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To: Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union

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Subject: COMMISSION STAFF WORKING DOCUMENT  
ASSESSMENT OF THE REVISED NATIONAL FORESTRY  
ACCOUNTING PLANS 2021-2025  
*Accompanying the document*  
Commission Delegated Regulation amending Annex IV to Regulation (EU) 2018/841 of the European Parliament and of the Council as regards the forest reference levels to be applied by the Member States for the period 2021-2025

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Delegations will find attached document SWD(2020) 236 final.

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Brussels, 28.10.2020  
SWD(2020) 236 final

**COMMISSION STAFF WORKING DOCUMENT**

**ASSESSMENT OF THE REVISED NATIONAL FORESTRY ACCOUNTING PLANS  
2021-2025**

*Accompanying the document*

**Commission Delegated Regulation**

**amending Annex IV to Regulation (EU) 2018/841 of the European Parliament and of the Council as regards the forest reference levels to be applied by the Member States for the period 2021-2025**

{C(2020) 7316 final}

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## 1. INTRODUCTION

The land use, land use change and forestry ('LULUCF') sector has the potential to contribute in three key ways to climate mitigation and the long-term climate goal of the Paris Agreement to limit global warming to less than 2 degrees:

- As a net sink, at least partly offsetting remaining emissions towards a net zero target of emissions by 2050
- As a means to substitute fossil- or carbon-intensive materials with bio-materials, in the transition to a low greenhouse gas-emitting economy
- By avoiding, to the extent feasible, emissions in agriculture, thus linked to carbon-friendly food production systems

Sustainable land management practices are key to effective carbon sequestration and precursors to carbon storage in long-living products. In addition, such practices can maintain the resilience, productivity, regeneration capacity and vitality of the land covered by the LULUCF sector, thereby underpinning economic and social development while reducing the carbon and ecological footprint of related sectors.

In line with the Paris Agreement, Member States should ensure that sinks and reservoirs, including forests, are conserved or enhanced with a view to meeting the ambitious and to be increased greenhouse gas emissions reduction targets of the Union by 2030<sup>1</sup>, the proposed climate neutrality target by 2050<sup>2</sup> and pathways to get there<sup>3</sup>. To this end, Regulation (EU) 2018/841<sup>4</sup> (hereafter 'LULUCF Regulation') sets out a robust accounting system to ensure that for each Member State accounted emissions from land use are at least compensated by an equivalent accounted removal of CO<sub>2</sub> from the atmosphere.

With regard to the accounting of managed forest land<sup>5</sup>, the LULUCF regulation requires the Commission to set a forward-looking benchmark that should reflect the forest age-

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<sup>1</sup> [COM\(2019\) 640 final. The European Green Deal.](#)

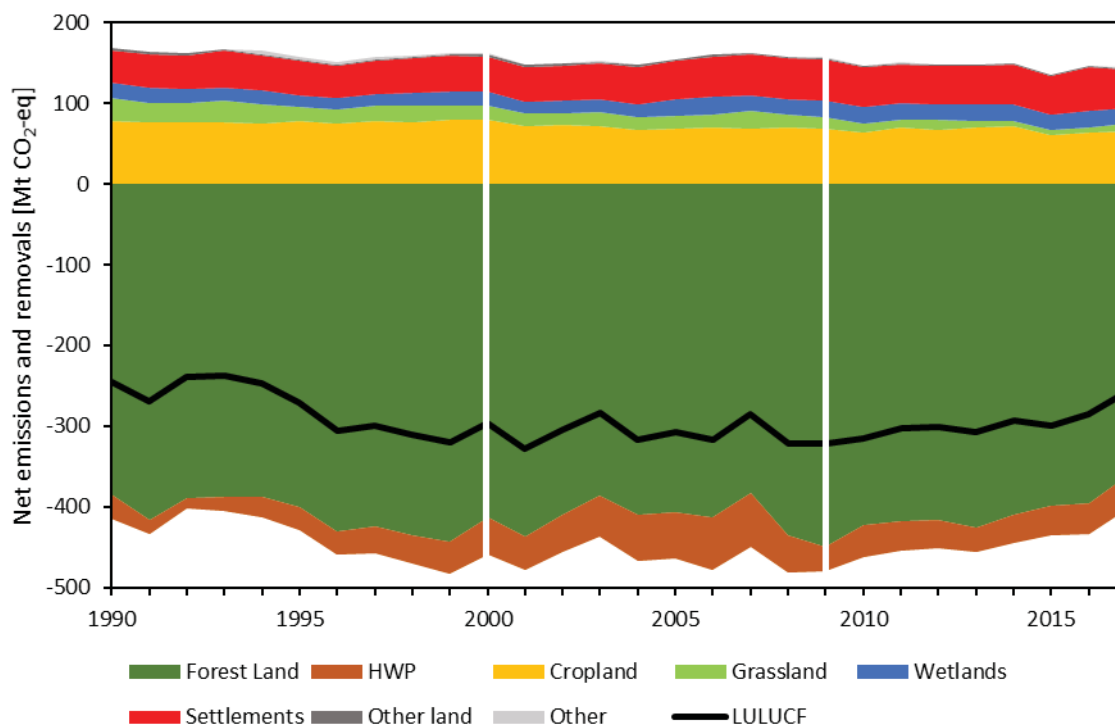
<sup>2</sup> [COM\(2020\) 80 final. Proposal for a Regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation \(EU\) 2018/1999 \(European Climate Law\)](#)

<sup>3</sup> [COM\(2018\) 773 final. A Clean Planet for all. A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy](#)

<sup>4</sup> [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 \(Text with EEA relevance\)](#)

<sup>5</sup> The LULUCF Regulation defines the land accounting category "managed forest land" as land use reported as "forest land remaining forest land" in annual GHG inventories. EU Member States compile national GHG inventories in accordance with the [2006 IPCC Guidelines](#) that defines managed land as "land where human interventions and practices have been applied to perform production, ecological or

structure, without unduly constraining future forest management intensity, such that long-term carbon sinks can be maintained or strengthened. This is achieved by applying sustainable forest management practices, as documented in the reference period from 2000 to 2009, and projecting into the future to set a forward-looking benchmark. It is against this benchmark value (or Forest Reference Level, FRL) that reported emissions and removals from managed forest land from the period 2021 to 2025 will be accounted.



**Figure 1. EU LULUCF net emissions and removals by IPCC land use categories extracted from 2019 EU GHG inventory for the period 1990-2017. The reference period 2000-2009 is marked.**

The LULUCF sector of the European Union (EU)<sup>6</sup> is a net sink, removing more CO<sub>2</sub> from the atmosphere than emitting GHG<sup>7</sup> (Figure 1). From 2000 to 2009 the LULUCF sector shows net removals of, on average, -308 million tonnes of CO<sub>2</sub>-equivalents (Mt CO<sub>2</sub>-eq)<sup>8</sup>. In the EU, only forests (-414 Mt CO<sub>2</sub>-eq) and products from forests, so-called harvested wood products (HWP, -50 Mt CO<sub>2</sub>-eq) are net removals; all other land uses are net emissions. Most of the net removals by forests originate from stable forest land (-369 Mt CO<sub>2</sub>-eq), i.e. managed forest land which in the EU mostly undergoes cycles of tree

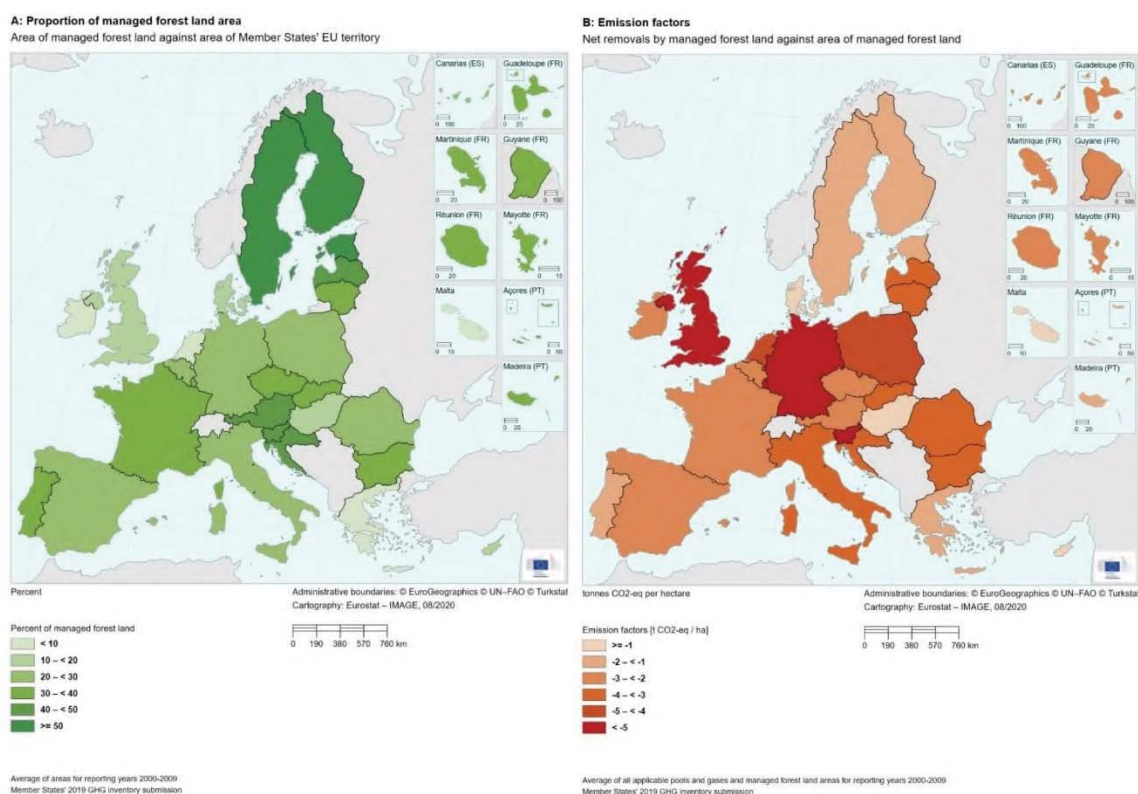
social functions” (volume 4: Agriculture, Forestry and Other Land Use, chapter 3: Consistent Representation of Lands).

<sup>6</sup> In this SWD the European Union includes its current 27 Member States and the United Kingdom, because this delegated act also includes the Forest Reference Level of the United Kingdom. It also includes all Member States that joined the EU during or after the period 2000-2009 for the full length of their GHG reporting time series.

<sup>7</sup> The analysis of this section is based on the 2019 GHG inventory of the European Union (Convention reporting). Quantifications in the text express the average for the period 2000-2009.

<sup>8</sup> Emissions or net emissions are denoted with ‘+’ and removals or net removals with ‘-’.

growth, harvest and regrowth but also includes areas under conservation status and old-growth forests, with the rest coming from land converted to forests (afforestation).



**Figure 2. A: Proportion of Managed Forest Land area by Member States' EU territory. B: Emission factor for Managed Forest Land (net removals by Managed Forest Land against Managed Forest Land area). All data are averages over the period 2000-2009 from the 2019 GHG inventory.**

Member States contribute to this managed forest sink differently, depending on their geographical and economic circumstances (Figure 2). National territories of Estonia, Finland and Sweden have more than 50% area coverage by Managed Forest Land; Croatia, Latvia, Austria, Portugal, Slovenia and Slovakia have shares greater than the EU average of 34%. The picture is different for removals by unit area, so-called emission factors. In the period 2000-2009, Germany, Luxembourg, Slovenia and the United Kingdom have emission factors of, on average, more than -5 t CO<sub>2</sub> ha<sup>-1</sup>; removals per area are above the EU average of -2.7 t CO<sub>2</sub> ha<sup>-1</sup> in Bulgaria, Croatia, Italy, Lithuania, Latvia, the Netherlands, Poland, Romania and Slovakia.

Member States with large proportions of their territory being forested remove sizable amounts of CO<sub>2</sub> from the atmosphere, which, depending on their total area, can make substantial contributions to the EU LULUCF sink. However, the removals per area unit, that is the effectiveness of CO<sub>2</sub> removals by forests, is higher in central and eastern European Member States. Forest age, climatic conditions, tree species, past and present management practices, and disturbance frequency are the main reasons for these differences.

## 2. CONTEXT FOR FOREST REFERENCE LEVELS

Article 8 of the LULUCF Regulation sets out the accounting rules for Managed Forest Land and the FRL accounting benchmark. Article 2 defines Managed Forest Land as ‘land use reported as forest land remaining forest land’ as reported to the United Nations Framework Convention on Climate Change (UNFCCC). Greenhouse gases covered include CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and carbon pools of above-ground and below biomass, litter, deadwood, soil organic carbon and harvested wood products must be reported<sup>9</sup>.

Member States must account their emissions and removals from Managed Forest Land for the periods 2021-2025 and 2026-2030 against the FRLs (Article 8(1)). Credits from managed forest land accounting are limited to 3.5% of the total emissions in the base year (Annex III of the LULUCF Regulation) although removals from dead wood and harvested wood products (except for the paper category) are excluded from this limit (Article 8(2)).

Article 8(5) sets out principles for setting the FRLs including:

- the continuation of sustainable forest management practice for the future compliance periods
- the reference period from 2000 to 2009
- the use of best available data
- the taking into account of the future impact of dynamic age-related forest characteristics in order not to unduly constrain forest management intensity
- the aim of maintaining or strengthening long-term carbon sinks
- the demonstration of consistency between the methods and data used to determine the proposed forest reference level and those used in the reporting to the UNFCCC

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<sup>9</sup> LULUCF Regulation Annex I, and Article 5(4)

### 3. PROCEDURAL STEPS FOR LAYING DOWN FOREST REFERENCE LEVELS (FRLs)

Figure 3 illustrates the governance process for laying down Forest Reference Levels:

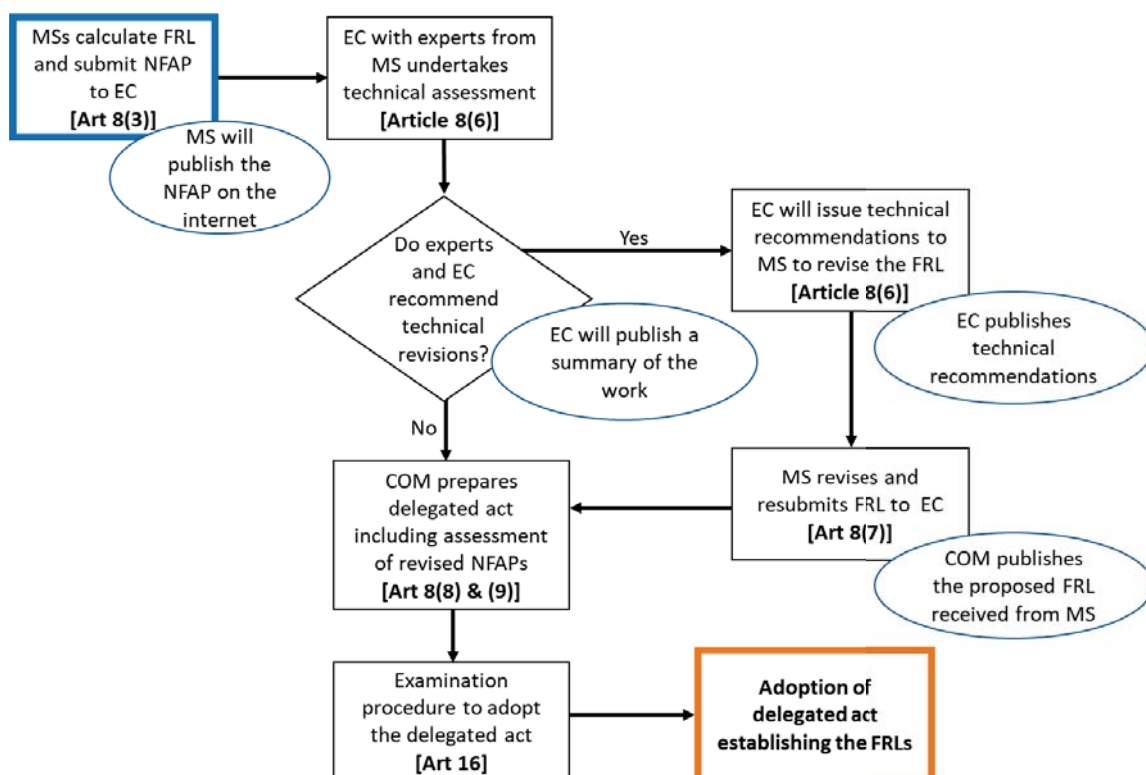


Figure 3. Governance process for laying down Forest Reference Levels.

#### 3.1 Assessment of draft NFAPs

Article 8(3) of the LULUCF Regulation requires Member States to submit to the Commission their NFAP, including a proposed FRL for the period from 2021 to 2025. All Member States submitted such draft NFAPs and published this document on a public website<sup>10</sup>. All Member States except Slovenia submitted their NFAP in English<sup>11</sup>.

The LULUCF Expert Group<sup>12</sup>, established on 30 of October 2018, consists of 10 Type A members with individuals appointed in their personal capacity, five Type C members from research institutions and non-governmental organizations, 27<sup>13</sup> Type D members from competent authorities of EU Member States with up to two representatives per Member State, three Type E members from other public entities and third countries'

<sup>10</sup> Romania's NFAP submission in December 2019 is considered in accordance with Article 8(3).

<sup>11</sup> Commission services provided an English translation of the Slovenian draft NFAP for technical assessment. The draft NFAP of France and Poland was provided in the Member State's native language along with a courtesy English translation.

