effectiveness of sustainable management documents (streamlining of management documents to make them more readable and more operational, digitalization of logging permits requests, etc).
- Supporting more dynamic forest management practices (development of innovative andmore productive silvicultural protocols)
- Improving accessibility of forest areas (use of financial resources to create forest roads, promotion of innovative logging methods such as airships for example)

As regards climate policy, the draft 2nd national low carbon strategy (SNBC 2) identifies the main following levers for the forest sector:

- Improving forest carbon sinks by better forest management practices, which both adapt forests to climate change and preserve soils carbon stocks (whose observation and statistical monitoring must be guaranteed and improved). The enhancing of carbon sinks in the forest-wood sector will also include the development of afforestation and a reduction in deforestation.
- Maximising the substitution effects and the storage of carbon in wood products, thanks to:
    - an increased wood harvest (in particular with an increased wood marketing objective set by the National forest and wood programme for the 2016-2026 period) while ensuring that biodiversity is preserved;
    - an incentive towards long-life uses (in particular through an intensified use of wood in construction) and development of recycling and energy recovery of end-of-life products.
- Assessing the implementation of the policies deployed and regularly adjust them accordingly, to ensure that all results are achieved, particularly in terms of biodiversity.

These policies are coordinated with the National forest and wood programme which guides forest policy for the 2016-2026 period and sets an objective of additional use of wood as part of sustainable and multifunctional management of the forest (issues of protection of biodiversity, soils, water resources and landscapes). One of the particularities of the sector is that it has a particularly long time horizon. It is necessary to combine the actions for mitigating and adapting to climate change and managing risks related to natural forest hazards to respond to all the issues while preserving the high economic value of the sector.

2.3.1.2 Overseas

French overseas forests cover 8.3 Mha, 8 Mha of which in French Guiana (representing 96% of the surface area of Guiana). There are mangroves on the Caribbean coastlines, large tropical forests in Guiana and mountain forests on La Réunion as well as on the volcanic slopes of Martinique and Guadeloupe.

In each oversea, the policy for mitigating climate change requires preserving as far as possible the ecosystems which sequester carbon and combating their degradation. The policies for the development of the territory are crucial here to control land urbanisation. Preservation of these ecosystems must be designed to adapt to climate change.

The ordinance of 28 July 2005 extended the Forest Code to French Guiana by adapting it to the context and the specific issues of this oversea. Accordingly, the national forest policy is deployed according to the same principles in all overseas departments and regions. Just as in Metropolitan France, the specificities of

overseas forest management systems are taken into account in Regional forest and wood programmes (PRFBs, regional declinations of the PNFB).

The Guianese forest is a primeval forest, rich or even exceptionally rich in biodiversity, and stores a lot of carbon (around 1000 tCO2eq /ha stored).

The primary feature of French Guiana forests must be taken into account: the issues in terms of biodiversity require to ensure the sustainability of current ecosystems, without their massively replacing them with other forest systems.

Thus, in French Guiana, forests are managed according to a selective and reduced impact logging: 5 stems per hectare every 65 years, with approximately 5,000 hectares harvested each year.

Forest management must however conciliate the need to preserve primary forests with the need of development. Indeed, French Guiana demographics is very dynamic. There is a strong and shared political will to accelerate the economic development of the territory, in particular agriculture, with the ultimate aim of ensuring food autonomy. Since 96 % of French Guiana is covered by forests, this agricultural development cannot be done without some deforestation, which must be taken into account in the accounting balance of the land sector.

Deforestation in French Guiana is a multifactorial process, driven by land urbanisation, development of agriculture, illegal gold placer mining and gold mining industry. Deforestation represents 3,000 ha /year (0.0375 per cent of the territory), for farming (60%), infrastructure (15%) and illegal gold placer mining (25%).

The fight against illegal deforestation in Guiana (approximately 800 ha/year) is also a priority.

The specific geographical and climatic characteristics of each territory play an important role in the land sector. French Guiana must be singled out in the analysis, since its dynamics are very different from those of Metropolitan France.

2.3.2 Description of the future harvesting rates according to the different policy scenarios

The 2nd National low-carbon strategy (SNBC 2), in line with the National forestry and wood programme (PNFB), projects a transitioning of annual harvesting rate from 55% of the natural net increment in 2013, to 65% in 2026 and 69% in 2030.

The trend scenario produced as part of the development of the strategy ("with existing measures" scenario, WEM, which takes into account all the measures existing in 2017) provides for a lower harvesting rate, of 64% in 2030. In comparison, the National Forestry Accounting Plan takes into account a harvesting rate of 48% between 2015 and 2030.

The mentioned harvesting level includes harvested above-ground biomass and root biomass as well all the exploitation losses, including biomass left in forest.

It should be noted that the assumptions about the variations with time of managed forest land area and biological increment are different between the SNBC 2 scenario, the trend scenario and the scenario used for the FRL in the National Forestry Accounting Plan. In particular, since biological increment is sensitive to climate change effects, but with strong uncertainties at this stage on the quantification of these effects, different assumptions have been used according to the scenarios, in connection with more or less proactive adaptation actions on forests. It should also be noted that the considered forestland area also varies between the different scenarios, in connection with more or less proactive afforestation actions.

3 CHAPTER 3: DESCRIPTION OF THE APPROACHES, METHODS AND MODELS

3.1 DESCRIPTION OF THE GENERAL APPROACH APPLIED TO ESTIMATE THE FOREST REFERENCE LEVEL

3.1.1 Metropolitan France

3.1.1.1 Definition of the forest

Pursuant to the Marrakesh Agreements (2001), and in accordance with the values indicated in Annex II of Regulation 2018/841, France adopts, for its definition of the forest, the following minimum values:

	Ground covered by tree crowns	Area	Height of mature trees	Width
Threshold	10 %	0.5 ha	5 m	20 m

A forest may consist either of closed forest stands where trees of various storeys and undergrowth cover a high proportion of the ground, or open forest stands. Young natural stands and all plantations established for forestry purposes that are likely to reach 5 metres in height at maturity but whose crown cover does not yet cover 10% of the area are included in the "Forest" category. Similarly, areas normally part of forest areas, but temporarily cleared because of human intervention or natural causes and which are expected to become forest again within 5 years of the clearing, are also included in the "Forest" category. However, trees stands complying with the defined thresholds but whose use is mostly non-forest (orchards, urban parks, gardens, etc.) are excluded from the "Forest" category.

3.1.1.2 Definition of managed forest

The FRL is calculated only for managed forest land. For France, a forest is managed according to the UNFCCC's definition when it is subject to forest management operations aimed at providing its environmental, economic and social functions. The term, "forest management operation" covers cutting or forestry work but also forestry planning, providing visitor access to forests and protection of the forest ecosystems. Only forests subject exclusively to natural processes, in particular due to limited accessibility, are considered as unmanaged. Such unmanaged forests are estimated from the surface areas of "other forests" defined by the IGN which represent approximately 5% of Metropolitan forests areas.

3.1.1.3 Taking afforestation and deforestation into account

The FRL of Metropolitan France is estimated on the basis of a surface area which is evolving, taking into account afforestation occurring during the reference period (2000-2009) which results in an increase in the forest area, these afforested areas of over 20 years old being gradually added each year during the periods from 2021 to 2030. This changing surface area does not include any deforestation, which, as soon as it is known about, will be included *a posteriori* through technical corrections.

