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Forest reference levels under Regulation (EU) 2018/841 for the period 2021–2025

Overview and main findings of the technical assessment

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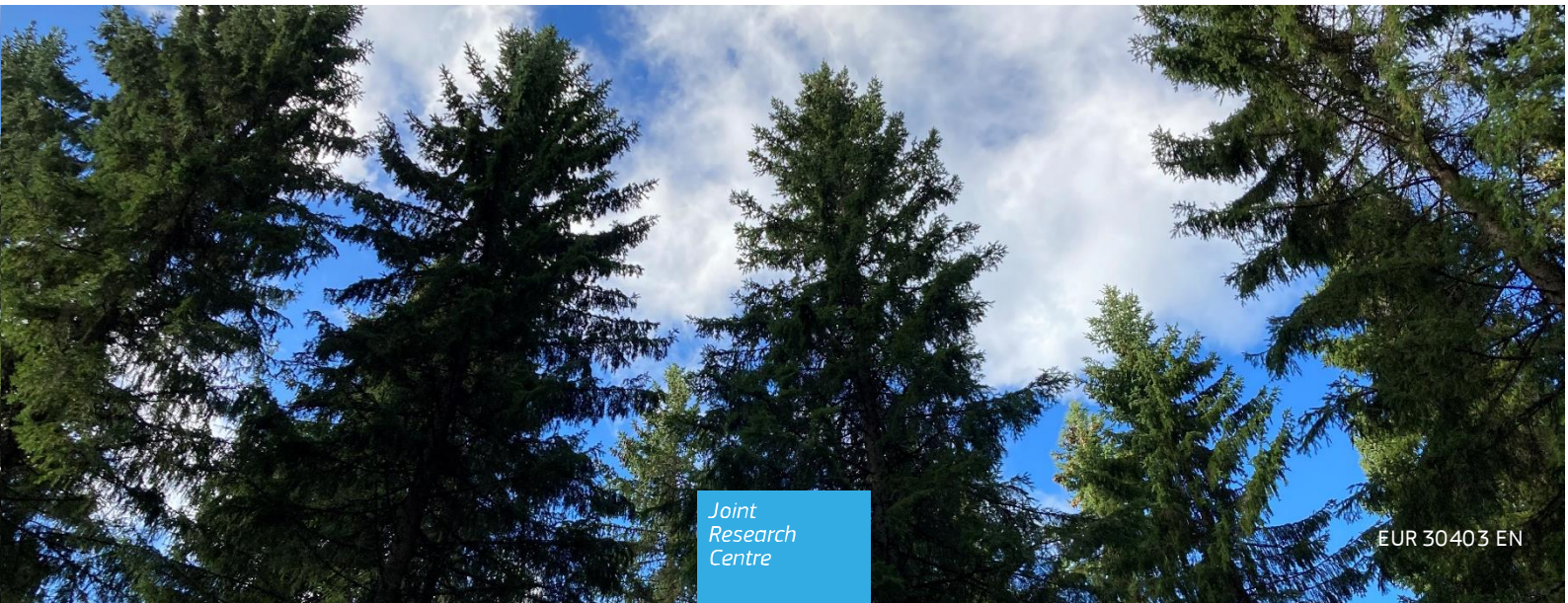

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Contents

Abstract

Regulation (EU) 2018/841[1] ('LULUCF regulation') sets the accounting rules for the Land Use, Land-Use Change and Forestry (LULUCF) sector in the EU for 2021–2030, i.e. how the emissions and removals of greenhouse gases from LULUCF will be counted towards the climate targets[2]. The LULUCF regulation is part of the EU's commitment to reduce overall emissions by at least 40% by 2030 under the Climate and Energy framework[3]. Every Member State must balance its accounted greenhouse gas emissions on the LULUCF sector by an equal amount of accounted greenhouse gas removals. Possible surplus removals, under certain conditions and up to an overall total of 280 Mt CO_2e, may be used to compensate emissions from the sectors covered by the Effort Sharing Regulation[4].

The technically most complex part of the LULUCF regulation is the set of accounting rules for managed forest land, which are based on a projected Forest Reference Level (FRL), estimated nationally by each EU Member State. The FRL is a benchmark level against which future net emissions from forests are accounted for. In its essence, the FRL is a projection of the *net* emissions from managed forest land in 2021—2030 (divided into two compliance periods, 2021—2025 and 2026—2030), assuming that the forest management practices had continued similar to the practices in the reference period 2000—2009. This way, the FRL provides a means to account for the impact of policy changes on the emissions and removals from forests, while factoring out the impact of age-related dynamics in the forests.

The FRLs for the 2021—2025 period are reported as a part of National Forestry Accounting Plans (NFAPs). After a thorough assessment by the European Commission and a dedicated Expert Group in 2019 and 2020, these FRLs are due to be laid down in a delegated act adopted by the Commission by the end of October 2020. This report outlines the main technical findings of the assessment of the Member States' proposed FRLs, and complements the Commission Staff Working Document (2020) 236 accompanying the delegated act.

The assessment found that the Member States had generally followed the principles and criteria laid out in the LULUCF regulation. The NFAPs provide a wealth of information on the forests and forest management practices in the Member States – some of which has not been available for the international community before – and in general include the elements required by the LULUCF regulation. All Member States projected the development of the forest net emissions for 2021—2025 as a continuation of the historical management practices, therefore excluding assumptions on policy development. While the submissions by the Member States were in general detailed and carefully prepared, the assessment identified in several cases minor issues that will need to be amended before the compliance check. The most common issues are related to methodological inconsistencies between carbon pools, greenhouse gases or forest area included in the FRL and those reported in the national greenhouse gas inventories. Some of these mismatches have already been amended by the Member States through Addenda or Corrigenda to the NFAPs. The remaining inconsistencies will be addressed through technical corrections to the FRLs at the end of the compliance period and therefore do not impair the reliability of the FRL as an accounting baseline. For five Member States, the assessment resulted in a recalculation of the Member State-proposed FRL by the Commission.

In numerical terms, the sum of the Member States' FRLs (incl. the United Kingdom) in the delegated act is a projected sink of -337 Mt CO_2 y^{-1} [5] for the period 2021–2025. This projection is about 18% lower than the sink of -413 Mt CO_2 y^{-1} reported by the EU 2019 greenhouse gas inventory on managed forest land for the period 2000—2009 (EEA 2019). The FRL projection is associated with a projected increase of harvest by about 16% over the same period, due to age-related effects. It is noteworthy that the FRLs project sustainable forest management practices as documented in the period 2000–2009, taking into account dynamic age-related forest characteristics, and do not represent an expected sink or expected harvest levels. Instead, the FRLs laid out in the delegated act provide a robust and trustworthy counterfactual for accounting the impact of mitigation actions on emissions and removals from managed forest land in the first compliance period 2021—2025.

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1 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. http://data.europa.eu/eli/reg/2018/841/oj

2 Since land-related fluxes of greenhouse gases are partly affected by natural phenomena and past management, assessing the impact of recent mitigation actions in the LULUCF sector is more difficult than in other sectors (energy, transport). In this context, the accounting rules filter the emissions and removals reported in the national GHGIs with the aim to assess the impact of mitigation actions, and count these towards the climate target.

3 https://ec.europa.eu/clima/sites/clima/files/strategies/2030/docs/2030_euco_conclusions_en.pdf

4 Regulation (EU) 2018/842. http://data.europa.eu/eli/reg/2018/842/oj

5 By default, a negative number indicates a net carbon sink (removal from the atmosphere) and a positive number indicates a net carbon source (addition to the atmosphere).

Foreword

The purpose of this report is to provide an overview of the technical findings of the assessment of the National Forestry Accounting Plans (NFAPs) and Forest Reference Levels (FRLs) projected for the period 2021–2025, submitted by the EU Member States under Regulation (EU) 2018/841 ('LULUCF regulation'). In this report, we document also the key information provided by the Member States with regard to their national projections and their underlying assumptions. This report covers those countries that were EU Member States when the LULUCF regulation entered into force in May 2018, i.e. including the United Kingdom; the delegated act under the LULUCF regulation also includes the United Kingdom's FRL.

The scope of this report is to provide an overview and comparison of the submissions by the Member States. For all details regarding individual countries' FRLs, we advise the reader to refer to the NFAP and possible Addenda or Corrigenda prepared by each Member State, which provide a wealth of background information and detailed description of the various assumptions employed by the Member States. This report is closely linked to the Commission Staff Working Document (2020) 236 final[6] accompanying the delegated act, where also the recalculations for five Member States' FRLs are documented. In the text, we refer to this document as 'SWD (2020) 236'.

[6] Commission Staff Working Document SWD(2020) 236 final. *Assessment of the revised national forestry accounting plans 2021-2025*, accompanying the document Draft 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.

Acknowledgements

This report is a result of an intensive and fruitful collaboration between the JRC and DG CLIMA. We wish to express our most sincere thanks to Simon Kay and other colleagues at DG CLIMA for advice throughout the assessment process, and the useful input and comments on the earlier drafts of this report.

We are deeply grateful for the constructive discussions, good collaboration and active sharing of insight and expertise by LULUCF Expert Group members and observers in the meetings and bilateral discussions throughout the whole assessment process.

We also thank the project consultants from ICF, Aether and IIASA for assistance with the data compilation, and our JRC colleagues Ragnar Jonsson, Andrea Camia, Jesús San Miguel and Viorel Blujdea for insightful comments that helped to refine the report. The interpretations and any errors are however purely those of the authors.

For the re-edition of this report (March 2021), we have identified and corrected misinterpretations of the projected harvest levels in the FRLs for some countries. After these updates, the harvest increase projected in the FRLs has been updated to 16%, compared to the harvests of the reference period. Consequently, figures 8, 9 and 10 have been adjusted on the appropriate parts, and the text in Chapter 3.3.2 has been updated accordingly. We thank Risto Päivinen and Liisa Käär at Tapio Ltd. for the constructive discussions when comparing our respective findings.

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Executive summary

Regulation (EU) 2018/841[7] (hereafter 'LULUCF regulation') sets the accounting rules for the Land Use, Land-Use Change and Forestry (LULUCF) sector in the EU for the compliance period 2021—2030, i.e. how the emissions and removals of greenhouse gases from LULUCF will be counted towards the climate targets[8]. The period 2021—2030 is further split into two compliance periods, 2021—2025 and 2026—2030. For forests, the accounting will be done against Member State-specific forest reference levels (FRLs). The FRLs are projected benchmarks of *net* emissions from forests (i.e. sum of emissions and removals) against which future net emissions from forests will be compared. This document details the findings of the technical assessment of the Member States' proposed FRLs for the compliance period 2021—2025. These FRLs will be laid down in a delegated act adopted by the Commission by the end of October 2020.

As detailed in the LULUCF regulation, the FRL is projected assuming that the forest management practice and wood use would have continued without changes from the reference period 2000—2009. The FRL takes into account the evolution of forests and forest management output (e.g. forest increment and harvest volumes) that is caused purely by age-related development. On the other hand, the FRL does not include assumptions on policy development or other changes in forest management after 2009. This way, the climate impact of forest policy changes will be accounted for, but changes in forest emissions and removals that are purely caused by the legacy of the forest age structure and its development are cancelled out. To help Member States in preparing their FRLs, a specific "Guidance on developing and reporting Forest Reference Levels" (hereafter "technical guidance document", Forsell et al. 2018) was prepared with the support of consultants and Member States' experts.

The FRLs are reported as part of the National Forestry Accounting Plans (NFAPs). The first drafts of the NFAPs were submitted by the Member States at the end of 2018, and assessed by an Expert Group in the first half of 2019. Based on this assessment and own analysis, the Commission issued technical recommendations to the Member States[9]. Taking into account these recommendations, the Member States submitted revised plans by the end of 2019, which were assessed by the Commission in the first months of 2020. In some cases, the assessment of revised plans found remaining or new issues that were further clarified by the Member States in an addendum or corrigendum to the NFAP, or which were solved by a recalculation of the FRL value by the Commission.

This document details the main findings of the 2020 assessment of the FRL proposals for the first compliance period (2021—2025), the underlying reasons for the recalculations, and additional technical details that need to be considered before the compliance check. The delegated act[10] laying down the FRLs for each Member State, to be adopted by 31 October 2020, is accompanied by a Commission Staff Working Document (SWD (2020) 236) which contains an overview of technical analysis and, for five Member States, recalculations of the FRLs by the Commission.

Policy context

The LULUCF regulation is part of the Union's commitments under the Paris Agreement, and an integral part of the EU's overall emissions' reduction target of at least 40%, by 2030 (compared to 1990) at the EU level[11]. The

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7 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. http://data.europa.eu/eli/reg/2018/841/oj

8 Since land-related fluxes of greenhouse gases are partly affected by natural phenomena and past management, assessing the impact of recent mitigation actions in the LULUCF sector is more difficult than in other sectors such as energy or transport (Grassi et al 2018a). In this context, the accounting rules filter the emissions and removals reported in the national GHGIs with the aim to assess the impact of mitigation actions, and count these towards the climate target.

9 Commission Staff Working Document, SWD (2019) 213 final. Assessment of the National Forestry Accounting Plans. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019SC0213

10 Commission Delegated Regulation (EU) 2021/268 of 28 October 2020 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 (Text with EEA relevance). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2021.060.01.0021.01.ENG. Delegated acts are legally binding acts that enable the Commission to supplement of amend non-essential parts of EU legislative acts, for example, in order to define detailed measures. The Commission adopts the delegated act and if Parliament and Council have no objections, it enters into force (https://ec.europa.eu/info/law/law-making-process/types-eu-law_en).

11 2030 Climate & Energy framework, https://ec.europa.eu/clima/sites/clima/files/strategies/2030/docs/2030_euco_conclusions_en.pdf. Since the adoption of the LULUCF regulation in 2018, the EU has upgraded its climate targets towards the commitments under the Paris Agreement. The principle of being climate neutral by 2050 – with net-zero greenhouse gas emissions – was set out in the

accounting of emissions and removals from the LULUCF sector towards the climate targets applies specific accounting rules to each land accounting category. This requires Member States to at least maintain the net carbon sink associated with the existing land use practices. If the Member State's LULUCF sector accounting results in surplus of accounted removals of carbon from the atmosphere (i.e. credit), these credits can be used in different ways such as compensating (up to EU total of 280 Mt CO_2e) emissions of the sectors covered by the Effort Sharing Regulation[4, 12], transferring to other Member States, or storing for the next compliance period. If instead the accounted emissions exceed the accounted removals (i.e. there is debit), the Member State must compensate this gap by extra emission reductions in the sectors included in the Effort Sharing Regulation (i.e. agriculture, waste, transport, buildings) or purchase surplus credits from other Member States.

The LULUCF regulation is also important for ensuring a complete accounting of emissions from forest biomass use. In line with internationally agreed rules (IPCC 2006, 2019), harvest of biomass is assumed to lead to direct emissions of the associated carbon to the atmosphere, unless it is shown that the biomass instead enters another carbon pool such as dead wood or soil, or is used to produce harvested wood products (HWP) such as sawn wood, wood panels or paper. For this reason, the FRLs for the Member States include also the changes in carbon stored in the HWP. In this way, the emissions resulting from biomass burning for energy use are fully included in the annual LULUCF accounting and, to avoid double-counting, the same emissions are zero-rated in the energy sector accounts.

The land categories accounted for under the LULUCF are afforested and deforested land, managed cropland, managed grassland, managed wetlands, and managed forest land. In this context, 'managed' does not necessarily refer to active management, but is used to refer to those land areas reported in the annual national greenhouse gas inventories (GHGIs) for which anthropogenic emissions and removals are reported[13]. The accounting rules for different land categories differ from each other. For managed forest land, which is the focus of this report, the accounting will be made against the country-specific FRL. It is important to note that the FRL is not a forecast of the future development of the forest sinks, but instead a theoretical estimate of how the forest sinks would develop if there were no changes to forest management practices after the reference period 2000–2009. In other words, the FRL represents an accounting baseline; it is not an estimate of probable, expected, or preferable development of the forest sink in the compliance period.

Main findings

The assessment of the revised NFAPs essentially aimed to address the following questions:

(i) Have the requirements of Art 8(5) and Annex IV of the LULUCF Regulation been met?

(ii) Have the technical recommendations issued in 2019 been addressed?

The LULUCF Regulation details a number of principles and criteria that the Member States' FRLs need to follow. In particular, the assessment of FRLs paid special attention on the assumptions defining the continuation of sustainable forest management practices of the reference period. Of similar importance is the consistency with the GHGI reported to the UNFCCC, because the accounting of emissions and removals will be based on the countries' GHGI reporting in the compliance period. Therefore it is essential that the land area and methodological assumptions used in the FRL are comparable and consistent with those used in the GHGIs.

The assessment concluded that for seventeen Member States (Belgium, Denmark, Estonia, Spain, Croatia, Italy, Lithuania, Luxembourg, Hungary, Netherlands, Austria, Portugal, Romania, Slovenia, Slovakia, Sweden and United Kingdom), the revised NFAP and the FRL proposed therein were sufficiently following the principles and criteria of the LULUCF regulation. After clarifications or corrections through addenda or corrigenda submitted by the Member State, also the NFAPs and FRLs of Ireland, Greece, France, Latvia, Malta and Finland were

European Green Deal at the end of 2019. In March 2020, the Commission proposed to raise the EU's ambition on reducing greenhouse gas emissions to at least 55% below 1990 levels in 2030 (https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en). As a part of the Green Deal, the Commission will review and, where necessary, propose to revise all relevant policy instruments to deliver the additional emissions reductions for 2030. This review is foreseen to be carried out by June 2021, and may lead to changes also in the LULUCF regulation.

12 This flexibility towards the ESR sector is determined in Article 7 of the Regulation (EU) 2018/842. http://data.europa.eu/eli/reg/2018/842/oj. The total amount for the EU Member States will be reduced by 17.8 Mt CO_2e, following the United Kingdom's leaving the Union.

13 In line with IPCC Guidelines (2006, 2019), GHGIs include emissions and removals from 'managed land', i.e. "where human interventions and practices have been applied to perform production, ecological or social functions".

considered to be compliant with the Regulation. For Bulgaria, Czech Republic, Germany, Cyprus and Poland, the assessment identified a need for a recalculation to correct for problematic assumptions or inconsistencies that were seen to be not in line with the LULUCF Regulation. The details of the recalculations are provided in the SWD (2020) 236 accompanying the delegated act.

The most common remaining issues are related to methodological inconsistencies between carbon pools, greenhouse gases or area included in the FRL and those reported in the national GHGIs. Most of these mismatches are of negligible quantitative impact, and will be addressed through technical corrections to the FRLs at the end of the compliance period. Technical corrections are aimed to ensure that the accounted quantities do not reflect the impact of methodological inconsistencies between FRL and the reporting of managed forest land[14] in the GHGI.

Furthermore, the assessment identified a number of elements where further transparency would have been desirable. There are also some elements required by the LULUCF regulation, usually related to the background and broader political context, which are not described or are insufficiently described in some of the revised NFAPs. In addition, Member States were found to have particular difficulties in addressing Commission's technical recommendations regarding the modelling of the forest management practices as a continuation of the reference period's practices; ensuring the consistency with the long-term sink; and demonstrating consistency between the carbon pools and greenhouse gases included in the FRL and those reported in the national GHGI, as well as in consistency between the model output and the national GHGI.

Overall, however, the Member States were found to have made a notable effort to provide a robust benchmark for accounting the emissions and removals from managed forest land. As a results, the FRLs form a good basis for ensuring that the forests' contribution in meeting the Union's climate objectives is reliably considered. In addition, the assessment noted that the NFAPs provide a valuable information source of data, methodologies and description of forest management practices in the Member States, some of which has not been available for the international scientific community before.

Key conclusions

Figure 1 illustrates the evolution on the forest sink at EU level, and offers a broader historical perspective on the impact of the forest accounting rules by comparing the EU-level FRLs in the delegated acts with the Forest Management Reference Levels (FMRL) determined under the Kyoto Protocol[15]. The black solid lines indicate the sink in forest land remaining forest land[16] in the GHGI submission of 2011 (when the FMRL was prepared) and the FMRL for the period 2013–2020. A number of recalculations have lowered the sink estimate (i.e. less negative number) by about 30 $MtCO_2/y$ between the GHGI submission of 2011 and 2019. For the level of the EU, this decrease is reflected in the current technical corrections to the FMRL (black dashed line, from the GHGI 2019). Overall, the FMRL plus technical corrections in the period 2013–2020 is a 132 $MtCO_2/y$ smaller sink than the forest management sink in 2000–2009. Grassi et al (2018a) noted that this large difference may be partly caused by age-related effects, but likely also reflects the inclusion of policy assumptions in the FMRL calculation.

The yellow and red lines indicate the EU-level FRLs as submitted in the NFAP 2018 and 2019, respectively. The green line indicates the EU-level FRLs in the delegated act, where addenda and corrigenda submitted by Ireland, Greece, Malta and Finland, and Commission's recalculations of the FRLs of Bulgaria, Czech Republic, Germany, Cyprus and Poland are reflected[17]. The total sum of the FRLs in the delegated act is a sink of -337 Mt CO_2/y. Compared to the reported sink of the period 2000–2009 (from GHGI 2019[18]), the FRLs in the delegated act is about 75 $MtCO_2/y$ smaller (18%). This projected decrease of the sink is associated with a projected increase of

[14] The land accounting category 'managed forest land' corresponds to the land use category 'Forest land remaining forest land' reported in the GHGI to the UNFCCC.

[15] The FMRL employed during the second commitment period of the Kyoto Protocol (2013-2020) was the first time when the reference level concept was used for accounting forest emissions and removals in the EU. The scope and specific details underlying the FMRLs differed from the rules now in place for the FRLs. Importantly, contrary to the FRLs under the LULUCF regulation, the FMRLs allowed assumptions on expected policy impacts.

[16] Although "forest land remaining forest land" does not exactly corresponds to "forest management" under the Kyoto Protocol, for the purpose of the figure the difference is deemed negligible.

[17] In addition, an addendum or corrigendum to the NFAP was also submitted by Czech Republic, Germany, France, Latvia and Poland, but these documents did not have a quantitative impact on the FRL value.

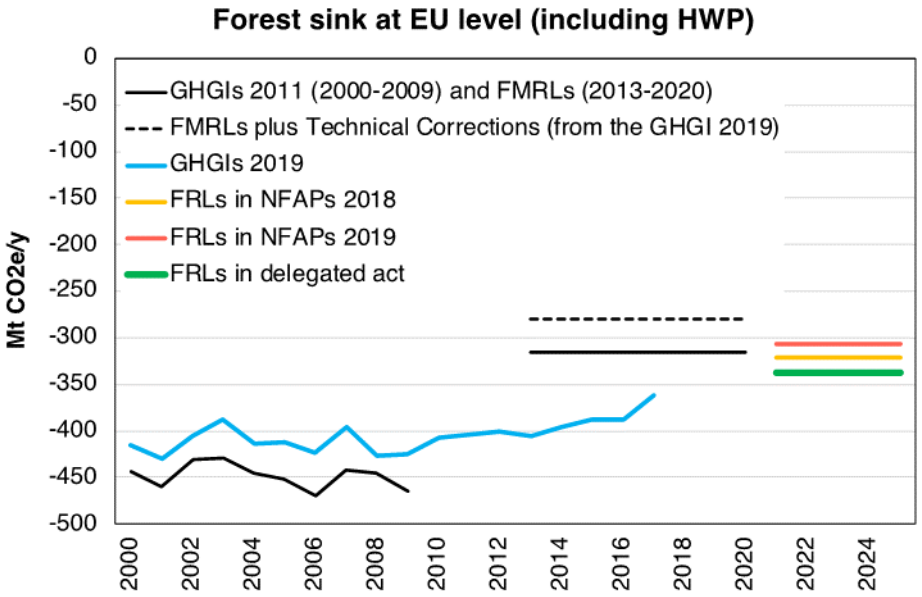
[18] This GHGI submission is used here because it was used by a majority of Member States in preparing their FRLs. When comparing each Member State's FRL to the GHGI submission used as reference by that Member State, the total difference is ca. 70 $MtCO_2/y$ (17%).

harvest by about 16% over the same period. According to the criteria for setting the FRL, these trends are exclusively due to age-related effects, and not to policy assumptions.