<sup>12</sup> [Commission expert group on Land Use, Land Use Change and Forestry \(LULUCF\) \(E03638\)](#)

<sup>13</sup> The expert group included representatives from the United Kingdom until the date of withdrawal.



authorities and seven observers. This Expert Group assisted the Commission with the technical assessment of the national forestry accounting plans. Specifically, it assisted the Commission in:

- Carrying out the technical assessment with the view of assessing the compliance of the FRLs with the LULUCF Regulation
- Preparing the delegated act laying down the FRLs for the first compliance period (from 2021 to 2025)
- Providing expertise when preparing the technical recommendations to the Member States

The Expert Group adopted Rules of Procedure<sup>14</sup> and Terms of References<sup>15</sup> in its first meeting on 6 February 2019, which together with the horizontal rules<sup>16</sup> and the call<sup>17</sup> set out the governance for Expert Group operation.

From 1 to 12 April 2019, the LULUCF Expert Group assessed the technical aspects of the draft NFAPs by working in five sub-groups<sup>18</sup>. Experts categorized issues as transparency (information missing or incomplete but likely no impact on the FRL) and accuracy if an impact on the FRL is expected. At the end of the Expert Group meeting sub-groups reported back to the whole expert group to discuss and adopt the findings<sup>19</sup>.

Taking into account the Expert Group report, harmonizing the views across the Member States, and own analysis, the Commission issued technical recommendations to 27 Member States<sup>20</sup> on 18 June 2019. This document also contains the Commission's interpretation – without prejudice to the LULUCF Regulation – of the principles of Article 8(5) and requirements of Annex IV with criteria in Section A and elements in Section B.

During summer and fall 2019 the Commission followed up with voluntary technical bilaterals, explaining in detail the reasons for the technical recommendations and

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<sup>14</sup> LULUCF Expert Group Rules of Procedure

<sup>15</sup> LULUCF Expert Group Terms of Reference

<sup>16</sup> C(2016) 3301 final. Horizontal rules on the creation and operation of Commission expert groups

<sup>17</sup> Call for Applications for the Selection of Members of the Expert Group on Land Use, Land Use Change and Forestry (LULUCFEG)

<sup>18</sup> Allocation of expert group members and observers and NFAPs to subgroups

<sup>19</sup> Compilation of Synthesis Reports - Technical Assessment of National Forest Accounting Plans as requested by the LULUCF Regulation. Individual expert group members could bring forward additional comments which were annexed to the adopted view of the whole Expert Group. In principle adoption was achieved by consensus and only in exceptional cases by vote.

<sup>20</sup> SWD(2019) 213 final. Assessment of the National Forestry Accounting Plans. Note: Romania did not receive technical recommendations as no draft NFAP was received at the time of publication.

discussing possible ways forward<sup>21</sup>. On 2 and 3 October 2019 the Commission organized the third LULUCF Expert Group meeting to discuss possible solutions to frequently occurring issues.

### 3.2 Assessment of revised NFAPs

Article 8(7) requires Member States to communicate their revised proposed FRL to the Commission, taking into account the technical assessment and technical recommendations. To this end, 27 Member States resubmitted revised NFAPs and 23 Member States also revised their FRL<sup>22</sup>. 25 Member States submitted, on a voluntary basis, explanatory notes responding to the Commission recommendations and findings from the Expert Group<sup>23</sup>. In accordance with Art 8(7) the Commission published the FRLs proposed by Member States on 25 February 2020<sup>24</sup>. Nine Member States submitted, on their own initiative or following discussions with the Commission or the Expert Group, corrections to their revised NFAP, including their FRL, or additional material for better understanding (in this document termed Corrigendum<sup>25</sup>).

The Commission undertook a technical assessment of all revised NFAPs, also taking into account, if applicable, corrigenda, in two steps:

- i. Have the technical recommendations been addressed?
- ii. Have the requirements of Art 8(5) and Annex IV of the LULUCF Regulation been met?

While the assessment of the technical recommendations (step i.) was crucial to understand the progress made by the Member State in its revision of the NFAP, it was also necessary to fully assess if all the specific regulatory requirements (step ii.) were compliant.

The Commission proposed a recalculation, therefore, where the FRL proposed by Member States was assessed as significantly not in compliance with the principles and requirements as set out in Article 8(5) and Annex IV of the LULUCF Regulation. All

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<sup>21</sup> The Czech Republic and Romania did not engage in bilateral discussions regarding the recommendations of draft NFAPs. However, Romania engaged in the NFAP/FRL process in fall 2019. Upon request by Romania, the Commission provided technical advice, including two missions to Romania. Romanian authorities submitted the NFAP in December 2019.

<sup>22</sup> All Member States submitted an English version of their revised NFAP. Spain, France, Poland and Slovenia also provided their NFAP in the Member State's language.

<sup>23</sup> Explanatory notes were not provided by Cyprus and Luxembourg. Romania did not receive recommendations in SWD(2019) 213.

<sup>24</sup> Forest Reference Levels proposed by EU Member States. Note that the revised NFAP for Greece was received after the date of the publication.

<sup>25</sup> Member States entitled material submitted after the revised NFAP as “Corrigendum”, “Addendum” or both. For simplicity, this document refers to all documents as “Corrigendum”.

recalculations were communicated to the respective Member State and discussed in at least one bilateral meeting, between February and June 2020. All Member States concerned engaged in the discussions and communicated additional information to the Commission. In some cases, recalculations were withdrawn by the Commission, after supplementary information or discussion, or otherwise put forward as Corrigendum by the Member State.

Issues with no or minor impact on the FRL proposed by Member States were noted (see ANNEX A: Technical assessment), to be addressed in 2027 either by a technical correction<sup>26</sup> or in the LULUCF compliance report to be submitted the Member State in accordance with Article 14(1) of the LULUCF Regulation.

The Commission's assessment, including recalculations, were discussed in the fourth LULUCF Expert Group meeting on 26 and 27 May 2020. This expert group meeting was preceded by a preparatory meeting with Type-A members (individuals appointed in their personal capacity). Extensive discussion, flagging issues or questions and replies, took place before, during and after this expert group meeting<sup>27</sup>. Overall, the Expert Group found the Commission's assessment and recalculation appropriate. Following the meeting, specific observations by the Expert Group were taken into consideration for the draft delegated act. On 22 June 2020 the Commission submitted this draft via a written procedure to the LULUCF Expert Group and also informed the European Parliament and Council of the European Union<sup>28</sup>. The draft act was revised, where applicable, after the Expert Group written procedure and consultation of Commission services. The general public was consulted between 17 August and 14 September 2020<sup>29</sup>.

In October 2020, the Commission adopted the Forest Reference Levels in a delegated act amending Annex IV of the LULUCF Regulation. The power to adopt is given by Article 8(8) if Member States submitted an NFAP and Article 8(9) if no NFAP was submitted<sup>30</sup>.

#### **4. ASSESSMENT OF THE REVISED NFAPs AND FRLs**

Revised NFAPs and, where applicable, revised FRLs were assessed against the recommendations issued on draft NFAPs and the legal requirements of the LULUCF Regulation. Table 1 provides an overview of the proposed and adopted FRL and Corrigendum or recalculation.

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<sup>26</sup> In order to improve the quality of accounting in Managed Forest Land, the FRLs can be adjusted when greenhouse gas inventory methods are upgraded. Member States may submit technical corrections (Article 8(11)) before the end of the compliance period, thereby ensuring consistency with the principles of Article 8(5).

<sup>27</sup> Between Experts during the 4<sup>th</sup> LULUCF Expert Group meeting.

<sup>28</sup> Interinstitutional Register of delegated acts on delegated act laying down FRLs.

<sup>29</sup> Public feedback on delegated act laying down FRLs.

<sup>30</sup> All Member States submitted an NFAP.

According to Art 3(1) definition (7) of the LULUCF Regulation, FRLs shall be expressed in tonnes of CO<sub>2</sub> equivalent per year. The Commission assumed “zeros” for all missing significant figures of FRLs proposed by Member States in kilo tonnes or mega tonnes. The Commission also applied mathematical rounding to the nearest tonne for Malta’s proposed FRL.

**Table 1. Overview of the FRL proposed by Member States in their draft and revised NFAPs, the FRL in the delegated act, and transmitted Corrigendum by the Member State or Recalculation of the FRL by the Commission<sup>31</sup>. FRLs are provided in t CO<sub>2</sub>-eq yr<sup>-1</sup> and include emissions and removals from HWP using the first-order decay function, the methodologies and the default half-life values as defined in the LULUCF Regulation.**

Member State	FRL in draft NFAP	FRL in revised NFAP	FRL in delegated act	Corrigendum, Recalculation
<u>Belgium</u>	-1 378 354	-1 369 009	-1 369 009	
<u>Bulgaria</u>	-5 905 700	-3 021 110	-5 105 986	Recalculation
<u>Czech Republic</u>	-7 685 130	-3 801 350	-6 137 189	<u>Corrigendum</u> , Recalculation
<u>Denmark</u>	+868 000	+354 000	+354 000	
<u>Germany</u>	-39 217 000	-10 022 400	-34 366 906	<u>Corrigendum</u> , Recalculation
<u>Estonia</u>	-1 890 000	-1 750 000	-1 750 000	
<u>Ireland</u>	+282 687	+141 897	+112 670	<u>Corrigendum</u>
<u>Greece</u>	-13 864 580	-3 038 670	-2 337 640	<u>Corrigendum</u>
<u>Spain</u>	-30 703 000	-32 833 000	-32 833 000	
<u>France</u>	-58 295 181	-55 399 290	-55 399 290	<u>Corrigendum</u>
<u>Croatia</u>	-4 533 000	-4 368 000	-4 368 000	
<u>Italy</u>	-19 656 100	-19 656 100	-19 656 100	
<u>Cyprus</u>	-120 280	-122 400	-155 779	Recalculation
<u>Latvia</u>	-54 000	-1 709 000	-1 709 000	<u>Corrigendum</u>
<u>Lithuania</u>	-2 272 240	-5 164 640	-5 164 640	
<u>Luxembourg</u>	-413 000	-426 000 <sup>32</sup>	-426 000	
<u>Hungary</u>	-474 000	-48 000	-48 000	
<u>Malta</u>	-37,6	+37,6	-38	<u>Corrigendum</u>
<u>Netherlands</u>	-1 531 397	-1 531 397	-1 531 397	
<u>Austria</u>	-4 663 000	-4 533 000	-4 533 000	
<u>Poland</u>	-29 433 000	-27 888 000	-28 400 000	<u>Corrigendum</u> , Recalculation
<u>Portugal</u>	-11 165 000	-11 165 000	-11 165 000	
<u>Romania</u>	N/A	-24 068 200	-24 068 200	
<u>Slovenia</u>	-2 582 720	-3 270 200	-3 270 200	
<u>Slovakia</u>	-4 827 630	-4 827 630	-4 827 630	
<u>Finland</u>	-34 770 000	-27 640 000	-29 386 695	<u>Corrigendum</u>
<u>Sweden</u>	-30 556 000	-38 721 000	-38 721 000	
<u>United Kingdom</u>	-16 657 070	-20 701 550	-20 701 550	

In order to adopt sound and technically correct FRLs, the Commission undertook an in-depth assessment whether the revised NFAPs addressed the recommendations and fulfilled the legal requirements of the LULUCF Regulation. The following section “Key

<sup>31</sup> All links point to public websites as communicated by Member States at the point of submission of their documents or latest updates. Links to revised NFAP in original language: [Spain](#), [France](#), [Poland](#), [Slovenia](#).

<sup>32</sup> Luxembourg provides the FRL value by considering the average of GHG emissions and removals in the period 2020-2025 instead of 2021-2025 (see p. 31 of the revised NFAP). The Commission considers this a clerical mistake without an impact on the final FRL number proposed by Luxembourg.

issues in the assessment of revised NFAPs” (and ANNEX A: Technical assessment) explain the six key issues identified in the technical assessment, where:

- Issues with a substantial numerical impact were either addressed by the Member State in a Corrigendum or by the Commission in a recalculation. The following sections “Corrigenda received by Member States” and “Recalculation by Commission” (and ANNEX B: Recalculations) explain the issues that were addressed through Corrigenda or recalculations.
- Other possible issues with no or minor impact proposed by Member States are noted in this document (see also ANNEX A: Technical assessment), and shall be addressed in 2027 either through a technical correction or in the LULUCF compliance report.

The Commission’s assessment concluded that, taking into account Corrigenda submitted by Member States, 23 submitted Forest Reference Levels to be in accordance with the LULUCF Regulation. The Commission undertook recalculations on issues that significantly underestimated the sink of managed forest land for Bulgaria, the Czech Republic, Germany, Cyprus and Poland.

#### **4.1 Key issues in the assessment of revised NFAPs**

This section explains the key issues that the Commission identified in the assessment of the revised NFAPs and how they were addressed – through the submission of a Corrigendum by the Member State, a recalculation by the Commission, a future technical correction or clarification in the compliance report:

- Forest definition: Article 8(5) and Annex IV, Section A (h) requires the FRL to be consistent with the GHG inventories, hence the forest definition used for the emission reporting under the Convention to the UNFCCC. In Annex II of the LULUCF Regulation Member States laid down specific minimum values for area size, tree crown cover and tree height to define forest.

Slovenia and Finland currently use forest definitions in their GHG Inventory that are different from the definitions in Annex II. This inconsistency must be addressed in the LULUCF compliance report to be submitted by Member States in accordance with Article 14(1) of the LULUCF Regulation.

- Managed Forest Land area: Article 2(1) defines Managed Forest Land as “land use reported as forest land remaining forest land” and Annex IV, Section B (e)-i requires Member States to specify the area under forest management. To ensure consistency with the GHG inventory as required by Article 8(5) and Annex IV, Section A (h), the area for Managed Forest Land must match the area of “forest land remaining forest land” as reported in the GHG inventory.

The Commission undertook a detailed assessment for all Member States to identify for which the Managed Forest Land area did not match with the area reported in the GHG inventory, for the year preceding the start of the FRL

projection. Due to the significance of this parameter and absence of adequate explanation, the Commission recalculated the Managed Forest Land area for Germany and Cyprus. All Member States are in any case requested to address the Managed Forest Land area through technical corrections in 2027.

- Consistency of Carbon Pools and greenhouse gases with GHG Inventory: According to Article 8(5), “Member States shall demonstrate consistency between the methods and data used to determine the proposed forest reference level in the national forestry accounting plan and those used in the reporting for managed forest land”. Annex IV, Section B (b) states that the NFAP shall identify “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 Commission thoroughly assessed the GHG inventory consistency and as a consequence recalculated FRLs for Bulgaria, Germany, Cyprus and Poland. Ireland addressed a clerical error through a Corrigendum. Inconsistencies for other Member States mostly related to neglecting emissions from biomass burning, hence resulting in conservative FRL proposals by Member States. As in most cases technical corrections will be necessary, e.g. by making use of the provision for natural disturbances (Article 10), the Commission requests Member States to address all remaining inconsistencies through technical corrections in 2027.

- Dynamic age-related forest characteristics: According to article 8(5), the FRL “shall be based on the continuation of sustainable forest management practice, as documented in the period from 2000 to 2009 with regard to dynamic age-related forest characteristics in national forests, using the best available data”. Annex IV, section B, element (e-iii) sets out that the NFAP shall contain a description of “forest characteristics, including dynamic age-related forest characteristics, increments, rotation length and other information on forest management activities under ‘business as usual’”.

The Commission analysed and categorized how Member States addressed dynamic age-related forest characteristics. All Member States were found to be in line with this legal requirement of the LULUCF regulation.

- Continuation of sustainable forest management practices: According to Art 8(5), “the forest reference level shall be based on the continuation of sustainable forest management practice, as documented in the period from 2000 to 2009 with regard to dynamic age-related forest characteristics in national forests, using the best available data.” Further, the FRL “shall take account of the future impact of dynamic age-related forest characteristics in order not to unduly constrain forest management intensity as a core element of sustainable forest management practice, with the aim of maintaining or strengthening long-term carbon sinks.”

The Commission thoroughly reviewed how Member States described forest management activities and in particular from which period information was used. Next, the Commission assessed how Member States defined harvest intensity, to project past management activities from the reference period to the compliance period. The assessment focussed on the parameters and periods used to define this. Inconsistencies of significance were recalculated for the Czech Republic and Germany. Other issues were noted but found to be broadly in line with the legal requirements of the LULUCF Regulation.

- **Methodological consistency with Greenhouse Gas Inventory:** According to Article 8(5), “Member States shall demonstrate consistency between the methods and data used to determine the proposed forest reference level in the national forestry accounting plan and those used in the reporting for managed forest land”, and to Annex IV, Section A (h), “[...] the model used to construct the reference level shall be able to reproduce historical data from the National Greenhouse Gas Inventory”.

Member States ensure methodological consistency by ex-ante or ex-post model calibration, along with qualitative and quantitative demonstration of modelling outputs against the GHG inventory. The Commission undertook an analysis of the periods used and if methodological consistency with the GHG inventory was assured. Greece and Finland provided Corrigenda to their NFAP addressing methodological inconsistencies through ex-post calibration. The Commission recalculated for model inconsistencies for Bulgaria, Germany and Poland.

ANNEX A: Technical assessment contains the detailed analysis for all six key issues and all Member States. This also includes specific recommendations and requests for technical corrections and adjustments in the LULUCF compliance report in 2027. More detailed technical analysis of the individual NFAPs will be available in a JRC report<sup>33</sup>.

## 4.2 Corrigenda received by Member States

The following list (and also Table 1) provides an overview of the nine corrigenda received from the Member States. These corrigenda either address corrections of specific information in the NFAP, including the FRL, or provide additional information for better understanding. The following Member States submitted corrigenda on specific matters:

- The **Czech Republic** noted the potential use of the natural disturbance provision. The Corrigendum is unrelated to the recalculation for the Czech Republic<sup>34</sup>.

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<sup>33</sup> Korosuo, A., Vizzarri, M., Pilli, R., Fiorese, G., Colditz, R., Abad Vinas, R., Rossi, S., Grassi, G. (2020). Forest reference levels under Regulation (EU) 2018/841 for the period 2021-2025. JRC Science for policy report. Forthcoming.

<sup>34</sup> In the case of CZ, this concerns the continuation of sustainable forest management practices.