3.1.1.4 Calculation of the forest carbon balance: living biomass

Living biomass is the main component of the forest carbon balance and therefore the calculation of the FRL. The implemented model is used to project the evolution of the living above-ground biomass and root biomass to estimate the gross biological production of the trees, their mortality and wood harvesting (see Section 3.2.1.1).

3.1.1.5 Calculation of the forest carbon balance: dead wood, litter and soil

- the **dead wood** pool is estimated to be in equilibrium, in line with the national inventory. The stock is considered to be constant, the incoming fluxes (mortality) being offset by the outgoing flux (decomposition and transfer to the litter), except for emissions from exceptional dead wood related to the decomposition, over several years, of windfall from storms, for which weak fluxes of CO2 are estimated;

- the **litter** pool is estimated to be in equilibrium, in line with the national inventory. The stock is considered constant, the incoming fluxes (contributions by branches, leaves; mortality) being offset by the outgoing fluxes (decomposition and transfer to the soil). No CO2 flux is therefore quantified for this pool;

- the **soil organic carbon** pool is estimated to be in equilibrium, in line with the national inventory. The stock is considered constant, the incoming fluxes (contributions by the litter) being offset by the outgoing fluxes (mineralisation). No flux of CO2 is therefore quantified for this pool, it being estimated at 0. Indeed, the IPCC proposes an estimate of soil carbon stocks on the basis of reference stocks associated with default stock change factors related to management. However, no information has been identified that can be used to translate the evolution of such forest soil management methods; soil carbon stocks are therefore stable over time in the absence of a land use change. It is considered that the carbon stock of this pool does not evolve over time. The conservative nature of this hypothesis has been strengthened by a study carried out by the ONF and the university of Louvain (Jonard, et al. 2013) on the plots of the RENECOFOR forest monitoring network. This study was launched by the French Ministry in charge of agriculture to respond to the reporting requirements of the Kyoto Protocol on monitoring the various soil carbon pools. This study concludes significantly that French forest soils can be considered as carbon sinks even if it does not formulate removal factors which could have been used in the GHG inventories.

3.1.1.6 Calculation of the forest carbon balance: harvested wood products

The pool of harvested wood products (HWPs) is estimated on the basis of the method developed in the technical guidance (Forsell, et al. 2018). The total wood harvested over the reference period (in this case 2003-2008, the harvests of 2000 to 2002 and 2009 being too high, due to the effects of the storms of 1999 and 2009, and therefore not representative of a classic reference level) are directly estimated in the GHG national inventory . An average level over this period is calculated. The harvesting levels modelled within the context of the FRL from 2010 to 2030, are compared to the average reference level. The difference, observed for each projected year, with the historical reference value is then applied to the productions of the various HWPs. For each of these products, stocks variations are estimated in accordance with the IPCC method applied to the national inventory.

3.1.1.7 Calculation of emissions related to burning on site of the wood harvest residues

On-site harvest residues biomass burning during wood harvesting is taken into account and generates different greenhouse gases (N2O, CH4) in addition to CO2. The volume of wood burned on site is poorly known about: it is therefore estimated using IPCC default data, assuming that 10% of the above-ground biomass is left to decompose and that the rest of the slashings remains are burned which corresponds to a range of 4% to 15% of the total above-ground biomass depending on the species. These emissions are estimated using emission factors from the IPCC 2006 guidelines. The projection of these emissions is based on a continuation of the average observed over the last 5 years calculated in the inventory (2012 to 2016).

3.1.1.8 Calculation of emissions related to forest fires

In Metropolitan France, to estimate emissions from forest fires, the territory is divided into two major areas: the Mediterranean area, which is more susceptible to forest fires and with lower biomass density, and the

rest of France. For the Mediterranean area, annual burned areas are provided by the *Prométhée* (2018) database. For the rest of France, annual burned surfaces are provided by the Ministry in charge of agriculture (2018).

Burned surface area (ha/year)	Mediterranean area	Rest of the country	Total
2000	18,860	5,218	24,078
2001	17,965	2,677	20,642
2002	6,298	23,871	30,169
2003	61,424	11,576	73,000
2004	10,596	3,104	13,700
2005	17,356	5,044	22,400
2006	5,483	1,917	7,400
2007	6,485	2,015	8,500
2008	3,746	2,260	6,006
2009	11,113	5,887	17,000
2010	5,453	4,847	10,300
2011	4,492	4,908	9,400
2012	4,392	4,208	8,600
2013	1,922	1,308	3,230
2014	4,113	3,327	7,440
2015	3,111	8,049	11,160
2016	12,128	3,972	16,100

Emissions are estimated using emission factors, which are specific to each of these two areas to reflect the differences in vegetation type and density. Since combustion during forest fires is uncontrolled by nature, representation of the emissions remains imprecise. The equation below, inspired by the IPCC's 2.14 equation (2006), is applied:

$$L_{fires} = \sum_i A_{burnt(i)} \times BW_i \times Frac\_burn_i \times CF$$

With:

L_{wild_fires}	=	Annual carbon losses related to fires, t C/year
$A_{burnt(i)}$	=	Annual surface burned in the geographical area i, ha
i	=	Geographic area (*Mediterranean area* and *Others*)
BW_i	=	Biomass stock on the surfaces burned in geographical area i, t DM/ha
Frac_burn	=	Biomass fraction actually burned in geographical area i
CF	=	Carbon fraction of the biomass, t C/t DM

The emission factors used for the national inventory and the FRL in Metropolitan France are the following:

Parameters	Mediterranean area	Rest of the country
Stock of above-ground biomass (in tDM/ha)	30	150
Combustion efficiency (FRAC_burn)	0.25	0.20

For the projection of years 2021 to 2030, the average of the surfaces observed during the past 5 years calculated in the inventory is used (2012 to 2016).

3.1.2 Overseas

3.1.2.1 Calculation of the forest carbon balance: living biomass

In order to maintain consistency with the national inventory, the FRL of French overseas forests uses a neutrality hypothesis. The strong uncertainties regarding French overseas forests, and the absence of monitoring as accurate and complete as the Metropolitan France forest inventory does not allow to quantify properly their carbon balance. In particular, the question of whether the French Guiana forests (excluding deforestation) are a net sink and, if yes, whether it will remain so, is still unclear. Thus, in the national inventory, for all the pools and for all overseas, hypotheses of neutrality or balance are adopted for all land concerned by the FRL.

(tCO2e/year)	French Guiana	Guadeloupe	Martinique	La Réunion	Mayotte
Living above-ground biomass	0	0	0	0	0
Living belowground biomass	0	0	0	0	0

3.1.2.2 Calculation of the forest carbon balance: dead wood, litter and soil

In order to maintain consistency with the national inventory, the projected hypotheses remain the same:

(tCO2e/year)	French Guiana	Guadeloupe	Martinique	La Réunion	Mayotte
Dead wood	0	0	0	0	0
Litter	0	0	0	0	0
Soil	0	0	0	0	0

3.1.2.3 Calculation of the forest carbon balance: harvested wood products

In order to maintain consistency with the national inventory, the projected hypotheses remain the same:

(tCO2e/year)	French Guiana	Guadeloupe	Martinique	La Réunion	Mayotte
Harvested wood products	0	0	0	0	0

There are some forest harvestings for these territories but they remains very low and they are assumed to be offset fully by gross production.

3.1.2.4 Calculation of emissions related to on-site burning of the wood harvest residues

When harvesting, the entire CO2 emitted is assumed to be offset by gross production. However, non-CO2 gases emissions are estimated when wood harvest residues are burned on site. This practice is only accounted for in French Guiana.