It is worth noting that this projected decrease of the sink is smaller than the one anticipated in the previous FMRL exercise, where the sink was projected to decrease by 132 $MtCO_2/y$ (or 30%) in 2013–2020 relative to 2000–2009. This suggests that, relative to the Kyoto Protocol, Regulation (EU) 2018/841 was successful in introducing more stringent and environmentally credible criteria to account for the contribution of EU forests to climate mitigation. Further, we emphasize that the FRL projections do not represent an expected sink nor expected harvest levels, but are instead a theoretical projection of the continuation of sustainable forest management practices as documented in the historical period 2000–2009. This way, the FRLs laid out in the delegated act provide a robust and trustworthy counterfactual for accounting the impact of mitigation actions on emissions and removals from managed forest land in the first compliance period 2021—2025.

Finally, it is noteworthy that all Member States had the necessary capacities to produce a National Forestry Accounting Plan with limited assistance by the Commission supported by contractors. This is a very different situation from the second commitment period of the Kyoto Protocol, when 14 Member States requested partial or full assistance to develop their FMRLs. In addition, the Member States, other experts and stakeholders participated actively in the whole process of setting the FRL, from the preparation of the technical guidance document to the assessment of the draft NFAPs and further discussions within the LULUCF Expert Group. Their commendable efforts were essential in clarifying questions for which the LULUCF Regulation does not provide details on a technical level, and to find a common ground for the assessment. The review process allowed for the identification of common challenges and mutual learning. We are confident that this experience will serve as a basis for continuing the collaboration towards improved GHGIs and more accurate accounting of the contribution of the forest sector to climate change mitigation.

Figure 1. Development of the forest sink at the EU level (sum of all Member States' values), and its relation to the FRLs (according to LULUCF regulation) and to the FMRLs (according to the Kyoto Protocol). The technical corrections added to the FMRLs are from the GHGI 2019 and are not yet the final ones for the period 2013–2020. The FRLs proposed by the Member States in the draft NFAPs in 2018 are shown in yellow, the revised FRLs proposed in the revised NFAPs in 2019 are shown in red, and the FRLs as included in the delegated act are shown in green. The EU values shown include Croatia (not EU Member State when FMRLs were submitted) and the United Kingdom.



1 Introduction

1.1 LULUCF regulation

Regulation (EU) 2018/841[19] (hereafter 'LULUCF regulation') entered into force in May 2018, setting the accounting rules for the land use, land use change and forestry (LULUCF) sector in the EU for 2021–2030. This period is further split into two compliance periods: 2021–2025 and 2026–2030. The LULUCF regulation is part of the Union's commitments under the Paris Agreement, and an integral part of the EU's overall emissions' reduction target of at least 40%, by 2030 (compared to 1990) at the EU level. This target should be achieved through a 43% emissions reduction on the sectors under the Emissions Trading System (ETS) and a 30% reduction by non-trading sectors regulated by the Effort Sharing Regulation (ESR, i.e. agriculture, waste, transport, buildings), compared to emission levels in 2005.

The accounting of emissions and removals from the LULUCF sector towards the climate targets will follow specific accounting rules. Every Member State must balance its accounted net emissions by an equal amount of accounted net removals ("no-debit rule", Article 4). If the Member State's LULUCF sector accounting results in surplus of accounted removals of carbon from the atmosphere (i.e. credit), these credits can be used in different ways such as compensating (up to EU total of 280 Mt CO_2e) emissions of the sectors covered by the ESR[20], transferring to other Member States, or storing for the next compliance period. If instead the accounted emissions exceed the accounted removals (i.e. there is debit), the Member State must compensate this gap by extra emission reductions in the sectors included in the ESR or purchase surplus credits from other Member States.

The LULUCF regulation applies to emissions and removals of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) from the following land accounting categories:

- Afforested land;
- Deforested land;
- Managed cropland;
- Managed grassland;
- Managed wetland (obligatory from 2026 onwards);
- Managed forest land.

Article 2 of the LULUCF regulation details the definitions of each land accounting category. A key underlying principle is that the land accounting categories are derived from land use categories as reported in the Member States' greenhouse gas inventories (GHGI). In accordance with the GHGI, the LULUCF regulation applies only to *managed* lands, i.e. those lands that are considered to be under human influence and therefore reported in the national GHGIs (IPCC 2006; IPCC 2019)[21].

For each land accounting category, the emissions and removals from the carbon pools of above-ground biomass, below-ground biomass, litter, dead wood, and soil organic carbon are to be included in the accounting. In addition, managed forest land and afforested land need also to consider the contribution of the harvested wood products (HWP) pool. However, for accounting purposes, the Member States may leave out pools that are not a source of emissions in a given category, with the exception of above-ground biomass, dead wood and HWP for managed forest land, which must always be included.[22]

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[19] 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. http://data.europa.eu/eli/reg/2018/841/oj

[20] This flexibility towards the ESR sector is determined in Article 7 of the Regulation (EU) 2018/842. http://data.europa.eu/eli/reg/2018/842/oj. The total amount for the EU Member States will be reduced by 17.8 Mt CO_2e, following the United Kingdom's leaving the Union.

[21] In line with IPCC Guidelines (2006, 2019), 'managed' does not necessarily refer to the active management of the land area, but rather to "land where human interventions and practices have been applied to perform production, ecological or social functions".

[22] Furthermore, in managed forest land, all pools included in the FRL must be also included in the GHGIs.

The purpose of the accounting is to estimate, as for any sector, the human-induced changes to greenhouse gas emissions and removals during the two compliance periods 2021–2025 and 2026–2030. The characteristics of the land categories under the LULUCF regulation differ substantially, and thereby also the accounting rules for different categories are different:

- On **afforested land and deforested land** (Article 6), the characteristics of the land category change profoundly, and this change can usually be attributed to a specific point in time. For these lands, the **total emissions and removals** associated with the land use change are considered in the accounting[23].
- On **managed cropland and managed grassland** (from 2026 onwards also obligatory **managed wetland**) (Article 7), the average reported emissions and removals in the compliance periods are **compared with the reported average emissions during 2005–2009**. This approach was taken because the greenhouse gas flux typically does not change dramatically from one year to another, and the impact of management changes are visible only over longer period.
- On **managed forest land** (Article 8) the emissions and removals are strongly dependent on the age structure of the forests, and the impact of management changes or natural disturbances is often reflected even decades afterwards. For these reasons, the accounting on managed forest land is compared against a **projected forest reference level (FRL)** – an estimate of the emissions and removals on managed forest land in the compliance periods assuming that there were no changes to forest management practice compared to the reference period 2000–2009. That is, the emissions and removals that occur on managed forest land during years 2021–2025 and 2026-2030 will be compared with the projected FRL estimated for those years. This accounting methodology aims to separate the impact of policy changes in forest management – i.e. those which the Member States can still influence – from those decisions that were made already in the past, but whose influence is still seen in the forests.

The LULUCF regulation requires that the total sum of the accounted emissions will not exceed the total sum of the accounted removals in the aggregate of the abovementioned categories – i.e. considering the different accounting rules applied to the different land categories (Article 4). Some detailed conditions and exceptions nevertheless apply. For instance, on managed forest land, the amount of net removals that may be included in the accounts is capped to 3.5% of the emissions of a Member State-specific base year or period (Article 8(2) and Annex III of the LULUCF regulation) – with dead wood and HWP exempted from this limit. The emissions caused by exceptional natural disturbances, such as wildfires, windfall or pest infestations, may also be excluded under specific conditions (Article 10). Furthermore, Member States may employ certain flexibilities defined in Articles 12 and 13. Specifically:

- use the surplus removals to compensate emissions on the ESR sector, up to a cap of 280 Mt CO_2e over the period 2021–2030;
- trade removals from another Member State;
- bank removals resulting in period 2021–2025 to the next period 2026–2030 for this compliance.

If a Member State's accounts do not meet the commitment under Article 4, and the total of managed forest land is an accounted emission, that Member State may compensate these emissions under certain conditions and to a certain extent as detailed in Article 13. However, this compensation is only possible if the overall LULUCF account at EU level shows removals, and if the Member State's managed forest land is a reported sink (even if accounted as emissions against the FRL).

Since the adoption of the LULUCF regulation, the EU has upgraded its climate targets towards the commitments under the Paris Agreement. The principle of being climate neutral by 2050 – with net-zero greenhouse gas emissions – was put forward in the European Green Deal[24] at the end of 2019, and shortly thereafter submitted

[23] By default, areas that are converted to forest land or from forest land are reported for 20 years in the categories afforested and deforested land, respectively (IPCC 2006). A Member State may change this period to 30 years (Article 6(2)), if duly justified based on the IPCC Guidelines.

[24] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

to the UNFCCC[25]. In the European Green Deal and the proposal for a European Climate Law[26] the Commission also proposed an increased ambition for greenhouse gas emissions reductions by 2030, for which the Climate Target Plan[27] sets out to cut greenhouse gas emissions by at least 55% compared to 1990. To this end, the Commission will review and, where necessary, propose to revise all relevant policy instruments to deliver the additional emissions reductions for 2030. This review is foreseen to be carried out by June 2021, and may lead to changes also in the LULUCF regulation. At the time of writing this report in October 2020, the review and its results were not yet available, so this report considers only the LULUCF regulation as it is defined in Regulation (EU) 2018/841. However, we note that the results of this report may soon need to be reflected against possible changes in the LULUCF regulation.

1.2 Forest reference level as a basis for accounting of managed forest land

The specific rules for accounting the net greenhouse gas emissions on managed forest land[28] are detailed in Article 8(5) and Annex IV of the LULUCF regulation. The aim of these rules is to assess the impact of LULUCF mitigation actions in a way that is comparable with other sectors, while at the same time taking into account that the forest greenhouse gas fluxes depend on natural circumstances, dynamic age-related characteristics, and on past and present management practices carried out in each Member State. The use of a common base year for the forest sector would not reflect adequately all country-specific circumstances, as the net emissions in any given year usually reflect the management practice of a longer time period, or may be affected by exceptional natural disturbances.

Under the Kyoto Protocol's second commitment period (2013–2020), a projected reference level[29] was introduced as a benchmark against which future emissions and removals from Forest Management would be compared for accounting purposes. However, the approach under the Kyoto Protocol allowed policy and economic assumptions in the projections, which proved to be controversial in terms of credibility of the accounting (see Grassi et al. 2018a).

The FRL for the period 2021–2025 is proposed by each Member State as a part of a National Forestry Accounting Plan (NFAP), which documents information for understanding how the FRL was calculated. The FRL reflects only the development of the dynamic age-related forest characteristics of each country, while not including assumptions on policy or economic development. For the purpose of accounting the contribution of forests towards each Member State's climate targets, the emissions and removals from managed forest land during each compliance period will be compared against this FRL benchmark. The accounted quantities will therefore reflect only the impact of changes in forest management compared to the reference period, adjusted for the age-related development of the forests.

As part of the FRL, the Member States include also the changes in carbon stored in the carbon pool harvested wood products (HWP), so that a change in the amount and use of HWP is also reflected in the climate accounts. The biomass that is not used for HWP is considered to be instantaneously oxidized, i.e. emitted directly to the atmosphere. This way, burning of biomass is considered in the annual LULUCF accounting framework and, to avoid double-counting, the emissions from biomass burning for energy use are zero-rated in the energy sector accounts.

[25] The Climate neutrality in 2050 is also included in the Long Term Strategy as submitted to the UNFCCC https://unfccc.int/sites/default/files/resource/HR-03-06-2020%20EU%20Submission%20on%20Long%20term%20strategy.pdf

[26] https://ec.europa.eu/clima/policies/eu-climate-action/law_en

[27] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0562

[28] Managed land corresponds to the land use category 'Forest land remaining Forest land (4.A.1)' in the GHGI submitted to the UNFCCC

[29] Under the activity-based Kyoto reporting and accounting the reference level is called Forest Management Reference Level (FMRL).

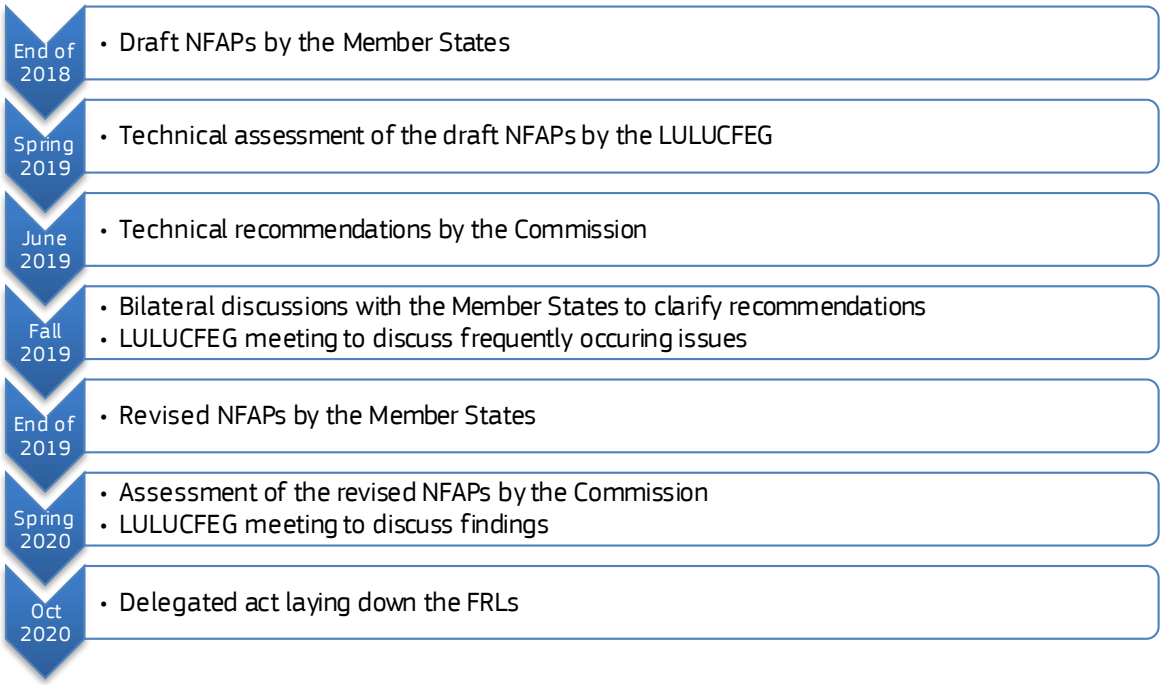
2 Description of the technical assessment

2.1 Timeline for preparing the NFAPs and the FRLs

After the LULUCF regulation entered into force in 2018, the Commission provided a technical guidance document[30] prepared by a team of consultants to assist the Member States in preparing the NFAPs and setting the FRL. The technical guidance document was discussed during its development in a number of workshops organized by the Member States and the European Commission in the first half of 2018. In addition, a number of Member States[31] asked to be part of a capacity building project, in which a team of consultants and Commission staff (JRC and/or DG CLIMA) visited the country to provide assistance in specific details of preparing data and projecting the FRL.

Figure 2 provides an overview of the timeline of the Member States' NFAPs, including the FRL, and their technical assessment. The draft NFAPs were to be submitted by the end of 2018, and were assessed during spring 2019 by an Expert Group (LULUCFEG)[32]. The Member States were to submit revised NFAPs, considering the technical recommendations issued by the Commission, by the end of 2019. These revised NFAPs were assessed by the Commission during the first half of 2020 and, where necessary, amended further by the Member State and/or Commission. This whole process was actively supported by the JRC, which provided both an independent technical assessment of the NFAPs and the FRLs and direct support to the LULUCFEG's activity. The delegated act that sets the FRLs for each Member State is to be adopted in October 2020.

Figure 2. Timeline of the NFAP submissions and the steps of the technical assessment.



[30] Forsell et al. 2018. Guidance on developing and reporting Forest Reference Levels in accordance with Regulation (EU) 2018/841. doi 10.2834/782602

[31] Croatia, Cyprus, Greece, Hungary, Lithuania, Luxembourg, Malta, Romania and Slovakia as well as Iceland were part of the consultancy project, while Bulgaria and Czech Republic were provided similar assistance by the JRC. The Romanian visit took place in 2019.

[32] The LULUCFEG consisted of representatives of the Member States, independent technical experts appointed by the Commission, other public entities, and representatives of NGOs, research organizations, and forestry interest organizations. More details are available in the Register of Commission Expert Groups: https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3638&NewSearch=1&NewSearch=1

2.1.1 Assessment of the draft NFAPs and technical recommendations

The draft NFAPs, including the proposed FRL, were to be submitted to the Commission by the end of 2018. In April 2019, the LULUCFEG convened for a two-week review in Brussels to assess the NFAP submissions by the Member States[33]. In this assessment, 27 NFAPs (Romania did not submit a NFAP at this point in time) were scrutinized in detail, with regard to transparency of the NFAPs and the accuracy of the proposed FRL and its components. Based on this assessment[34], and a parallel analysis by the JRC and DG CLIMA, the Commission published technical recommendations for each Member State[35]. As detailed in Article 8(7), the Member States were expected to submit revised NFAPs, including a revised FRL proposal, where necessary, by the end of 2019. An overview of the technical recommendations issued for each Member State is shown in Figure 3.

Each Member State was offered an opportunity to discuss the technical recommendations in a bilateral meeting between the Member State and the Commission (DG CLIMA and the JRC), during which the technical recommendations and expectations for the revised NFAPs were clarified. Over the course of summer and fall 2019, the Commission met bilaterally with a total of 26 Member States (all except the Czech Republic and Romania), as well as with representatives of different stakeholder groups.

Commonly occurring issues and their possible solutions were further discussed in a LULUCFEG meeting on 2–3 October 2019 in Brussels[36]. Frequent recommendations were issued on:

- Annex IV, Part A (a): consistency of long-term goal to achieve a balance between emissions and removals
- Annex IV, Part A (e): constant ratio between solid and energy use of forest biomass
- Annex IV, Part A (g): consistency with national projections
- Annex IV, Part A (h): consistency with GHGI
- Annex IV, Part B (b) : consistency of carbon pools and greenhouse gases included in the FRL
- Annex IV, Part B (e)-i : area of Managed Forest Land
- Annex IV, Part B (e)-iii: forest characteristics
- Annex IV, Part B (e)-iv: disaggregation of harvesting rates between energy and non-energy uses

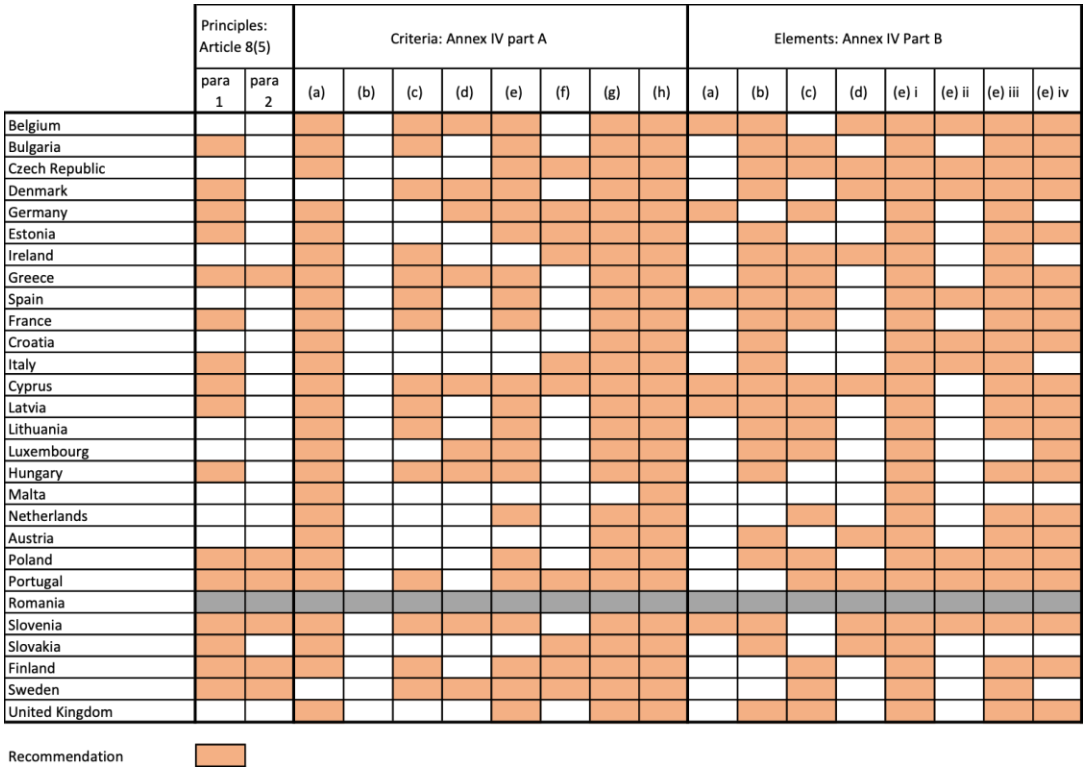
[33] 2nd LULUCFEG meeting. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeeting&meetingId=12931

[34] Compilation of the Synthesis Reports of the LULUCEF assessment of the draft NFAPs. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=30965

[35] Commission Staff Working Document, SWD (2019) 213 final. Assessment of the National Forestry Accounting Plans. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019SC0213

[36] 3rd LULUCFEG meeting. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeeting&meetingId=17658

Figure 3. Overview of the technical recommendations issued to the Member States related to the principles of Article 8(5), the criteria of Annex IV Part A, and the elements of the NFAP as required by the Annex IV Part B. See text for an explanation of the different letters referring to the different parts of the LULUCF regulation. Romania (in grey) did not submit a NFAP in 2018.



2.1.2 Revised NFAPs and their assessment

The revised NFAPs by the Member States were to be submitted by the end of 2019; by March 2020 all Member States[37] submitted a NFAP to the Commission. These revised plans were assessed by the JRC and DG CLIMA between January and June 2020. The assessment of the revised NFAPs focused specifically on two questions:

1. Have the technical recommendations been addressed?
2. Have the requirements of Article 8(5) and Annex IV of the LULUCF regulation been met?

The assessment started by comparing the draft and revised submissions, and found that most NFAPs had been revised substantially. Most Member States submitted on a voluntary basis explanatory notes along with the revised NFAP, addressing the Commission's recommendations and other changes applied to the revised NFAP, which were helpful in quickly understanding the modifications. Next, the JRC and DG CLIMA engaged in a detailed and thorough assessment, starting an in-depth evaluation of how the Member States had addressed the technical recommendations issued in the SWD (2019) 213[38], followed by an assessment of whether the requirements of Article 8(5) and Annex IV of the LULUCF Regulation are met.

For cases of potential incompliance with the LULUCF Regulation, the Commission assessed the potential quantitative impact on the FRL and the possibility to apply a technical correction before the compliance check in accordance with Article 8(11). For cases of a substantial quantitative impact or where a technical correction would not be applicable, the Commission prepared an estimate of a corrected FRL, using data reported in the NFAP and the Member States National Inventory Report (NIR). In all cases corrected estimates were discussed bilaterally with the respective Member State. Many Member States provided additional clarifications as an

[37] The FRL of the United Kingdom is part of the delegated act and is therefore included in this analysis

[38] Commission Staff Working Document, SWD (2019) 213 final. Assessment of the National Forestry Accounting Plans. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019SC0213

addendum or addressed the detected issues by submitting a corrigendum to the NFAP. This technical report considers Addenda and Corrigenda as parts of the Member State's NFAP submission.