- **Germany** provided a detailed description of the model used for estimating emissions from living biomass in the FRL and additional tables of the area development by age-volume classes, including several corrected tables and data of higher precision of Annex I of the German NFAP. This corrigendum indirectly underpins the recalculation.
- **Ireland** corrected a clerical error of the FRL including HWP and provided additional explanations regarding the Managed Forest Land area.
- **Greece** corrected the FRL for methodological consistency with GHG Inventory using ex-post calibration.
- **France** provided extended information and a correction of the Managed Forest Land area with no impact on the FRL.
- **Latvia** provided extensive additional explanation for the modelling of living biomass and other carbon pools. This document adds confidence to the Latvian NFAP but has no impact on the FRL.
- **Malta** provided a clerical correction of the sign of the FRL.
- **Poland** provided clarifications, clerical corrections and additional explanations of harvest intensity with no change of the FRL.
- **Finland** corrected the FRL for methodological consistency with GHG Inventory using ex-post calibration.

### 4.3 Recalculation by Commission

The following list (and Table 1) provides an overview of recalculations:

- The FRL of **Bulgaria** was corrected to ensure Consistency of Carbon Pools and greenhouse gases with GHG Inventory and Methodological consistency with Greenhouse Gas Inventory.
- The recalculation of the FRL for the **Czech Republic** concerned the Continuation of sustainable forest management practices.
- **Germany's** FRL was recalculated to ensure the Managed Forest Land area, the Consistency of Carbon Pools and greenhouse gases with GHG Inventory, the Continuation of sustainable forest management practices and Methodological consistency with Greenhouse Gas Inventory.
- For **Cyprus**, the Managed Forest Land area was corrected and Consistency of Carbon Pools and greenhouse gases with GHG Inventory was ensured.
- The FRL of **Poland** was recalculated to ensure Consistency of Carbon Pools and greenhouse gases with GHG Inventory and Methodological consistency with Greenhouse Gas Inventory.



ANNEX B: Recalculations contains the technical documentation for recalculations by the Commission.

ANNEX C: FRL and reference level without HWP provides a comparison between estimates by Member State.

## ANNEX A: TECHNICAL ASSESSMENT

This Annex provides a detailed overview for all six key issues and for all Member States. This includes, where necessary, Member State-specific analysis, recommendations and requests for technical corrections or clarification in the compliance report to be submitted in accordance with Article 14(1) of the LULUCF regulation in 2027.

### Forest definition

Credible accounting for Managed Forest Land requires the use of the same forest definition for laying down the FRL and for reporting data in Member State GHG inventories. Article 8(5) and Annex IV, Section A (h) requires the FRL to be consistent with the GHG inventories, hence the forest definition used for the emission and removal reporting under the Convention to the UNFCCC. Annex II of the LULUCF Regulation laid down specific minimum values for area size, tree crown cover and tree height to define forest, for each Member State.

The parameters for the forest definition in Member States' GHG inventories<sup>35</sup> was found to be in line with the minimum values of Annex II of the LULUCF Regulation for all Member States except Slovenia<sup>36</sup> and Finland<sup>37</sup> (see Table 2). The Commission considers that in such cases of discrepancy, the FRL should be made consistent with the current GHG inventory<sup>38</sup>. The Commission requests Slovenia and Finland to align the forest definition between Annex II and the GHG inventory and to apply a technical correction to all relevant parameters in the compliance report to be submitted in accordance with Article 14(1) of the LULUCF regulation in 2027.

**Table 2. Minimum values for defining forests in Annex II of the LULUCF Regulation and Member States GHG inventories' National Inventory Reports (NIR) for Slovenia and Finland.**

Member State	Area [ha]		Tree crown cover [%]		Tree height [m]	
	Annex II	NIR	Annex II	NIR	Annex II	NIR
Slovenia	0.25	0.25	30	10	2	5
Finland	0.5	0.5 / 0.25	10	10	5	5

<sup>35</sup> The Forest definition is provided in National Inventory Reports (NIR) to the UNFCCC. For all Member States the consistency was checked against the inventory report for 2019.

<sup>36</sup> In Annex II Slovenia proposed the forest definition corresponding to GHG reporting under the Kyoto Protocol; LULUCF accounting will be based on GHG data reported under the Convention for which Slovenia defines a minimum tree crown cover of 10% and tree height of 2m. Slovenian National Inventory Report of 2019 (p. 230, 360-361)

<sup>37</sup> In Annex II Finland proposed the forest definition corresponding to GHG reporting under the Kyoto Protocol; LULUCF accounting will be based on GHG data reported under the Convention for which Finland stratifies the country into northern and southern Finland with a guide to minimum areas of 0.5 and 0.25 ha, respectively Finnish National Inventory Report of 2019 (p. 297, 440-441). In 2019, Finland consulted the Commission on this inconsistency and included an analysis in the revised NFAP (section 2.2.6, p. 11-12).

<sup>38</sup> The main reason is the significant number of quantitative and qualitative checks of the FRL against the GHG inventory, including data and methods.

## Managed Forest Land area

The LULUCF Regulation applies to the EU territories of the Member States, for which the area of Managed Forest Land sets the geographic scope of the FRL for each Member State. Article 2(1) defines Managed Forest Land as “land use reported as forest land remaining forest land”. Annex IV, Section B (e)-i requires the specification of how the area under forest management was considered as an element in the NFAP. To ensure consistency with the GHG inventory as required by Art 8(5) and Annex IV, Section A (h), the area for Managed Forest Land must match the area of “forest land remaining forest land” as reported in the GHG inventory.

The Managed Forest Land area is key to correctly setting the geographic scope for accounting of Managed Forest Land against the emissions or removals reported in the GHG inventory, and to avoid both double counting and accounting gaps. Nevertheless, neither the static nor the dynamic approach<sup>39</sup> are likely to predict the correct area for the compliance period at the point of laying down the FRL. Consistency of the area for Managed Forest Land with the GHG inventory at the end of the compliance period is of paramount importance. Consequently, all Member States will apply technical corrections following Article 8(11) in the LULUCF compliance report (Article 14(1)) for Managed Forest Land area once the average area in the compliance period is known from GHG inventories. Nevertheless, Member States noted below, also including Member States with inconsistencies smaller than 1000 ha, must take into account additional technical corrections, because their FRLs likely include a technical bias.

An overview of the geographic coverage, including the EU coverage of each Member State’ GHG inventory, is described in the GHG inventory of the European Union<sup>40</sup>. Specific inventories and inventory submission years used as reference for the FRL proposed by Member States are indicated in Table 3<sup>41</sup>. From that GHG inventory, the reporting year corresponds with the year preceding the start of the projection of the FRL. As a matter of principle, at the start of the projection the Managed Forest Land area must correspond to the area reported in CRF Table 4.A for row “forest land remaining forest land”. Exceptions may apply in case of:

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<sup>39</sup> Member States may choose to estimate the FRL based on the area as determined in the year preceding the start of the FRL projection (static approach) or to project area development between the reference period and the compliance period (dynamic approach). The dynamic approach is described in more detail in Box 19 (alternative 2) on page 79 in Guidance on developing and reporting Forest Reference Levels in accordance with Regulation (EU) 2018/841. Some Member States have adapted this methodology to their particular circumstances.

<sup>40</sup> EEA/PUBL/2019/051. For this analysis the 2019 submission was used. The geographic coverage is defined in Table 1.18, column “EU territory coverage (UNFCCC)”.

<sup>41</sup> In line with the EU National Inventory Report inventories of the Kyoto Protocol were used for Denmark (DNM) and France (FRK). For the United Kingdom the Convention inventory (GBR) was used but areas corresponding to overseas territories and Crown dependencies were excluded. With a view to for future accounting in accordance with the LULUCF Regulation, Member States should provide appropriate indication of its emissions and removals for their EU territory, e.g. by sub-categories in CRF reporting tables.

- Exclusion of area reported as unmanaged forests: France<sup>42</sup>, Greece
- Exclusion of non-EU territories by sub-categories in CRF reporting tables: United Kingdom
- “Forest land remaining forest land” with no emission estimation<sup>43</sup>: Bulgaria, Italy, Hungary, Austria

The default reporting year is 2009, because the projection should begin after the reference period (2000-2009), but depending on specific modelling circumstances exceptions may apply. Member States with notable exceptions of very late model starts justified by best available data are: Germany, Estonia, Ireland, Croatia and Portugal.

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<sup>42</sup> In CRF Table 4.1 France reports a total forest area of 761,873 ha as “unmanaged”. In this analysis this area is fully counted towards “forest land remaining forest land”. In the 2020 GHG inventory submission France declares all its forest as “managed”.

<sup>43</sup> In general, it is recommended that Member States with this particularity choose the area reported under “forest land remaining forest land” and model the FRL with one strata for “forests with zero emissions”. This way the Member State ensures that all land in the scope of the LULUCF Regulation is taken into account. Alternatively, the Member State may transparently choose only the areas of “forest land remaining forest land” for which emissions and removals are reported. Croatia also notes a sub-category “out of yield” in CRF table 4.A but estimates emissions and removals. Therefore this option does not apply.

**Table 3. Overview of Reference GHG inventory and submission year, the reporting year used to assess the Managed Forest Land area, the area used in the NFAP and the approach chosen to represent Managed Forest Land in the compliance period.**

Member State	Inventory acronym	GHG inventory Submission year	Reporting year used to assess the area	Area in Table 4.A [ha] <sup>44</sup>	Area in NFAP [ha]	Approach
Belgium	BEL	2019 <sup>45</sup>	2009	690,858	612,978	Static
Bulgaria	BGR	2018	2010	3,631,375 (3,608,784)	3,631,375	Static
Czech Republic	CZE	2019	2010	2,614,224	2,614,224	Static
Denmark	DNM	2018	2010	542,651	529,085	Dynamic
Germany	DEU	2019	2017	10,832,447	N/A	Dynamic
Estonia	EST	2019	2017	2,354,123	2,354,100	Dynamic
Ireland	IRL	2019	2017	446,244	419,411	Dynamic
Greece	GRC	2018	2009	3,354,729 (1,247,687)	1,247,687	Static
Spain	ESP	2018	2010	14,480,239	14,480,238	Static
France	FRK	2019	2010	22,462,751 (21,700,878)	21,700,878	Dynamic
Croatia	HRV	2018	2016	2,312,478	2,312,220	Static
Italy	ITA	2018	2009	7,482,537 (7,283,533)	7,482,540	Static
Cyprus	CYP	2019	2010	158,843	147,726	Static
Latvia	LVA	2019	2009	3,071,133	3,071,000	Static
Lithuania	LTU	2019	2010	2,050,161	2,050,160	Dynamic
Luxembourg	LUX	2020	2010	88,205	88,205	Dynamic
Hungary	HUN	2020	2009	1,876,822 (1,750,392)	1,853,171	Static
Malta	MLT	2020	2009	72	41	Dynamic
Netherlands	NLD	2018	2008	326,059	326,000	Static
Austria	AUT	2018	2009	3,821,828 (3,307,204)	3,822,000	Static
Poland	POL	2019	2009	8,664,325	8,664,000	Static
Portugal	PRT	2018	2016	3,995,734	N/A	Dynamic
Romania	ROU	2019	2009	6,639,904	6,639,904	Static
Slovenia	SVN	2019	2009	1,003,620	1,003,620	Static
Slovakia	SVK	2018	2009	1,978,447	1,978,447	Dynamic
Finland	FIN	2019	2010	21,780,765	21,780,765	Static
Sweden	SWE	2019	2010	27,877,300	27,479,000	Dynamic
United Kingdom	GBR	2019	2011	3,125,272 (3,120,779)	3,120,779	Dynamic

Except for Malta, area differences smaller than the thousand-hectare level have been be disregarded<sup>46</sup>. The following list addresses MS with differences in areas, explanations provided by Member States and the specific Commission views:

<sup>44</sup> Areas correspond to row “forest land remaining forest land”. Area in parenthesis correspond to alternative areas that may apply, see further explanation in the text.

<sup>45</sup> Belgium notes that the 2018 GHG inventory submission was used for Flanders.

<sup>46</sup> For laying down FRLs in a delegated act several Member States provided the area in thousand hectares but stated that it is the same as in the GHG inventory for the reporting year preceding the start of the projection. In LULUCF compliance reports all Member States shall provide the Managed Forest Land area in hectares for the start of the projection and for the compliance period.

- Belgium has a difference of 11% between areas of Managed Forest Land for the FRL and “forest land remaining forest land” in CRF Table 4.A. Belgium provides substantial explanations for each region in the NFAP<sup>47</sup>, where Managed Forest Land is limited to productive forest areas. However, the Commission notes that Belgium does not make a distinction between productive and unproductive forests in the GHG inventory, which leads to inconsistencies and potentially non-compliance in LULUCF accounting. Therefore the Commission requests Belgium to align the area for Managed Forest Land with the area reported in Table 4.A for “forest land remaining forest land”<sup>48</sup> by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)).
- Denmark has a difference of 2.5% between areas of Managed Forest Land for the FRL and “forest land remaining forest land” in CRF Table 4.A and does not provide further explanations. The Commission considers this difference substantial, but given the rather complicated FRL modelling by Denmark a correction could have resulted in unforeseen side effects. Instead, the Commission requests Denmark to align, in a transparent manner, the area for Managed Forest Land with the area reported in CRF Table 4.A for “forest land remaining forest land” by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)).
- Germany did not state an area for Managed Forest Land in its revised NFAP<sup>49</sup> but noted that the area is the same as for “forest land remaining forest land” in the most recent National Inventory Report. However, throughout the NFAP Germany referred to different GHG inventories, and tabular information in the annex on the forest area used for modelling were different from all inventories. This issue was addressed, among others, in the recalculation of the German FRL (see Germany).
- Ireland has a difference of 6% between areas of Managed Forest Land for the FRL and “forest land remaining forest land” in CRF Table 4.A. This difference is due to the current GHG reporting of Ireland to the UNFCCC with no specific transition period for “land converted to forest land” (corresponding to the Afforested land accounting category) entering “forest land remaining forest land”, i.e. the scope of the FRL for Managed Forest Land (see also Corrigendum to the Irish NFAP). For laying down the FRL the Commission considers the difference in area justified. The Commission requests Ireland to align the area for Managed Forest Land with the area reported in CRF Table 4.A for “forest land remaining forest land” by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)).

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<sup>47</sup> NFAP Belgium, section 3.2.2 Area under forest management (p. 17-19)

<sup>48</sup> Reconciliation could be achieved, for instance, by an additional strata for unproductive forest land with zero emissions and removals.

<sup>49</sup> NFAP Germany, section “Assumptions concerning area of Managed Forest Land” (p 13)

- Cyprus has a difference of 7% between areas of Managed Forest Land for the FRL and “forest land remaining forest land” in table 4.A and does not provide further explanations. The Commission found that this difference was not justified and recalculated the FRL of Cyprus for this and other issues (see Cyprus).
- Hungary has a difference of 1.3% between areas of Managed Forest Land for the FRL and “forest land remaining forest land” in CRF Table 4.A. The Hungarian NFAP notes that the area for Managed Forest Land refers to the area covered by trees and is consistent with the National Inventory Report; though this area does not correspond to the areas for which emissions and removals are estimated in the GHG inventory. The Commission notes this ambiguity and requests Hungary to align the area for Managed Forest Land by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)). This alignment may either be with the area reported in CRF Table 4.A for “forest land remaining forest land” or, alternatively and with substantial justification, the area for which emissions and removals are estimated in the GHG inventory.
- Malta’s area difference is an exception because the Member State currently does not estimate emissions and removals from forests. This area refers to forest for which data were available for estimating emissions and removals. The Commission recommends that Malta improves its GHG inventory and estimates emissions and removals for land use categories as required for compliance with the LULUCF Regulation.
- Portugal does not provide the area for Managed Forest land for 2016, i.e. the year preceding the start of the FRL projection. Instead, Portugal presents in its NFAP<sup>50</sup> the area of “forest land remaining forest land” for 2000-2009 and 2021-2025, including the Managed forest land area used in the compliance period employing the dynamic area approach. Assuming a constant annual increase of 28,000 ha in Managed Forest land area between 2009 and 2021<sup>51</sup> the area in 2016 would be approximately 3,983,000 ha, hence a difference of 12,734 ha or 0.3 % to the area in the GHG inventory for 2016. Although the area difference is likely marginal, the Commission requests Portugal to specify the area of Managed Forest Land for the year preceding the start of the projection, and, if applicable, align the area for Managed Forest Land by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)).
- Sweden has a difference of 1.4% (400,000 ha) between areas of Managed Forest Land for the FRL and “forest land remaining forest land” in CRF Table 4.A. Sweden explains the difference in area by not including low productivity forests,

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<sup>50</sup> NFAP Portugal, Section 3.2.5 (p 36)

<sup>51</sup> This assumption was made by the approximate area difference between 2009 and 2021 and is justified by the average annual net area increase in the years 2005-2009 and 2021-2025.

described as being “unmanaged”, in mountain areas in the FRL<sup>52</sup>. The Commission requests Sweden to align the area for Managed Forest Land by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)).

### **Consistency of Carbon Pools and greenhouse gases with GHG Inventory**

According to Article 8(5), “Member States shall demonstrate consistency between the methods and data used to determine the proposed forest reference level in the national forestry accounting plan and those used in the reporting for managed forest land”, and to Annex IV, Section B (b), the NFAP shall identify “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.”

As a matter of principle, carbon pools and greenhouse gases used for laying down the FRL must be the same as in the reference GHG inventory. The Commission thoroughly checked this precondition against quantities and notation keys provided in the reference GHG inventory submission used for setting the FRL. The Commission also assessed the inclusion of mandatory carbon pools in accordance with Art 5(4) of the LULUCF Regulation<sup>53</sup> and the consistency with carbon pools and greenhouse gases listed in Annex I<sup>54</sup> of the LULUCF Regulation. If omissions or inconsistencies were detected, the Commission notes this issue and indicates a need for a future technical correction in accordance with Art 8(11) of the LULUCF Regulation. If the impact was significant, the Commission sought clarification with the Member State with a view of correction in a Corrigendum or recalculation.