	French Guiana	Source
Logs harvests (m³/year)	249,400	According to Guitet, et al. 2006
Above-ground biomass harvest (tC/year)	124,628	Citepa (expansion factors)
On-site burned part	41%	According to Guitet, et al. 2006 and IPCC, 2003 (3.187)
Oxidised fraction	30%	IPCC, 2003 (3.93)

For the other overseas, no emission is associated with this practice.

3.1.2.5 Calculation of emissions related to forest fires

Emissions related to forest fires, unlike other forest losses (mortality, harvesting), are assumed not to be offset. They are estimated according to an estimate of the areas burned:

Burned surface area (ha/year)	**French Guiana**	**Guadeloupe**	**Martinique**	**La Réunion**	**Mayotte**
2000	1000	0	0	10	11
2001	1000	0	0	82	11
2002	1000	0	0	69	11
2003	1000	0	0	1	11
2004	1000	0	0	7	11
2005	1000	0	0	56	11
2006	1000	0	0	70	11
2007	1000	0	0	2	11
2008	1000	0	0	40	11
2009	1000	0	0	34	31
2010	1000	0	0	937	51
2011	1000	0	0	2718	11
2012	1661	0	0	154	11
2013	279	0	0	375	77
2014	1318	0	0	245	11
2015	1318	0	0	85	11
2016	1000	0	0	301	11
Sources	Pref. of Guiana and Citepa hypothesis	BDIFF	BDIFF	BDIFF	BDIFF

The emission factors used are estimated using the same approach as for Metropolitan France. The parameters specifically used for Overseas France are presented below:

Parameters	French Guiana	Guadeloupe	Martinique	La Réunion	Mayotte
Stock of above-ground biomass (in tMS/ha)	350	189	256	103	159
Combustion efficiency (Frac_burn)	0.25	0.25	0.25	0.25	0.25

Projection of the burned area uses the hypothesis of a continuation of the trends observed over the historical period:

Burned surface area (ha/year)	French Guiana	Guadeloupe	Martinique	La Réunion	Mayotte
2021-2025	1000	0	0	157	11
2026-2030	1000	0	0	157	11

For La Réunion, the projected value is equal to the average of the historical values, excluding 2011, considered as exceptional and not representative of a background level.

3.2 DOCUMENTATION OF DATA SOURCES USED TO ESTIMATE THE FRL

3.2.1 Documentation of the stratification of managed forests

3.2.1.1 Metropolitan France

The French National Institute for Geographic and Forest Information (IGN) is the public institution responsible for producing reference information on the state of French forests, their dynamics and their diversity [Hervé, 2016; Hervé et al., 2014]. This information is used to define and assess public policies relating to forest ecosystems.

As such, IGN makes the National Forest Inventory (NFI), a permanent statistical survey of French forests, which consists in measuring, according to public and standardised protocols and definitions, the forests state and changes in terms of area, volume and biological production at the national and regional levels. Since 2005, an inventory of all the public and private forests of metropolitan France is carried out every year. Each year, a sample of 7,500 new points all over the country is surveyed in forests available for wood supply (equivalent to managed forests according to the UNFCCC definition).

Modelling has been carried out on the basis of a division of French forests into 56 strata for forest stands (see annex) and 2 strata for poplar plantations.

The stratification principle is that all stands of the same stratum have similar characteristics and therefore the same growth, mortality and harvesting scenarios can be applied to them. Each stratum is composed of at least 200 different inventory plots, which can be used to describe the current resource and the natural dynamics with good statistical accuracy.

Strata of poplar plantations distinguish the two large areas of national poplar production, with a “North” area consisting of the main ecological regions (GRECO) B, C, D and E, and a “South and West” area corresponding to GRECOs A, F, G, H, I and J. These two major areas are distinguished primarily by their climatic conditions and by the cultivars of the poplar trees planted.

The 56 forest strata are defined as a clustering of 116 strata initially presented in the previous national studies [Colin & Thivolle-Cazat, 2016; Roux & Dhôte, 2017]. Each stratum groups comparable stands in

terms of species, ownership, environmental conditions and management practices. More specifically, these strata are derived from a combination based on expert opinion of the four following factors determined from NFI data:

- The type of forest cover, with a distinction between closed forests (53 strata) and open forests where the rate of tree cover is less than 40% (3 strata);
- The objective species for the manager. This is defined by expert opinion. 20 or so groups of broadleaf and conifer species are distinguished. A species is said to be "objective" when its presence guides forestry operations: it is often the species of the greatest economic interest;
- The ownership category, distinguishing state forests, municipal forests and private forests;
- The 11 French main ecological regions (GRECO) (IFN, 2011), that distinguish types of soils, relief and climates in France, i.e. site-specific factors which have an impact on the productivity of the forests.

To improve the robustness of the calibration of the natural dynamics, the 116 initial strata have been clustered into 56 new strata according to statistical proximity and the proximity of the descriptive criteria of the strata. For example the state-owned beech forests of the GRECO Vosges (D) and Jura (E) have been merged.

Finally, each NFI plot is assigned to a stratum, and for each stratum the NFI estimators fill out:

- state variables such as area, stand density and stock of standing wood per diameter class for year 2010. The state in 2010 is calculated as the average of the 5 annual NFI surveys, 2008 to 2012, after exclusion in the 2008 survey of windfall trees from the Klaus storm of January 2009;

-variables of dynamics necessary for simulation of the evolution of the resource, such as biological production, natural mortality and number of trees recruited per diameter class. The forest dynamics are also calculated using the same statistical sample as the initial stock (annual NFI surveys 2008 to 2012), which corresponds to the fluxes occurring during the 2003-2011 period.

3.2.1.2 Overseas

For Overseas France, no stratification of managed forests is applied.

3.2.2 Documentation regarding the surface area covered by managed forests

The IGN national forest inventory provides an estimate of the forest area available for wood supply at the beginning of 2010. This area includes afforestation of less than 20 years old, which does not meet the UNFCCC definition of managed forest. For calculation of the FRL, since the projections are made including all the stands of 2010, without any increase or decrease in the forest area, it is necessary to exclude from the 2020 area, afforestation which was less than 10 years old in 2010, from that of 2025 afforestation which was less than 5 years old in 2010, and none for the 2030 area. Specific processing aimed at excluding young afforestation of less than 20 years old from the projected carbon sink has been established.