In other cases, the Commission's recalculation forms part of the basis for the FRL laid down in the delegated act. The respective recalculation sheets are documented in the SWD (2020) 236 accompanying the delegated act. The revised NFAPs and their Addenda and Corrigenda, recalculations by the Commission, as well as a compilation of the Commission's assessment[39], were discussed in a LULUCFEG meeting in May 2020[40]. The observations and comments made in this LULUCFEG meeting[41] were considered when finalizing the assessment presented in this technical report.

It should additionally be noted that this report aims to discuss from a technical perspective the potential implications of various aspects of the FRLs identified over the course of the assessment. We emphasize that even the critical observations reported in this technical report do not necessarily indicate incompliance with the Regulation. In cases where this report raises questions or a critique towards certain aspects of the FRL or the NFAP but no recalculation has been put forward by the Commission, the final assessment concluded that this given aspect was within the boundaries of the Regulation.

[39] Commission's presentation in the 4th LULUCFEG meeting. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=42118

[40] Minutes of the 4th LULUCFEG meeting. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=42185

[41] Material from the 4th LULUCFEG meeting. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeeting&meetingId=20855

3 Main findings

The most important parts of the LULUCF regulation for laying down the FRL are Article 8(5), which sets the overarching principles of the FRL, and Annex IV listing criteria and guidance for determining the FRL (Section A), and the elements of the NFAP (Section B). The elements required in Annex IV, Part B are understood as items that should be reported in the NFAP, through which the criteria of Annex IV, Part A and principles of Article 8(5) can be met.

In this chapter, we first describe how the Member States have addressed the technical recommendations issued on the draft NFAPs (section 3.1). The chapter then continues with section 3.2, an overview of the completeness of the revised NFAPs with regard to principles (Article 8(5)), criteria (Annex IV Part A) and elements (Annex IV Part B) of the LULUCF regulation. After this, we provide an assessment of the Member States' approaches to address the principles of the Regulation under Article 8(5) (section 3.3) and the criteria of Annex IV Part A (section 3.4). Specific observations for individual Member States, where applicable, are provided in Annex 1, together with an assessment by the JRC of how the Member States addressed the technical recommendations issued by the Commission on the draft NFAPs.

3.1 Member State responses to the technical recommendations

The Commission published technical recommendations on draft Member States' NFAPs in SWD (2019) 213 that also take into account the summary of the Expert Group meeting from 1–12 of April 2019. In total, the Commission issued 289 technical recommendations[42] addressing Article 8(5) and Annex IV, Parts A and B.

In the Commission's assessment (Table 1), about 59% of those recommendations have been addressed, 29% partially addressed and 10% not addressed. Member States had particular difficulties in addressing recommendations to the first sub-paragraph of Art 8(5) (various issues) (about 44% of recommendations being partially addressed or not addressed), the consistency with the long-term sink (Annex IV Part A (a)) (74% of recommendations being partially addressed or not addressed) and consistency of carbon pools and greenhouse gases included in the FRL (Annex IV Part B (b)) (65% of recommendations being partially addressed or not addressed). The consistency with the GHGI (Annex IV Part A (h)) could often only be partially addressed (two third of recommendations being partially addressed), an outcome that was to be expected considering the complexity of this criterion.

It should be noted that addressing or partially addressing all recommendations on the draft NFAP does not guarantee that the revised NFAP is assessed without significant issues. Firstly, the Commission strengthened its assessment protocol for revised NFAP, including quantitative analysis, where applicable. Second, Member States may have applied changes in addition to the recommendations issues on the draft NFAPs.

[42] The number of technical recommendations refers to the LULUCF regulation principles, criteria or elements. Each of these categories consisted often of various (sub-)recommendations.

Table 1. Overview of how the technical recommendations issued to the Member States related to the principles of article 8(5), the criteria of Annex IV Part A, and the elements of the NFAP as required by the Annex IV Part B were addressed: no recommendations (empty boxes); recommendations addressed (green boxes); recommendations partially addressed (yellow boxes); recommendations not addressed (orange boxes). Asterisks (*) indicate an averaged final evaluation among sub-recommendations.

Member State	Article 8.5		Annex IV Part A - criteria								Annex IV Part B - elements							
	para 1	para 2	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(a)	(b)	(c)	(d)	(e-i)	(e-ii)	(e-iii)	(e-iv)
Belgium																		
Bulgaria										(*)								
Czech Republic																		
Denmark																		
Germany																		
Estonia										(*)								
Ireland																		
Greece													(*)					
Spain													(*)					
France										(*)								
Croatia																		
Italy										(*)								
Cyprus										(*)			(*)					
Latvia	(*)																	
Lithuania																		
Luxembourg										(*)		(*)						
Hungary										(*)								
Malta															(*)			
Netherlands																		
Austria																		
Poland																		
Portugal										(*)					(*)			
Romania																		
Slovenia	(*)									(*)								
Slovakia																		
Finland															(*)			
Sweden									(*)	(*)							(*)	
United Kingdom																		

3.2 Overview of the completeness of the NFAPs

An overview of the completeness of the NFAPs submitted by the Member States and the FRLs therein with respect to the requirements of the Regulation principles, criteria and elements is shown in Table 2.

In more than 90% of cases, the Member States fulfilled or partially fulfilled the principles of the Regulation (Article 8(5)). Five Member States (Bulgaria, Czech Republic, Germany, Cyprus and Poland) had accuracy issues related to the consistency of the FRL with either continuation of sustainable forest management practice of the reference period or consistency with GHGI reporting, or both. Based on the information reported in the NFAPs, for Czech Republic, Latvia, Poland and Slovenia, it was not possible to determine whether the NFAPs fulfilled the Article 8(5), paragraph 2 of the Regulation concerning the relationship between harvest intensity and age-related dynamics. However, concerning these issues, the European Commission proposed a recalculation only for Czech Republic, because of inconsistent representation of historical harvest over the period 2000–2009. Based on further clarifications by the Member States and discussions within the LULUCFEG[43], Latvia, Poland and Slovenia were considered within the legal boundaries of the Regulation. A detailed description of the problematic issues for each of these Member States is also reported in Annex 1.

In more than 60% of cases, the Member States sufficiently fulfilled the criteria of the LULUCF Regulation. However, thirteen Member States provided limited or no information on the comparison between FRL simulations and the forest sector development under climate scenarios for the Regulation 1999/2018 (Annex IV Part A(a)), and 26 Member States only partially ensured consistency with GHGI (Annex IV Part A(h)).

In total, only 55% of the elements (Annex IV Part B) were reported transparently and completely in the revised NFAPs. Sixteen Member States did not report adequate information on pools and gases, or were inconsistent with the GHGI (Annex IV Part B(b)). Thirteen Member States did not ensure area consistency with the GHGI (Annex IV Part B(e-i)), and two Member States did not provide explicit information on the area of managed forest land at the beginning of the simulation (Germany and Portugal). The Commission noted that the majority of inconsistencies in pools and gases derives from missing emissions from biomass burning in the FRL. These inconsistencies were typically of a negligible quantitative value. The Commission also noted that the area inconsistency was usually caused by exclusion of unmanaged forests, exclusion of forest land with no emissions estimation, or exclusion of non-EU territories from the FRL, although these areas are included in the national GHGI reporting. Issues concerning pools and the gases and the managed forest land area were explained (or corrected) in addenda or corrigenda provided by Member States or in the recalculations by the Commission, or in some cases requested to be technically corrected later. In particular, the Commission corrected the FRL value because of (not limited to) inconsistencies about area (Cyprus) or pools and gases (Bulgaria, Germany, Cyprus, Poland). Elements related to the consistency with the GHGIs (Annex IV Part B(b), Annex IV Part B(e-i), and Annex IV Part B(e-ii)) are further described in section 3.4, under Annex IV Part A(h). About one third of NFAPs report information on how harvest rates develop under different policy scenarios (Annex IV Part B(d)). Further information on this element are provided in section 3.4, under Annex IV Part A(a, g).

In more than 80% of cases, Member States report a summary on how the FRL was determined (Annex IV Part B(a)). However, the Commission noted that only half of Member States provide detailed and quantitative description of the approaches and methods as well as of forest management practices and intensity used to determine the FRL (Annex IV Part A(c)). The revised NFAPs also lacked adequate information concerning the description of dynamic age-related forest characteristics (area, living biomass, increment) and forest management practices as documented in the reference period (including rotation length, size threshold, targeted species). Seventeen Member States provide limited information on those parameters (Annex IV Part B(e-iii)), and fourteen Member State report limited or no information about the historical and future harvesting rates, disaggregated between energy and non-energy uses (Annex IV Part B(e-iv)). Elements related to describing forest management practices, including harvest intensity, and the consideration of age-related dynamics (Annex IV Part A(c), Annex IV Part B(e-iii), and Annex IV Part B(e-iv)) are further described in section 3.3. More complete information especially on age-related dynamics, forest management practices, and harvest rates would have helped in performing a more exhaustive assessment of the revised NFAPs. However, the Member States provided sufficient qualitative and quantitative information to support the FRL projections. For this reason, the European Commission is sufficiently confident that Member States made all necessary efforts to calculate robust FRL numbers.

[43] 4th LULUCFEG meeting in May 2020. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeeting&meetingId=20855

Table 2. Completeness of the revised NFAPs with regards to principles (Article 8(5)), criteria (Annex IV Part A) and elements (Annex IV Part B) of the LULUCF Regulation. Colours indicate the fulfilment of principles, criteria and elements: green (complete fulfilment, adequate information), yellow (partial fulfilment, limited information), and orange (no fulfilment, unclear or missing information). R: The issue addressed in a Recalculation; C: The issue addressed in a corrigendum or addendum by the Member State; N/A: not available.

Member State	Article 8(5)			Annex IV Part A - criteria								Annex IV Part B - elements							
	para 1	para 2	para 3	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(a)	(b)	(c)	(d)	(e-i)	(e-ii)	(e-iii)	(e-iv)
Belgium													(2)						
Bulgaria	(R)										(R)		(R) (2)			(6)			
Czech Republic	(R)												(2)						
Denmark													(2)						
Germany	(C) (R)		(R)								(R)					N/A			
Estonia																			
Ireland																(C)			
Greece											(C)		(2)			(5)			
Spain																			
France													(2)			(C) (5)			
Croatia													(3a,b)						
Italy													(3a)			(6)			
Cyprus	(R)							N/A					(R)			(R)			
Latvia	(C)												(2)						
Lithuania													(2)						
Luxembourg																			
Hungary																(6)			
Malta								N/A		N/A			(4)						N/A
Netherlands													(2)						
Austria													(2)			(6)			
Poland	(C)	(C)	(R)										(C) (R) (3b)						
Portugal																N/A			
Romania													(2) (3b)						
Slovenia												(1)							
Slovakia																			
Finland			(C)									(1)	(2)						
Sweden																			
United Kingdom																(7)			

(1) Inconsistent forest definition with GHGI
(2) Only missing emissions from biomass burning in the FRL
(3a) Dead wood included as zero in the FRL
(3b) Dead wood included in the FRL, but inconsistently with GHGI
(4) Living biomass not estimated in the GHGI
(5) Area inconsistency due to the exclusion of unmanaged forests
(6) Forest land remaining forest land with no emission estimation
(7) Area inconsistency due to the exclusion of non-EU territories

3.3 Regulation principles according to Article 8(5)

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' (subparagraph 1).

Furthermore, the forest reference levels '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' (subparagraph 2).

Article 8(5) also requires that the 'Member States shall demonstrate consistency between the methods and data used to determine the proposed forest reference level and those used in the reporting for managed forest land' (subparagraph 3). This requirement for consistency and comparability is reiterated in criterion (h) of Annex IV Part A.

3.3.1 Age-related dynamics and forest management practices

Consideration of age-related dynamics

The consideration of age-related dynamics in modelling the FRLs is one of the pillars of the Regulation, as it allows the exclusion of policy or market assumptions from the calculation of the projected emissions and removals for managed forest land (Grassi et al. 2018a).

Dynamic age-related forest characteristics were considered in various ways, which can be broadly divided into the following interlinked proxies:

- **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 assessment found 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 directly consider age in the modelling framework (Figure 4), 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[44] (Greece). Indeed, in Mediterranean Member States, where the combination of human and natural disturbances frequently alters the forest structures, the use of other indicators or age-related proxies represents a more robust approach to simulate forest growth (e.g. Alberdi et al. 2013; FAO and Plan Bleu 2018). Finland and Sweden use a combination of age and size (height and diameter at breast height) and Germany uses age and other parameters (volume).

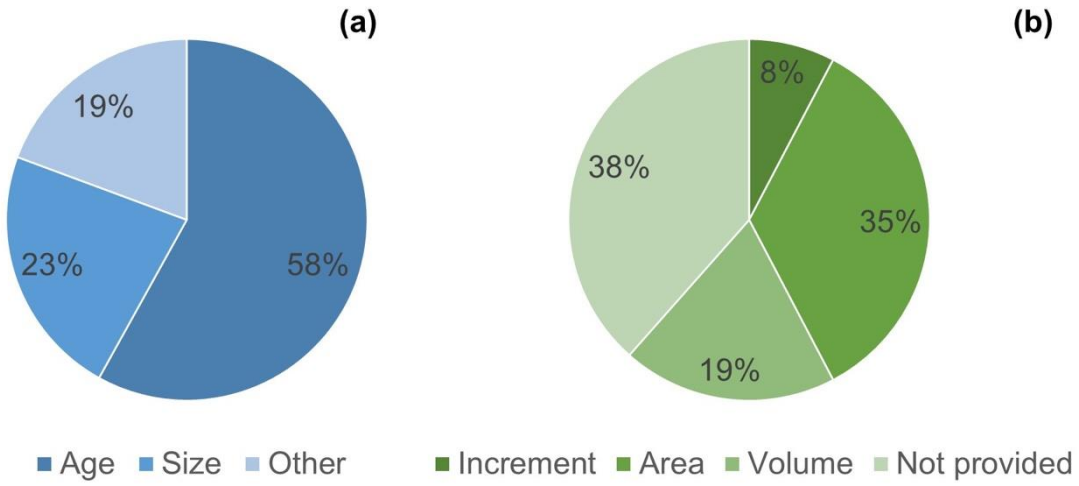
In addition, it was assessed whether the revised NFAP contains a transparent description of the development of the relevant age-related forest characteristics e.g., by increment, area, volume of growing stock or biomass density. The age-related forest characteristics are important descriptors of the state of forests at the beginning of the simulation, depending on the effects of past management activities and natural disturbances, and are adopted in the modelling exercise as input or ancillary data for the simulation of forest growth. This information is used to understand if the Member States demonstrate that there is an age-dependent dynamic in the

[44] increment correlated with the volume of growing stock

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 Figure 4. 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. This lack of documentation limits a complete understanding of how future age-related forest characteristics develop based on the continuation of forest management practices. This in turn means that for at least ten Member States, it is not possible to assess the relationships between the evolution of age-related forest characteristics, such as e.g. growing stock, and management intensity. Therefore, in these cases, the European Commission analysis concluded that the "limited / not reported" information on the dynamics of age-related forest characteristics might have an impact on the proposed FRLs, but noted that only the modelling (i.e. consideration) of the age-related forest characteristics in the determination of the FRL is required by the Regulation.

Figure 4. Consideration of age or age-related proxies in modelling (a), and of the development of age-related characteristics in NFAPs for the simulation period (b), as a proportion of NFAPs submitted by the Member States.



Description of forest management practices

Article 8(5) requires the Member States to define the forest management practices 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, GHGIs, and national statistics.

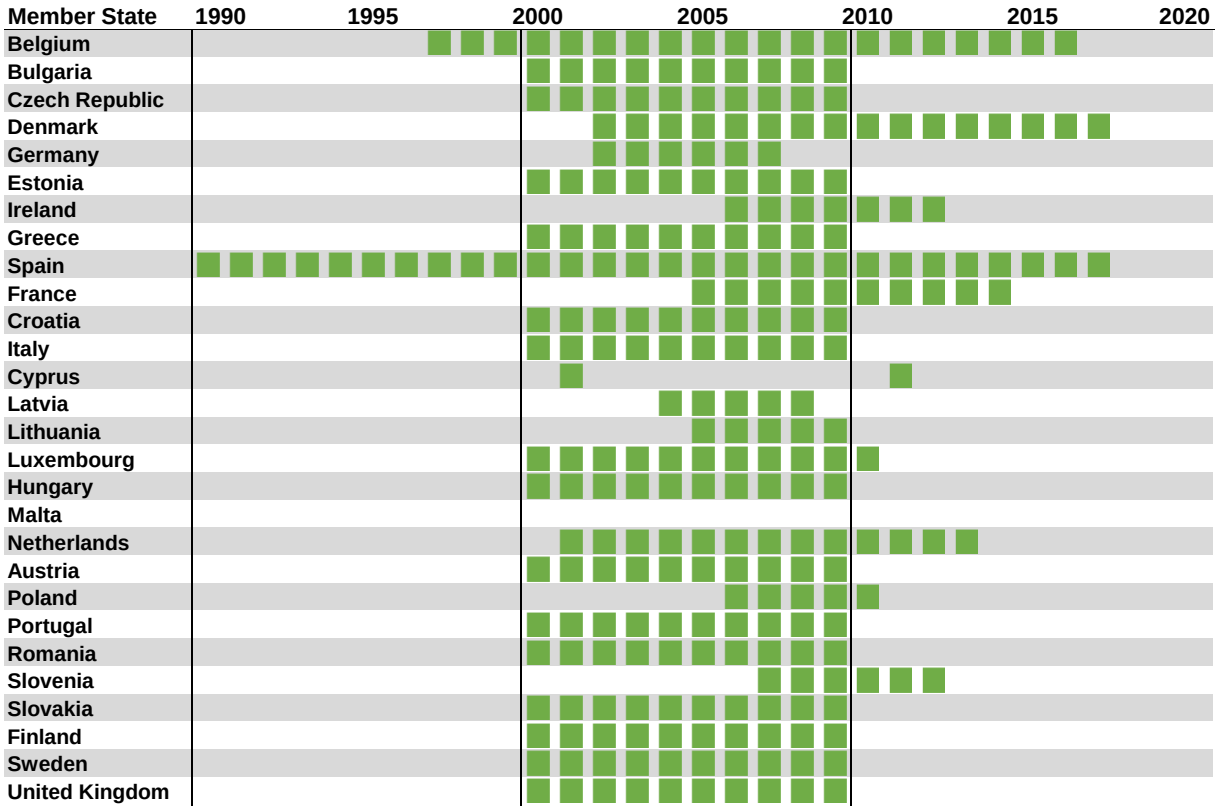
The European Commission thoroughly assessed to what extent the period chosen for the definition of forest management activities, such as rotation lengths, age or size thresholds, target species or cohort, is aligned with the reference period 2000–2009 in the revised NFAPs. The period chosen to define the forest management activities can differ from the period chosen to set the harvest intensity (see the following section), and the period covered by the comparison between modelled and reported estimates as in the GHGIs (see Section 3.3.3), in the framework of model calibration. The data sources used by Member States were generally comprehensively reported, and include appropriate national forest inventories and latest GHGIs. The data sources were found to be compatible with the description of best available data as described in the technical guidance document[30].

The majority of Member States define: determining modalities for forest management activities in the reference period (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.

The outcomes of this assessment are reported in Figure 5. 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 use of data outside or partially overlapping the period 2000–2009 has implications in ensuring that forest management activities are defined according to actual practices as documented in the period 2000–2009. Such implications may include: considering or not certain target species, shortening / prolonging the rotation length, increasing / reducing the size threshold, altering the forest management system (e.g. from even- to uneven-aged forests). For example, the exclusion of some reference years from the definition of forest management activities could not reflect a change in species targets and management system due to a change in management prescriptions or the occurrence of large-scale disturbances within the period 2000–2009. However, the assessment noted that in the vast majority of cases, Member States used appropriate data sources (management prescriptions, NFIs, national statistics, experts) that can be considered the best available data to transparently represent the forest management practices in the period from 2000 to 2009.

In addition, forest management activities should reflect the actual variation of harvest intensity as a core element of forest management practices occurring in the period 2000–2009, which in turn affects the state of forests (in terms of growing stock, increment, etc.) at the end of the reference period or prior the starting year of simulation. Specific cases are described in the following section.

Figure 5. Reference periods used for the documentation of forest management activities (green). The vertical lines highlight the reference period 2000–2009.



Forest management practices in terms of harvest intensity

Harvest intensity is generally used in forest management to refer to the proportion of wood removed in harvests, relative to other forest characteristics. The LULUCF regulation recognizes harvest intensity as "a core

element of sustainable management practice" (Article 8(5)), but does not determine in detail how it should be defined. Furthermore, while the intention of the FRL, as noted in the LULUCF's preamble (recital 23), is to extrapolate forest management practices and intensity from the reference period, Article 8(5) outlines that the FRL should "take account of the future impact of dynamic age-related forest characteristics in order not unduly constrain forest management intensity".

With these aspects in mind, the Commission assessed two elements regarding harvest intensity in the Member States' proposed FRLs:

- The parameters used to describe harvest intensity in the reference period and projected to the compliance period;
- The period used to define harvest intensity of the reference period.

The assessment found that the Member States defined harvest intensity through a number of different parameters, all relative to the forestry parameters documented for the reference period (Figure 6). Thirteen Member States[45] determined intensity as the ratio between harvest and growing stock, either by total growing stock or by growing stock available for wood supply. Six Member States (Belgium, Denmark, Germany, Lithuania, the Netherlands and Austria) set the modelling framework to use the same harvest- and age class transition probability as in the reference period. Estonia, Finland[46] and the United Kingdom[47] computed the ratio 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. Malta did not project harvests for the FRL.

The variety of different parameters used to describe harvest intensity reflects on the one hand the differing traditions of forest management practice in the Member States, and on the other hand the differences in the methodologies employed to project the FRLs. In the assessment, we noted that the choice of parameters to define intensity may – depending on the national circumstances – have an impact on the projected harvest volumes, and thereby the FRL. Nevertheless, given that the Regulation relies first and foremost on the Member States' judgment of the best available data and methodologies to represent their national forests, all approaches chosen by the Member States were considered acceptable in the assessment, as long as they were demonstrated to be consistent with the Member State-defined forest management practice during the reference period.

Figure 7 gives an overview of the periods from which the Member States derived the parameters defining harvest intensity. Due to data characteristics and availability, the period is in many cases different to the period from which management activities are derived from (see 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 (Belgium, Denmark, Ireland, France, Cyprus, Netherlands, and Slovenia) justified their choice by issues concerning data availability, 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, taking into consideration the special provisions provided by art. 8(4), 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, and suggests a correction (see the SWD (2020) 236). Furthermore, the assessment found that 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 for the Czech FRL (see the SWD (2020) 236).