#### **Carbon pools and greenhouse gas reporting in CRF tables**

Information on carbon stock changes and emissions and removals from CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O was extracted from each Member States reference GHG inventory submission year (see Table 3). Net carbon stock changes were extracted from CRF Table 4.A (Forest Land), row “forest land remaining forest land” for carbon pools of living biomass, dead wood, litter, mineral soils and organic soils. Net CO<sub>2</sub> emissions and removals of harvested wood products (HWP) were taken from CRF Table 4.Gs1, Approach B

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<sup>52</sup> Explanatory notes by Sweden on recommendation (e)-i from Annex IV Section B (p 6)

<sup>53</sup> Regarding dead wood as an obligatory carbon pool for Managed forest land, several Member States do currently not report emission or removals in its GHG inventory or include those emissions and removals elsewhere. With a view to ensure consistency with the current GHG inventory, the Member States were in these cases requested to also not include or disclose this carbon stock change in its FRL. Instead, those Member States are requested to estimate emissions and removals from dead wood, include those in future GHG inventories, and apply a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)).

<sup>54</sup> For consistency with GHG inventories, the carbon pools from the UNFCCC Convention reporting tables were used, i.e. living biomass, dead wood, litter, organic soils, mineral soils and harvested wood products.



(Production approach). The total HWP was calculated for Member States reporting HWP domestic consumption and export separately. HWP in solid waste disposal sites were not considered.

Emissions from N<sub>2</sub>O fertilization were extracted from CRF Table 4(I) (Direct nitrous oxide emissions from nitrogen inputs to managed soils), row “forest land remaining forest land” for N<sub>2</sub>O. Emissions and removals from drainage and rewetting were taken from CRF Table 4(II) (Emissions and removals from drainage and rewetting and other management of organic and mineral soils), row “forest land”<sup>55</sup> for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O. Emissions from N<sub>2</sub>O mineralization were taken from CRF Table 4(III) (Direct nitrous oxide emissions from nitrogen mineralization/immobilization associated with loss/gain of soil organic matter resulting from change of land use or management of mineral soils), row “Forest land remaining forest land” for N<sub>2</sub>O. Emissions from biomass burning were extracted from CRF Table 4(V) (Biomass burning), row “Forest land remaining forest land” and sub-categories “controlled burning” and “wildfires”<sup>56</sup> for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O.

The full time series of emissions and removals reported in reference Member States’ GHG inventories, including notation keys, was extracted and converted to CO<sub>2</sub>(-eq)<sup>57</sup>. For assessment against carbon pools and greenhouse gases of the FRL, the average emission value over the reference period (2000-2009) is represented in categorical form as emission or removal<sup>58</sup>. In case of using notation keys for all years in the reference period, the aggregate of notation keys will be retained.

#### Linking carbon pools and greenhouse gases between FRL and GHG inventory

Member States’ NFAPs were scrutinized for quantitative and qualitative information regarding carbon pools included in the FRL<sup>59</sup>. All Member States except Luxembourg<sup>60</sup>

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<sup>55</sup> The Commission assumes for that drainage and rewetting, emission and removals reported under “forest land” are representative for Managed Forest Land. This rule only applies to drainage and rewetting due to limitations in the current tabular reporting format. If Member States estimated emission and removals of drainage and rewetting for “forest land remaining forest land”, the Member State is requested to transparently apply this disaggregation in its LULUCF compliance report (Article 14(1)) with a view to avoid double counting or no counting. Only the United Kingdom reports N<sub>2</sub>O emissions from drainage and rewetting disaggregated by “total organic soils” and total mineral soils”. In its NFAP the United Kingdom provided an aggregate for value. Therefore this disaggregation was not pursued.

<sup>56</sup> The separation between “controlled burning” and “wildfires” is necessary in case of applying the natural disturbance provision of Article 10 of the LULUCF Regulation.

<sup>57</sup> Converting carbon to carbon dioxide:  $CO_2 = C * (-44) / 12$ . Converting methane and nitrous oxide to carbon dioxide equivalents: Following the 4<sup>th</sup> IPCC Assessment Report and global warming potential for 100 years (GWP100): For methane:  $CO_2 = CH_4 * 25$ . For nitrous oxide:  $CO_2 = N_2O * 298$ .

<sup>58</sup> An average emission or removal value was calculated if at least one year represented a numerical value.

<sup>59</sup> In most cases information, including tables, was provided in one or several sections including: Preamble/introduction, a dedicated section on carbon pools and greenhouse gases or consistency of pools and gases between FRL and GHG inventory, the calculation of the forest reference level including the consistency analysis by pool and in a few cases in the description of the modelling approach.

provided numerical information. In several cases there is a one-to-many relationship between information provided in the NFAP and tabular reporting in the GHG inventory. Most frequently, often due to the modelling framework, emissions and removals from drainage and rewetting and emissions from biomass burning have been calculated as CO<sub>2</sub>-eq; yet Member States indicated to which gases this aggregate corresponds<sup>61</sup>. Almost all Member States provided individual estimates for each carbon pool<sup>62</sup>. Allocation of estimates to carbon pools and greenhouse gases was unclear for Denmark<sup>63</sup> and Latvia<sup>64</sup>. Portugal and Sweden included indirect N<sub>2</sub>O emission, corresponding to reporting CRF Table 4(IV), in their FRL<sup>65</sup>.

Croatia and Italy estimated zero carbon stock change for dead wood and Italy also for litter. The Commission notes that such estimate is unlikely and discourages such an approach to demonstrate accordance of the FRL with Article 5(4) of the LULUCF Regulation. Instead, Member States should undertake proper efforts and introduce those estimates to their annual GHG inventories and apply a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)). Germany modelled carbon pools and greenhouse gases with inconsistent starting dates or periods. The recalculation addressed this issue (see Germany).

The sum of all carbon pools and greenhouse gases reported in the NFAP should correspond to the FRL. In several cases the numerical precision for individual carbon pools and greenhouse gases differs from the FRL as aggregates of all pools and gases, though, differences are usually small<sup>66</sup> and allow for disentangling issues related to

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<sup>60</sup> Luxembourg is clear about the carbon pools and greenhouse gases included in the FRL (e.g. p 5) and provides disaggregated information by carbon pools in form of figures (e.g. p 30-31) but does not state specific values in the text or tables. In this respect, this qualitative analysis of consistency of carbon pools and greenhouse gases included in the FRL and GHG inventory can be completed.

<sup>61</sup> Germany provided emission and removals from drainage and rewetting together with carbon stock change from organic soils.

<sup>62</sup> Due to specific modelling environments Germany and Austria provided aggregate estimates for litter and mineral soils. Sweden provided one aggregate for litter, mineral and organic soils.

<sup>63</sup> From table 1 of the Danish NFAP (adding estimates in areas I and II and V) the Commission assumes (all in t CO<sub>2</sub>-eq): an aggregate of living biomass, deadwood and litter (+364,000), HWP (-192,000), organic soils (-28,000) and drainage and rewetting with CO<sub>2</sub> (+159,000), CH<sub>4</sub> (+29,000) and N<sub>2</sub>O (+22,000).

<sup>64</sup> From table 1 and p 22-27 of the Latvian NFAP the Commission assumes (all in t CO<sub>2</sub>-eq): living biomass (-2,326,604), dead wood (-335,072), HWP (-1,411,006), an aggregate of litter, organic soils and drainage and rewetting for CH<sub>4</sub> and N<sub>2</sub>O (+2,038,960) and an aggregate of biomass burning for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O (+324,844)

<sup>65</sup> The Commission does not recommend to include emissions from indirect N<sub>2</sub>O of CRF Table 4(IV) (Indirect nitrous oxide emissions from managed soils) into the FRL, because both categories, “Atmospheric deposition” and “Nitrogen leaching and run-off”, are not strictly linked to Managed Forest Land.

<sup>66</sup> Member States with differences greater than ±100 t CO<sub>2</sub>-eq due to precision (all in t CO<sub>2</sub>-eq): Germany (+400), Estonia (-8,600), Croatia (-525), Latvia (+122), the Netherlands (-203), Portugal (-2,000), Slovakia (-1,624) and Sweden (+1,000). The comparison between the aggregate and the FRL prior to

precision from genuine numerical errors. A genuine error was found for Poland regarding an incorrect disaggregated estimate for living biomass<sup>67</sup>, which, among other consistency issues, was corrected in a recalculation (see Poland). The Irish NFAP also contained an aggregation error for HWP<sup>68</sup> which was addressed and corrected in a Corrigendum by Ireland.

#### Analysis of consistency of carbon pools and greenhouse gases with GHG inventory

Table 4 presents the comparison between FRL and GHG inventory for carbon pools and emission and removal estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O. “E” and “R” correspond to emissions and removals, respective, for the average of the GHG inventory for the reference period (2000-2009) and notation keys indicated the reason for no estimation. Cells marked in green indicate that emissions and removals were also estimated in the FRL<sup>69</sup>. Cells in blue indicate the inclusion of an estimate in the FRL that is not reported in the reference GHG inventory, and cells in brown show the omission of estimates from the FRL. Cells in yellow correspond to an estimate in the FRL and notation key “IE” (included elsewhere) in the GHG inventory, which could either mark an error or an estimate to ensure consistency between FRL and GHG inventory<sup>70</sup>; all those cases will not be analysed further and are assumed to reflect consistency between FRL and GHG inventory.

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ex-post calibration shows differences below the  $\pm 100$  t CO<sub>2</sub>-eq threshold for Greece and Finland, yet still considered within the range of precision. Luxembourg cannot be assessed.

<sup>67</sup> NFAP Poland (English translation), Table 24.

<sup>68</sup> NFAP Ireland, Table 20, 25 and 26.

<sup>69</sup> Green color does not indicate a quantitative agreement of the estimate between FRL and GHG inventory or that the estimate of the FRL corresponds to emission or removals as noted for the GHG inventory.

<sup>70</sup> Notation key IE indicates that estimates are reported elsewhere in the GHG inventory, hence avoid double counting in the inventory. Estimates may appear along with another pool, in another table or even another sector. For instance, Ireland estimates deadwood together with litter and reports the aggregated result under litter; Germany reports CO<sub>2</sub> emissions from biomass burning (wildfires) already under carbon stock changes of Table 4.A. Therefore, depending on the modelling framework of the FRL, the specific estimation may ensure the consistency with the GHG inventory – or include an estimate inconsistent with the GHG inventory.

**Table 4. Consistency of carbon pools and greenhouse gases between the FRL and GHG inventory. Green...Estimated for FRL and in GHG inventory, Brown...Estimated in GHG inventory but not for FRL. Blue...Estimated for FRL but not in GHG inventory, Yellow...Estimated for FRL but included elsewhere in GHG inventory. Notation keys for estimates in GHG inventory: R...Removal, E...Emission, IE...included elsewhere, NO...not occurring, NA...not applicable, NE...not estimated. Other abbreviations: FLr..."forest land remaining forest land", LB...living biomass, DW...dead wood, HWP...Harvested Wood Product, LT...litter, min/org SOC...soil organic carbon from mineral or organic soils.**

Type	Carbon stock change and HWP						Fertilization	Drainage and rewetting			Mineralization	Biomass burning		
	Table4.A		Table4.Gs1		Table4.A			Table4(II)		Table4(III)		Table4(V)		
	FLr		net E/R		FLr			Forest land		FLr		FLr		
Pool / gas	LB	DW	HWP	LT	min SOC	org SOC	N <sub>2</sub> O	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	N <sub>2</sub> O	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
Belgium	R	NO	R	NO	NO	NO	NO	NO	NO	NO	NO	NO, IE	E	E
Bulgaria	R	R	R	R	E	NO	NO	NO	NO	NO	E	E	E	E
Czech Republic	R	E	R	NO	NO	NO	NO	NO	NO	NO	NO	E	E	E
Denmark	R	R	E	R	NA	E	NO, IE	NO, IE	E	E	NO	NO, IE	E	E
Germany	R	R	R	E	R	E	NO	NO, IE	E	E	NO	NO, IE	E	E
Estonia	R	R	R	NO	R	E	NO	IE, NA	E	E	NO	NO, IE	E	E
Ireland	R	IE	R	E	E	E	IE	NO, IE	E	E	NO	E	E	E
Greece	R	NA, NO	R	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO	NO	E	E	E
Spain	R	NA	R	NA	NA	NO	NO	NO	NO	NO	NA	NO, IE	E	E
France	R	E	R	NE	NE	NO	NO	NO, NA	NO, NA	NO, NA	NE	E	E	E
Croatia	R	NO	R	NO	NO	NO	NO	NO	NO	NO	NO	E	E	E
Italy	R	R	R	R	NA, NO	NO	IE	NO	NO	NO	NO	NO, IE	E	E
Cyprus	R	NO	E	NO	R	NO	NE	NE, NO	NE, NO	NE, NO	NE	E	E	E
Latvia	R	R	R	NA	NA	E	NO	E	E	E	NO	E	E	E
Lithuania	R	R	R	NO	NE	IE	NO	E	NO, NE	E	NO	E	E	E
Luxembourg	R	R	R	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Hungary	R	R	E	NO	NO	E	IE	NO	NO	NO	NO	IE	E	E
Malta	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
Netherlands	R	R	E	NO	NO	NO	NO	NO, NE, IE	NO, NE	NO, NE, IE	NO	E	E	E
Austria	R	R	R	NE, IE	E	NO	NO	NO	NO	NO	NO	NO, IE	E	E
Poland	R	NO	R	NO	R	E	IE	NA	NA	NA	NO	NO, IE	E	E
Portugal	R	IE	R	E	R	NO	IE	NO	NO	NO	E	E	E	E
Romania	R	NO	R	NO	NO	E	IE	NO	NO	E	NO	E	E	E
Slovenia	R	R	R	NO	NO	NO	NO	NO	NO	NO	NO	E	E	E
Slovakia	R	NO	R	NO	NO	NO	NO	NO	NO	NO	NO	E	E	E
Finland	R	IE	R	IE	R	E	E	IE, NA	E	E	NA	E	E	E
Sweden	R	R	R	E	R	E	E	NO, IE	E	E	NO	IE	E	E
United Kingdom	R	R	R	R	R	R	NO	NO, NE, IE, NA	NO, NE, NA	E	NO	E	E	E

For most Member States the carbon pools (noted as “Carbon stock change and HWP”) are consistent between FRL and GHG inventory. Member States with inconsistencies are:

- Bulgaria: omitted removals from litter and omitted emissions from mineral soils. Along with corrections of other issues the avoided carbon pools were added to the Bulgarian FRL (see Bulgaria).

- Croatia: estimated dead wood with zero while this pool is not estimated in the GHG inventory. In principle, there is an inconsistency, but the quantitative impact is zero.
- Cyprus: omitted removals from mineral soils. Along with corrections of other issues the avoided carbon pool was added to the FRL of Cyprus<sup>71</sup> (see Cyprus).
- Latvia: Inclusion of estimates for litter. The FRL includes litter estimates for organic soils, while no emissions or removals are reported in the GHG inventory.
- Malta: There are currently no estimated emissions and removals in the GHG inventory of Malta. Therefore, in principle, the estimate of living biomass is marked as inconsistency but will not be considered as such with a view to forthcoming emissions estimates by the Member State.
- Poland: Inclusion of estimates for deadwood and litter. Along with corrections of other issues related to carbon pools those pools were removed from the Polish FRL (see Poland).
- Romania: Inclusion of deadwood and omitted emissions for organic soils.

There are no inconsistencies for emissions from N<sub>2</sub>O fertilization (estimated only by Finland and Sweden). Regarding drainage and rewetting, most Member States with specific estimates in the GHG inventory also included corresponding estimates in the FRL. Inconsistencies are noted for Latvia with omitted emission of CO<sub>2</sub><sup>72</sup> and Romania for N<sub>2</sub>O. Portugal includes an estimate of N<sub>2</sub>O mineralization consistent with the GHG inventory, but Bulgaria omits this estimate.

Twelve Member States show inconsistencies for biomass burning with omitted emissions for one or several gases<sup>73</sup>. The consistency analysis for biomass burning is complicated by the possibility to make use of the natural disturbance provision in Article 10 of the LULUCF Regulation, which, in the case of forest fires, requires the separation between wildfires and controlled burning the FRL and the GHG inventory. To date, fourteen Member States have indicated the intention to use the natural disturbance provision, four Member States have noted that natural disturbances are implicitly included in the FRL

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<sup>71</sup> Removals from mineral soils are the same as net carbon stock change for living biomass. Therefore this estimate is likely an error but was included in the FRL for consistency with the reference GHG inventory.

<sup>72</sup> Latvia estimated emission and removals from CO<sub>2</sub> for drainage and rewetting from 2009 onwards. Therefore these avoided emissions only have theoretical relevance.

<sup>73</sup> Bulgaria, Greece, France and Finland show omitted emission of CO<sub>2</sub>, only, and it is possible that the modelling framework of the FRL included those emissions already under other carbon stock changes; hence those Member States should first clarify whether there is an inconsistency in the LULUCF compliance report (Article 14(1)).

and six Member States calculated background levels which are partly included in the FRL<sup>74</sup>.

Twelve Member States had no inconsistency between carbon pools and greenhouse gases included in the FRL and reference GHG inventory. Severe inconsistencies of carbon pools and greenhouse gases between the FRL and GHG inventory as well as erroneous aggregations for the FRL were corrected in Corrigenda by Member States or in Commission recalculations<sup>75</sup>. All other issues are considered as of minor importance and are not addressed when laying down FRLs. The topic of consistency needs to be revisited at the point of LULUCF compliance against the GHG inventory used for accounting. At that stage, issues of lower importance identified in this analysis shall also be addressed by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)).