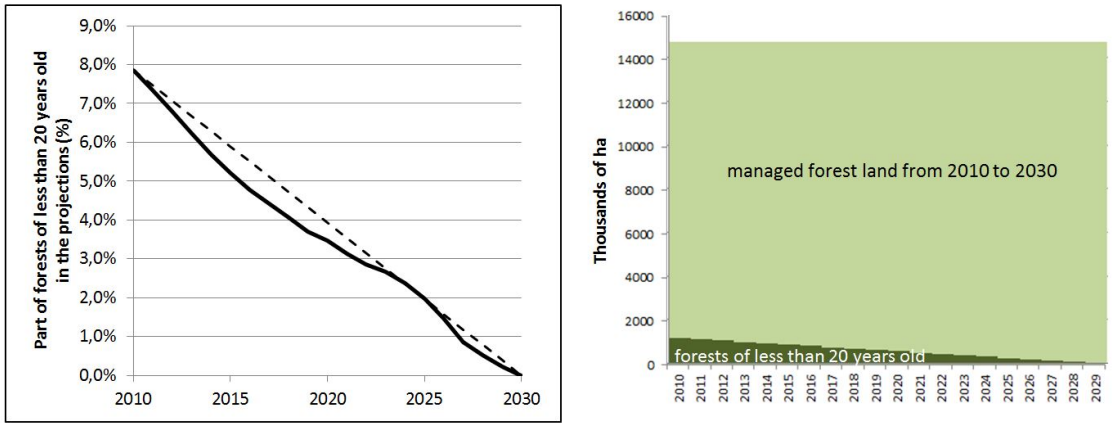


Figure2: Contribution of forests of less than 20 years old to the calculation of the projections

The land use annual survey by the Ministry in charge of agriculture (Teruti-Lucas survey) provides information about the situation of forest areas distinguishing afforestation, forest clearance and forest remaining forest. This matrix can be used to find out the proportion of afforestation of less than 20 years old in 2010, i.e. all the afforestation which has occurred since 1990, in the Teruti-Lucas 2010 forested area. Young afforestation thus represented 7.9% of the area in 2010.

The Teruti-Lucas matrix also shows changes to forested areas for all the years between 1990 and 2010. The annual surface area of incorporation of afforestation in the category of managed forests can be derived from it. The solid line on the left-hand graph shows the decline in the surface pool of young afforestation over time.

The contribution of this young afforestation to the carbon sink in living biomass is estimated according to the method defined by CITEPA for the France's GHG national inventory report. The difference between the production per hectare of young afforestation and that of managed forest is considered stable over the entire period. Given this difference and the annual proportion of young afforestation, it is possible to calculate the contribution of this afforestation to total annual production. This contribution of forest land of less than 20 years old at year X is finally subtracted from the total carbon gain projected for this same year X. Concerning carbon losses, the same method is applied for mortality; however, the share of young afforestation in harvests is considered to be zero in France's GHG inventory (no cutting in this type of stand).

3.2.3 Documentation of the sustainable management practices of forests applied to estimate the forest reference level

3.2.3.1 Metropolitan France

The LULUCF regulation specifies that the FRL must be based on the continuation of sustainable forest management practices as documented over the 2000 -2009 period.

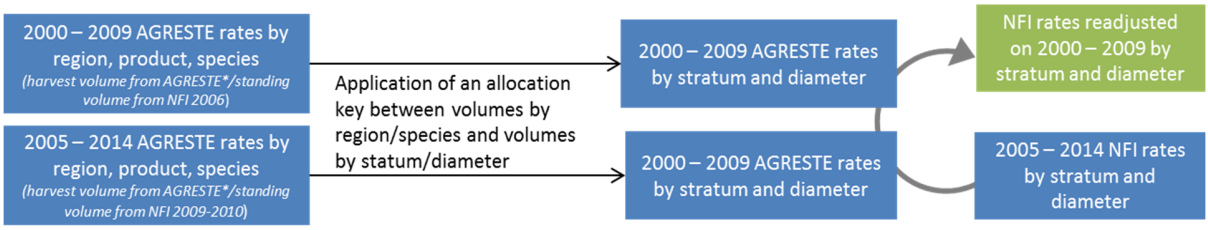
Given the characteristics of the MARGOT model used for the projections, the forest management scenario for the reference period is defined as a rate of harvested number of trees per diameter class.

Since 2010, the IGN measures harvesting from forests available for wood supply by remaking the inventory of all NFI points which were visited 5 years previously [Hervé et al., 2014]. Harvesting rates are known per stratum and per diameter class, and they are consistent with all the other dendrometric estimators of the NFI.

However, these data are not directly usable to define the reference scenario because the first period of direct measurement of wood harvesting from French forests refers to the 2005-2010 period. Moreover, these results are statistically poor because they rely on a single measuring campaign. By contrast, the harvesting rates usable by the MARGOT model can be calculated robustly thanks to the NFI observations per stratum and per diameter class over the 2005-2014 period.

A specific method has been developed to define a forest management scenario over the reference period using these NFI data, compatible with the MARGOT model. It consists of using the spatio-temporal changes observed in the AGRESTE data as a proxy to readjust the NFI harvesting rates of the 2005-2014 period to the reference period.

Every year since 1948, the Ministry in charge of agriculture has carried out a survey on commercialized wood removals [Agreste, 2018]. All the logging companies, every year declare the volumes of timber harvested and traded, distinguishing the species, categories of products and regions of origin. These data have been supplemented by a non-traded wood energy value per region and per species derived from comparing AGRESTE data with the total forestry harvest observed by the IGN. Since 2000, the harvesting of wood energy (traded and non-traded) is estimated to be stable.



* Harvesting volumes from the national annual survey on commercialized wood removals [Agreste, 2018] for sawn wood and pulpwood, and a fix estimate from Agreste and NFI data for fuelwood.

During the reference period the harvesting of wood in French forests was severely affected by the Lothar and Martin storms of December 1999. These storms affected nearly all the country and the volume of windfall trees has been estimated at more than 140 million m3 [NFI, 2003]. Since this weather event of an unprecedented scale had a significant impact on the harvest of 2000, 2001 and 2002, it was decided to exclude these 3 exceptional years from the calculation of total harvests over the reference period. This choice was used to define a scenario that reflects the normal management practices over the reference period and not practices related to managing an exceptional crisis.

The harvest volumes observed by AGRESTE over the 2003-2009 and 2005-2014 periods were compared to the stocks measured by the NFI over the same periods (i.e. respectively, the central years 2006 and 2010). In order to make these cutting rates defined using the AGRESTE data comparable to those used as input for the MARGOT model, these rates per region/species/product have been converted into a rate per stratum and diameter class using an allocation key for these various criteria.

Changes in the harvesting rates observed with AGRESTE between the 2003-2009 and 2005-2014 periods were finally applied to the harvesting rate as measured by the NFI over the 2005-2014 period to estimate the harvesting rate over the 2003-2009 reference period.

The analysis of the sustainability of forest management practices over the reference period has been made on the sustainable management indicator “harvest rate” [Forest Europe, 2015], which consists of dividing harvesting by the net biological increment. At the level of all French forests, this rate is around 50%, and at the stratum level, it is always less than 100%, indicating that harvesting does not overwhelm forest production (see Annex). The only exception is the North of France poplar stand stratum where it reaches 102%. These stands which represent less than 1% of the national forest area suffer from an imbalance of

age classes in favour of the older classes which are currently being cut. The cutting scenario for this stratum has been maintained unchanged.

3.2.3.2 Overseas

For French overeas, the neutrality hypothesis is justified by sustainable forest management practices since any harvesting is fully offset by the growth of other trees (Guitet, et al. 2006).

3.3 DETAILED DESCRIPTION OF THE MODEL APPLIED TO ESTIMATE THE FOREST REFERENCE LEVEL

3.3.1.1 Metropolitan France – Forest carbon balance

The MARGOT resource model (*MAtrix model of forest Resource Growth and dynamics On the Territory scale*), used by the IGN for projections of French forest-wood resources [Wernsdörfer *et al.*, 2012; Colin *et al.*, 2017], is the main modelling tool used to simulate the development of the 56 strata of forests with the exception of poplar stands.

It is a dynamic model of the forest resource per diameter class, which iteratively simulates growth, mortality and forest- management (harvesting) at the scale of strata and for successive 5-year periods. It is used to estimate the future state of the resource (and of the carbon stock), and to simulate future wood harvesting and mortality.