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

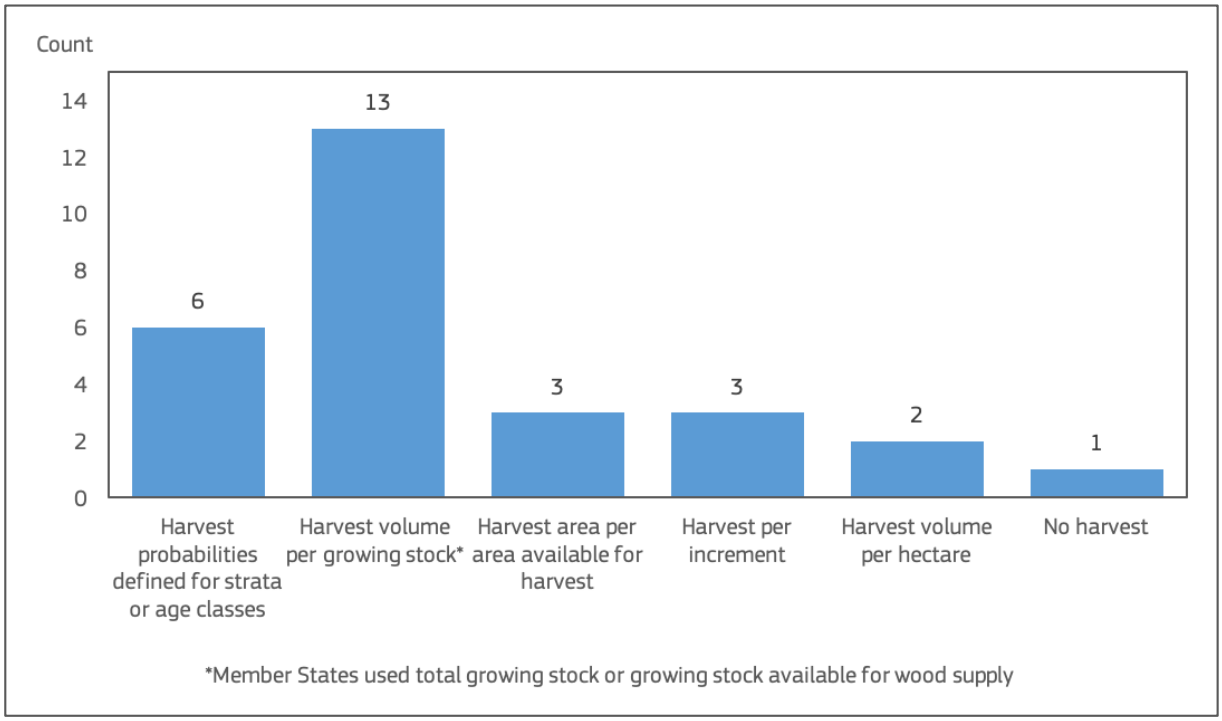
[45] Bulgaria, Czech Republic, Spain, France, Croatia, Italy, Latvia, Luxembourg, Hungary, Poland, Romania, Slovenia and Slovakia.

[46] Finland's modelling considered also the interest rate, alongside with harvested area and area available for harvest in different management and maturity classes (determined by diameter).

[47] In addition to relative area of harvests, the United Kingdom also used detailed information on the timing of harvests and the biomass removed for each strata and age class, and aligned them with the practice in the reference period 2000-2009.

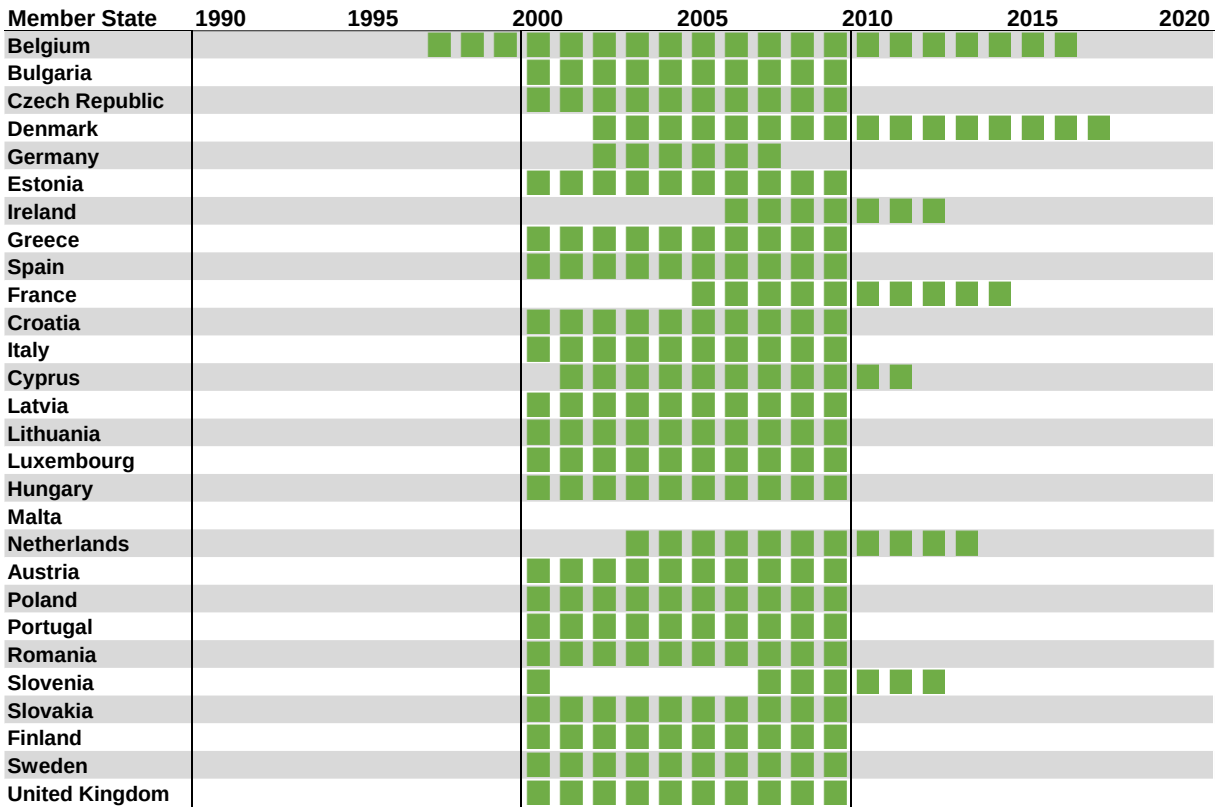
average transition probabilities over the reference period. The assessment noted that Slovenia used harvest data from 2007–2012 (mid-year 2010), and defined harvest level based on the growing stock in 2000. Similar approaches were used by Poland with the average harvest from 2000 to 2009 in relation 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 the bias introduced to the estimation of the ratio, and raised the issue for discussion in the meeting of the LULUCFEG[48]. During the discussion, some experts expressed critique towards mixing different time periods when determining the harvest intensity parameters from the reference period. However, provided that the Regulation grants room for interpretation of harvest intensity definition, the assessment concluded that these approaches were still within the boundaries of the legal interpretation of the LULUCF regulation.

Figure 6. The use of different parameters to model harvest intensity.



[48] Commission's presentation in the 4th LULUCFEG meeting. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=42118

Figure 7. Reference period used as a basis to determine the harvest intensity. The vertical lines highlight the reference period 2000–2009.



3.3.2 Projection of the forest management practice and projected harvests for the FRL

All Member States prepared a projection of the continuation of sustainable forest management practice, using a variety of modelling tools (Table 3). As the FRL is a projection of future development and as such inherently different from the reporting of historical observations in the GHGI, the modelling tools in general were not the same between the FRL and the GHGI. Furthermore, the models used to project living biomass development in the FRL were usually modelling forest increment and harvest in cubic metres of timber. For the FRL, these results were converted to gains and losses of carbon, and further to net emissions of CO_2, utilizing the same biomass expansion and conversion factors as in the GHGI. The modelling results of living biomass and other carbon pools included in the FRLs are detailed in Annex 1. Here, we provide an overview of the projection of harvest rates, forest increment, and forest growing stock as reported in the Member State's NFAPs.

Table 3. The modelling tools used by the Member States for estimating living biomass in the FRL.

Member State	Modelling approach applied to FRL for living biomass	Approach applied in GHGI 2019
Belgium	SIMREG	IPCC C stock change
Bulgaria	Ad hoc FRL model	IPCC C stock change
Czech Republic	CBM-CFS3 model	IPCC Gain-loss
Denmark	IPCC C stock change combined with ancillary approaches	IPCC C stock change
Germany	C stock change combined with other ancillary approaches	IPCC C stock change
Estonia	Ad hoc FRL model	IPCC C stock change
Ireland	CBM-CFS3 model	CBM-CFS3 and FORCARB models
Greece	gain loss approach	IPCC C stock change
Spain	Vael model	IPCC C stock change
France	MARGOT model	IPCC Gain-loss
Croatia	HS-MODEL	IPCC Gain-loss
Italy	*for-est* model	*for-est* model
Cyprus	Ad hoc FRL model	Growing stock, annual increment and losses
Latvia	AGM model	IPCC Gain-loss
Lithuania	EFDM model	IPCC C stock change
Luxembourg	Ad hoc FRL model	IPCC Gain-loss
Hungary	CASMOFOR model	IPCC C stock change
Malta	Ad hoc FRL-model	--
Netherlands	EFISCEN space	IPCC C stock change
Austria	CALDIS-VB	IPCC Gain-loss
Poland	CBM-CFS3 model and other ancillary approaches	IPCC C stock change
Portugal	IPCC Gain-loss	IPCC Gain-loss
Romania	Ad hoc age-dynamic model	IPCC C stock change
Slovenia	Ad hoc FRL model	IPCC C stock change
Slovakia	Ad hoc FRL model	IPCC Gain-loss
Finland	MELA	IPCC Gain-loss
Sweden	Heureka Reg Vis model	IPCC C stock change
United Kingdom	CARBINE model	CARBINE model

In general, the carbon sink of living biomass reflected in the FRL is mostly determined by two drivers: net annual increment (i.e. the gross increment minus losses due to natural mortality) and the amount of harvest. The impact of these two drivers is shown as a change in the growing stock. Increment generally varies within a medium to long term horizon, since it mostly depends on species composition and climatic conditions. Harvest is directly linked to forest management activities, as detected within the reference period and modelled by Member States. On a yearly basis, the carbon sink is mostly determined by the absolute difference between the net annual increment and the annual amount of harvest. When the amount of harvest exceeds the net annual increment, forests become a carbon source and, as the overall biomass growing stock is reduced, forest activities may also affect the future forest carbon sink.

Because the forest sink expressed by the FRL is as dependent on the net annual increment as it is on the assumed harvests, it is important to compare these two variables when considering the potential implications of the FRL for forest management. Unfortunately, this comparison is not always easy in the NFAPs, because in many cases the Member States document harvests and increments in different units, or separately for different strata of forests. When Member States did not report national total increment, the evolution of biomass growing stock can be considered as a proxy, since this parameter is mostly determined by the difference between the net annual increment and the amount of harvest.

To provide an overview of the Member States' assumptions on harvest development in the FRL, we compile the harvest rates projected by the Member States in Figure 8 and compare them with the increments, when available, or the growing stocks (when the increment was not available).

In many cases, the Member States provided increments and/or growing stock per hectare, or further disaggregated per tree species or strata. This information was duly noted in the assessment, and considered to

fulfil the requirements of the LULUCF Regulation. However, such data is not always possible to aggregate to a national total based on the information reported in the NFAP. To avoid errors in data aggregation in the illustration here, we only show those data that are reported by the Member States as national totals. The data sources used in the figures are recalled in Table 4

The harvests are shown as total harvests as reported in the NFAP, and may include also harvest on afforested and deforested land. In some cases, the NFAP does not specify whether the values are reported under or over bark, whether the reported harvest volumes include stemwood only or also other wood components or residues. Therefore, the values reported in these figures may not always be comparable across Member States. There may also be differences to official national statistics or the country's international reporting. In addition, we have used historical data only when provided by the Member State in the NFAP. Through this, we seek to ensure – to the extent possible – that the historical values shown in the figures are comparable with the values projected for the FRL.

The harvest volumes in the FRLs are projected to increase in most Member States, when compared to the reference period. The exceptions are Belgium, Greece, the Netherlands and the United Kingdom, where the total harvest is projected to be slightly lower in the compliance period 2021–2025, compared to the reference period 2000–2009. At the same time, increment is projected to increase in most Member States (where increment was available as a national total), with the exception of Austria and Ireland. The total growing stock was reported by much fewer countries, but it also showed an increasing trend in all Member States where it was possible to assess (except possibly for Denmark where, however, this data is only reported for the period 2012–2018).

From the modelling perspective, the role of harvested volumes differs considerably between the Member States. In some cases, the amount of harvest reported by the country in the compliance period was not a direct model output, but instead derived from the model results that project the forest carbon sink directly (e.g. Italy, Denmark and Germany). In most cases, however, the harvest amount was determined ex-ante, through specific modelling assumptions on forest management practices. The harvest volume was then used as input for modelling the forest net emissions within the compliance period. In this case, the specific assumptions on harvest intensity (see Figure 6) that were used to determine the future amount of harvest are likely to affect the final sink attributed to managed forest land. For this reason, also the specific assumptions related to the harvest sub-model - when used - were carefully scrutinized within the review process[49]. In most cases they were considered in line with the regulation's requirements. In some cases, however, where the harvest intensity was defined by mixing data from the beginning and the end of the reference period - such as for Latvia, Poland and Slovenia – the assessment noted some possible bias within the final calculations. For Czech Republic, where the amount of harvest from salvage felling within the compliance period was estimated excluding - for this specific activity- the management practices that occurred before 2005, the projected harvest volume was partially recalculated.

[49] Romania does not report information on the amount of harvest expected within the compliance period, but this was considered to not directly affect the final estimates.

Table 4. Sources of the data used in Figure 8. All references are to the English versions of the revised NFAPs submitted by the Member States, unless otherwise stated.

	Historical harvest	Projected harvest	Recalculated harvest	Historical increment	Projected increment	Historical growing stock	Projected growing stock	Biomass change
Belgium	Appendix 2	Appendix. 2 and Tab. 10				Appendix 2	Appendix 2	
Bulgaria	Fig. 21	Fig. 37				Tab. 6	Tab. 17	
Czech Republic	Fig. 10 (left)***;	Fig. 10 (left)***;	SWD (2020) 236			Tab. 2		
Denmark	Tab. 9	Tab. 9		Tab. 9				
Germany	SWD (2020) 236	Tab. I-3 and I-6	SWD (2020) 236					
Estonia	Tab. 3.8	Tab. 3.8		Tab. 3.2, Fig. 4.2*	Fig. 4.2*			
Ireland	Tab. 24	Tab. 24		Tab. 24	Tab. 24			
Greece	Tab. 20	Tab. 20				Tab. 17		
Spain	Fig. 6*	Tab. 3 and Fig. 14*			Fig. 13*			
France	p. 70	p. 71		p. 66	p. 66			
Croatia	Tab. 5.3-4	Tab. 5.3-5		p. 5				
Italy	Tab. 31	Tab. 31		Tab. 30****	Tab. 30****			
Cyprus								p. 22 and 23
Latvia	Tab. 15 in Addendum	Tab. 15 in Addendum		Tab 25 in Addendum	Tab 25. in Addendum			
Lithuania	Tab. 1-2	Tab. 1-2 and 4-5		Tab. 1-2	Tab. 1-2			
Luxembourg	Fig. 4.8	Fig. 4.9*						
Hungary	Tab. 2 and 16	Tab. 2 and 16		Tab. 13 (b)				
Malta					Tab. 15			
Netherlands	Fig. 4.1*	Fig. 4.1*				Tab. 1.1 and 3.12		
Austria	Tab. 6	Tab. 6		Fig. 17	Fig. 17 and Tab. 4			
Poland	Tab. 9 and 19	Tab. 9 and 19				Corrigendum/addendum	Corrigendum/addendum	
Portugal	Tab. 25, 27 and 29**	Tab. 26, 28 and 30**						
Romania	Tab. 1, 4, 15 and Annex 3*****					Annex 5*****	Tab. 19	
Slovenia	Annex 1	Tab. 14			Tab. 14			
Slovakia	Tab. A6 and Tab. A19	Tab. A19**				Tab. A3 and p. 18		
Finland	Tab. 14	Tab. 14			Tab. 14			
Sweden	Tab. 12	Tab. 12		Tab. 12	Tab. 12			
United Kingdom		Tab. 3.13						

* Values estimated from a figure.
** Values from the tables added together.
*** Exact values received from the country experts
**** The tables reported by Italy indicate the units in tonnes of carbon. However, comparison with ancillary data shows that the values provided correspond instead to tonnes of dry biomass.
***** Annexes to Romania's NFAP are only available in the Romanian version.

Figure 8. The development of harvest (H, in black), increment (I, in orange) and growing stock (GS, in green), in case increment was not reported. Solid lines show historic data, dashed lines projected data and dotted lines recalculated data. All information shown is based on the NFAPs submitted by the countries. As the specific definitions and units (e.g. harvests under bark or over bark, the inclusion of harvesting residues, etc.) was not always provided and differs between the countries, the absolute values are not comparable between the Member States. For Czech Republic and Germany, also the recalculated harvest is shown (dotted black line).

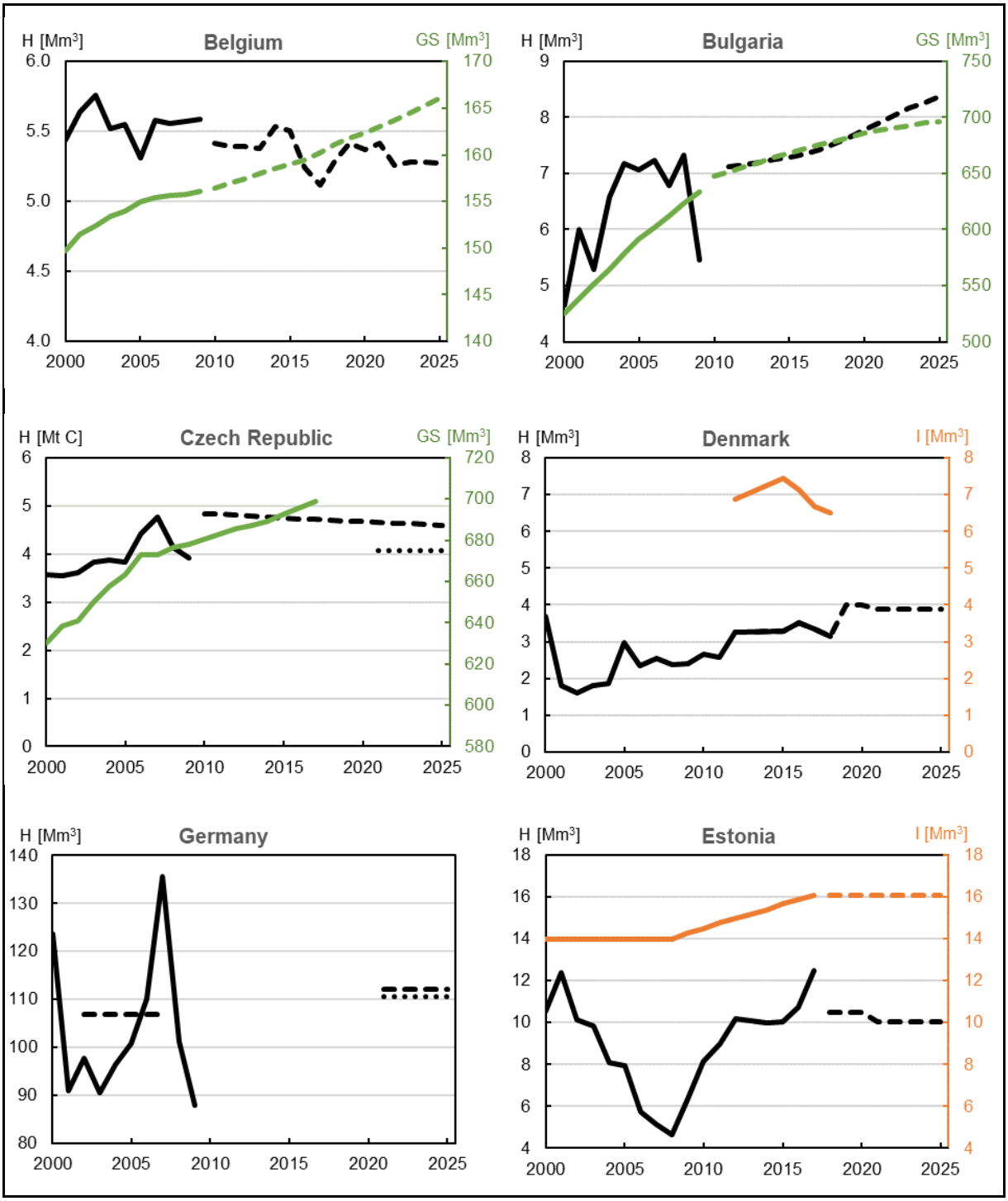


Figure 8 (continued). France reports the increment in CO_2, which is here shown as a positive figure to allow for easier comparison with the reported harvest.

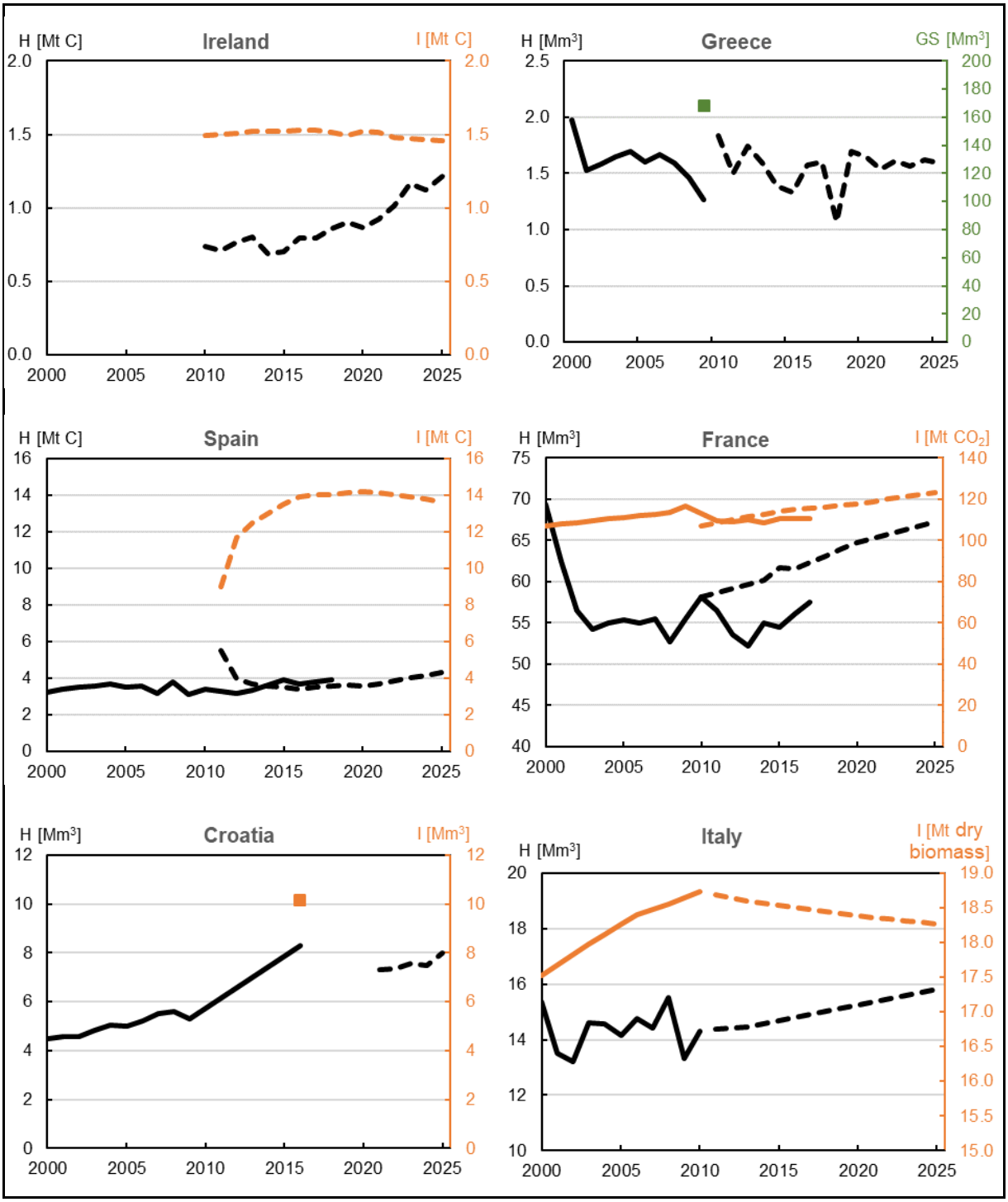


Figure 8 (continued). Cyprus reported biomass change (here shown in purple) instead of harvests or increment. For Malta, no harvests were projected for the FRL. All information shown is based on the NFAPs submitted by the countries.