### **Dynamic age-related forest characteristics**

According to Article 8(5), subparagraph 1, the FRL “shall be based on the continuation of sustainable forest management practice, as documented in the period from 2000 to 2009 with regard to dynamic age-related forest characteristics in national forests, using the best available data”. Annex IV, section B, element (e-iii) sets out that the NFAP shall contain a description of “forest characteristics, including dynamic age-related forest characteristics, increments, rotation length and other information on forest management activities under ‘business as usual’”.

The Member States must define forest management practices and their main parameters (e.g. rotation length, age or size thresholds, target species or cohort) as documented in the period 2000 to 2009 with regard to dynamic age-related forest characteristics. The NFAP must contain adequate information on how age-related forest characteristics and their development over time were considered in the determination of the FRL.

This section addresses two separate but linked questions:

- How did Member States describe age-related forest characteristics?
- If and how did Member States document the evolution of age-related forest dynamics?

The Commission assessed how the Member States consider age in the determination of the FRL, and which information about the dynamics of age-related forest characteristics

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<sup>74</sup> Bulgaria, Estonia, Romania and Slovakia note that the included natural disturbances indirectly or implicitly in the FRL estimation. Ireland, Italy, Luxembourg, Hungary, Portugal and the United Kingdom estimated provisional background levels. Ireland, Portugal and the United Kingdom apply the background level to the FRL.

<sup>75</sup> Specific issues regarding carbon pools and greenhouse gases were corrected for Bulgaria, Germany, Ireland, Cyprus, and Poland.

(i.e. development in the simulation) is reported in revised NFAPs. The following non mutually-exclusive categories are found:

- Age: Specific years or time periods (e.g. 5-year average) that directly enter the modelling tool as input parameters (e.g. yield tables correlating volume with age)
- Size: Dimensional features of individual trees, stands or forest landscapes that enter the modelling tool directly as input parameters e.g., diameter at breast height, basal area, or height
- Other: Criteria or parameters indirectly representing the age-related dynamics e.g., average increment or growth, or volume of growing stock.

The Commission notes that Member States, overall, adequately considered age or age-related proxies in their modelling frameworks to determine the FRL, either explicitly by age or size or implicitly by other parameters. Most Member States specifically consider age in the modelling framework (Table 5), through the use of yield tables (e.g. Bulgaria, Hungary) or as input in modelling frameworks (e.g. Czech Republic, Ireland, Poland). Five Member States use only size as a proxy for age-related characteristics by diameter at breast height or girth and/or basal area (Belgium, France, the Netherlands, Austria, and Slovenia). Five Member States use other parameters to represent the age in the modelling framework, such as increment or growth (Cyprus, Malta, and Portugal), biomass density (Italy), or a combination of those<sup>76</sup> (Greece). Due to frequent natural disturbances, mostly by fires, in those Mediterranean Member States, forest management and forest characteristics are rather uncorrelated to age or size. Finland and Sweden use a combination of age and size (height and diameter at breast height) and Germany uses age and other parameters (volume).

In addition, the Commission assessed whether the revised NFAP contains a transparent description of the development of the relevant age-related forest characteristics e.g., by increment, area, volume of growing stock or biomass density. This information is used to understand if the Member States demonstrate that there is an age-dependent dynamic in the development of forest characteristics from the starting year of projection until 2021-2025, based on the continuation of forest management practices documented in the reference period.

The outcome of this assessment is shown in Table 5. Nine Member States report the evolution of the area (Bulgaria, Germany, Ireland, Croatia, Latvia, Luxembourg, Austria, Poland, the United Kingdom), five Member States report the evolution of the volume (Belgium, the Netherlands, Romania, Slovenia, Sweden), Hungary and Finland report the evolution of area and volume, Greece reports the evolution of increment, and Italy the evolution of increment and biomass density. The remaining Member States provide limited or no information about the dynamics of age-related characteristics. In these cases, the Commission analysis concluded that the “limited / not reported” information

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<sup>76</sup> increment correlated with the volume of growing stock

on the dynamics of age-related forest characteristics does not have an impact on the proposed FRLs, but is considered an issue of transparency in the documentation.

**Table 5. Information on the consideration of age or age-related proxies in modelling and on the development of age-related forest characteristics in NFAPs for the simulation period.**

Member State	Consideration of age or age-related proxies in modelling			Development of age-related forest characteristics				
	Age	Size	Other	Increment	Area	Volume	Biomass density	Not provided
Belgium		X				X		
Bulgaria	X				X			
Czech Republic	X							X
Denmark	X							X
Germany	X		X		X			
Estonia	X							X
Ireland	X				X			
Greece			X	X				
Spain	X							X
France		X						X
Croatia	X				X			
Italy			X	X			X	
Cyprus			X					X
Latvia	X				X			
Lithuania	X							X
Luxembourg	X				X			
Hungary	X				X	X		
Malta			X					X
Netherlands		X				X		
Austria		X			X			
Poland	X				X			
Portugal			X					X
Romania	X					X		
Slovenia		X				X		
Slovakia	X							X
Finland	X	X			X	X		
Sweden	X	X				X		
United Kingdom	X				X			

### Continuation of sustainable forest management practices

According to Article 8(5), “the forest reference level shall be based on the continuation of sustainable forest management practice, as documented in the period from 2000 to 2009 with regard to dynamic age-related forest characteristics in national forests, using the best available data.” Further, the FRL “shall take account of the future impact of dynamic age-related forest characteristics in order not to unduly constrain forest management intensity as a core element of sustainable forest management practice, with the aim of maintaining or strengthening long-term carbon sinks.” As detailed in the Commission’s recommendations on draft NFAPs, allowing the age-related characteristics of the managed forest land to develop over time in the FRL modelling means that the harvest volumes may differ in the compliance period relative to the reference period. Any projected variation in harvested volumes in the compliance period must therefore be justified by the age-related dynamics of forest characteristics.



The assessment of the NFAPs found that the Member States put commendable effort into documenting the forest management practice that took place in the reference period 2000-2009. The majority of Member States defines forest management practices of the reference period in two distinct parts: determining modalities for forest management activities (e.g. rotation lengths, age or size thresholds, target species or cohort), and determining the relative harvest intensity. For example, rotation lengths and age or size thresholds for forest management activities are used to determine the biomass available for wood supply, while the final harvest volume projected for the FRL is modelled to continue the relative harvest intensity as documented in the reference period. Six Member States (Belgium, Denmark, Germany, Lithuania, the Netherlands and Austria) use methodologies based on age- or size class transitions, which are understood to consider the forest management activities and relative harvest intensity simultaneously.

#### Forest management activities

Art 8.5 requires the Member States to define the forest management practices in national forests using the best available data for the period from 2000 to 2009. These practices are then used in the estimation of the FRL. Data and information sources are expected to be national forest inventories, greenhouse gas inventories, and national statistics.

The Commission thoroughly assessed to what extent the period chosen for the definition of forest management activities, such as rotation lengths, age or size thresholds, target species or cohort, is aligned with the reference period 2000–2009 in the revised NFAPs. The period chosen to define the forest management activities can differ from the period chosen to set the harvest intensity (see Assumptions regarding harvest intensity), and the period covered by the comparison between modelled and reported estimates as in the greenhouse gas inventories (see Methodological consistency with Greenhouse Gas Inventory), in the framework of model calibration.

Fifteen Member States define the forest management activities including the period from 2000 to 2009. Few Member States define the management activities by using data from a period shorter but within the period from 2000 to 2009 (Germany, Latvia, Lithuania) or for specific years within the period from 2000 to 2009 (Cyprus, Luxembourg, Romania). Malta assumes no forest management activities on managed forest land. Denmark, Ireland, France, the Netherlands, Poland and Slovenia use data to define forest management activities from periods that partially overlap with the period from 2000 to 2009. The outcomes of this assessment are reported in Figure 4.

The Commission notes that the use of data from a period which is shorter or partially outside the period from 2000 to 2009 may have an impact on the FRL, depending on the modelling assumptions and input parameters, but acknowledges that in the vast majority of cases Member States used appropriate data sources that can be considered the best available data to transparently define and document the forest management practices in the period from 2000 to 2009.



between harvested area and area available for harvest, for instance in terms of maturity and management category, to remain the same as in the reference period. Greece and Sweden projected the ratio between harvest and increment to continue as in the reference period. A similar proxy for harvest intensity was used by Ireland, who calibrated the harvests projected for the FRL using the ratio between harvests and biomass increment observed in the reference period. Cyprus and Portugal projected the harvest volume per hectare to remain as in the reference period, and Malta did not project harvests for the FRL.

There is some variation in the reference period used to define the values for the parameters that determine the harvest intensity (Figure 5). Nineteen Member States used the reference period 2000-2009 to define the values for these parameters, seven Member States employed data from outside 2000-2009 and Germany limited the period to 2002-2007. Member States using data outside the reference period justified their choice, mostly by issues concerning data availability and best available data, and demonstrated that the deviations do not have an impact on the forest management practice as compared to data from the reference period 2000-2009. In the case of Croatia, the impact of the war period was taken into account and documented accordingly. For Germany, the assessment concluded that the shortened period does not represent appropriately the whole reference period 2000-2009, which was therefore corrected (see Germany).

Most Member States considered the reference period data consistently for all parameters used to determine the harvest level, usually calculating the ratio from the averages of the numerator and denominator or using average transition probabilities over the reference period. The assessment noted that Slovenia used harvest data from 2007-2012 (mid-year 2010), and defined harvest level based on the growing stock in 2000. Similar approaches were used by Poland with the average harvest from 2000 to 2009 in relation to growing stock in 2000, and by Latvia with two 5-year intervals for harvest in 2000-2004 and 2005-2009 to growing stock in 2000 and 2005, respectively. The Commission notes reservations against such choices because of potential bias introduced to the estimation of the ratio. However, these approaches described above are considered within the legal interpretation of the regulation.

The Czech Republic used salvage felling only from the period 2005-2009 when this felling type was highest, while all other harvests were based on the whole reference period 2000-2009. This model assumption was found to lead to an inconsistent representation of the reference period 2000-2009 practice, and is addressed in a recalculation (see Czech Republic).

Table 6. Parameters chosen by Member States to define harvest intensity.

Member State	Harvest probabilities defined for strata or age classes	Harvest volume per growing stock <sup>79</sup>	Harvest area per area available for harvest	Harvest per increment	Harvest volume per hectare	No harvest
Belgium	X					
Bulgaria		X				
Czech Republic		X				
Denmark	X					
Germany	X					
Estonia			X			
Ireland				X		
Greece				X		
Spain		X				
France		X				
Croatia		X				
Italy		X				
Cyprus					X	
Latvia		X				
Lithuania	X					
Luxembourg		X				
Hungary		X				
Malta						X
Netherlands	X					
Austria	X					
Poland		X				
Portugal					X	
Romania		X				
Slovenia		X				
Slovakia		X				
Finland			X			
Sweden				X		
United Kingdom			X			

<sup>79</sup> Member States used the total growing stock or growing stock available for wood supply

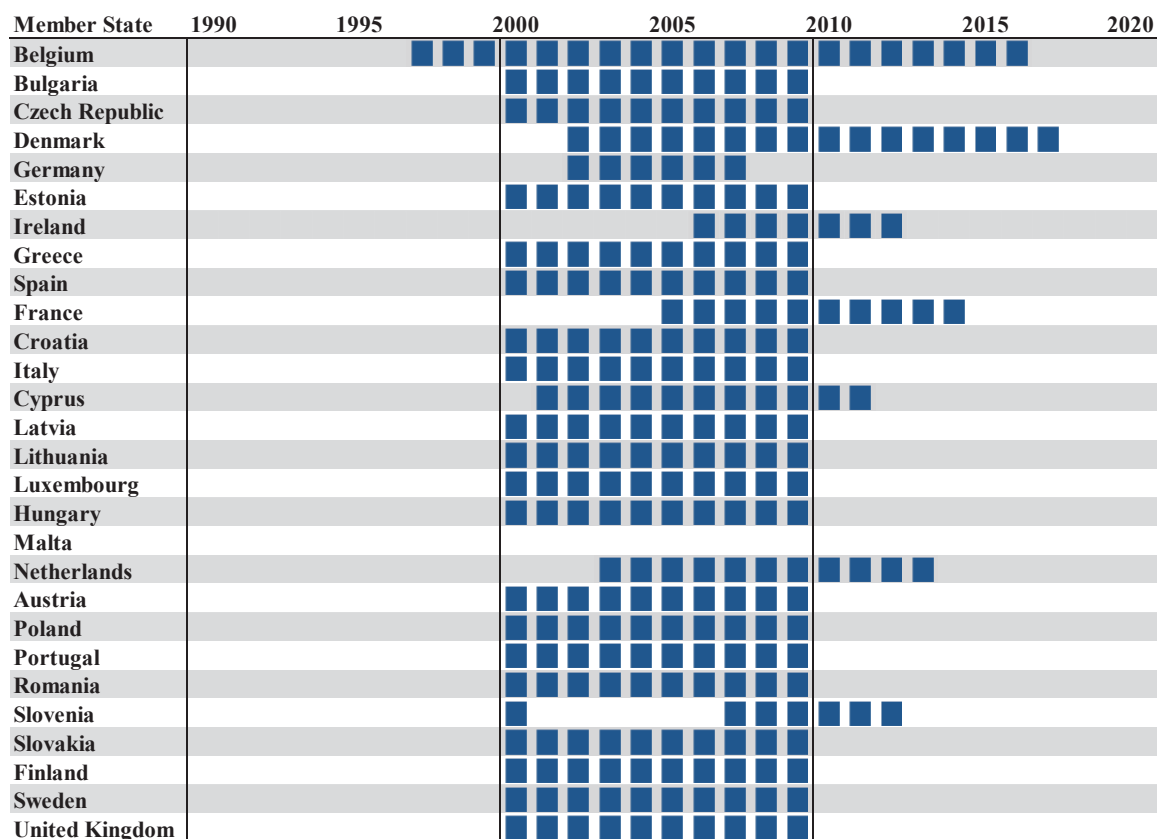


Figure 5. Reference period to determine harvest intensity.

### Methodological consistency with Greenhouse Gas Inventory

According to Article 8(5), “Member States shall demonstrate consistency between the methods and data used to determine the proposed forest reference level in the national forestry accounting plan and those used in the reporting for managed forest land”, and to Annex IV, Section A (h), “[...] the model used to construct the reference level shall be able to reproduce historical data from the National Greenhouse Gas Inventory”.

The Member States must ensure that the methods and approaches used to determine the FRL are consistent with those used in the GHG inventories. To this end, the Member States must demonstrate that the model used to determine the FRL is able to reproduce historical estimates, in particular for the period 2000 to 2009.

The Commission thoroughly assessed whether or not the model output is consistent with estimates reported in the greenhouse gas inventory (Table 7), and for which period this comparison is done in the NFAP (Figure 6). If an inconsistency was found, the Member States should ex-post calibrate the model to ensure the alignment between the model and reported estimates.

Sixteen Member States used the period 2000 to 2009 to compare the modelled estimates with reported estimates. Estonia, Lithuania, the Netherlands, Slovakia and Finland used a period shorter or partially outside the period from 2000 to 2009. Denmark, Ireland, Spain, Cyprus and Slovenia used a comparison period completely outside the 2000 to

2009. Germany and Malta did not provide information on the comparison with historical estimates. Figure 6 provides a summary of assessment outcomes.

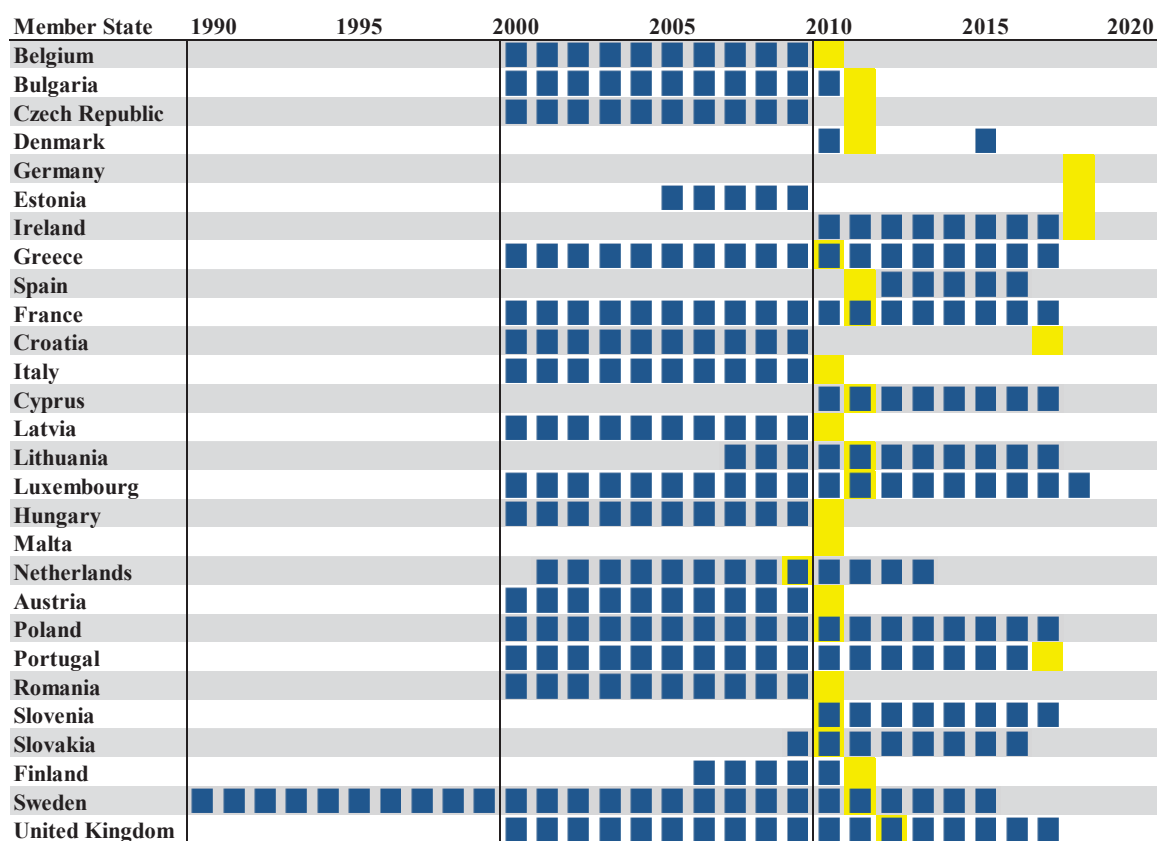


Figure 6. Periods used to compare modelled and reported estimates (blue) and starting year of projection (yellow).