The model is generic, i.e. it is configurable and applicable regardless of the type of stand. Using modelling of the diameter (a parameter which is a key variable of tree growth and forestry), it can be used both for even-aged stands (regular forest) and for heterogeneous stands (uneven-aged forest), the latter being the most prevalent in France [Morneau *et al.*, 2008].

The model is of a matrix type, in which the resource and the parameters are described by stratum, by class of basal area per hectare and by diameter class. Adjustment of the production, recruitment and mortality by class of basal area means that the effect of the density of the stands on the variation of these parameters is taken into account. For each iteration, the 3 following matrices are combined to calculate the demographic development of each stratum:

- A state matrix, describing the resource per diameter class at the beginning and at the end of each simulation step. The matrix contains, for each diameter class of a width of 5 cm, (1) a number of trees which develop over time as a function of growth (transfer to the next diameter class) and removals (harvesting, mortality), and (2) coefficients to calculate the carbon stock in the biomass of trees in the diameter class (class i stock = numbers in i multiplied by the average stock of a tree in class i).
- A transition matrix, describing the growth of the trees. It is expressed in the form of a **growth parameter** corresponding to the probability over 5 years that a tree of diameter class i will move up to the diameter class i+1. **Recruitment** corresponds specifically to the number of new trees that grow in the first diameter class, i.e. the trees which become eligible for inventory over the period in already existing stands (case of areas undergoing regeneration). It is expressed in the form of a number of stems per hectare.
- A disappearance matrix, representing natural mortality and harvesting related to forest management practices. Mortality corresponds to the probability that a tree of a specified diameter class will die during the 5-year period. It is expressed in the form of a **mortality rate**. Harvesting in a diameter class is expressed as a harvesting rate, the ratio between the number of trees cut and the number of living trees.

The development of the two strata of poplar stands was projected using the forest dynamics model by age-class developed by the IGN [Colin *et al.,* 2017], also using 5-year iterations. This model is particularly well adapted to plantations in which the trees have the same age and show the characteristics of uniform growth. The resource is described per stratum thanks to an average area and volume per hectare by age-class. The forest dynamics are modelled for each age class by a biological production per hectare, a natural mortality per hectare, a thinning volume harvesting rate and a clear cutting rate over the 5-year period.

The values of the parameters of these models are established statistically from the data collected by the NFI system, i.e. a very large number of observations. This gives the models great robustness for short and medium-term projections. The models are adjusted using cross-class data, i.e. where all the diameter classes are measured in the same year.

3.3.1.2 Metropolitan France – Harvested Wood Products (HWP)

HWPs are accounted using a production approach, which takes into account wood products manufactured with the domestic wood, whether they are intended for the French market or exported. Imports are not taken into account. The activity data (production during the different steps of the industrial chain) are provided in particular from sector surveys from the Statistics and Prospective Service of the Ministry in charge of agriculture. In order to take into account HWPs before 2000, but still in the course of decomposition during the projection years, calculation of HWPs starts in 1900.

3.3.1.3 Overseas

For Overseas France, no model is applied.

4 FOREST REFERENCE LEVEL

4.1 FRL AND DETAILED DESCRIPTION OF THE ESTIMATE OF EACH CARBON POOL

4.1.1 Metropolitan France

In total, for all the carbon pools and greenhouse gases taken into account, France FRL amounts to -**58 467 881** tCO2e for the 2021-2025 period and to -**60 298 881** tCO2e for the 2026-2030 period.

2021-2025	**above-ground biomass**	**below-ground biomass**	**dead wood**	**litter**	**soil organic carbon**	**harvested wood products**	**FRL**
total (in tCO2e)	-42,793,397	-12,522,965	1,106,878	0	0	-4,258,397	**-58,467,881**

2026-2030	**above-ground biomass**	**below-ground biomass**	**dead wood**	**litter**	**soil organic carbon**	**harvested wood products**	**FRL**
total (in tCO2e)	-43,738,753	-12,791,678	671,356	0	0	-4,439,480	**-60,298,556**

4.1.1.1 Living above-ground and below-ground biomass

Before adjustment, the total living biomass is estimated at – 55 316 632 tCO2e on average for the 2021-2025 period and at – 56 530 431 tCO2e on average for the 2026-2030 period. This pool represents the majority of the FRL.

This overall trend results in particular from increased gross production (-40 421 681 tC to -46 707 792 tC between 2010 and 2030 before adjustment, i.e. + 0.8%/year).

4.1.1.2 Dead wood, litter and soil

Among these pools, only emissions from exceptional dead wood related to the decomposition, over several years, of windfall from storms are reported. The other pools are estimated to be in balance.

4.1.1.3 Harvested wood products

HWPs represent a net sink for the reference period, -3872 ktCO2 on average (decreasing from -5154 ktCO2 in 2000 to -1333 ktCO2 in 2009). This sink tends to decrease during the reference period and throughout time, as estimated in the inventory. The projection made for the FRL estimate is based on the increasing in the overall level of wood harvest, with a constant ratio between energy and solid use. Accordingly, the HWP sink increases slightly between 2010 and 2030. The entire managed forest land carbon balance, included HWPs, is then adjusted in order to have a starting level consistent with the inventory.

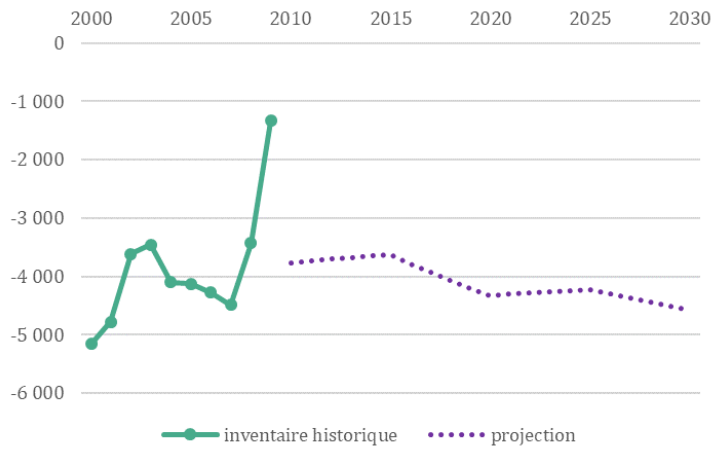


Figure3 Projection of harvested wood products (in ktCO2)

4.1.2 Overseas

The estimates of the different pools are presented in the tables below:

Above-ground biomass					
tCO2e/year	**French Guiana**	**Guadeloupe**	**Martinique**	**La Réunion**	**Mayotte**
2021-2025	164,380	0	0	7,460	859
2026-2030	164,380	0	0	7,460	859

Belowground biomass					
	French Guiana	**Guadeloupe**	**Martinique**	**La Réunion**	**Mayotte**
2021-2025	0	0	0	0	0
2026-2030	0	0	0	0	0

Dead wood, litter, soil					
	French Guiana	**Guadeloupe**	**Martinique**	**La Réunion**	**Mayotte**
2021-2025	0	0	0	0	0
2026-2030	0	0	0	0	0

Harvested wood products					
	French Guiana	**Guadeloupe**	**Martinique**	**La Réunion**	**Mayotte**
2021-2025	0	0	0	0	0
2026-2030	0	0	0	0	0

4.2 CONSISTENCY BETWEEN THE FRL AND THE LATEST NATIONAL INVENTORY REPORT

4.2.1 Metropolitan France

Regarding the scope, the FRL calculated here is consistent with the latest inventory report (Citepa, 2018). The FRL scope corresponds to the "Forest remaining forest" scope of the national GHG inventory in the UNFCCC format.