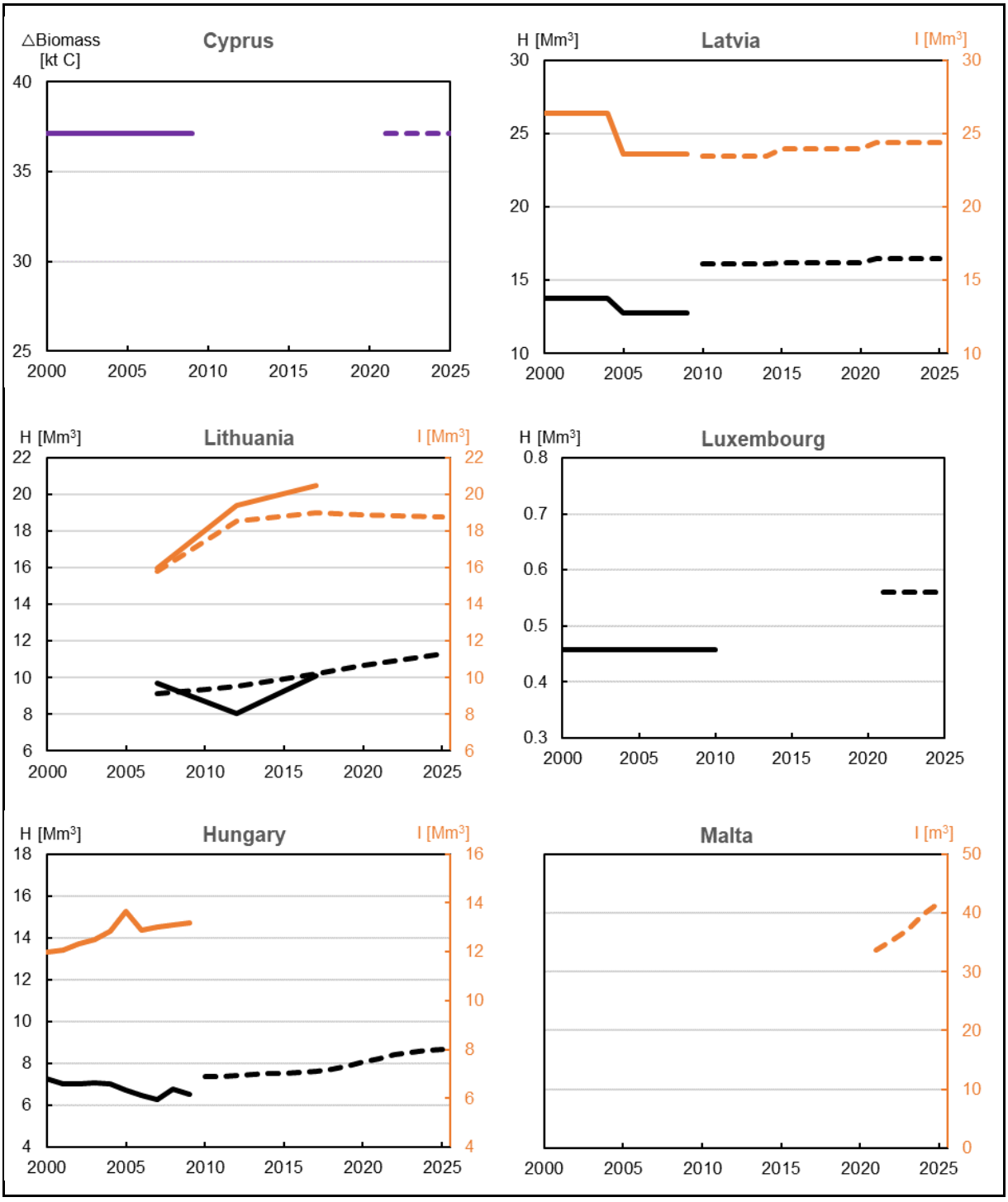


Figure 8 (continued).

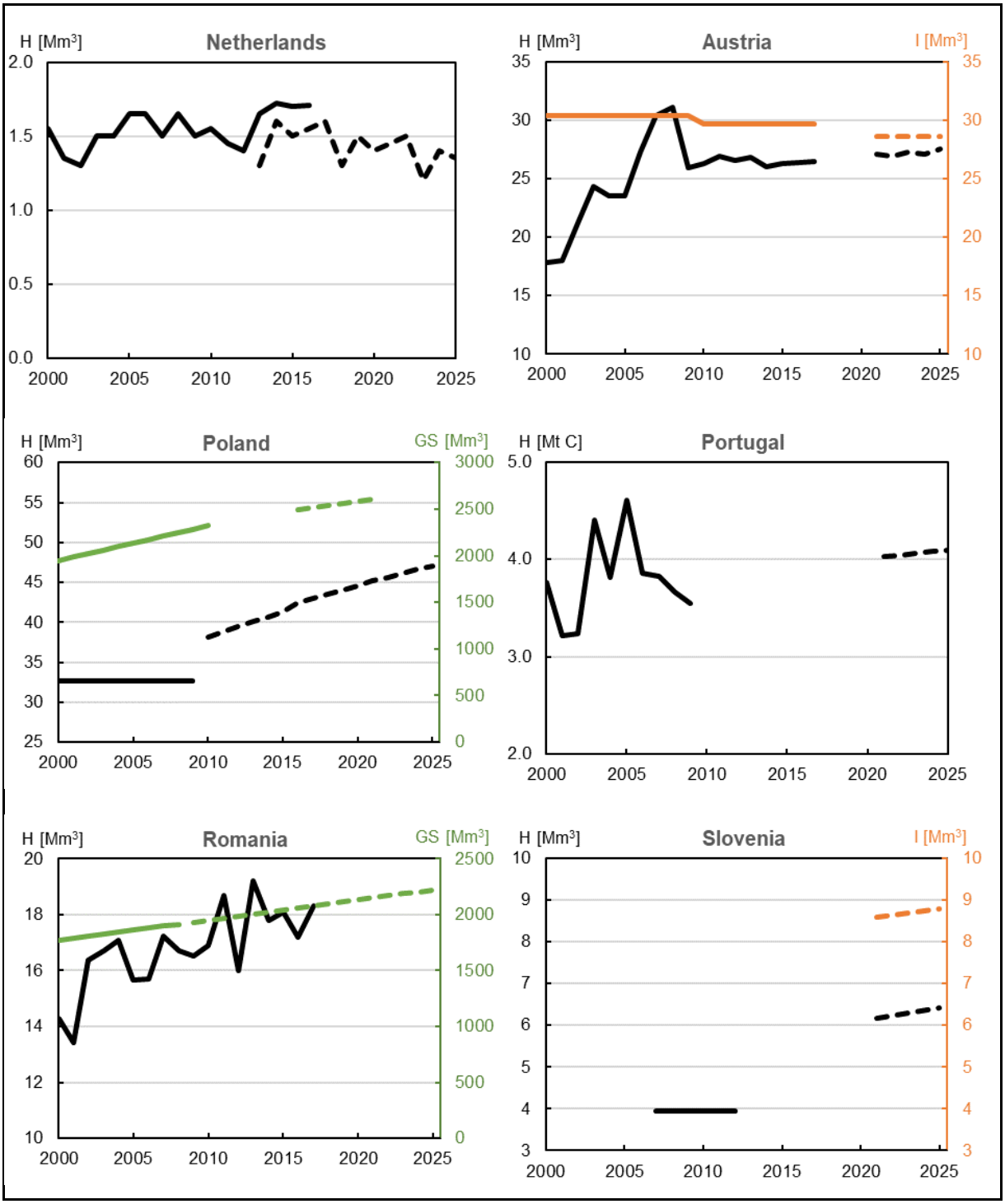
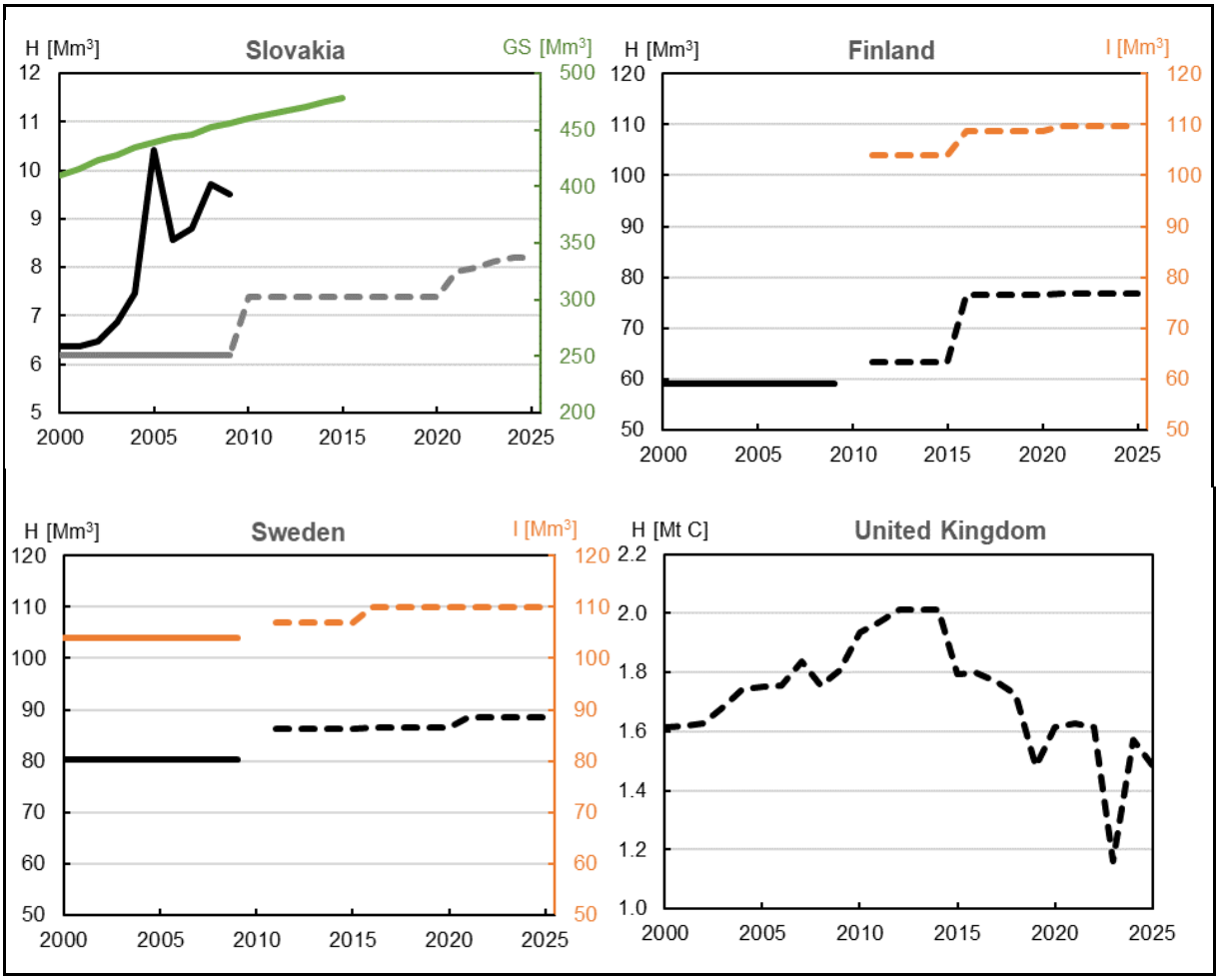


Figure 8 (continued). For Slovakia, the black line shows the total harvest, while the grey lines show the reported and projected harvests in final fellings only.



For an overview on the EU level, we computed an estimate of the EU aggregate of the Member States' harvests assumed for the FRL. For this exercise, the original values reported in Figure 8 for each MS were preliminarily harmonised in order to report the total amount of harvest, as total removals over bark. At this purpose, country-specific correction factors (based on the information directly provided within the NFAPs and on other ancillary data) were applied to account for the bark's fraction, when excluded from the original data reported by the countries (such as in case of Denmark or Greece), or to exclude the fraction of primary residues from the total amount of fellings (such as in case of Austria or Bulgaria), or to convert the amount of biomass reported as tons of carbon to volume (such as in case of Czech Republic or the United Kingdom). Romania did not report projected harvests in the NFAP, but the data received after the assessment (courtesy of Tapio Ltd.) suggests that the FRL projection assumed a harvest level of ca. 17 Mm³ in 2021-2025. This information has been used in Figures 9 and 10. The complexity of this harmonization and the uncertainty of underlying data suggests that these results should be considered with some caution.

The FRLs project the total harvests in the EU to increase from ca. 510 Mm³ in the reference period 2000–2009 to ca. 600 Mm³ for the compliance period 2021–2025 (Figure 9), or by ca. 16%. In these numbers, the harvests of all Member States have been converted to cubic metres over bark, and include industrial roundwood and fuelwood, while forest residues are excluded. The differences between Member States are notable: as shown in Figure 10, ranging from more than 50% higher harvests in the FRL than in the reference period projected by Denmark, Croatia and Ireland, to a slight decrease projected by Belgium, Greece, the Netherlands and the United Kingdom between the reference period and the FRL.

The assessment noted that many Member States have refined the harvest statistics used for the FRL modelling to be more comparable with GHGI reporting, and also to improve the consistency of the historical data series.

These refinements enhance the comparability with the GHGI reporting, and also seek to provide a more realistic report of historical forest use. Consequently, the reported harvest volumes for the historical period are not always the same as those reported by e.g. FAOSTAT or Forest Europe, as is evident also on the total EU level (Figure 9). One of the most prominent reasons for the differences is the reporting of harvest over bark in the NFAPs by most Member States (for Figure 9, all Member States' reported values were converted to over bark), while the FAOSTAT harvest removals are reported under bark. The bark fraction explains ca. 12% of the difference between the NFAPs and FAOSTAT shown in Figure 9 and FAOSTAT data.

Other differences are due to the fact that many Member States (e.g. Belgium, Germany, etc.) improved the accuracy of their estimates, especially to include previously missing information on household fuelwood, for which official statistics are known to be very uncertain (Camia et al. 2018). Furthermore, it should be noted that the numbers reported by Forest Europe are "fellings", which include also residues and harvest losses that are not removed from the felling site. Fellings are therefore expected to be approximately 10-15% greater than the "removals" that we complied from the NFAPs.

Figure 9. The aggregate EU-level harvests reported in the NFAPs (incl. corrigenda or recalculations, where applicable) for the reference period 2000–2009 and projected for the compliance period 2021–2025, compared with harvest reporting in international databases of FAOSTAT and Forest Europe in the State of Europe's Forests Report (SoEF 2015). The harvests reported in the NFAPs have been converted to cubic metres over bark (o.b.) to enable aggregation of the different Member State's values. It should be noted that the NFAP harvest is the best harmonized compilation of information that we could assemble, but the uncertainty of underlying data suggests some caution when interpreting the results.

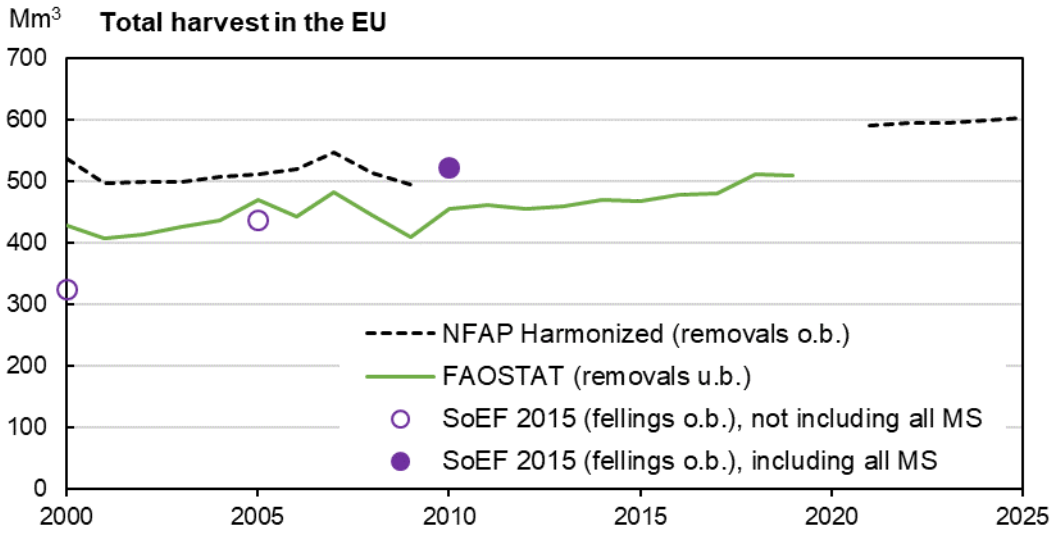
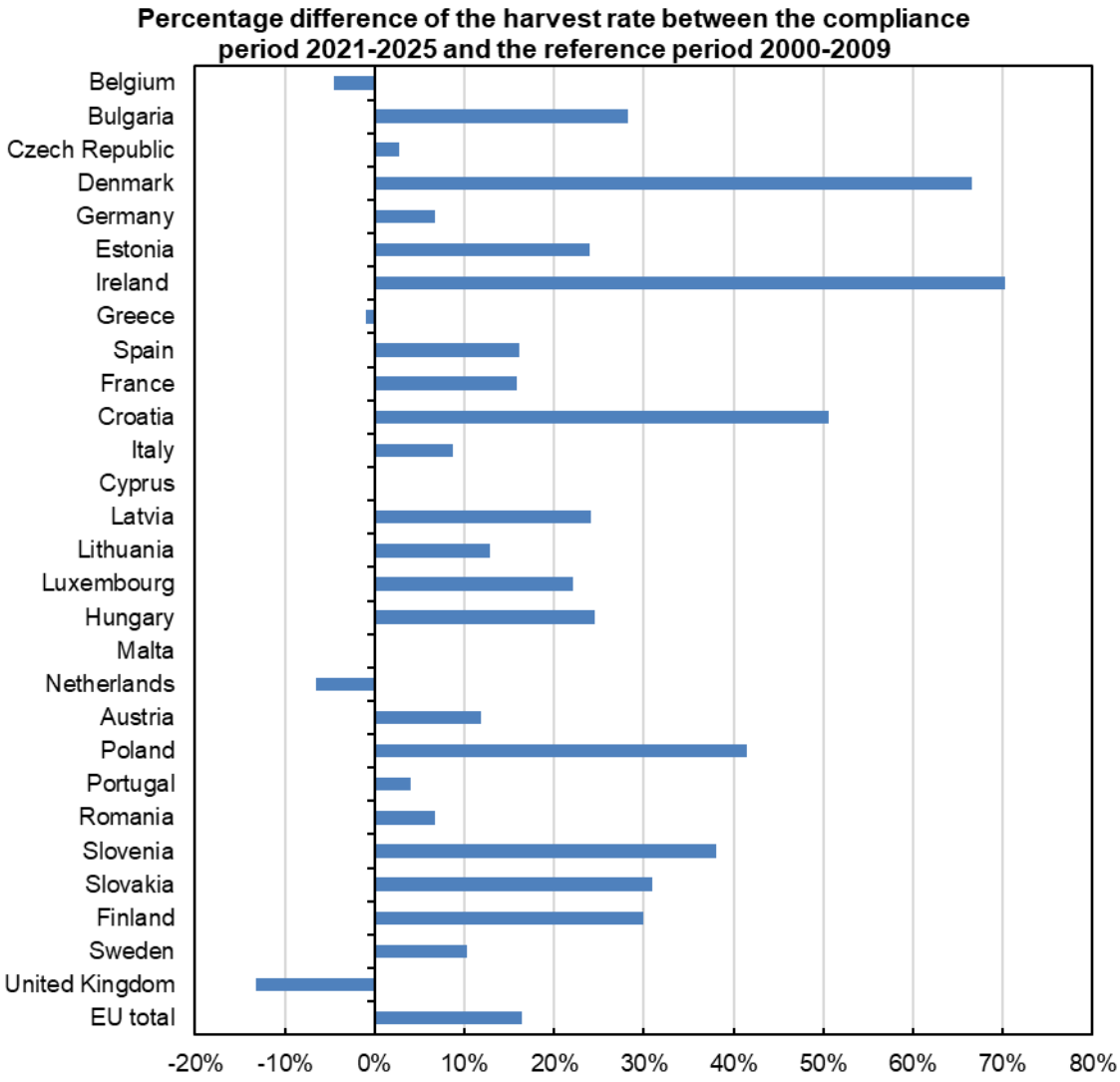


Figure 10. The difference between the harvest rate projected in the FRL for the compliance period 2021–2025 and as reported in the NFAP (incl. corrigenda and recalculations, where applicable) by the Member States for the reference period 2000–2009. The uncertainty in some of the underlying data suggests some caution in interpreting the results. Please refer to the individual NFAPs for more details.



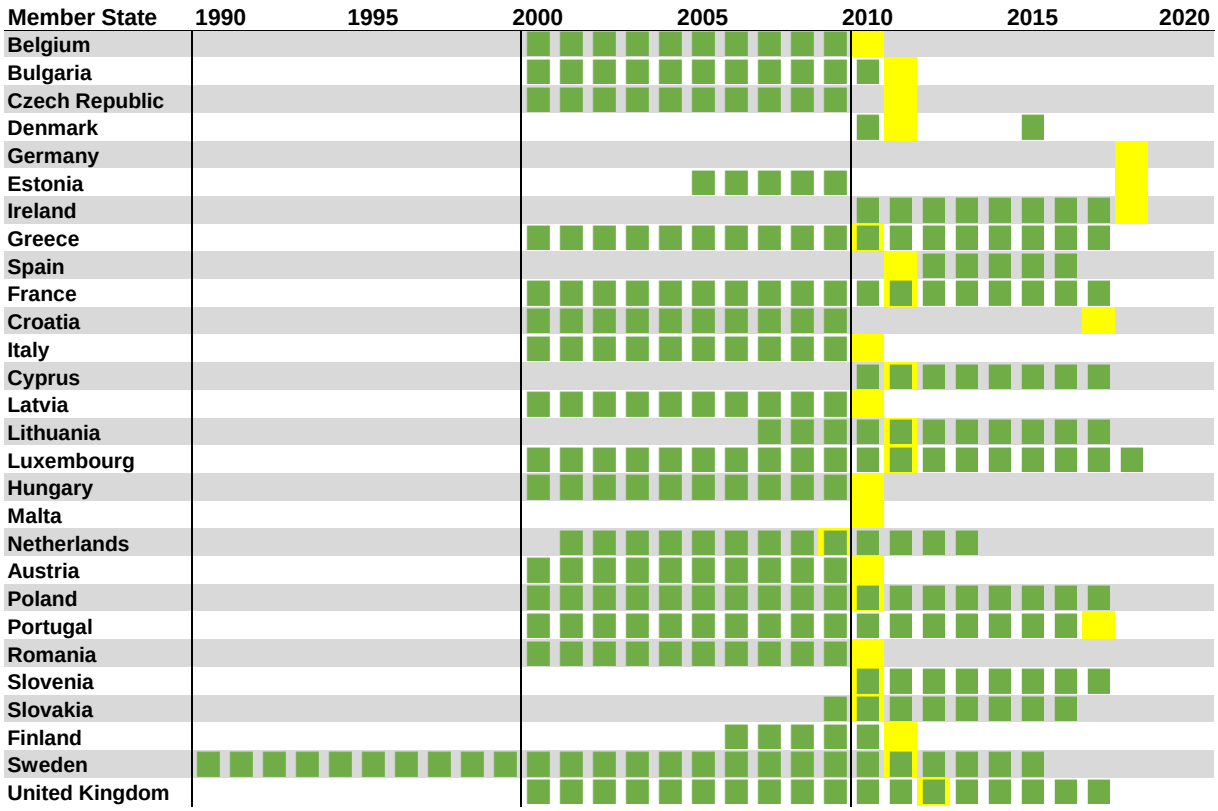
3.3.3 Methodological consistency with the GHGI

Consistency between the methods and data used to determine the FRL and those used in the reporting of the Member States' GHGI is key for reliable accounting of the Member States' forest-related emissions and removals. The European Commission thoroughly assessed whether or not the model output is consistent with estimates reported in the GHGI, and for which period this comparison is done in the NFAP. If an inconsistency was found, the Member States should ex-post calibrate the model to ensure the alignment between the model and reported estimates. This principle is also embedded in criterion (h) of Annex IV Part A, and further assessment is described under that criterion, as well as separately for each Member State in Annex 1.