The Commission considers that most Member States achieved consistency between the model output and historical estimates in the greenhouse gas inventories (Table 7). Nine Member States<sup>80</sup> report information on ex-ante efforts to align input data, including ex-ante calibration. Among these, Spain provides very little information on ex-ante model calibration. Slovenia shows inconsistent figures on model consistency with the greenhouse gas inventory. Greece, France, Hungary and Finland performed an ex-post calibration. Some Member States did not explicitly show quantitative consistency between model outputs and historical estimates reported in the greenhouse gas inventory (Bulgaria, Germany, Cyprus, Lithuania, Malta, Austria, and Slovakia). In some cases (Bulgaria for living biomass and Germany and Poland for mineral soils) the Commission decided to correct the model outputs. In the other cases:

- For Lithuania, the Commission notes that the trend in modelled estimates at first diverges from and then converges with the estimates reported in the greenhouse gas inventory. However, the Commission notes and accepts the explanations provided by Lithuania on ex-ante model calibration, in particular about the alignment with historical wood removals;

<sup>80</sup> Czech Republic, Ireland, Spain, France, Cyprus, Lithuania, Romania, Slovakia, and Finland

- Malta does not report emissions and removals on forest land remaining forest land, hence consistency with the GHGI could not be ensured. The Commission notes that this inconsistency will be assessed at the time of compliance, and where necessary, may be subject to a technical correction according to art 8(11).
- Austria provided only qualitative description on consistency between modelled and reported estimates, and showed a comparison about standing stock and increment between modelled and historical estimates;
- For Slovakia, despite some discrepancy between the model output and the greenhouse gas inventory, the Commission notes and accepts the explanations provided by Slovakia in the revised NFAPs, including on the ex-ante model calibration.

**Table 7. Model consistency and model calibration.**

<b>Member State</b>	<b>Model output consistent with GHGI estimates</b>	<b>Ex-ante model calibration</b>	<b>Ex-post calibration</b>
<b>Belgium</b>	X		
<b>Bulgaria</b>			
<b>Czech Republic</b>	X	X	
<b>Denmark</b>	X		
<b>Germany</b>			
<b>Estonia</b>	X		
<b>Ireland</b>	X	X	
<b>Greece</b>			X
<b>Spain</b>	X	X	
<b>France</b>		X	X
<b>Croatia</b>	X		
<b>Italy</b>	X		
<b>Cyprus</b>		X	
<b>Latvia</b>	X		
<b>Lithuania</b>		X	
<b>Luxembourg</b>	X		
<b>Hungary</b>	X		X
<b>Malta</b>			
<b>Netherlands</b>	X		
<b>Austria</b>			
<b>Poland</b>	X		
<b>Portugal</b>	X		
<b>Romania</b>	X	X	
<b>Slovenia</b>	X		
<b>Slovakia</b>		X	
<b>Finland</b>		X	X
<b>Sweden</b>	X		
<b>United Kingdom</b>	X		

## ANNEX B: RECALCULATIONS

Commission recalculations only address specific issues with a notable or significant numerical impact on the FRL, while maintaining the overall structure of a Member State NFAP.

The Commission explored various options for proposed corrections and recalculations, including supplementary proposals and data provided by Member States. The following recalculations, however, only demonstrate the approach selected for estimating the FRL as laid down in the delegated act.

### Bulgaria

Table 8. FRL for Bulgaria (t CO<sub>2</sub>-eq yr<sup>-1</sup>).

	With HWP	Without HWP
Draft NFAP	-5,905,000	-5,589,000
Revised NFAP	-3,021,000	-2,723,000
FRL in delegated act	-5,105,986	-4,808,056

There is a difference of, on average, -2.6 Mt CO<sub>2</sub>-eq yr<sup>-1</sup> in the period 2001-2009 between the model output and the GHG inventory estimates (submission 2018) for emissions and removals in forest biomass (Figure 42, page 90 of Bulgarian NFAP; Table 9). It is not possible to calculate the carbon stock change for years 1999-2000 because of missing information. Therefore, year 2000 is excluded from this calculation.



**Table 9. Detailed calculation of the carbon stock changes in living biomass (above- and belowground) for total forest land in the period 2001-2009, and comparison with GHG inventory estimates (submission 2018). The calculation of the offset value is also provided.**

Parameters	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Carbon stock (t C ha <sup>-1</sup> ) <sup>(1)</sup>	53.30	53.59	54.14	54.84	54.59	55.42	56.15	56.97	57.69	58.24
Carbon stock change per hectare <sup>(2)</sup>		0.29	0.55	0.70	-0.25	0.83	0.73	0.82	0.72	0.55
Area (ha) <sup>(3)</sup>	3,375,000	3,441,000	3,489,000	3,526,000	3,625,000	3,651,000	3,669,000	3,680,000	3,698,000	3,725,000
Total carbon stock change (t CO <sub>2</sub> -eq) <sup>(4)</sup>		-3,658,930	-7,036,150	-9,050,067	3,322,917	-11,111,210	-9,820,690	-11,064,533	-9,762,720	-7,512,083
Average emissions/removals (t CO <sub>2</sub> -eq yr <sup>-1</sup> )						<b>-7,299,274</b>				
Reported emissions and removals in the GHGI 2018 (t CO <sub>2</sub> -eq yr <sup>-1</sup> )		-11,810,126	-10,014,556	-10,034,309	-9,997,204	-9,983,984	-9,705,493	-9,699,777	-9,716,238	-9,718,613
Average emissions and removals in GHGI 2018 (t CO <sub>2</sub> -eq yr <sup>-1</sup> )						<b>-9,877,926</b>				
Proposed Offset value (t CO <sub>2</sub> -eq yr <sup>-1</sup> ) <sup>(5)</sup>										<b>-2,578,652</b>

Notes:

(1) Total Forested Lands' values, Table 7, p. 46 of NFAP of Bulgaria.

(2) Calculated using the stock-difference method (see Equation 2.5, Chapter 2, IPCC 2006 Guidelines).

(3) Annual values of the area of Total Forested Lands, Table 4, p. 41-42, NFAP of Bulgaria.

(4) Calculated as follow:

$$CSC_i = CSC_{i,A} \cdot A_i \cdot \left( -\frac{44}{12} \right)$$

where:  $CSC_i$  is the carbon stock change for the year  $i$  (t CO<sub>2</sub>-eq yr<sup>-1</sup>);  $CSC_{i,A}$  is the carbon stock change per hectare for the year  $i$  as calculated using the stock-difference method (t C ha<sup>-1</sup>);  $A$  is the cumulative area of Total Forested Lands in the year  $i$  as retrieved from Table 4, p. 41-42 of NFAP of Bulgaria (ha yr<sup>-1</sup>).

(5) Calculated as the difference between reported (2018 GHG inventory submission) and modelled emissions and removals in the period 2001-2009, as follow:  
 $-9,877,926 - (-7,299,274) = -2,578,652 \text{ tCO}_2\text{e yr}^{-1}$

As recommended in Forsell<sup>81</sup>(section 2.4.4), in cases where the two trends show a consistent behaviour across time (in this case, as shown in Fig. 42, p. 90 of the Bulgarian NFAP), an adjustment factor of the projected estimates can be calculated by comparing the overlap between a set of annual estimates composed from as many years as possible. In this case, the calculated offset value in Table 9 of this document is used to correct the modelled emissions and removals for living biomass in the period 2021-2025 (see Table 10). Calibrated consistently with the GHG inventory estimates (2018 GHGI submission) for the period 2001-2009, the model adjustment simulates a biomass sink of -5.2 Mt CO<sub>2</sub>-eq yr<sup>-1</sup> (see Table 10).

**Table 10. Detailed implementation of the offset value in the period 2021-2025 in t CO<sub>2</sub>-eq yr<sup>-1</sup>.**

<b>C pools and gases</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>Average 2021-2025</b>
Modelled emissions and removals in living biomass pool <sup>(1)</sup>	-3,209,200	-2,886,340	-2,608,250	-2,313,910	-2,033,960	<b>-2,610,332</b>
Proposed Offset value <sup>(2)</sup>			<b>-2,578,652</b>			
Corrected emissions and removals in living biomass pool <sup>(3)</sup>	-5,787,852	-5,464,992	-5,186,902	-4,892,562	-4,612,612	<b>-5,188,984</b>

Notes:

<sup>(1)</sup> Table 34, p. 90, NFAP of Bulgaria.

<sup>(2)</sup> Calculated (see Table 9).

<sup>(3)</sup> Calculated by adding the proposed offset value to the annual modelled emissions and removals in the living biomass pool.

Based on previous calculation (see Table 10) the FRL value for Bulgaria is adjusted (see Table 11). Please note that the adjusted FRL also includes previously missing emissions and removals in the litter and mineral soil carbon pools as averages over the period 2000-2009. Detailed explanation are included in Table 11.

<sup>81</sup> Guidance on developing and reporting Forest Reference Levels in accordance with Regulation (EU) 2018/841

**Table 11. Forest Reference Levels (proposed and adjusted), including and excluding the emissions and removals associated with Harvested Products in t CO<sub>2</sub> year<sup>-1</sup>.**

<b>C pools and gases</b>	<b>Modelled (2021-2025) by Bulgaria</b>	<b>GHG inventory 2018 (2000-2009)</b>	<b>Corrected value(s)</b>
Living biomass	-2,610,332 <sup>(1)</sup>		-5,188,984 <sup>(2)</sup>
Deadwood	-167,290 <sup>(1)</sup>		-167,290
Harvested Wood Products	-297,930 <sup>(1)</sup>		-297,930
Biomass burning	54,430 <sup>(1)</sup>		54,430
Litter	Not included	-166,904 <sup>(3)</sup>	-166,904
Mineral soil	Not included	660,692 <sup>(3)</sup>	660,692
<b>FRL incl. HWP</b>	<b>-3,021,122</b>		<b>-5,105,986</b>
<b>FRL excl. HWP</b>	<b>-2,723,192</b>		<b>-4,808,056</b>

Notes:

<sup>(1)</sup> Table 34, page 90, NFAP of Bulgaria.

<sup>(2)</sup> Emissions and removals in living biomass pool, corrected by using the offset value (see Table 10).

<sup>(3)</sup> Average value of emissions and removals in the period 2000-2009 (Source: Tables 4.A, 2018 GHG inventory submission, and inventory years from 2000 to 2009).

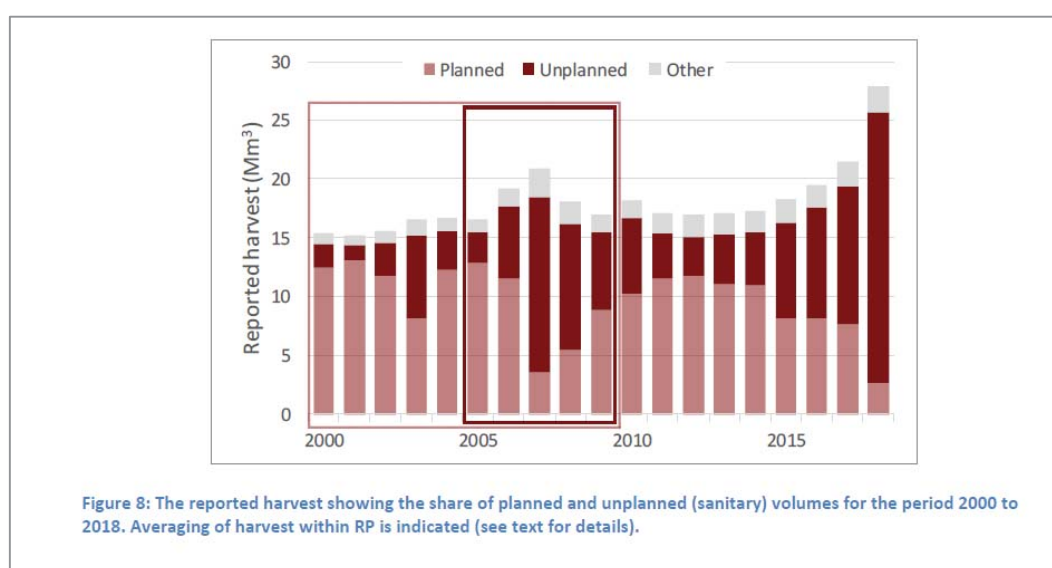
## Czech Republic

**Table 12. FRL for the Czech Republic (t CO<sub>2</sub>-eq yr<sup>-1</sup>).**

	With HWP	Without HWP
Draft NFAP	-7,685,130	-6,585,640
Revised NFAP	-3,801,350	-2,208,230
FRL in delegated act	-6,137,189	-4,739,425

### Wood removals and harvested wood products

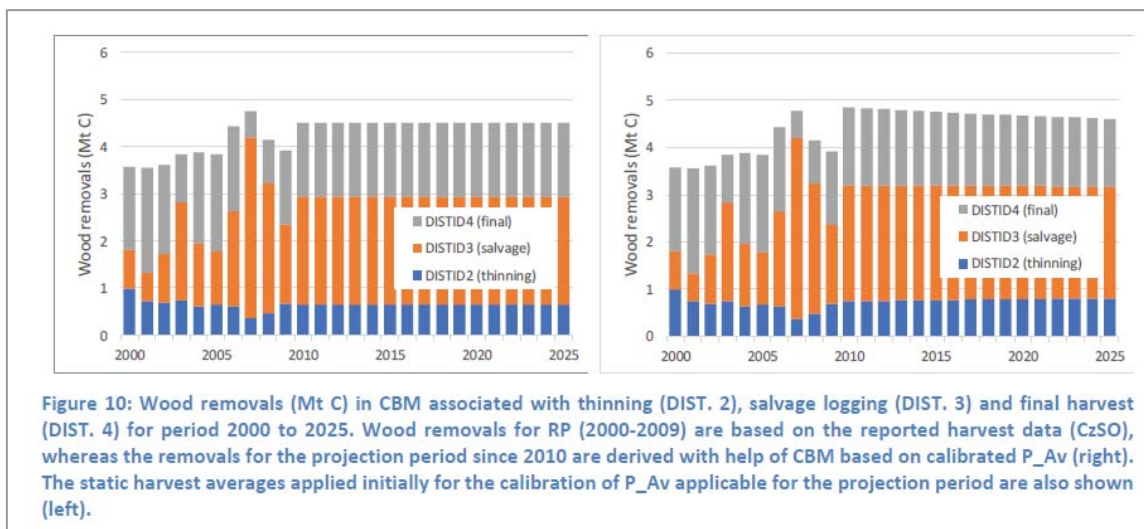
The Czech Republic considers wood removals separately for planned fellings and unplanned fellings (salvage fellings). In the Czech FRL, the wood removal in planned fellings is based on the ratio of harvest to available biomass observed in the reference period 2000-2009, while unplanned fellings (salvage felling) are based on the period 2005-2009 (Figure 7).



**Figure 7. Extract from the Czech NFAP (Fig. 8 on p. 27), showing the reference period used for final fellings and thinnings (‘Planned’) and salvage logging (‘Unplanned’), mostly due to insect infestations. As described in the Czech NFAP (p. 26), the harvest volume in ‘Other’ (residue extraction) is allocated between the planned and unplanned harvests.**

The wood removals as reported in the Czech NFAP are shown in Figure 8 of this document, and the underlying data is detailed in Table 13 of this document.

In 2000-2009, the total average harvest volume was equal to 3.952 MtC yr<sup>-1</sup> (incl. roundwood and residue extraction from planned and unplanned fellings). In the FRL, the Czech Republic considered the harvest volume from the reference period as a sum of the average salvage logging in 2005-2009 (2.276 MtC yr<sup>-1</sup>) and average planned harvests in 2000-2009 (sum of thinning and final felling, equal to 2.228 MtC yr<sup>-1</sup>), which equals to 4.504 MtC yr<sup>-1</sup>. In other words, the approach used by the Czech Republic overestimates the total harvests during 2000-2009 by 0.552 MtC yr<sup>-1</sup>, or 12.263% (Table 13).



**Figure 8.** Extract from the Czech NFAP (Fig. 10 on p. 31). The figure on the right-hand side shows the wood removals in 2000-2025. In this document, we consider the right-hand side figure (calibrated results).

For the compliance period 2021-2025, the total wood removals reported by the Czech Republic are  $4.627 \text{ Mt C yr}^{-1}$ . In this estimate, the Czech Republic has used the average of 2000-2009 for determining final felling and thinning volumes, but a shorter period of 2005-2009 to determine the salvage felling volume. As determined above, the approach used by the Czech Republic overestimates the harvests by 12.263%. To remove this overestimate from the FRL, the total harvest in the compliance period 2021-2025 is reduced by 12.263%, corresponding to  $0.567 \text{ Mt C yr}^{-1}$  ( $4.627 \text{ Mt C yr}^{-1} * 12.263\%$ ). As a result, the EC calculates that using the period 2000-2009 as reference for all fellings (incl. salvage fellings), the total fellings in the period 2021-2025 are  $4.060 \text{ Mt C yr}^{-1}$  (Table 14).

The same reduction of total harvest volume, 12.263%, is reflected directly in the harvested wood product (HWP) estimates. To estimate the impact on HWP pool, this reduction in the inflow of wood is applied as a relative reduction of 12.263% in the HWP pool, reducing thereby the HWP carbon stock change from  $434.49 \text{ kt C yr}^{-1}$  to  $381.21 \text{ kt C yr}^{-1}$  (12.263%, equal to the reduction in wood removals, Table 14).