From the methodological point of view, the FRL is consistent with the latest inventory report (Citepa, 2018), since it applies the same approaches for each carbon pool and each greenhouse gas. The national inventory is based on the same data as the FRL, namely the surveys of the national forest inventory made by the IGN every year. These surveys allow the IGN to estimate the forest carbon balance (production, mortality, harvests).

From a quantitative point of view, the forest carbon balance projected by the model for 2010 to 2016 shows a difference of level with the forest GHG balance as estimated in the inventory for this same period. The average difference is 7 868 151 tCO2/year, or 12.5% of the average annual level of the forest carbon balance of the FRL. The causes of this difference could not all be identified and analysed. Possible explanations could be that:

- the projected estimates for the FRL are based only on the data available before 2010. The model, based on a continuation of the observations made before 2010, does not exactly reproduce the observations made between 2010 and 2016, reflecting weather changes, for example.
- the fact that the inventories and the projection do not use the IGN data in the same way. The inventories use each new survey (from results over five years) on an annual basis, allocating the result of each survey to its median year. The projections for the FRL however are based on longer periods of time, each result provided being based on five surveys.

An adjustment is therefore made in accordance with the technical guidance document (Forsell et al. 2008), based on the average of the observed differences between the inventory observations and the simulations, for the longest period available which covers both of them, namely 2010 to 2016. The final correction factor is 0.87. This adjustment is only carried out on the perimeter of the forest carbon balance (production, mortality, harvesting, the latter affecting the calculation of HWPs) and not on the other elements (decomposition of dead wood, burning of wood harvest residues, forest fires) because only the estimate of the balance of the forest biomass, via the MARGOT model, differs from the inventory methodology.

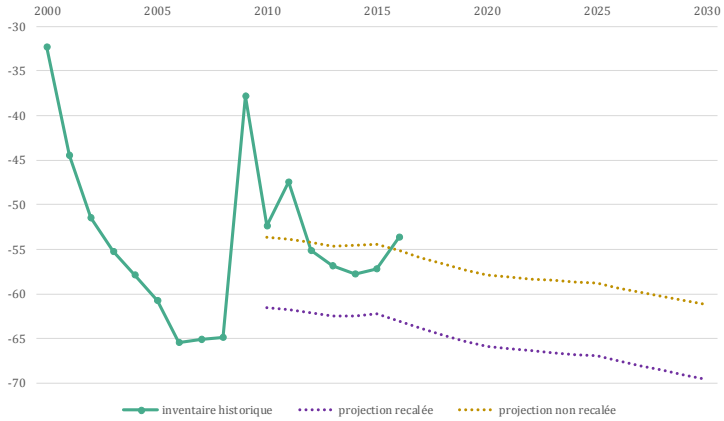


Figure 4 Impact of the adjustment between the projection and the inventory (biomass – metropolitan France) in MtCO2e

The differences observed over recent periods as regards biomass can be analysed more precisely by comparing the gains and losses separately. The gains correspond to gross forest production, the losses to the sum of mortality and harvesting.

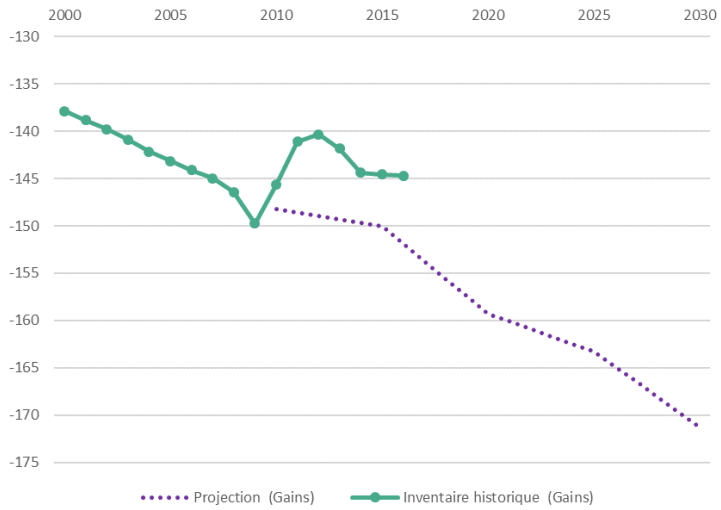


Figure 5 Overview of projections without adjustment (biomass : gains, metropolitan France) in MtCO2e

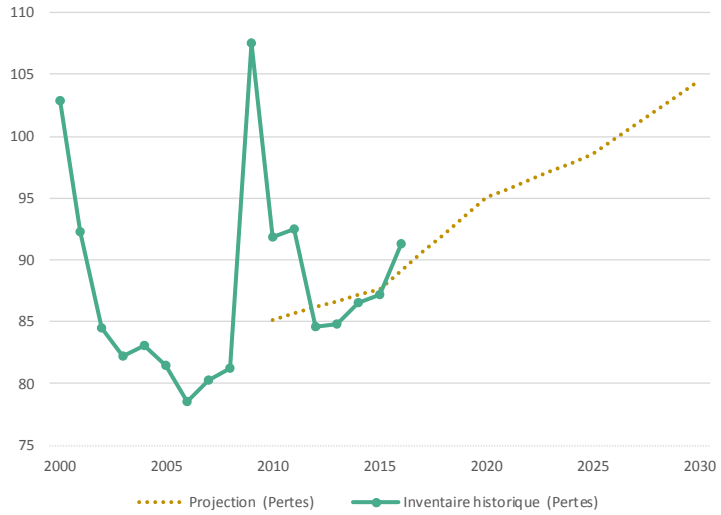


Figure 6 Overview of projections without adjustment (biomass: losses, metropolitan France) in MtCO2e

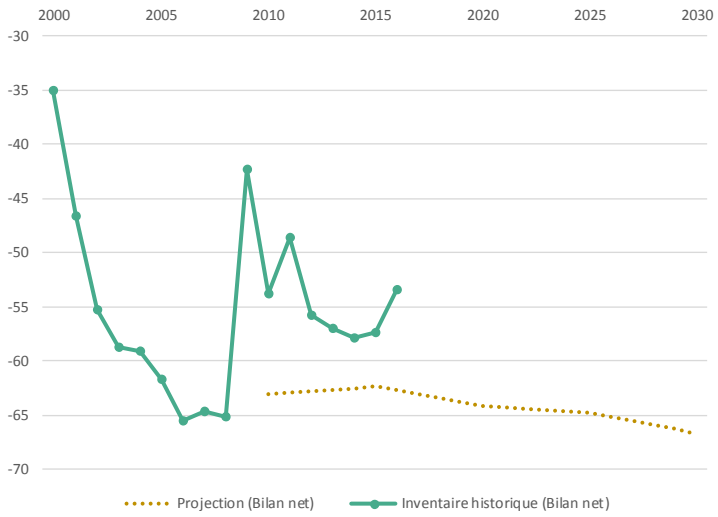


Figure 7 Overview of projections without recalibration (biomass – net balance, metropolitan France) in MtCO2e

It appears that the losses (harvesting + mortality) are of the same order of magnitude in the projection and the GHG inventory over the 2010-2016 period, considering the fact that a part of the losses of 2010 and 2011 is directly due to the 2009 storm.