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 reference period 2000 to 2009. Germany and Malta did not provide information on the comparison with historical estimates. Figure 11 provides a summary of assessment outcomes.

Figure 11. Periods used to compare modelled and reported estimates (green) and starting year of projection (yellow). The vertical lines highlight the reference period 2000–2009.



The Commission considers that most Member States achieved consistency between the model output and historical estimates in the GHGIs (Table 5). Nine Member States 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 GHGI. 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 GHGI (Bulgaria, Germany, Cyprus, Lithuania, Malta, Austria and Slovakia). In some cases (Bulgaria for living biomass and Germany and Poland for mineral soils) the European Commission decided to correct the model outputs. In the other cases:

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

— Malta does not report emissions and removals on forest land remaining forest land, hence consistency with the GHGI could not be ensured. The European 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 Article 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 GHGI, the European Commission notes and accepts the explanations provided by SK in the revised NFAPs, including the ex-ante model calibration.

Table 5. Overview of the consistency between the methodology for setting the FRL and the GHGI.

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

3.4 Member States' consideration of the FRL criteria as detailed in Annex IV, Part A

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

The consistency of the forest reference level of the Member States with the long-term goal of achieving a balance between anthropogenic emissions by sources and removals by sinks was considered sufficiently addressed, when the Member State discusses the long-term development of their forest sinks up to at least 2050, and provides also quantitative information for at least one future scenario.

Sixteen Member States provided both quantitative and qualitative information of the development of the forest sink in the long term (see Table 2 in section 3.2). Three Member States provided only qualitative description of the development of the sinks and/or their contribution to the balance between emissions and removals, in which cases the criterion is marked as 'partially' addressed.

Nine Member States did not reflect on the evolution of the forest sink beyond the FRL projection period (ie. beyond 2025 or 2030). However, the lack of this information was not considered to have a quantitative impact on the FRL.

Criterion (b): 'The reference level shall ensure that the mere presence of carbon stocks is excluded from accounting.'

All Member States were found to use approaches that account for net changes in forest carbon stocks, rather than accounting for total existing carbon stocks in forests, and therefore the proposed forest reference levels of all Member States were found to ensure that the mere presence of carbon stocks is excluded from accounting.

Criterion (c): 'The reference level should ensure a robust and credible accounting system that ensures that emissions and removals resulting from biomass use are properly accounted for.'

To comply with this criterion, FRLs were expected to be based on the continuation of forest management practices applied during the reference period 2000–2009, with comprehensive documentation of the underlying assumptions. Any changes to harvesting or its associated biomass use, compared with those of the reference period will thereby be accounted for.

For twenty-one Member States, the assessment concluded that the revised FRL fulfilled these expectations. For three Member States (Latvia, Poland and Slovenia), the assessment found that the revised NFAP was not clear on this regard, but concluded this criterion to be fulfilled after clarifications provided the Member States. For four Member States (Bulgaria, Czech Republic, Germany and Cyprus), the Commission decided to recalculate the FRL, to ensure proper accounting of biomass use[50].

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

For 27 Member States, the carbon pool of harvested wood products (HWP), estimated using the methodologies specified in Annex V of the Regulation (EU) 2018/841, is included in the FRL. For Malta, no harvests were projected in the FRL and there is also no production of HWP in the country, thereby no inclusion of HWP was possible in the FRL. All other Member States except Luxembourg provided the revised FRL value also assuming instantaneous oxidation of HWP. For Luxembourg, the contribution of HWP could be derived through comparing the revised and draft NFAPs, as HWP was assumed instantaneously oxidized in the draft NFAP. See Table 6 for an overview of the FRLs for each Member State, with and without the contribution of the HWP pool In cases

[50] A recalculation of was also applied to the proposed FRL by Poland. However, that recalculation did not address the carbon pool of living biomass.

where the FRL proposed by the Member State changed due to a recalculation by the Commission, the recalculated value is provided, consistent with the delegated act.

Table 6. Overview of the FRLs (including the contribution of the HWP pool) and the value of the reference levels without HWP. The FRL values are given as in the delegated act, i.e. considering the addendum and/or corrigendum by the Member State and the Commission recalculation, when applicable.

	FRL including HWP with first-order decay function and half-life values	**Reference level assuming instantaneous oxidation of HWP**	**Comments** For details on specific countries, see Annex 1
	[t CO_2 e yr^{-1}]	*[t CO_2 e yr^{-1}]*	
Belgium	-1 369 009	-1 235 641	
Bulgaria	-5 105 986	-4 808 056	Recalculation
Czech Republic	-6 137 189	-4 739 425	Corrigendum; Recalculation
Denmark	+354 000	+545 000	
Germany	-34 366 906	-26 209 877	Addendum and Corrigendum; Recalculation
Estonia	-1 750 000	-1 330 000	
Ireland	+112 670	+1 506 091	Addendum*
Greece	-2 337 640	-2 164 050	Corrigendum
Spain	-32 833 000	-28 971 000	
France	-55 399 290	-52 292 549	Corrigendum and addendum
Croatia	-4 368 000	-3 906 000	
Italy	-19 656 100	-19 335 400	
Cyprus	-155 779	-169 569	Recalculation
Latvia	-1 709 000	-298 000	Addendum
Lithuania	-5 164 640	-4 455 320	
Luxembourg	-426 000	-413 000	
Hungary	-48 000	+291 000	
Malta	-38	-38	Corrigendum
Netherlands	-1 531 397	-1 524 424	
Austria	-4 533 000	-1 659 000	
Poland	-28 400 000	-24 384 000	Corrigendum and Addendum; 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	Addendum and Corrigendum
Sweden	-38 721 000	-34 348 000	
United Kingdom	-20 701 550	-19 755 260	

* The addendum to Ireland's NFAP contains also changes that have a quantitative impact on the FRL.

Criterion (e): 'A constant ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 shall be assumed.'

To comply with this criterion, the Member States were expected to show that the ratio between solid and energy use of forest biomass is assumed to stay constant and the same as in 2000–2009.

As detailed in Table 7, the Member States used different parameters to define solid and energy use. Most Member States provided numerical values for the ratio between solid and energy use of wood, mostly considering the share of harvested wood used for energy, or the complementary share of wood used as industrial roundwood. These parameters were derived from different sources: official harvest statistics, carbon inflow of the industrial roundwood commodities to the HWP pool (e.g. Bulgaria), or were based on other specific assumptions (e.g. Sweden used information from the wood industry for wood based panels and pulp products). In some cases, the harvest statistics were further corrected to account for possible underestimates (e.g., for Belgium, Germany and the Netherlands).

Some Member States calculated several ratios between solid and energy use of wood, taking into account e.g., the wood assortment, tree species, or commodity type. This means that the overall total ratio may vary over time, but the relative share of wood used for each individual ratio remains constant and at the level of the reference period. This approach was considered acceptable under the criterion (e), as discussed in the LULUCFEG meeting in October 2019[5]. In these cases, the Member States distinguished between different commodities (Ireland, Croatia, Portugal, Slovakia, Finland and Sweden), species (Denmark and Latvia) or silvicultural treatments (Hungary). Luxembourg directly reported the ratio between the amount of biomass used for energy and non-energy, while Hungary reported the ratio between non-energy and energy use of biomass. The Czech Republic, Italy and Portugal did not specify the values explicitly, but demonstrated sufficiently that the ratio between energy and solid use was kept constant (e.g. through showing that the ratio between the inflow to HWP and the total harvest remains constant in the projection). Cyprus did not provide information on the constant ratio between solid and energy use of wood.

Table 7. Overview of the assessment on Annex IV Part A criterion (e).

	Parameter reported by the Member State	**Specific assumption applied by the Member State**
Belgium	0.27	Average share of harvest for energy use, based on specific corrections applied to FAOSTAT data.
Bulgaria	0.12	Average share of industrial roundwood production, estimated as the ratio between the total inflow to the HWP pool and the total roundwood production, both reported as tons of C
Czech Republic	The ratio not specified numerically	The annual rate of change of the projected harvest, compared to the average harvest within the RP, was used to estimate the carbon inflow to the HWP pool further distinguished between different commodities (i.e., sawn wood, wood-based panels and paper and paperboard).
Denmark	0.61 for coniferous and 0.35 for broadleaves	Average share of harvest for energy use.
Germany	0.54	Average share of harvest for energy use, based on specific corrections applied to official harvest statistics, to account for production of firewood by private households.
Estonia	0.72	Average share harvest for industrial roundwood production.
Ireland	0.44	Average share of harvest for energy use, based on the ratio between sawn wood and wood based panels from domestic harvest over the total roundwood, excluding deforestation.
Greece	0.42	Average share of harvest for energy use
Spain	0.13	Average share of harvest for energy use. Within the specific modelling framework used by ES, the disaggregation between industrial wood (sawn wood, wood-based panels, paper and paperboard) and firewood in each stratum of the RP was replicated in the CP.
France	0.42	Average share of harvest for energy use.
Croatia	0.15 for sawn wood and 0.10 for paper	Average share of harvest used for sawn wood production and paper production, estimated on the total amount of felling.
Italy	The ratio not specified numerically	All C losses associated with harvesting of industrial roundwood were assigned to "high forests" FMPs and all C losses associated with harvesting of fuelwood were assigned at the "coppices" FMPs. Considering that the harvesting ratio of each FMP was assumed as constant, the ratio between material use and energy use remains constant.
Cyprus	The ratio not specified numerically	
Latvia	0.16	Average share of harvest for energy use, as determined within the RP. Since this value was calculated and considered for different species, the overall average share slightly varies within the model run, due to the evolution of the age class distribution.
Lithuania	0.61	Average ratio between forest biomass used for solid wood production and energy production. This value was determined on different commodities, based on domestically produced and consumed products.

	Parameter reported by the Member State	Specific assumption applied by the Member State
Luxembourg	0.15	Average ratio between energy and non-energy uses, based on data available for public forests, and also applied to wood harvested in private forests.
Hungary	0.27 for thinning and 0.25 for final cut	Average ratio between non-energy and energy uses.
Malta	No HWP modelled for the FRL.	No HWP modelled for the FRL.
Netherlands	0.38	Average share of harvest for energy use, based on specific corrections applied to FAOSTAT data.
Austria	0.62	Average share harvest for industrial roundwood production, estimated as the sum of the HWP production of sawn wood, wood panels and paper and paperboard, over the total stem wood drain.
Poland	0.23	Average share of harvest for energy use.
Portugal	The ratio not specified numerically	The ratio of wood use in the different HWP categories was fixed and based on the values observed in the period 2000—2009. The ratio between solid and energy is not explicitly considered (because it has no implications in the FRL calculations), but given the methodology on HWP, it can be concluded that this ratio is also fixed.
Romania	0.47	Average share of harvest for energy use.
Slovenia	0.22	Share of total inflow to the HWP pool, over the total amount of harvest, in tons C.
Slovakia	0.25 for sawn wood, 0.08 for wood panels and 0.11 for paper and paperboard	Average share of sawn wood, wood panels and paper with paperboard on the total amount of harvest.
Finland	0.2 for sawn wood, 0.025 for wood panels and 0.2 paper	Estimated as the ratio between the average production of each commodity within the RP and the total amount of harvest (in Mm^3).
Sweden	0.48	Average ratio between sawn wood and entire logs. For the wood fibre industry, the ratios were estimated separately: wood based panels (0.89), pulp (0.02) and energy (0.09), derived as raw material/wood used for these commodities.
United Kingdom	0.13	Average share of harvest for energy use

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

The Member States were expected to ensure that their FRL is based on the continuation of sustainable forest management practice, and consistent with the objective of contributing to the conservation of biodiversity and the sustainable use of natural resources.

All Member States provided sufficient qualitative description of the forest management practice of the reference period. The information referred to in the NFAPs typically contained documentary information on specific national policies for biodiversity protection, overview of certification systems in place, and/or description of specific forest management practices directed for conservation purposes. Twenty-one Member States considered conservation of biodiversity explicitly in their modelling, usually by setting aside specific strata for protection or for protection-oriented management. For seven Member States (Germany, Greece, France, Cyprus, Latvia, Poland, Portugal) the assessment noted that there was very limited or no documentation of whether the FRL projection included any explicit consideration to conservation of biodiversity in the modelling setup.

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

This criterion links the FRL with the national projections under Regulation (EU) No 525/2013 (now replaced with Regulation (EU) 2018/1999). In case the FRL projection differs from these national projections, the Member States were expected to provide a rationale and explanations for the differences. Seventeen Member States

provided numerical information on other national projections in addition to the FRL, although it was not always clear whether these projections were those reported under Regulation (EU) 525/2013 or Regulation (EU) 2018/1999. Seven Member States provided no reflection of other projections, and four Member States reflected on the other projections only qualitatively. Even though this criterion does not have a direct impact on the FRL projection and therefore did not trigger amendments to the numerical values of the FRLs, it is noteworthy that a reflection of the consistency between the FRL and other national projections is necessary for proper evaluation of the national policies and planning of forest-based mitigation options until 2030.

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

This criterion reflects consistency requirements outlined also in Article 8(5) sub-paragraph 3, connects with a number of elements (Annex IV Part B (b), (c), (e-i)), entails a number of technical aspects, and is a prerequisite for trustworthy accounting. Therefore, the assessment paid specific attention to this criterion. Here, we provide a brief overview of the most important findings. An overview of the ability of the models to reproduce historical data from the GHGI is discussed under the analysis of Article 8(5) in section 3.3.3. Member State-specific findings are detailed in Annex 1. Furthermore, a detailed overview of the consistency of different carbon pools and greenhouse gases as well as forest area used in the FRLs is provided in SWD (2020) 236.

Completeness and comparability between the FRL and historical estimates mean on the one hand that all the carbon pools and greenhouse gases required by the LULUCF regulation are included in both the FRL and GHGI, and on the other hand that the methods and approaches are compatible and model outcomes comparable with each other. As the national GHGIs are continuously improved and often undergo recalculations of the historical time series, it is important to first establish the GHGI submission which is the basis for the consistency checks. Fifteen Member States[51] used the GHGI submission of 2019 as the reference for setting the FRL. Ten Member States used the submission of 2018[52], and three Member States used the submission of 2020[53]. In any case, independent of the GHGI submission used for the assessment at this point in time, all countries need to ensure consistency with the GHGI at the time of compliance (see section 4.3).

As shown in Table 8, all Member States included the carbon pool of living biomass (sometimes disaggregated into above-ground and below-ground biomass) in the FRL, which is consistent with the GHGI reporting for all Member States except for Malta, which does not report emissions or removals on Forest land remaining Forest land in the GHGI. There were further discrepancies with regard to other pools in eight Member States' FRLs when compared to the GHGI: Bulgaria, Cyprus and Romania did not include all pools reported in the GHGI in the FRL estimate, while Croatia, Poland and Romania included pools that are not included in the GHGI. Furthermore, Ireland, Latvia and Austria indicate that some pools are included elsewhere in the GHGI reporting or not applicable, while these pools' contribution was explicitly considered in the FRL. For Bulgaria, Cyprus and Poland, a recalculation of the FRL was put forward to correct for these discrepancies, while the other countries should correct the discrepancies as a technical correction.

There were considerably more inconsistencies with regard to coverage of CO_2 and non-CO_2 gases, especially from wildfires that were often not included in the FRL (Table 8). The assessment noted inconsistencies in the gases for seventeen Member States. Usually these inconsistencies were of a minor quantitative impact, but nevertheless they should be addressed in a technical correction before the compliance check. For wildfires, the natural disturbance provision according to Article 10 may be applied which requires the calculation of background levels, to ensure proper accounting of the emissions and removals. At this stage, six Member States (Ireland, Italy, Luxembourg, Hungary, Portugal and the United Kingdom) calculated a provisional background level and report it in the NFAPs.

[51] Belgium, Czech Republic, Germany, Estonia, Ireland, France, Cyprus, Latvia, Lithuania, Poland, Romania, Slovenia, Finland, Sweden and United Kingdom.

[52] Bulgaria, Denmark, Greece, Spain, Croatia, Italy, Netherlands, Austria, Portugal and Slovenia.

[53] Luxembourg, Hungary and Malta. Czech Republic demonstrated consistency with the GHGI submissions of both 2019 and 2020. For simplicity, in the assessment we refer to the submission of 2019 for Czech Republic.

Table 8. Consistency of carbon pools and greenhouse gases between the FRL and GHGI. The colours indicate the consistency identified in the analysis: estimated for FRL and in GHGI (green); estimated in GHGI but not for FRL (brown); estimated for FRL but not in GHGI (blue); estimated for FRL but included elsewhere in GHGI (yellow).

Type	**Carbon stock change and HWP**						**Fertil-ization**	**Drainage and rewetting**			**Minera-lization**	**Biomass burning**		
Table	**Table4.A**		**Table4. Gs1**	**Table4.A**			**Table 4(I)**	**Table4(II)**			**Table 4(III)**	**Table4(V)**		
Scope	**FLr**		**net E/R**	**FLr**			**FLr**	**Forest land**			**FLr**	**FLr**		
Pool / gas	**LB**	**DW**	**HWP**	**LT**	**min SOC**	**org SOC**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	**N_2O**	**CO_2**	**CH_4**	**N_2O**
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

Notation keys of estimates in GHGI:
R – Removal (average in 2000-2009)
E – Emission (average in 2000-2009)
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 Products
LT – Litter
min/org SOC - soil organic carbon from mineral or organic soils.

Another important aspect of consistency is the area of managed forest land (Table 9). The assessment noted inconsistencies in several Member States' NFAPs, as detailed in the Member State-specific documentation in Annex 1 (see also SWD (2020) 236). These inconsistencies can be sometimes attributed lack of transparency in the NFAP or rounding of the documented values. For Belgium, Denmark, Germany, Ireland, Cyprus, Hungary,

Malta, Portugal and Sweden the assessment noted considerable inconsistency between the area of managed forest land reported in the GHGI and the area used in the projection of the NFAP. Although in most of these cases, the country could provide reasonable explanation for the differences, the discrepancies need to be addressed before the compliance check, either through improvement of the GHGI reporting of managed forest land, or a technical correction of the FRL. We note, however, that even for those countries that ensured consistency between managed forest land area in the GHGI and the FRL projection now, a technical correction will be necessary before the compliance check to correct for the actual areas that were afforested and deforested during the compliance period.

Table 9. Overview of area of managed land used to project the FRL and the area reported in table 4.A for Forest land remaining Forest land in the corresponding year, using the GHGI submission chosen as the reference by the Member State. 'Approach' refers to Member State's choice to either maintain the area constant throughout the projection ('static'), or project its development over time ('dynamic').

Member State	GHGI submission	Reporting year used to assess the area	Area in Table 4.A [ha][54]	Area in NFAP [ha]	Approach
Belgium	2019[55]	2009	690,858	612,978	Static
Bulgaria	2018	2010	3,631,375 (3,608,784)	3,631,375	Static
Czech Republic	2019	2010	2,614,224	2,614,224	Static
Denmark	2018	2010	542,651	529,085	Dynamic
Germany	2019	2017	10,832,447	N/A	Dynamic
Estonia	2019	2017	2,354,123	2,354,100	Dynamic
Ireland	2019	2017	446,244	419,411	Dynamic
Greece	2018	2009	3,354,729 (1,247,687)	1,247,687	Static
Spain	2018	2010	14,480,239	14,480,238	Static
France	2019	2010	22,462,751 (21,700,878)	21,700,878	Dynamic
Croatia	2018	2016	2,312,478	2,312,220	Static
Italy	2018	2009	7,482,537 (7,283,533)	7,482,540	Static
Cyprus	2019	2010	158,843	147,726	Static
Latvia	2019	2009	3,071,133	3,071,000	Static
Lithuania	2019	2010	2,050,161	2,050,160	Dynamic
Luxembourg	2020	2010	88,205	88,205	Dynamic
Hungary	2020	2009	1,876,822 (1,750,392)	1,853,171	Static
Malta	2020	2009	72	41	Dynamic
Netherlands	2018	2008	326,059	326,000	Static
Austria	2018	2009	3,821,828 (3,307,204)	3,822,000	Static
Poland	2019	2009	8,664,325	8,664,000	Static
Portugal	2018	2016	3,995,734	N/A	Dynamic
Romania	2019	2009	6,639,904	6,639,904	Static
Slovenia	2019	2009	1,003,620	1,003,620	Static
Slovakia	2018	2009	1,978,447	1,978,447	Dynamic
Finland	2019	2010	21,780,765	21,780,765	Static
Sweden	2019	2010	27,877,300	27,479,000	Dynamic
United Kingdom	2019	2011	3,125,272 (3,120,779)	3,120,779	Dynamic

[54] Areas correspond to row "Forest land remaining Forest land". Areas in parenthesis correspond to alternative areas where exceptions may apply based on GHGI reporting, namely: exclusion of area reported of unmanaged forest (France, Greece); exclusion of non-EU territories by sub-categories in CRF tables (United Kingdom); and areas of "Forest land remaining Forest land" with no emission estimation (Bulgaria, Italy, Hungary, Austria).

[55] Belgium notes that the 2018 GHGI submission was used for Flanders.

4 Overview of forest reference levels and the trend in the forest sink

4.1 Forest reference levels for each Member State

Table 10 shows the FRLs for each Member State for the draft and revised NFAP and the FRL laid down in the delegated act. Figure 12 shows the FRLs compared with the reporting in the Member State's GHGI. For each Member State, the GHGI reporting shown in the graph corresponds to those carbon pools and greenhouse gases that are included in the FRL (see Annex 1 for details for each Member State). The reporting year of the GHGI is consistent with that used in the NFAP of each Member State, as indicated in the figures. As determined in the LULUCF regulation, the FRL includes the carbon pool of HWP. To allow for comparison between assuming instantaneous oxidation and applying the first-order decay function and half-life values according to Annex IV Part A (d) of the LULUCF regulation, the GHGI and FRL shown in the figures is also shown without the contribution of the HWP pool.

Table 10. Overview of the FRLs proposed by the Member States in the draft and revised NFAPs, and the FRL in the delegated act (considering addenda, corrigenda and recalculations where applicable). All FRLs are provided in t CO_2e yr^{-1}, and include HWP. The links direct to sources maintained by the Member States (accessed on 11 August 2020). The recalculations are documented in SWD (2020) 236.