**Table 13. Wood removals as reported in Fig. 10 of the Czech NFAP, in MtC yr<sup>-1</sup>.**

	<b>DISTID2 (thinning)</b>	<b>DISTID3 (salvage)</b>	<b>DISTID4 (final)</b>	<b>Total harvest</b>
2000	1.000068	0.813972	1.760949	3.574989
2001	0.739887	0.586509	2.226272	3.552668
2002	0.686449	1.045504	1.876562	3.608515
2003	0.754027	2.073775	1.003881	3.831683
2004	0.623611	1.337579	1.918354	3.879544
2005	0.666581	1.123268	2.048551	3.838399
2006	0.627768	2.007578	1.786045	4.421391
2007	0.371292	3.828205	0.560566	4.760064
2008	0.470938	2.751317	0.921050	4.143305
2009	0.685143	1.670337	1.551293	3.906773
2010	0.743517	2.452340	1.645343	4.841200
2011	0.747673	2.448948	1.626047	4.822667
2012	0.752109	2.444925	1.608014	4.805048
2013	0.757720	2.441133	1.587745	4.786598
2014	0.763427	2.436237	1.567591	4.767254
2015	0.767878	2.431471	1.550228	4.749577
2016	0.772229	2.426398	1.533861	4.732488
2017	0.776696	2.419803	1.519388	4.715888
2018	0.780729	2.413420	1.506041	4.700189
2019	0.783086	2.406912	1.494683	4.684681
2020	0.786135	2.400566	1.482529	4.669230
2021	0.790088	2.394548	1.468541	4.653178
2022	0.792219	2.388653	1.458888	4.639761
2023	0.794210	2.383036	1.449099	4.626345
2024	0.796017	2.377546	1.440888	4.614450
2025	0.797143	2.372197	1.433272	4.602611
Average 2000-2009	0.662576 <sup>(1)</sup>	1.723804	1.565352 <sup>(1)</sup>	3.951733
Average 2005-2009		2.276141 <sup>(1)</sup>		
Avg. 2005-2009 for salvage felling, avg. 2000-2009 for thinning and final felling				4.504070 <sup>(1)</sup>
Difference		0.552337		0.552337 <sup>(2)</sup>

Notes:

(1) The values used by the Czech Republic for determining the FRL.

(2) 12.263% of the avg. 2005-2009 for salvage and 2000-2009 for planned felling

**Table 14. The wood removals and HWP in the Czech NFAP and the JRC recalculation for the compliance period 2021-2025.**

<b>2021-2025</b>	<b>Parameter</b>	<b>Mt C yr<sup>-1</sup></b>	<b>%</b>
Total wood removals	Total wood removals <sup>(1)</sup>	4.627269	
	Overestimated amount	0.567445 <sup>(3)</sup>	12.263 <sup>(4)</sup>
	Recalculated total wood removals <sup>(2)</sup>	4.059824	
HWP	HWP in the NFAP <sup>(5)</sup>	0.43449	
	Overestimated amount	0.053282	12.263 <sup>(6)</sup>
	Recalculated HWP <sup>(2)</sup>	0.381208	

Notes

(1) Figure 7 and Table 13.

(2) Value reported in the NFAP minus the overestimated amount.

(3) Relative overestimate in the RP (12.263%) multiplied by the total removals reported by the Czech Republic for the compliance period 2021-2025.

(4) The overestimated share relative to total wood removals.

(5) Table 13 of the NFAP.

(6) The overestimated share in the HWP pool is equal to overestimated share of the total fellings.

## Living biomass

As detailed in Table 16 of this document, the reduced wood removals in the CP, 0.567 Mt C yr<sup>-1</sup>, are added to the stock change reported for living biomass in table 13 of the NFAP (p. 36). This addition reflects the impact of the reduced wood removal estimate on above-ground biomass.

In addition, the reduced wood removals affect the below-ground biomass pool. The stock-change in below-ground biomass is adjusted using the root-to-shoot ratios reported in the National Inventory Report 2019 of the Czech Republic, weighted by the area share reported for different tree species in the Czech NFAP (Table 15). For the below-ground biomass, this calculation results in an adjustment of the stock change by +0.123 Mt C yr<sup>-1</sup>, as shown in Table 16 of this document.

**Table 15. Root/shoot ratio used in the calculations for estimation of below-ground biomass.**

Tree species	Root/shoot ratio <sup>(1)</sup>	Area share <sup>(2)</sup>
Beech	0.232	0.2
Oak	0.231	0.08
Pine	0.229	0.17
Spruce	0.205	0.55
<b>Weighted average</b>	<b>0.21656</b>	

Notes:

<sup>(1)</sup> NIR 2019 (p. 283).

<sup>(2)</sup> Relative share of species groups reported in the NFAP for 2021-2025 (Figure 4 on p. 16).

**Table 16. The estimates of the contribution of different carbon pools, as reported in the Czech NFAP and after the adjustments by the Commission.**

2021-2025	Carbon pool	Adjustment by the JRC [kt C yr <sup>-1</sup> ]	Δ C [kt C yr <sup>-1</sup> ]	Δ CO <sub>2</sub> [kt CO <sub>2</sub> -eq yr <sup>-1</sup> ] <sup>(2)</sup>
Reported in NFAP <sup>(1)</sup>	Above-ground biomass		Not provided	Not provided
	Below-ground biomass		Not provided	Not provided
	Living biomass in total		599.93	-2,199.75
	Dead wood		2.31	-8.48
	HWP		434.49	-1,593.13
	<b>FRL excluding HWP</b>		<b>602.24</b>	<b>-2,208.23</b>
	<b>FRL including HWP</b>		<b>1036.73</b>	<b>-3,801.35</b>
Calculated by the JRC	Above-ground biomass <sup>(3)</sup>	+567.445		
	Below-ground biomass <sup>(4)</sup>	+122.886		
	Living biomass in total	+690.331	1,290.261	-4,730.955
	Dead wood	0	2.31	-8.48
	HWP <sup>(3)</sup>	-53.282	381.208	-1,397.764
	<b>FRL excluding HWP</b>		<b>1,292.571</b>	<b>-4,739.425</b>
	<b>FRL including HWP</b>		<b>1,673.779</b>	<b>-6,137.189</b>

Notes

<sup>(1)</sup> Table 13 on p. 36 of the NFAP of the Czech Republic.

<sup>(2)</sup> Δ C x [-44/12]

<sup>(3)</sup> The overestimated share in % multiplied by the total removals reported by the Czech Republic for the CP (12.263% x 4.627 Mt C yr<sup>-1</sup>), as determined in Table 13.

<sup>(4)</sup> Adjustment of the above-ground biomass x R<sub>weighted average</sub> in Table 15 of this document.

## Germany

Table 17. FRL for Germany (t CO<sub>2</sub>-eq yr<sup>-1</sup>).

	With HWP	Without HWP
Draft NFAP	-39,217,000	-33,286,000
Revised NFAP	-10,022,400	-1,415,400
FRL in delegated act	-34,366,906	-26,209,877

Taking into account the work of the Expert Group, as reflected in the technical recommendations<sup>82</sup>, the Commission noted inconsistencies regarding Art 8(5) and Annex IV, Part A (h) of Regulation (EU) 2018/841, specifically with respect to data and methods used in the German NFAP and the German GHG inventory and the reference period 2000-2009. This recalculation addresses those issues for all carbon pools and greenhouse gases included in the German GHG reporting. The Commission notes that Germany has provided corrected data sets and additional information in an Addendum and Corrigendum to its revised NFAP as well as directly to the Commission which is taken into account in this recalculation. Germany also contributed by delivery of methodological proposals and supporting calculations, regarding at least for issues addressed in sections Emission factors for living biomass for the reference period 2000-2009, Compliance period and Adjustments for HWP.

### General approach

In recalculating the German FRL, and after consultations with Germany, the Commission used the following approach. For meeting consistency as stipulated in Art 8(5) and Annex IV, Part A (h) of Regulation (EU) 2018/841:

- The reference GHG inventory submission used in setting the FRL is 2019.
- The Reference period 2000-2009 is applied to all pools and gases included in the GHGI 2019.
- The pools and gases included in Germany's GHGI 2019 are: Living biomass, Deadwood, Mineral soils and Litter, Organic soils and Drainage (CRF Table 4(II)), Harvested wood products, and Forest fires.

### Emission factors for living biomass for the reference period 2000-2009

The matrix model used in Germany's FRL proposal describes the stock-change of living biomass in 2002-2007 and is based on the German National Forest Inventory 2002 and Inventory Study 2008 (see German NFAP). The weighted emission factor of this model (NFAP Addendum and Corrigendum, Table 6, amended to NFAP, Annex 1, Table I-2: -1.72 t CO<sub>2</sub>-eq ha<sup>-1</sup> yr<sup>-1</sup>), however, is not representative for the full reference period (2000-2009).

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<sup>82</sup> [SWD\(2019\) 213 final. Assessment of the National Forestry Accounting Plans.](#)



In consultations with Germany it was decided to adjust net emissions from living biomass to reflect the full reference period, using a correction factor based on emission factors estimated by the logging factor method as described by Roehling et al. (2016)<sup>83</sup>. This method provides annual emission factors by using the periodical averages of stock changes in GHG reporting as a basis, but modulating these with annual harvest data. This can be interpreted as a surrogate method described in IPCC guidelines. The method was applied using updated data on harvest, which are consistent with the data as referenced in the GHG inventory (referenced there as <http://faostat3.fao.org/home/E>). The same harvest data also serve for the proportional adjustment of the HWP inflow (see Adjustments for HWP).

Table 18 (provided by Germany) shows the emission factors used in this recalculation of the German FRL, and the underlying harvest data. The ratio for emission factors was used to correct for the reference period for living biomass (see Overview of the approaches for pools and gases); the ratio for harvests for the adjustment in the HWP pool (see Adjustments for HWP).

**Table 18. Emission factors for the reference period as used in the recalculated German FRL, and the underlying harvest data.**

Year	EF (using Roehling et al. (2016) logging factor method) [t C ha <sup>-1</sup> yr <sup>-1</sup> ]	Annual harvest based on Faostat, calibrated with German NFI [m <sup>3</sup> o.b.]
2000	0.955	123,671,605
2001	1.458	91,004,951
2002	0.460	97,831,353
2003	0.490	90,504,077
2004	0.466	96,432,663
2005	0.448	100,864,165
2006	0.410	110,228,980
2007	0.306	135,610,116
2008	0.990	101,297,196
2009	1.131	87,937,665
Average 2002-2007	0.430	105,245,226
Average 2000-2009	0.711	103,538,277
<b>Ratio between both averages</b>	<b>1.655</b>	<b>0.984</b>

#### Area of Managed Forest Land (MFL)

The revised German NFAP, section “Assumptions concerning area of Managed Forest Land”, states that the area of managed forest land corresponds to the area of “forest land remaining forest land” in the most recent German National Inventory Report. The same section in the NFAP states that afforested areas are added to the managed forest land after 20 years while deforestation is set to zero.

For the estimation of living biomass contribution to the FRL, the Commission estimated the managed forest land area in the compliance period 2021-2025 following the German approach described in the NFAP and illustrated in Table 19. The area of “forest land

<sup>83</sup> Röhling, S., K. Dunger, G. Kändler, S. Klatt, T. Riedel, W. Stümer and J. Brötz (2016). "Comparison of calculation methods for estimating annual carbon stock change in German forests under forest management in the German greenhouse gas inventory." Carbon Balance and Management 11(1): 12.

remaining forest land” in 2017 from the GHGI 2019 was taken as starting point. For 2018 to 2025 the area entering the scope of managed forest land area<sup>84</sup> was added. The yearly values of the period 2021-2025 were used to estimate emissions and removals from living biomass. For simplicity with regards to other corrections, emissions and removals of all other pools and gases were estimated with the average area of reference period (10,607,070 ha); emissions and removals for HWP are independent of area.

**Table 19. Area of managed forest land for living biomass.**

<b>Year</b>	<b>Area afforested 20 years ago [ha]</b>	<b>Area of managed forest land per year [ha]</b>
2017		10,832,447
2018	27,619	10,860,066
2019	27,619	10,887,685
2020	27,619	10,915,304
2021	15,350	10,930,654
2022	15,350	10,946,004
2023	15,350	10,961,354
2024	15,350	10,976,704
2025	15,350	10,992,055

#### Compliance period

The matrix model employed by Germany is only able to estimate net emissions in living biomass in full five-year cycles. In the NFAP Germany estimated net emissions from living biomass with the 5-year cycle 2018-2022 of the matrix model, to represent the emissions and removals in the compliance period.

After consultation with Germany, it was decided to match the compliance period as stipulated in the LULUCF Regulation (2021-2025). Therefore, net emissions for living biomass and HWP are calculated as weighted average of two 5-year cycles: 40% from 2018-2022 and 60% from 2023-2027. Germany also provided, for information, 5-year cycles of areas as modelled in the matrix model for 2008-2012 and 2012-2017 (see Addendum and Corrigendum to German NFAP). The estimates for all other pools and gases will be refined for the period 2021-2025 by technical corrections when the final area for managed forest land is known.

#### Adjustments for HWP

Changes in the net emissions for living biomass (reference period 2000-2009, compliance period 2021-2025) affect the inflow to the HWP pool.

The ratio for harvest (0.984, see Table 18 for adjustments of the reference period to 2000-2009) was applied to both 5-year cycles of the matrix model and the weighted average for the compliance period 2021-2025 (Table 20).

<sup>84</sup> Area entering the scope of managed forest land is defined here, in line with the German NFAP as: “land converted to forest land” 20 years ago and zero deforestation. In practice: area entering managed forest land in 2018 is “land converted to forest land” in 1998.

**Table 20. Adjustments in HWP inflow in reference period and compliance period.**

Period	Harvest for HWP-inflow, reference period 2002-2007 [Mio. RSCM yr <sup>-1</sup> ]	Harvest for HWP-inflow, reference period 2000-2009 [Mio. RSCM yr <sup>-1</sup> ]
2018-2022	112.1 <sup>(1)</sup>	110.2
2023-2027	112.5 <sup>(2)</sup>	110.6
2021-2025	112.3	<b>110.5</b>

Notes:

RSCM...reserve solid cubic meters

<sup>(1)</sup> Corresponds to total in table I-6 of German NFAP.

<sup>(2)</sup> Estimate provided by Germany.

The value for HWP emissions with application of the adjustment proposed for the compliance period (2021-2025) is -8,157,029 t CO<sub>2</sub> (calculation by Germany).

#### Overview of the approaches for pools and gases

In order to ensure consistency with GHGI 2019 and meeting requirements of Art 8(5) and Annex IV, Part A (h) of Regulation (EU) 2018/841 the following considerations were made.

- Living biomass: The approach as described in NFAP was maintained. Emission factors (EF) of the reference period for each volume and age class were modelled by Germany for the period 2002-2007. Weighted emission factors were estimated by Germany for 5-year intervals 2018-2022 (-0.655 t CO<sub>2</sub> ha<sup>-1</sup> yr<sup>-1</sup>) and 2023-2027 (-0.453 t CO<sub>2</sub> ha<sup>-1</sup> yr<sup>-1</sup>). Those emission factors were combined with the modelled areas for the compliance period (see Area of Managed Forest Land (MFL) and Table 19). Resulting emissions were corrected by correction factor (1.655) to represent the forest management of the full reference period 2000-2009 (see Emission factors for living biomass for the reference period 2000-2009). The emissions in the compliance period 2021-2025 are the average, see Table 21.
- Mineral soil and litter: As an approximation for the development of the pool after the reference period (2000-2009) in the absence of any changes in forest management, the average net emissions and removals for the reference period from GHG inventory 2019 were used, assuming that the area of managed forest land remains constant between reference period and compliance period.
- Organic soils and drainage (CRF Table 4(II)): Average net emissions and removals for the reference period (2000-2009) from GHG inventory 2019, assuming that the area of managed forest land remains constant between reference period and compliance period. These emissions include emissions from CRF table 4(II) for “forest land”, which are assumed to occur entirely on “Managed Forest land”.
- Dead wood: Average net emissions and removals for the reference period (2000-2009) from GHG inventory 2019, assuming that the area of managed forest land remains constant between reference period and compliance period.

- Forest fires: Average net emissions and removals for the reference period (2000-2009) from GHG inventory 2019, assuming that the area of managed forest land remains constant between reference period and compliance period.
- HWP: Value calculated by Germany (see Adjustments for HWP), taking into account the changes implemented for living biomass as described in section (Emission factors for living biomass for the reference period 2000-2009).

**Table 21. Recalculated sink for living biomass, based on the Emission Factors (EF) provided by Germany and the corrections due to the managed forest land area for the first compliance period and the use of Roehling et al. 2016.**

	2021	2022	2023	2024	2025
EF as estimated by Germany according to methodology described in NFAP and Corrigendum [t CO <sub>2</sub> ha <sup>-1</sup> yr <sup>-1</sup> ]	-0.655	-0.655	-0.453	-0.453	-0.453
Managed Forest Land area [ha]	10,930,654	10,946,004	10,961,354	10,976,704	10,992,055
Sink corrected for the area [t CO <sub>2</sub> -eq yr <sup>-1</sup> ]	-7,159,578	-7,169,632	-4,965,493	-4,972,446	-4,979,400
Correction factor for EF	1.655	1.655	1.655	1.655	1.655
Sink corrected for area and the Emission Factor [t CO <sub>2</sub> -eq yr <sup>-1</sup> ]	-11,849,101	-11,865,740	-8,217,890	-8,229,398	-8,240,907
<b>Corrected sink, average for Compliance period [t CO<sub>2</sub>-eq yr<sup>-1</sup>]</b>			<b>-9,680,607</b>		

### Overview of the recalculated FRL

Table 22 illustrates the impact of the recalculation on the FRL for each pool.