However, there is a clear gap clearly appears in biomass earnings for the recent period, 2010-2016. This gap is due to the fact that the production data are lower for recent years that what the model predicted using data of the reference period. This difference regarding production, although difficult to interpret, is not related to the implementation of new forest management practices over the 2010-2016 period. The adjustment carried out on the total biomass corresponds to an adjustment of the production and avoids a very strong bias associated with the elaboration of the FRL.

4.2.2 Overseas

For Overseas France's forests, the same assumptions are applied for calculation of the FRL as for the production of the national inventory, namely, neutrality for the forest GHG balance and only emissions related to the burning of wood harvest residues and forest fires.

4.3 FRL ESTIMATED FOR EACH CARBON POOL AND EACH GREENHOUSE GAS

4.3.1 Whole of France (Metropolitan and Overseas)

Whole of France (Metropolitan and Overseas)

2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	-43,509,883	-12,522,965	1,106,878	0	0	-4,258,397	-59,184,367
CH4 (in tCO2e)	581,882	0	0	0	0	0	581,882
N2O (in tCO2e)	307,304	0	0	0	0	0	307,304
total (in tCO2e)	-42,620,697	-12,522,965	1,106,878	0	0	-4,258,397	-58,295,181

Whole of France (Metropolitan and Overseas)

2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	-44,455,239	-12,791,678	671,356	0	0	-4,439,480	-61,015,042
CH4 (in tCO2e)	581,882	0	0	0	0	0	581,882
N2O (in tCO2e)	307,304	0	0	0	0	0	307,304
total (in tCO2e)	-43,566,054	-12,791,678	671,356	0	0	-4,439,480	-60,125,856

4.3.2 Metropolitan France

Metropolitan France

2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	-43,661,662	-12,522,965	1,106,878	0	0	-4,258,397	-59,336,145
CH4 (in tCO2e)	564,933	0	0	0	0	0	564,933
N2O (in tCO2e)	303,332	0	0	0	0	0	303,332
total (in tCO2e)	-42,793,397	-12,522,965	1,106,878	0	0	-4,258,397	**-58,467,881**

Metropolitan France

2026-2030	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	-44,607,018	-12,791,678	671,356	0	0	-4,439,480	-61,166,820
CH4 (in tCO2e)	564,933	0	0	0	0	0	564,933
N2O (in tCO2e)	303,332	0	0	0	0	0	303,332
total (in tCO2e)	-43,738,753	-12,791,678	671,356	0	0	-4,439,480	**-60,298,556**

4.3.3 Overseas: French Guiana

French Guiana							
2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	144,375	0	0	0	0	0	144,375
CH4 (in tCO2e)	16,422	0	0	0	0	0	16,422
N2O (in tCO2e)	3,583	0	0	0	0	0	3,583
total (in tCO2e)	164,380	0	0	0	0	0	**164,380**

French Guiana							
2026-2030	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	144,375	0	0	0	0	0	144,375
CH4 (in tCO2e)	16,422	0	0	0	0	0	16,422
N2O (in tCO2e)	3,583	0	0	0	0	0	3,583
total (in tCO2e)	164,380	0	0	0	0	0	**164,380**

4.3.4 Overseas: Guadeloupe

Guadeloupe							
2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	0	0	0	0	0	0	0
CH4 (in tCO2e)	0	0	0	0	0	0	0
N2O (in tCO2e)	0	0	0	0	0	0	0
total (in tCO2e)	0	0	0	0	0	0	**0**

Guadeloupe							
2026-2030	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	0	0	0	0	0	0	0
CH4 (in tCO2e)	0	0	0	0	0	0	0
N2O (in tCO2e)	0	0	0	0	0	0	0
total (in tCO2e)	0	0	0	0	0	0	**0**

4.3.5 Overseas: Martinique

Martinique							
2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	0	0	0	0	0	0	0
CH4 (in tCO2e)	0	0	0	0	0	0	0
N2O (in tCO2e)	0	0	0	0	0	0	0
total (in tCO2e)	0	0	0	0	0	0	**0**

Martinique							
2026-2030	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	0	0	0	0	0	0	0
CH4 (in tCO2e)	0	0	0	0	0	0	0
N2O (in tCO2e)	0	0	0	0	0	0	0
total (in tCO2e)	0	0	0	0	0	0	**0**

4.3.6 Overseas: La Réunion

La Réunion							
2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	6,672	0	0	0	0	0	6,672
CH4 (in tCO2e)	475	0	0	0	0	0	475
N2O (in tCO2e)	313	0	0	0	0	0	313
total (in tCO2e)	7,460	0	0	0	0	0	**7,460**

La Réunion							
2026-2030	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	6,672	0	0	0	0	0	6,672
CH4 (in tCO2e)	475	0	0	0	0	0	475
N2O (in tCO2e)	313	0	0	0	0	0	313
total (in tCO2e)	7,460	0	0	0	0	0	**7,460**

4.3.7 Overseas: Mayotte

Mayotte							
2021-2025	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	732	0	0	0	0	0	732
CH4 (in tCO2e)	52	0	0	0	0	0	52
N2O (in tCO2e)	76	0	0	0	0	0	76
total (in tCO2e)	859	0	0	0	0	0	**859**

Mayotte							
2026-2030	above-ground biomass	below-ground biomass	dead wood	litter	soil organic carbon	harvested wood products	**FRL**
tCO2	732	0	0	0	0	0	732
CH4 (in tCO2e)	52	0	0	0	0	0	52
N2O (in tCO2e)	76	0	0	0	0	0	76
total (in tCO2e)	859	0	0	0	0	0	**859**

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ANNEXES

Annex 1: List of the 58 strata

Name	Link with the 116 strata of the previous national studies	Type of forest	Objective species	Ownership	GRECO	Number of points	Harvesting rate over the projection period
FEU_01	FF01-FF02	Closed deciduous	Chestnut	Private	A&B&C&D&E&G(East)	770	50%
FEU_02	FF03	Closed deciduous	Chestnut	Private	F&G(West)	653	56%
FEU_03	FF04-FF05-FF06	Closed deciduous	Robinia	Private	A&B&C&D&E&F&G	428	50%
FEU_04	FF07-FF08-FF10-FF67	Closed deciduous	Other deciduous	Public	A&B&C&F	828	65%
FEU_05	FF09-FF17	Closed deciduous	Other deciduous	Public&Private	D&E	368	31%
FEU_06	FF10-FF19-FF66	Closed deciduous	Other deciduous	Public&Private	G	573	29%
FEU_07	FF11-FF12-FF20-FF21	Closed deciduous	Other deciduous	Public&Private	H&I	478	9%
FEU_08	FF13-FF22-FF44	Closed deciduous	Other deciduous and pubescent oak	Public&Private	J	735	17%
FEU_09	FF14-FF15-FF65	Closed deciduous	Other deciduous	Private	A&B(Centre)	548	29%
FEU_10	FF15-FF65	Closed deciduous	Other deciduous	Private	B(North)	578	32%
FEU_11	FF16-FF65	Closed deciduous	Other deciduous	Private	C	531	39%
FEU_12	FF18-FF66	Closed deciduous	Other deciduous	Private	F	400	18%
FEU_13	FF23-FF45-FF48	Closed deciduous	All deciduous	Public&Private	K	403	7%
FEU_14	FF24-FF25-FF30	Closed deciduous	European & sessile oaks	State	A&B&F&G(except Bourgogne)	618	88%
FEU_15	FF26-FF29	Closed deciduous	European & sessile oaks	Public	C&D&E&G(Bourgogne)	1350	83%
FEU_16	FF27-FF28-FF30	Closed deciduous	European & sessile oaks	Municipal	A&B&F&G(except Bourgogne)	313	57%
FEU_17	FF31	Closed deciduous	European & sessile oaks	Private	A	533	36%
FEU_18	FF32	Closed deciduous	European & sessile oaks	Private	B(Centre)	1744	46%
FEU_19	FF33	Closed deciduous	European & sessile oaks	Private	B(North)	846	68%
FEU_20	FF34	Closed deciduous	European & sessile oaks	Private	C&D	896	45%
FEU_21	FF35-FF38-FF39-FF43	Closed deciduous	European & sessile and pubescent oaks	Private	E&H&I	516	24%
FEU_22	FF36	Closed deciduous	European & sessile oaks	Private	F	841	48%
FEU_23	FF37	Closed deciduous	European & sessile oaks	Private	G	1212	44%
FEU_24	FF40-FF42	Closed deciduous	Pubescent oak	Private	A&B&F(North)&G	503	32%
FEU_25	FF41	Closed deciduous	Pubescent oak	Private	F(South)	860	34%
FEU_26	FF46-FF47	Closed deciduous	Holm oak	Public&Private	G&H&I&J	701	21%
FEU_27	FF49-FF50-FF67	Closed deciduous	Common ash	Public&Private	A&B&C	803	43%