Member State	FRL in draft NFAP	FRL in revised NFAP	FRL in delegated act	Addendum/Corrigendum[56], Recalculation
Belgium	-1 378 354	-1 369 009	-1 369 009	
Bulgaria	-5 905 700	-3 021 110	-5 105 986	Recalculation
Czech Republic	-7 685 130	-3 801 350	-6 137 189	Corrigendum; Recalculation
Denmark	+868 000	+354 000	+354 000	
Germany	-39 217 000	-10 022 400	-34 366 906	Addendum and Corrigendum; Recalculation
Estonia	-1 890 000	-1 750 000	-1 750 000	
Ireland	+282 687	+141 897	+112 670	Addendum*
Greece	-13 864 580	-3 038 670	-2 337 640	Corrigendum
Spain	-30 703 000	-32 833 000	-32 833 000	
France	-58 295 181	-55 399 290	-55 399 290	Corrigendum and addendum
Croatia	-4 533 000	-4 368 000	-4 368 000	
Italy	-19 656 100	-19 656 100	-19 656 100	
Cyprus	-120 280	-122 400	-155 779	Recalculation
Latvia	-54 000	-1 709 000	-1 709 000	Addendum
Lithuania	-2 272 240	-5 164 640	-5 164 640	
Luxembourg	-413 000	-426 000	-426 000	
Hungary	-474 000	-48 000	-48 000	
Malta	-37,6	+37,6	-38	Corrigendum
Netherlands	-1 531 397	-1 531 397	-1 531 397	
Austria	-4 663 000	-4 533 000	-4 533 000	
Poland	-29 433 000	-27 888 000	-28 400 000	Corrigendum and Addendum; Recalculation
Portugal	-11 165 000	-11 165 000	-11 165 000	
Romania	N/A	-24 068 200	-24 068 200	
Slovenia	-2 582 720	-3 270 200	-3 270 200	
Slovakia	-4 827 630	-4 827 630	-4 827 630	
Finland	-34 770 000	-27 640 000	-29 386 695	Addendum and Corrigendum
Sweden	-30 556 000	-38 721 000	-38 721 000	
United Kingdom	-16 657 070	-20 701 550	-20 701 550	

* The addendum to Ireland's NFAP contains also changes that have a quantitative impact on the FRL.

[56] SWD (2020) 236 refers to all documents submitted by a Member State after submission of the revised NFAP as "Corrigendum". In this document, we refer to the additional documents with the titles used by the Member States.

Figure 12. Profiles of historical GHGI time series corresponding to managed forest land (black lines) and FRLs laid down in the delegated act (blue line). Orange lines show FRLs proposed in the revised NFAP s that were corrected or amended by the Member State or recalculated by the Commission. Solid lines show the GHGI profile including HWP, dashed lines exclude HWP. All units are in Mt CO_2e.

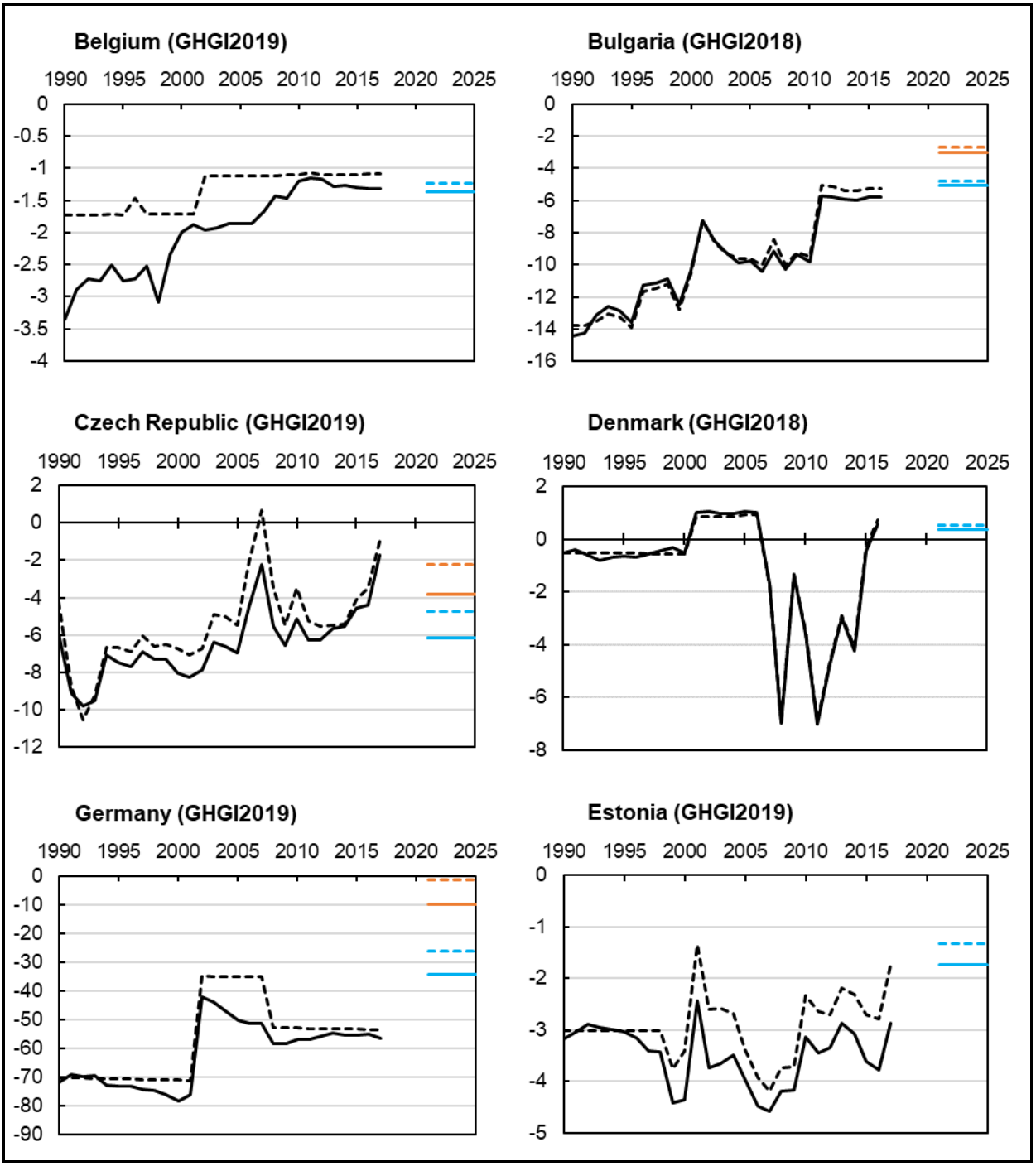
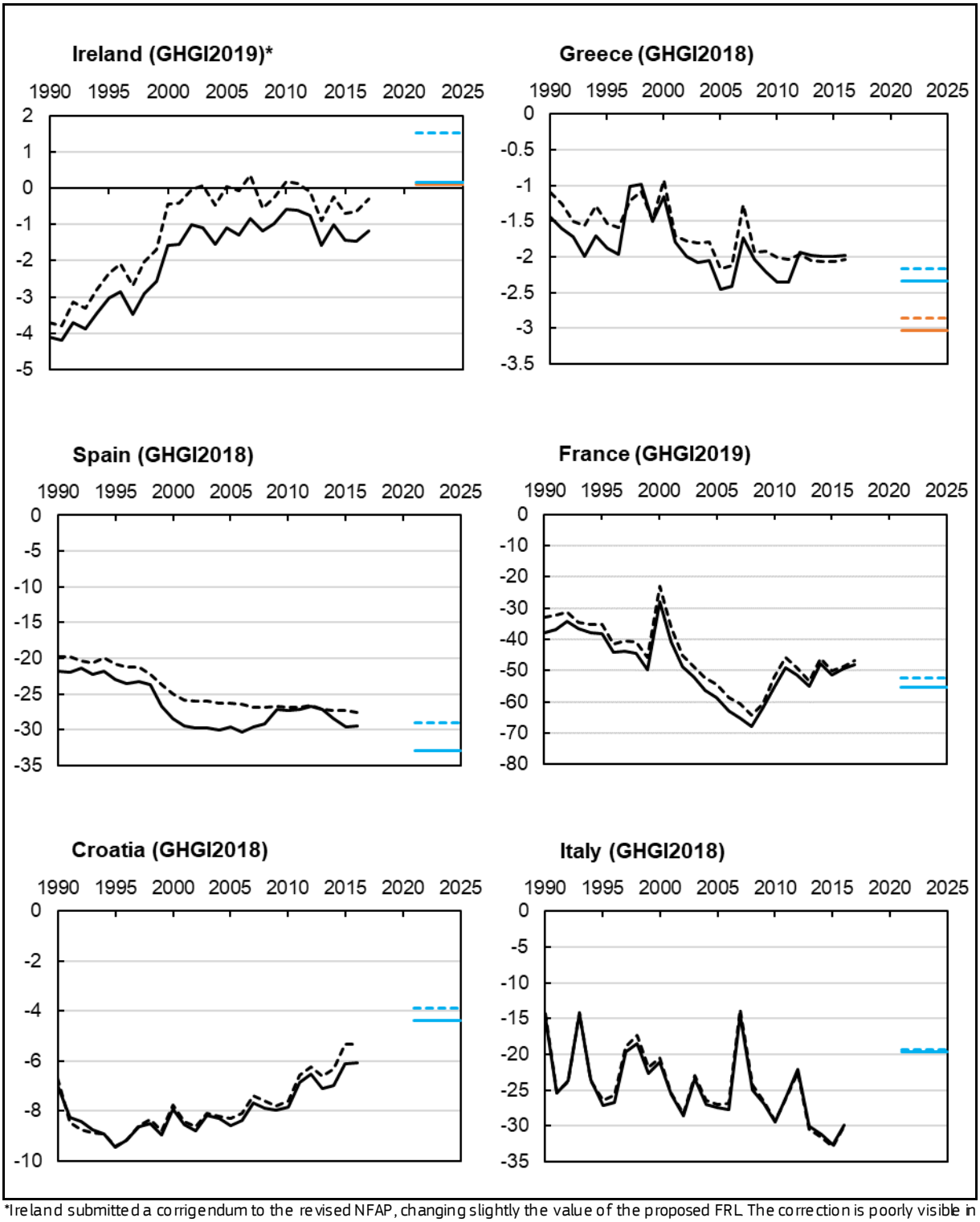


Figure 12 (continued). All units are in Mt CO_2e.



*Ireland submitted a corrigendum to the revised NFAP, changing slightly the value of the proposed FRL. The correction is poorly visible in the graph due to graph resolution.

Figure 12 (continued). All units are in Mt CO_2e.

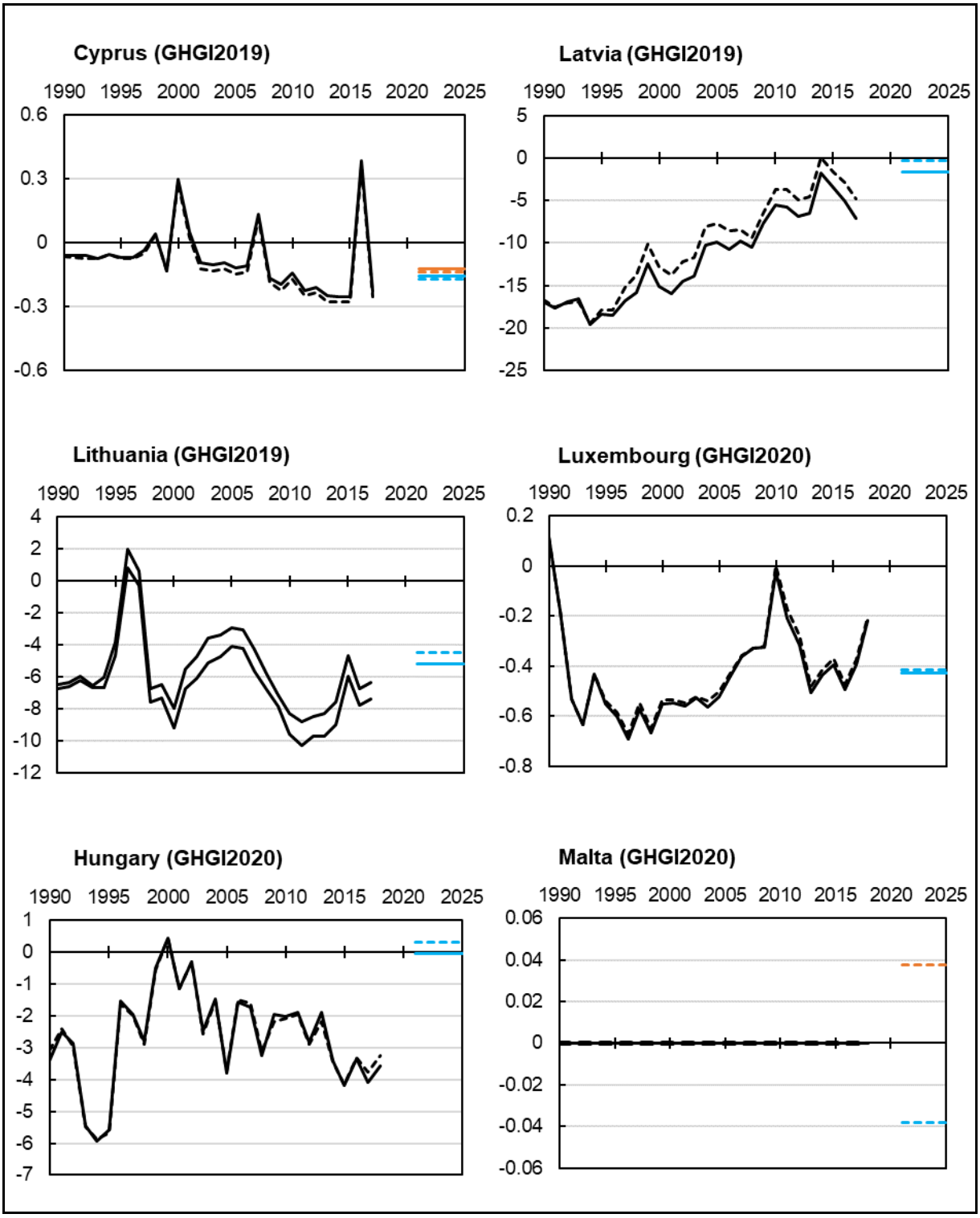


Figure 12 (continued). All units are in Mt CO_2e.

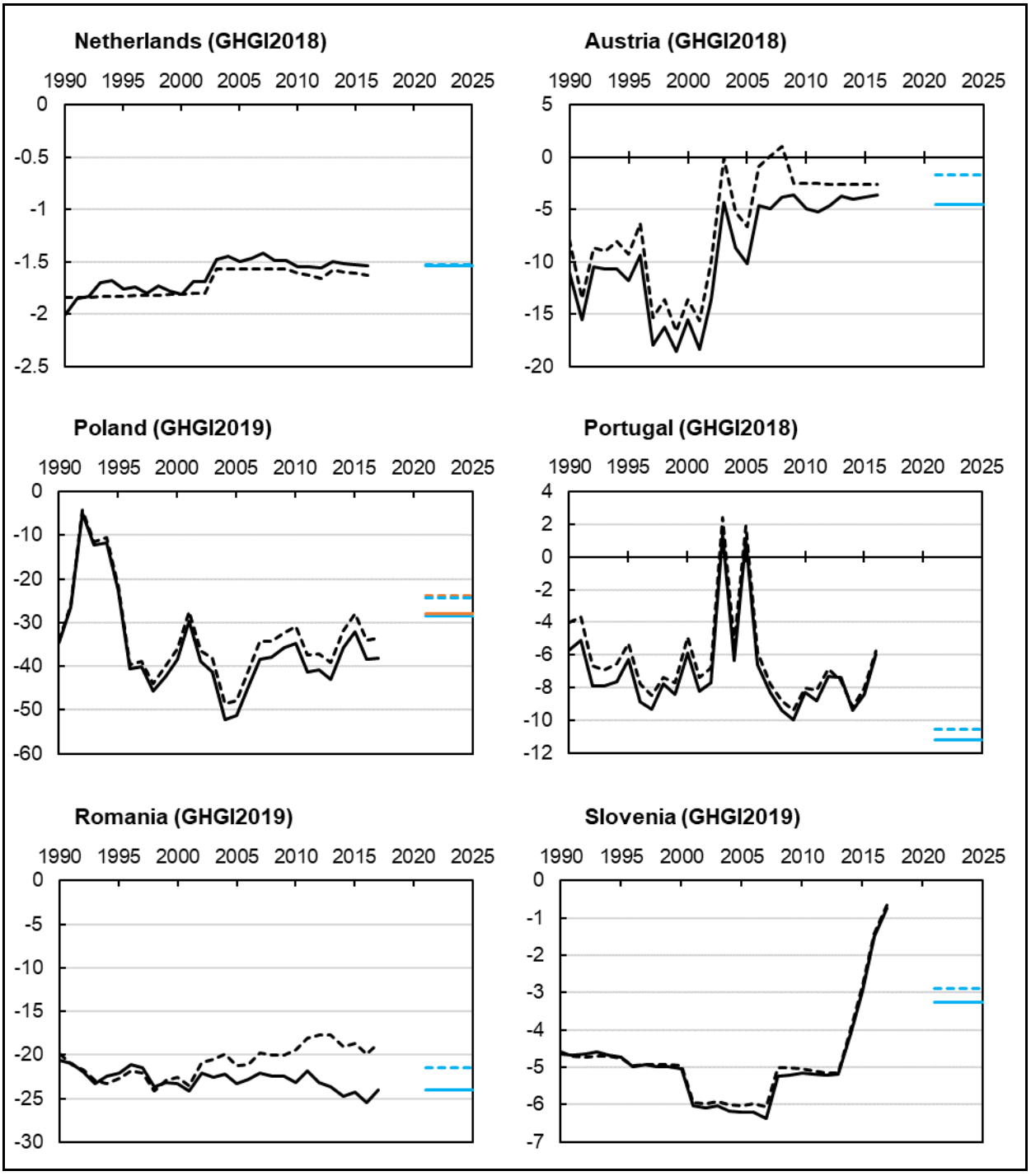
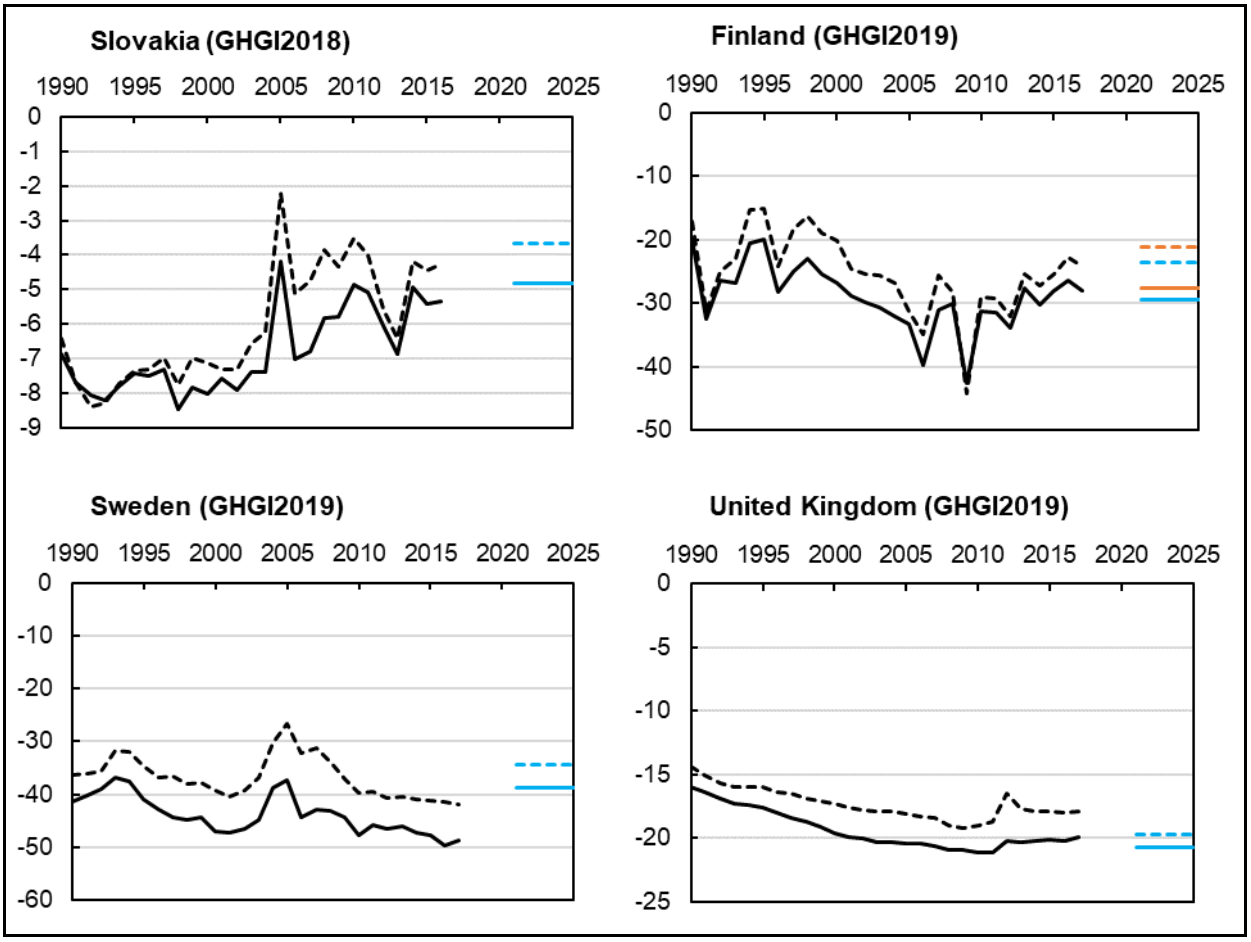


Figure 12 (continued). All units are in Mt CO_2e.



4.2 Sum of forest reference levels at the EU level

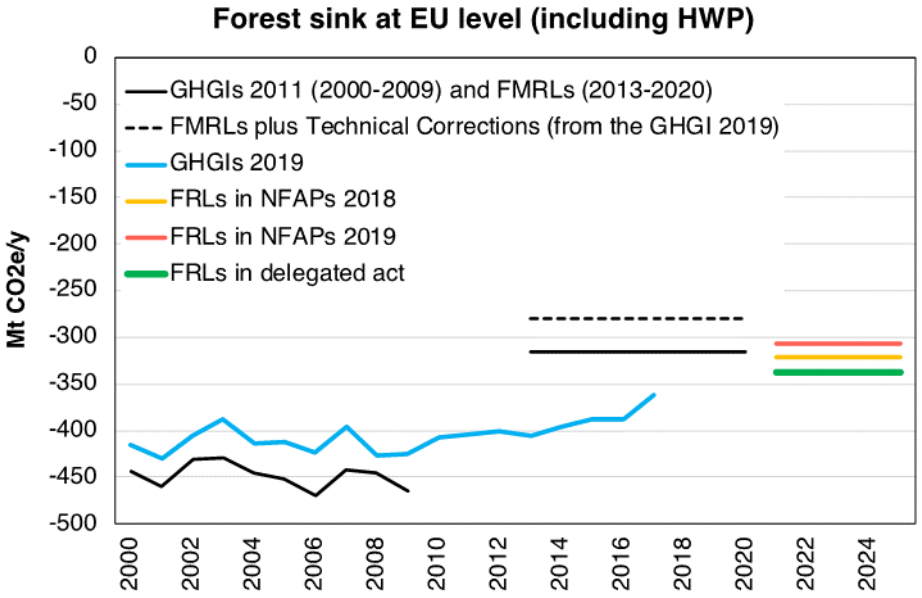
Figure 13 illustrates the evolution on the forest sink at EU level, and offers a broader historical perspective on the impact of the forest accounting rules by comparing the EU-level FRLs in the delegated acts with the Forest Management Reference Levels (FMRL) determined under the Kyoto Protocol's second commitment period. The black solid line indicates the sink in forest land remaining forest land[57] in the GHGI 2011 (when the FMRL was prepared) and the FMRL for the period 2013–2020. Due to a number of recalculations the sink has decreased by about 30 $MtCO_2/y$ for the 2019 GHGI (blue solid line) compared to the 2011 GHGI. This is reflected in technical corrections to the FMRL (black dashed line, from the 2019 GHGI). Overall, the FMRL plus technical corrections in the period 2013–2020 is a 132 $MtCO_2/y$ smaller sink than the forest management in 2000–2009. This large difference may be due to both age-related effects and the inclusion of policy assumptions in the FMRL calculation (Grassi et al. 2018a). The yellow and red lines indicate the EU-level FRLs as submitted in the draft NFAP by the end of 2018 and revised NFAP in 2019, respectively, and the green line indicates the EU-level FRLs in the delegated act. The total sum of the FRLs in the delegated act is -337 Mt CO_2/y. Compared to the sink of the period 2000–2009 (from GHGI 2019[58]), the FRLs in the delegated act is about 75 $MtCO_2/y$ smaller (or 18%). According to the criteria for setting the FRL, this decrease of the sink is exclusively due to age-related effects, and not to policy assumptions. Furthermore, it should be noted that the FRL is just a benchmark sink, based on

[57] Although "forest land remaining forest land" does not exactly corresponds to "forest management", for the purpose of the figure the difference is deemed negligible.