**Table 22. Recalculation of the German FRL and the carbon pools included.**

Carbon pool or source of non-CO <sub>2</sub> gases	Reported in revised NFAP <sup>(1)</sup> (t CO <sub>2</sub> -eq yr <sup>-1</sup> )	Delegated act (t CO <sub>2</sub> -eq yr <sup>-1</sup> )	Recalculation method Method used
Living biomass	-7,085,000	-9,680,607	EF for 2000-2009 based on Roehling et al (2016) for the projected state of the forest in the compliance period (Table 19)
Mineral soil and litter	3,873,800	-15,309,647	As an approximation for the development of the pools in the absence of changes in forest management: Net emissions and removals assumed for compliance period, expressing the average 2000-2009 values from the GHGI 2019.
Organic soils and 4(II)	2,846,800	912,138	
Dead wood	-1,081,000	-2,135,723	
Forest fires	30,000	3,962	
HWP	-8,607,000	-8,157,029	Recalculation contributed by Germany due to the methodological changes as demonstrated in Adjustments for HWP
<b>FRL excluding HWP</b>	<b>-1,415,400</b>	<b>-26,209,877</b>	
<b>FRL including HWP</b>	<b>-10,022,400</b>	<b>-34,366,906</b>	

Notes:

<sup>(1)</sup> Table 2 and II-1 of Germany's NFAP 2019.

### Technical Corrections

Several assumptions in this recalculation require attention by technical corrections at the end of the first compliance period. The Commission notes:

- A necessary technical correction for the area of managed forest land for estimates of all pools and gases.
- A necessary technical correction, addressing “land converted to forest land” in and after 2002 entering the scope of managed forest land from 2022 onwards<sup>85</sup>, regarding the specific treatment of the strata and appropriate emission factors.
- A potential technical correction of the correction factor (1.655) in order to ensure consistency between FRL and GHG inventory, should the German GHG inventory submission of 2027 not employ the logging factor method described in Roehling et al (2016) and its specific implementation for setting the FRL.
- A technical correction for mineral soils and litter should be applied as necessary, in order to maintain consistency between FRL and GHG inventory, and to reflect changes in reported emissions not caused by any management changes after the reference period and to reflect changes caused by legacy effects.

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<sup>85</sup> The Commission notes that the matrix model uses a constant area for all 5-year intervals and is only representative for all managed forest land for 20 years after its initial state in 2002.

## Cyprus

**Table 23. FRL for Cyprus (t CO<sub>2</sub>-eq yr<sup>-1</sup>).**

	With HWP	Without HWP
Draft NFAP	-120,280	-136,200
Revised NFAP	-122,400	-136,200
FRL in delegated act	-155,779	-169,569

Cyprus made great efforts to improve forest data collection and analysis to fulfil the requirements of the LULUCF Regulation, in terms of harvest information and the modelling approach, even though in a simplified manner. However, Cyprus did not ensure consistency between the area of MFL for setting the FRL and the area of “forest land remaining forest land” (FL-FL) as reported in the GHG inventory 2019 Table 4.A row “forest land remaining forest land” for the year 2010. Moreover, Cyprus did not include the emissions and removals associated with mineral soil and biomass burning, also comprising non-CO<sub>2</sub> gases.

For the reasons above, the EC distributed the emissions and removals estimates as calculated for living biomass pool in the NFAP across the area of FL-FL as reported in the GHG inventory 2019 (see Table 24).

**Table 24. Detailed calculation of emissions and removals in the living biomass pool, based on the area of “forest land remaining forest land” as reported for year 2010 in the GHGI 2019.**

Parameter	Value
Area of MFL (ha) <sup>(1)</sup>	147,726.00 <sup>(1)</sup>
Living biomass pool (t CO <sub>2</sub> -eq yr <sup>-1</sup> )	-136,225.72 <sup>(2)</sup>
Emissions/Removals per hectare (t CO <sub>2</sub> -eq ha <sup>-1</sup> yr <sup>-1</sup> )	-0.922151 <sup>(3)</sup>
Area of FL-FL (ha)	158,843.42 <sup>(4)</sup>
Living biomass pool (corr.) (t CO <sub>2</sub> -eq yr <sup>-1</sup> )	-146,477.62 <sup>(5)</sup>

Notes:

- (1) Sum of the area covered by conifers and broadleaves (pp. 22-23).
- (2) Reported in the revised NFAP (pp. 22-23, separately for conifers and broadleaves).
- (3) Calculated emissions and removals on area basis, as follow:  

$$-136,225.72 [tCO_2e yr^{-1}] / 147,726.00 [ha] = -0.922151 [tCO_2e ha^{-1} yr^{-1}]$$
- (4) Table 4.A, GHG inventory (submission year 2019, inventory year 2010).
- (5) Corrected emissions and removals in the living biomass pool, as follow:  

$$158,843.42 [ha] \cdot (-0.922151 [tCO_2e ha^{-1} yr^{-1}]) = -146,477.62 [tCO_2e yr^{-1}]$$

The EC used the corrected value of emissions and removals for the living biomass pool. To ensure consistency with the GHG inventory 2019 the corrected FRL value also comprises previously missing emissions and removals estimates for mineral soil and associated with biomass burning. See Table 25 for details about the corrected FRL for Cyprus.

**Table 25. Summary of the components and associated emissions and removals as included in the corrected FRL.**

	<b>FRL component</b>	<b>Emissions and removals (t CO<sub>2</sub>-eq yr<sup>-1</sup>)</b>
Managed Forest Land	Living biomass pool (corr.) <sup>(1)</sup>	-146,477.62
	Mineral soil <sup>(2)</sup>	-40,792.13
	HWP <sup>(3)</sup>	13,790.00
Biomass burning	CO <sub>2</sub> <sup>(4)</sup>	15,454.89
	CH <sub>4</sub> <sup>(4)</sup>	1,662.87
	N <sub>2</sub> O <sup>(4)</sup>	582.98
<b>Corrected FRL (excl. HWP)</b>		<b>-169,569.01</b>
<b>Corrected FRL (incl. HWP)</b>		<b>-155,779.01</b>

Notes:

<sup>(1)</sup> Table 24.

<sup>(2)</sup> Tables 4.A, GHG inventory 2019, average for inventory years 2000 to 2009.

<sup>(3)</sup> Table at page 27, CY-NFAP, average value in the period 2021-2025.

<sup>(4)</sup> Tables 4(V), GHG inventory 2019, inventory years 2000 to 2009. Values for GWP: 1 for CO<sub>2</sub>; 25 for CH<sub>4</sub>; and 298 for N<sub>2</sub>O (100 year time horizon).

## Poland

**Table 26. FRL for Poland (t CO<sub>2</sub>-eq yr<sup>-1</sup>).**

	<b>With HWP</b>	<b>Without HWP</b>
Draft NFAP	-29,433,000	-24,612,000
Revised NFAP	-27,888,000	-23,872,000
FRL in delegated act	-28,400,000	-24,384,000

### Data inconsistency in carbon pools included in the FRL

Table 24 of the Polish NFAP (courtesy English translation) lists all estimates of carbon stock changes of carbon pools included in the FRL of Poland and their total, and Table 25 of the NFAP lists emissions from forest fires by gas (in CO<sub>2</sub>-eq) and its total. Table 27, column “revised NFAP” lists all estimates in CO<sub>2</sub>-eq as average over the compliance period. The Commission communicated, *inter alia*<sup>86</sup>, an incorrect total of the individual carbon pools and greenhouse gases to the Polish authorities (Table 27, column “EC correction of sum”). Polish authorities responded in writing and clarified a clerical error (Table 27, column “PL response to EC correction”, Table 28 for full detail of annual data between 2010-2025 corresponding to Table 24 in the Polish NFAP).

### Inconsistencies between the FRL and GHG inventory with regard to carbon pools

The Commission also found inconsistencies regarding the inclusion of carbon pools between the FRL and GHG inventory submission of 2019 used in the Polish NFAP (Table 27, column “GHGI 2019 average 2000-2009”). Notably, the GHG inventory (2019 submission) does not include estimations of carbon stock changes for carbon pools dead wood and litter, which are included in the FRL proposal by Poland. In addition, the estimation of carbon stock changes in mineral soils differs significantly from the entire GHG time series. To ensure consistency between the FRL and the GHG inventory, the Commission sets the individual carbon pools as indicated in Table 27, column “FRL PL proposed for delegated act”, resulting in an FRL of -28,400,000 t CO<sub>2</sub>-eq yr<sup>-1</sup> including HWP (-24,394,000 t CO<sub>2</sub>-eq yr<sup>-1</sup> without HWP).

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<sup>86</sup> This recalculation sheet only addresses issues of relevance to the recalculation of the FRL of Poland.



**Table 27. Emissions and removals by carbon pools and greenhouse gases in the NFAP of Poland, communications between EC and PL, and FRL proposed for delegated act (kt CO<sub>2</sub>-eq yr<sup>-1</sup>).**

	<b>revised NFAP<sup>(1)</sup></b>	<b>Commission correction of sum</b>	<b>Poland response to Commission correction</b>	<b>GHGI 2019 average 2000-2009</b>	<b>FRL Poland proposed for delegated act<sup>(2)</sup></b>
Living biomass	-24,783	-24,783	-22,402	-35,326	-22,402
Litter	-1,906	-1,906	-1,906	NO	NO
Deadwood	-186	-186	-185	NO	NO
Mineral soils	-289	-289	-289	-2,892	-2,892
Organic soils	638	638	638	557	638
Biomass burning	272	272	272	35	272
HWP	-4,016	-4,016	-4,016	-3,230	-4,016
FRL (excluding HWP)	-23,872	-26,254	-23,872	-37,626	-24,384
FRL (including HWP)	-27,888	-30,270	-27,888	-40,857	-28,400

Notes:

(1) Estimates converted to CO<sub>2</sub>.

(2) Regarding dead wood, the Commission notes in accordance with Art 5(4) of Regulation (EU) 2018/841 the need to include estimations in the annual GHG reporting for forest land remaining forest land (Managed forest land accounting category) and consequently a need for technical correction, at the latest at the end of the compliance period.

**Table 28. Data for carbon pools as reported in the Polish NFAP (section A and section D), and the corrected values (sections B, C, E); changes to the Polish NFAP are marked with yellow. Section A: original values (including the signs) by carbon pools, including the total as reported by Poland in Table 24 of the NFAP. Section B: correction of clerical error (yellow) for living biomass by Poland. Section C: conversion of the corrected carbon pools of section B to CO<sub>2</sub>-eq yr<sup>-1</sup> (negative values reported within the table represent a sink and positive values represent a source). Section D: original values for emissions resulting from forest fires, including the total as reported by Poland in Table 25. Section E: total net emissions including all carbon pools reported by country within Table 24 (C) plus fire emissions (D). The last column within each section reports the average net emissions calculated within the compliance period (CP, 2021-2025). LB=living biomass, LT=litter, DW=dead wood, mineral soil=SOM, organic soil=SOC.**

Section	Table 24 (NFAP): Effect of the modelling of carbon stock changes in its pools for category 4.A.1 Forest land remaining in forest land																	Avg. CP	
	Carbon pool	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024		2025
A	LB	kt C	-10,885	-10,726	-10,523	-10,244	-9,901	-9,560	-9,024	-8,628	-8,177	-7,947	-7,719	-7,346	-6,958	-6,909	-6,482	-6,100	
	LT	kt C	-387	-562	-646	-688	-704	-703	-718	-697	-673	-651	-630	-603	-571	-494	-475	-456	
	DW	kt C	665	500	389	293	210	136	29	-15	-54	-88	-115	-114	-117	26	-10	-39	
	SOM	kt C	203	100	36	-6	-33	-51	-65	-73	-78	-82	-85	-83	-82	-79	-76	-74	
	SOC	kt CO <sub>2</sub> -eq	575	579	584	588	593	598	603	608	613	618	623	628	633	638	643	648	
	Total	kt CO <sub>2</sub> -eq	-39,229	-38,604	-37,631	-36,907	-35,568	-34,168	-32,414	-30,749	-29,099	-28,250	-27,417	-26,052	-24,602	-24,418	-22,846	-21,443	<b>-23,872</b>
B	LB	kt C	-11,366	-10,764	-10,302	-9,843	-9,374	-8,942	-8,271	-7,843	-7,372	-7,125	-6,890	-6,547	-6,188	-6,363	-5,920	-5,531	
	LT	kt C	-387	-562	-646	-688	-704	-703	-718	-697	-673	-651	-630	-603	-571	-494	-475	-456	
	DW	kt C	665	500	389	293	210	136	29	-15	-54	-88	-115	-114	-117	26	-10	-39	
	SOM	kt C	203	100	36	-6	-33	-51	-65	-73	-78	-82	-85	-83	-82	-79	-76	-74	
	SOC	kt CO <sub>2</sub> -eq	575	579	584	588	593	598	603	608	613	618	623	628	633	638	643	648	
	Total	kt CO <sub>2</sub> -eq	-39,338	-38,750	-38,002	-36,973	-35,711	-34,456	-32,486	-31,028	-29,368	-28,520	-27,680	-26,307	-24,879	-24,694	-23,123	-21,719	<b>-24,145</b>
C	Conversion of C pools reported on Tab. 24 to CO <sub>2</sub> (considering the stoichiometric ratio 44/12 and that negative values reported within the table represent sinks and positive values represent sources)																		
	LB	kt CO <sub>2</sub> -eq	-41,677	-39,469	-37,773	-36,091	-34,370	-32,788	-30,326	-28,759	-27,030	-26,126	-25,262	-24,005	-22,688	-23,330	-21,708	-20,280	-22,402
	LT	kt CO <sub>2</sub> -eq	-1,419	-2,061	-2,370	-2,522	-2,580	-2,577	-2,633	-2,555	-2,467	-2,388	-2,309	-2,209	-2,095	-1,811	-1,743	-1,671	-1,906
	DW	kt CO <sub>2</sub> -eq	2,437	1,833	1,425	1,074	769	499	107	-55	-197	-324	-423	-417	-428	97	-35	-143	-185
	SOM	kt CO <sub>2</sub> -eq	746	367	132	-22	-122	-188	-238	-268	-287	-301	-310	-304	-302	-289	-280	-273	-289
	Total	kt CO <sub>2</sub> -eq	-39,338	-38,750	-38,002	-36,973	-35,711	-34,456	-32,486	-31,028	-29,368	-28,520	-27,680	-26,307	-24,879	-24,694	-23,123	-21,719	<b>-24,145</b>
D	Table 25 (NFAP): Estimates and projections of emissions resulting from forest fires (natural disturbances)																		
	CO <sub>2</sub>	Kt	98	131	335	59	128	259	65	251	243	243	236	231	249	249	249	249	
	CH <sub>4</sub>	kt CO <sub>2</sub> -eq	10	13	33	6	13	26	6	25	24	24	23	23	24	24	25	25	25
	N <sub>2</sub> O	kt CO <sub>2</sub> -eq	1	2	4	1	1	3	1	3	3	3	3	3	3	3	3	3	3
	Total Fire	kt CO <sub>2</sub> -eq	109	146	372	66	142	288	73	279	270	270	262	256	276	276	277	277	277
	Total + fire	kt CO <sub>2</sub> -eq	-39,229	-38,604	-37,631	-36,907	-35,568	-34,168	-32,414	-30,749	-29,099	-28,250	-27,417	-26,052	-24,602	-24,418	-22,846	-21,443	<b>-23,872</b>

## ANNEX C: FRL AND REFERENCE LEVEL WITHOUT HWP

Table 29 presents a comparison between the FRL<sup>87</sup> and the reference level that does not consider the HWP carbon pool, i.e. assuming instantaneous oxidation. Column “Comment” denotes:

- Estimations of the FRL or reference level without HWP that differ from the revised NFAP by a Recalculation or Corrigendum
- Small differences between the reference level without HWP as stated in the NFAP (presented in column “Reference level without HWP”) and the calculation FRL-HWP, likely related to precision
- Cases for which the revised NFAP did not include a specific estimate for “Reference level without HWP”

**Table 29. FRL and reference level without HWP (instantaneous oxidation). Values are provided in t CO<sub>2</sub>-eq yr<sup>-1</sup>.**

Member State	FRL	Reference level without HWP	Comment
Belgium	-1,369,009	-1,235,641	
Bulgaria	-5,105,986	-4,808,056	Recalculation
Czech Republic	-6,137,189	-4,739,425	Recalculation
Denmark	354,000	545,000	Difference
Germany	-34,366,906	-26,209,877	Recalculation
Estonia	-1,750,000	-1,330,000	
Ireland	112,670	-1,506,091	Corrigendum
Greece	-2,337,640	-2,164,050	Corrigendum
Spain	-32,833,000	-28,971,000	
France	-55,399,290	-52,292,549	Difference
Croatia	-4,368,000	-3,906,000	Difference
Italy	-19,656,100	-19,335,400	
Cyprus	-155,779	-169,569	Recalculation
Latvia	-1,709,000	-298,000	
Lithuania	-5,164,640	-4,455,320	
Luxembourg	-426,000	-413,000	draft NFAP <sup>88</sup>
Hungary	-48,000	291,000	
Malta	-38	-38	Corrigendum
Netherlands	-1,531,397	-1,524,424	Difference
Austria	-4,533,000	-1,659,000	
Poland	-28,400,000	-24,384,000	Recalculation
Portugal	-11,165,000	-10,556,000	
Romania	-24,068,200	-21,475,600	
Slovenia	-3,270,200	-2,876,700	
Slovakia	-4,827,630	-3,661,430	
Finland	-29,386,695	-23,490,244	Corrigendum
Sweden	-38,721,000	-34,348,000	
United Kingdom	-20,701,550	-19,755,260	

<sup>87</sup> FRLs include emissions and removals from HWP using the first-order decay function, the methodologies and the default half-life values as defined in the LULUCF Regulation, namely Article 9 and Annex V.

<sup>88</sup> Luxembourg states in the revised NFAP that the FRL assuming instantaneous oxidation is provided in the draft NFAP, hence the reference level without HWP is -413,000 t CO<sub>2</sub>-eq yr<sup>-1</sup>.