FEU_28	FF51-FF53	Closed deciduous	Beech	Public	C	596	78%
FEU_29	FF52-FF54	Closed deciduous	Beech	Public	D&E	368	84%
FEU_30	FF55-FF59	Closed deciduous	Beech	Public&Private	A&B	375	92%
FEU_31	FF56-FF62	Closed deciduous	Beech	Public&Private	F&G	575	46%
FEU_32	FF57-FF63	Closed deciduous	Beech	Public&Private	H	340	23%
FEU_33	FF58-FF64	Closed deciduous	Beech	Public&Private	I	406	12%
FEU_34	FF60-FF61	Closed deciduous	Beech	Private	C&D&E	403	49%
RES_01	FR01-FR05-FR29	Closed conifer	Other conifers and Scots pine	Public&Private	A&B	390	83%
RES_02	FR01-FR06-FR27-FR30	Closed conifer	Other conifers and Scots pine	Public&Private	C&D&E	369	77%
RES_03	FR01-FR03-FR07-FR10	Closed conifer	Other conifers	Public&Private	F&I	242	21%
RES_04	FR01-FR08-FR25-FR28	Closed conifer	Other conifers	Public&Private	G	313	52%
RES_05	FR02-FR09-FR17-FR25	Closed conifer	Other conifers	Public&Private	H	507	24%
RES_06	FR04-FR11-FR33-FR34	Closed conifer	Other conifers	Public&Private	J&K	324	15%
RES_07	FR12-FR13-FR14	Closed conifer	Douglas	Public&Private	A&B&C&D&E	332	69%
RES_08	FR12-FR15	Closed conifer	Douglas	Public&Private	F&G&I	698	58%
RES_09	FR18-FR19	Closed conifer	Aleppo pine	Public&Private	H&I&J&K	372	20%
RES_10	FR20-FR23	Closed conifer	Laricio and maritime pines	Private	A&B	451	49%
RES_11	FR21-FR22-FR26-FR28	Closed conifer	Maritime and Scots pines	Public	A&B&F	299	70%
RES_12	FR24	Closed conifer	Maritime pine	Private	F	1133	82%
RES_13	FR31	Closed conifer	Scots pine	Private	F&G	473	44%
RES_14	FR32	Closed conifer	Scots pine	Private	H	347	23%
RES_15	FR35-FR36-FR38	Closed conifer	Fir and spruce	Public	D&E	593	88%
RES_16	FR37-FR41	Closed conifer	Fir and spruce	Public&Private	A&B&C	333	77%
RES_17	FR39-FR44	Closed conifer	Fir and spruce	Public&Private	F&G	772	96%
RES_18	FR42-FR43	Closed conifer	Fir and spruce	Private	D&E	388	91%
RES_19	FR10-FR16-FR40-FR45-FR46	Closed conifer	Fir and spruce	Public&Private	H&I	666	50%
OUV_01	OF01	Open deciduous	Deciduous	Public&Private	A&B&C&F	220	37%
OUV_02	OF02	Open deciduous	Deciduous	Public&Private	D&E&G&H&I	235	18%
OUV_03	OR01	Open conifer	Conifers	Public&Private	A&B&C&D&E&F&G&H&I	263	35%
PEU_01		Poplar stand	Poplar	Public&Private	A&F&G&I&J	387	69%
PEU_02		Poplar stand	Poplar	Public&Private	B&C&D&E	1011	102%

Annex 2: Biodiversity and sustainable management of the forest under the forest and wood national plan (PNFB)

The PNFB plans to improve the knowledge base on this subject, by developing inventory and monitoring measures by:

- developing continuous inventory measures and monitoring of biodiversity, at the national level (in particular the forest and environmental inventory of the IGN) and by widely publicising the results obtained. This monitoring must be shared, standardised and spread over the country and be representative of Metropolitan France forests;
- developing atlases of municipal biodiversity as well as ecological and socio-economic diagnoses;
- updating, consolidating and making available to owners and forest managers which areas of forest are important for biodiversity, located in existing environmental zones (Natura 2000, sites, etc.) and available on the websites of the Regional environment, development and housing departments (DREAL) and the national inventory of the natural heritage.

In addition, the regional forestry and wood programmes (regional variations of the PNFB) being deployed, will propose measures enabling:

- a strengthening of knowledge about biodiversity;
- the preservation of forest biodiversity;
- the preservation and rehabilitation of ecological forest continuities, based on the regional ecological coherence schemes, or for the Overseas France, the regional development schemes.

Integration of the issues of biodiversity will be improved in the diagnoses carried out on the development of forested areas within the context of the National observatory on the use of natural, agricultural and forestry spaces (ONCENAF).

In the overseas departments, in order to maintain a high level of monitoring and policing of the forest environment, new tools will be developed using imaging analysis. Monitoring plans will build on these analyses. The restoration by afforestation of degraded sites (mines, quarries, erosion, illicit activities, pollution) will be encouraged.
The development and evaluation of forestry practices aimed at preserving biodiversity, adapted to the various conditions of forest environments, will be encouraged, through a research programme which, in particular, will extend the biodiversity and forest management programme.

Certain forestry practices have a very positive impact on biodiversity. These practices can be promoted in the PRFBs. Examples are:

- leaving stumps and slashings in situ;
- keeping dead wood in the forest standing and/or on the ground;
- creating islands, networks and senescence continuities;
- ensuring there is a diversity of tree species in the stands and/or per forest area;
- in the overseas departments, protect particularly sensitive forest ecosystems, mangroves in particular.

Finally, an analysis of the coverage of the heritage challenges of forest biodiversity, taking into account scarcity and vulnerability, through existing protected spaces and being planned as part of the Strategy for the creation of protected areas (SCAP) and being created by the National museum of natural history. Forest biodiversity will be fully integrated at the national and regional levels, with the proposals which will follow this analysis. The managers, operators on the ground and actors researching and raising awareness of the preservation of biodiversity, will be encouraged to become involved in the concrete realisation of these proposals.