[58] GHGI year 2019 is used here because it was used by most Member States in preparing their FRLs. When comparing each Member State's FRL to the GHGI submission used as reference by that Member State, the total difference is ca. 70 $MtCO_2/y$ (17%).

continuation of forest management practices in 2000–2009, and not the sink expected under current or planned policies.

Figure 13. Development of the forest sink at the EU level (sum of all Member States' values), and its relation to the FRLs (according to the LULUCF regulation) and to the FMRLs (according to the Kyoto Protocol). The technical corrections added to the FMRLs are from the GHGI 2019 and are not yet the final ones for the period 2013–2020. The FRLs proposed by the Member States in the draft NFAPs in 2018 are shown in yellow, the revised FRLs proposed in the revised NFAPs in 2019 are shown in red, and the FRLs as included in the delegated act are shown in green. The EU values shown include Croatia (not EU Member State when FMRLs were submitted) and the United Kingdom.



4.3 Expected technical corrections before the compliance check

Accounting of the emissions and removals in the compliance period 2021–2025 will be done by comparing the FRL projection against the national GHGI reporting for managed forest land. To ensure reliable accounting, it is essential that the FRL projection is methodologically consistent with the GHGI. To comply with this requirement at the time of setting the FRL, the Member States were required to ensure consistency with the latest GHGI inventory submission available at the time of FRL projection[59]. However, it is essential to ensure that the consistency is maintained also at the time of compliance check. To this aim, if methodological inconsistency exists between FRL and GHGI reporting during the compliance period, Member States shall submit to the Commission technical corrections by 15 March 2027 (Articles 8(11) and 14(1)).

Conceptually, following the logic applied under the Kyoto Protocol[60], the technical correction is a net value of emissions and removals, which is added to the original FRL at the time of accounting to ensure that the accounted emissions and removals will not reflect the impact of methodological inconsistencies. In this way, the accounting will reflect only the impact of changes in management (relative to the period 2000–2009) and not be affected by methodological inconsistencies.

For some methodological elements, based on the assessment of the NFAPs, it is already foreseen that all Member States will need to submit a technical correction. For example, the forest area development in the Member States was either assumed to remain stable in the FRL (static approach for forest area), or to develop

[59] The GHGI submission of 2018 was used as reference by Bulgaria, Denmark, Spain, Croatia, Italy, the Netherlands, Austria, Portugal and Slovakia. The GHGI submission of 2019 was used by Belgium, the Czech Republic, Germany, Estonia, Ireland, France, Cyprus, Latvia, Lithuania, Poland, Romania, Slovenia, Finland, Sweden and the United Kingdom. Luxembourg, Hungary and Malta used the submission of 2020.

[60] IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol https://www.ipcc-nggip.iges.or.jp/public/kpsg/index.html

over time (dynamic approach, with assumptions on future deforestation rates). In both cases, the area of managed forest land will need to be updated to match that of the real development observed during the compliance period 2021–2025. It has also not been possible to accurately estimate the background level for natural disturbances when preparing the FRL estimates, as Article 10 defines that the average emissions considered are to be derived from the period from 2001 to 2020. That is, in cases where the Member State chooses to use the natural disturbance provision, the background level will need to be (re-)calculated to consider the whole period 2001–2020.

Furthermore, while the Member States mostly demonstrated consistency between the methods and data for the FRL and the GHGI with regard to the carbon pools of living biomass and HWP, the assessment found several inconsistencies between in the Member States' FRLs and the GHGI with regard to other pools or sources of greenhouse gases, particularly wildfires. Most frequently these inconsistencies stem from a mismatch between a pool or greenhouse gas included in the FRL and the GHGI reporting; either a pool or gas was included in the FRL but not reported in the GHGI, or vice versa. In some cases, there was also a clear methodological inconsistency between the estimation methods of a certain carbon pool, leading to incomparable estimates of the net emissions of that pool. The recalculations of the FRLs addressed many such issues, but in some cases the assessment concluded that smaller issues will remain to be corrected as a technical correction before the compliance check (see Annex 1 for country-specific observations).

In addition to methodological inconsistencies already identified at this stage, there will likely arise other inconsistencies between the FRL and the GHGI in the future. This is because the GHGI methodologies are continuously developed and refined, and the Member States may add new reporting categories. As a summary, methodological inconsistencies that will likely require a technical correction to the FRL include:

- Discrepancies between the pools and gases reported in the GHGI and those included in the FRL;
- For Member States currently not reporting dead wood in the GHGI, the changes in carbon stocks of this pools will need to be included (Article 5(4));
- Updates to historical data that change the reporting of the time period used as reference in the construction of the FRL (usually the reference period 2000–2009), including model parameters, emission factors, etc.;
- Changes in the area of managed forest land;
- Possible exclusion of emissions associated with natural disturbances according to Article 10;
- Other methodological inconsistencies between the FRL and the GHGI which affect the historical data.

By contrast, deviations between the reported GHGI data and the FRL projection that relate to *changes in forest management practices* are not subject to technical correction. Specifically, changes to the FRL assumptions in future forest management activities such as fertilization, planting or harvesting decisions, or changes in production quantities of different HWP categories are not subject for technical correction, but their impact on greenhouse gas emissions and removals will instead be accounted for.

5 Discussion

The core of the FRL is the determination of the projected amount of emissions or removals from managed forest land within the compliance periods 2021–2025 and 2026–2030, under the assumption that the forest management practices continue as occurred within the reference period 2000–2009. The FRL is a complex exercise: its estimation requires appropriate data sets covering all the different carbon pools, in-depth understanding of the GHGI reporting and its methodologies, detailed information and understanding of forest management taking place in the country, as well as modelling tools and expertize to build a proper representation of the reference period and project it to the future.

For the FRL, the Member States have to collect specific information on forests and their management, not based on the expected or ideal forest management practices applied on managed forest land, but on the actual activities carried out within the period 2000–2009. This information is then applied on the actual status of the forests in the beginning of the simulation (for most Member States, in 2010) and forest evolution is projected assuming that there are no changes in the forest management practices. Furthermore, forestry parameters and variables such as harvested volume of different tree species, natural mortality and forest increment need to be translated into net greenhouse gas emissions. In the meantime, interlinkages between different carbon pools need to be considered as forestry operations have an impact on all carbon pools. As a result, the FRL then reflects how the net greenhouse gas emissions from managed forest land (ideally including all its pools) would have been in the compliance period 2021–2025, if there had not been any changes to the forest management practice since 2010. That is, *the FRL represents a theoretical situation under clearly defined circumstances, and provides a counterfactual against which all real-life changes can be compared to in the accounting.*

In many countries, the GHGIs on LULUCF are led by one team, forest inventories by another, and future projections by yet another team, which according to the NFAP submissions often belong to different institutions or ministries. This means that the FRL has also required a notable collaborative effort of combining the expertise of different teams and sharing experiences, both nationally and between the Member States. In the assessment, we noted that the NFAPs submitted by the Member States provide valuable documentation of the historical and current forest management practices in the EU Member States and forests' and forestry's contribution to climate change mitigation. In the meantime, we also identified some methodological challenges that many Member States faced when projecting the FRLs and compiling the NFAPs.

5.1.1 Best available data and the reference period

The first stumbling block, for many countries, has been the collection of reliable information on a period that is already up to 20 years ago. In most EU Member States, information on forest characteristics is collected in National Forest Inventories (NFIs), i.e., specific surveys based on direct field measurements that are sometimes combined with remote sensing data. Comparing two inventories can provide information on the development of the forest characteristics, and indirectly also information on management that took place between the inventories (Schelhaas et al. 2018). Statistical forest inventories are generally considered as the most accurate estimates of the forest state (Gschwantner et al. 2019; Röhling et al. 2016). However, while the NFIs are seen as the most adequate data source for determining the actual forest management practice that took place in the reference period (Forsell et al. 2018), there are also clear challenges in using them for the FRL.

For example, the statistical NFIs are carried out at different time intervals, usually from five to more than ten years between two NFI inventory rounds, and typically the inventory of the whole country is completed over several years. In most cases, the Member States did not have NFIs that would match both to the beginning (2000) and to the end (2009) of the reference period. Furthermore, in some Member States systematic NFIs have only started after the year 2000, and the methodologies are developed over time, which means that there may not have been two inventories that can be reliably compared for estimating reference period practices.

Another data frequently used by the Member States are forest management plans based on stand-wise inventories. However, they often do not cover the whole forest area, and it is not possible to evaluate the consistency between the plans and the practice that really took place in the reference period. Furthermore, the forest management plans usually refer to a period of at least ten years. For these reasons, inferring the real state of the forests or the management practice that took place during the exact time interval of the reference

period was extremely challenging, and in some cases, technically impossible. As a result, many Member States had to deviate from the reference period 2000–2009 (see Figure 5 and Figure 7).

Even when modelling forest development at a national level, the forest management practices are typically modelled using stand-level (or tree-level) models. Since most countries do not have detailed data on the real management practices carried out at stand level, the Member States determined this information indirectly based on ancillary data, such as aggregated harvest data at a national scale. This generally required a preliminary stratification of the forested area (based on, for example, species composition, management type, etc.). Thereafter, a set of typical management activities applied within each strata for determined, and modelled to take place with a similar intensity as in the reference period. This last quantity was defined in different ways, according to the specific characteristics of each forest or to the information available at country level. Generally, the FRL projections required determination of the average harvest intensity attributed to each management practice within the reference period. Since national statistics on the amount of harvest, disaggregated by strata, in most cases are not available, inferring this information has required further methodological assumptions (see Figure 4 and Figure 6). At this stage, some countries partially excluded data from specific years within the reference period, because of specific circumstances due to natural disturbances that were not considered to be representative of the reference period practice (e.g., Czech Republic before 2005); due to the lack of data for this modelling exercise – as considered appropriate by the country's experts - (e.g., Germany before 2002 and after 2007, Netherlands before 2003); or because of possible inconsistencies between the different methodological approaches applied within the reference period (e.g., in case of Finland, for the validation of the model's output). All these methodological choices were carefully assessed within the review process, taking into account the overall methodological consistency within the national proposal and the Member State's proposal compared with the approaches used by other countries. In the case of the Czech Republic and Germany, the observed deviations led to a recalculation of the Member State's proposed FRL.

For all Member States, however, an important outcome of this exercise is the collection of a set of data and information, sometimes previously unpublished or not available for the international community, regarding both the characteristics of managed forest land and the specific management practices applied within the country. Many countries – e.g. Germany, Poland and Sweden – discussed the possible discrepancies between official harvest statistics and the GHGIs, providing useful information also for other users of these datasets. Some countries (e.g. Belgium, Netherlands) took this opportunity to improve their official harvest statistics, in order to account for unreported removals, mainly regarding the use of wood for energy. Other countries, such as Romania and Bulgaria, identified needs to carefully monitor and update official statistics, also to reflect harvests that are not captured by harvest statistics. All in all, all this information now publicly available in the NFAPs, certainly improves the transparency of the final results, as well as represents an important data source from where other studies may draw further information.

5.1.2 Projection of forest management practice and methodological consistency with the GHGI

Once all this data and the detailed information on the state of the forests in the beginning of the projection period[61] was collected, the Member States had to set up a modelling framework that is able to simulate the continuation of forest management practices with regard to the dynamic age-related forest characteristics. This has been, generally, the most challenging requirement. On the one hand, the LULUCF regulation expects consistency between the methods and data used for the FRL and those used in the GHGI. On the other hand, the countries were required to apply a dynamic approach that considers the evolution of the forests over time, which is often intrinsically different from methods applied in the national GHGIs (e.g. the stock-difference method). Furthermore, the countries had to model the theoretical evolution of the forest stands strictly based on the management practices defined within the reference period, while also considering age-related forest characteristics. In some cases, age-related forest characteristics were however not considered the most appropriate variables to determine the dynamics of the forest stands or management activities at country level. This is the case especially in the Mediterranean region and also more generally on uneven-aged forest stands, where it may not be possible to determine a mean age for a stand, and consequently neither its evolution over time based on age classes.

[61] The start of the projection was defined differently among the Member States, depending on the characteristics and quality of the best data available at country level – see Figure 11.

Taking into account all these issues, estimating the FRL requires generally a completely novel approach compared to the ones applied to GHGIs. For this reason, Article 8 of the LULUCF regulation requires the Member States to demonstrate the ability of these methods to reproduce the historical GHGI. The technical guidance document recommended to reproduce the historical GHGI within the same time interval that defined the reference period (Forsell et al. 2018). As specified in criterion (h) of Annex IV Part A, this has the purpose to show the consistency between the modelling output applied to FRL, and the historical GHGI. In some cases, however, due to lack of specific data referred to the beginning of the reference period (and data needed to initialize the model), some countries could not fully fulfil this specific requirement (see Figure 11).

To overcome all these technical problems, three countries adapted the methodological approach applied to their national GHGI to the specific requirements of the LULUCF regulation. This is the case for Italy, Portugal and the United Kingdom, which used the same methods as applied within their GHGI, integrated with other additional assumptions and thereby implicitly considering the forest dynamics in the FRL. The main advantage, in this case, is the full consistency between the estimates provided by the country for the compliance period and those reported in the GHGI for the reference period, as requested by the LULUCF regulation. The majority of the countries, however, used or developed a completely different approach to set their FRL, to explicitly consider the dynamics of forest parameters in the FRL. This solution generally allowed to satisfy the specific requirements of the LULUCF regulation concerning both the continuation of the historical management practices and the consideration of dynamic age-related forest characteristics. In some cases, this new modelling framework was also considered as a valuable alternative to the approach applied within the GHGI (e.g., Ireland updated the historical GHGI according to the approach used within the FRL). In other cases, however, due to the complexity of these models, some countries had difficulties to reproduce their historical GHGI, at least within the reference period, because the models could typically not run back in time, i.e., provide estimates before the starting year of the actual FRL projection.

The starting year, i.e., the time step from which the modelling framework starts to simulate the theoretical evolution of the forests stands under the continuation of the reference period's management practices, is generally linked to the data used as input to initialize the model, which in turn depend on the information available at country level. At this purpose, Article 8(5) specifies that the FRL shall use the best data available at country level. This choice, however, was sometimes controversial, because these data should ensure an appropriate representativeness both of the state of the forests within the reference period, and in the beginning of the simulation period. This last aspect induced many countries to move their starting year beyond 2010 (i.e, the one suggested by the technical guidance document, see Forsell et al. 2018), even if this posed other technical problems (i.e., to reproduce the historical GHGI within the reference period or to guarantee the consistency with the approach used by other Member States), and it led to requests of further clarifications during the review process (see Figure 5). For the same reason, countries that defined harvest intensity by mixing data from the beginning and the end of the reference period, such as Latvia, Poland and Slovenia (considering growing stock from the beginning of the reference period, and harvested volume as the average harvest volume), or countries that only considered a part of the reference period 2000–2009, such as Germany or the Czech Republic (for salvage logging), introduced a possible bias in their final calculations, and were seen to have an inconsistent approach compared to the approaches used by other Member States.

From a methodological point of view, the countries opted for a large variety of different solutions, ranging from very sophisticated modelling approaches, such as in case of Finland, to simplest solutions, such as in case of Cyprus and Malta. Some of these approaches could not directly simulate the dynamic evolution of managed forest land, such as in case of Portugal or Italy, where traditional age-related forest characteristics were not directly considered within the modelling framework. Nevertheless, all countries, in the end, were found to exclude economic drivers and other exogenous assumptions from their simulations, except for Croatia which, according to Article 8(4), has a special derogation allowing to consider the effects specific to the war circumstances). All Member States considered the specific parameters – i.e., age-related characteristics and management practices- from the reference period. This is the main methodological novelty of the FRL approach applied under the LULUCF regulation, which substantially distinguishes this exercise from the estimates prepared for the previous forest emissions baseline in the EU, the FMRL under the Kyoto Protocol (Grassi et al. 2018a).

The harvest levels projected as part of determining the FRLs show an increase by 16% for the EU as a whole, when comparing 2021–2025 and the reference period 2000–2009. This is broadly in line with independent estimates of the projected harvest associated to the FRL (Grassi et al. 2018a; Nabuurs et al. 2018; Forsell et al. 2019). These results emphasize the age-related dynamics considered in the FRL: more forests reach the harvest age (or dimensions) compared to what was observed in the reference period. As a result of the interplay between harvest and increment, the sum of the Member States' forest sink projected for the FRL – i.e. -337 Mt

$CO_2e\ y^{-1}$ for the period 2021–2025 – represents a decrease of 18% compared to the reference period 2000–2009. The results also alleviate concerns that have been raised about possible constraints that FRLs could put on the harvesting in the EU Member States (e.g. Kallio et al. 2018). Furthermore, as defined in the LULUCF regulation and emphasized in the scientific literature (Grassi et al. 2018a; 2018b), the FRL represents the net emissions only. While harvest is an important driver of the net emissions, the total increment is an important factor too to determine the net emissions. Real-life changes in forest management that influence either the harvest or increment assumed in the FRLs will both have a direct impact on the final accounting results. Although not many Member States report the information on forest increments on a national level in their NFAP, those reporting it generally project an increase in total increment.

5.1.3 Consistency between the FRL and the GHGI with regard to carbon pools and GHGs

As determined in Article 5, FRL includes the carbon pools of above-ground and below-ground biomass, dead wood, litter, soil organic carbon, and harvested wood products. Of these pools, above-ground biomass, dead wood and harvested wood products are mandatory pools, while the other three pools may be excluded if they are not a source of emissions. In the meantime, Article 8(5) and criterion (h) of Annex IV Part A require consistency with the reporting in the GHGI. Specifically, as the FRL is calculated for managed forest land, corresponding to the land use category 'Forest land remaining forest land' in the GHGI, consistency between the FRL and reporting under this category were assessed.

Currently, above-ground and below-ground biomass are reported as a single item of living biomass in the GHGI, and all Member States except for Malta report emissions or removals for living biomass under the land use category 'Forest land remaining forest land'. For the FRL, some Member States provided estimates separately for above-ground and below-ground biomass, while most reported these as a single pool of living biomass. Both approaches were considered consistent with the GHGI.

All Member States were also diligent with including the contribution of HWP in the FRL. The HWP is an important pool from the forestry sector's perspective: following the internationally agreed practice (IPCC 2006), the carbon in harvested wood is assumed to be released to the atmosphere directly (instantaneously oxidized), unless they are used for material uses. Therefore, to account for the climate impact of using wood for energy, it is important to also consider the use of wood for HWP. Here, we found that all Member States applied the 'production approach' defined by the IPCC (2014), in line with the requirements of the LULUCF regulation.

Furthermore, the LULUCF regulation requires that the ratio between solid and energy use of wood is kept constant and the same as in the reference period. As explained in the technical guidance document (Forsell et al. 2018), this constant ratio is achieved when the ratio between the total harvests and the inflow to the HWP pool is maintained at the same level as in the reference period. However, this assumption creates a challenge for more detailed forest modelling systems, if the inflow to a certain HWP commodity is dependent on the dimensions of the harvested wood or tree species composition of the harvests, and the dynamics of these parameters are modelled over time. If the wood dimensions or the tree species distribution are in the FRL modelled to be notably different in the compliance period compared to the reference period – due to the development of age-related forest characteristics – it may not be possible to maintain the same total ratio between the total harvests and the HWP inflow. Therefore, it was considered acceptable to model the constant ratio between solid and energy use of wood either as a total value (and a single ratio), or as separate ratios for e.g. wood commodities or tree species[62].

The third mandatory pool in the LULUCF regulation is dead wood. Here, a number of countries do not currently report dead wood in the GHGI, but instead apply the IPCC Tier 1 method that assumes the pool to be in balance. The reason for this choice is usually lack of reliable data to estimate the carbon stock change in the dead wood pool. Some countries, such as Poland and Romania, carried out an additional effort to collect data and to set up a specific modelling approach to include the contribution of dead wood in the FRL. However, as this pool is not reported in the GHGI used as reference for the FRL, this methodological and data improvement led to an inconsistency when comparing the model output with the historical GHGI. This is linked to the fact that, from one side, criterion (h) of the Regulation states that the FRL shall be consistent with historical GHGI, and from the other side, Article 5 states that Member States shall include in their account dead wood. Other countries

[62] This topic was discussed in detail also in the LULUCFEG meeting in April 2019. https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=30964

which could not provide this estimate within their NFAP, will refine their FRL through a technical correction. For all countries that do not currently report dead wood in the GHGI, we noted the need to include it by the time of compliance check (see the Member State-specific assessment in Annex 1).

While below-ground biomass, litter and soil organic carbon are not mandatory pools in the FRL unless they are a source of emissions, they are nevertheless important for complete estimations of forest carbon flows. The completeness of the reporting is especially prominent in cases where the carbon modelling framework employs a system that projects the development of all carbon pools – such as the CBM-CFS3 model used by Czech Republic, Ireland and Poland – but the GHGI does not report all these pools. In these cases, ensuring consistency with the GHGI through omission of those pools from the FRL that are not reported in the GHGI will lead to an incomplete representation of the carbon flows as projected by the model. However, as the FRL is only a single number that needs to be comparable with those pools reported in the GHGI, the assessment concluded that the carbon pools not reported in the GHGI should not be included in the FRL. Instead, the Member States are encouraged to develop their methodologies for reporting estimates for different carbon pools in the GHGIs, and where applicable, consider these improvements accordingly in technical corrections of the FRL before the compliance check.

The FRL includes the greenhouse gases CO_2, CH_4 and N_2O (Annex I of the LULUCF regulation). Emissions of non-CO_2 gases are reported on managed forest land from nitrogen fertilization or mineralization (N_2O), drainage and rewetting (N_2O and CH_4), and biomass burning (N_2O and CH_4). The most frequently occurring issue in the FRLs with respect to non-CO_2 gases was the omission of emissions from wildfires from the FRL. In all such cases, the contribution of wildfires on the FRL value was negligible. However, this omission triggered often an inconsistency with both N_2O and CH_4 reporting, as in many countries the only source for these gases is wildfires. In those cases where the Member State did not include the fires in the FRL submission, they are expected to do so as a technical correction.

5.1.4 Natural disturbances

Natural disturbances (NDs), such as wildfires, windstorms, insect and disease infestations, and other extreme weather events are recognized to result in emissions that may be beyond the control of the Member States. The occurrence of these events is increasing in Europe (Seidl et al. 2014) and in some NFAPs serious concerns are expressed on current trends (e.g. the cascade effect of bark beetle attacks, following droughts and windstorms in the Czech Republic).

As detailed in Article 10 of the LULUCF Regulation, the Member States have a possibility to exclude from the accounting greenhouse gas emissions from exceptional natural disturbances under specified rules. In such a case, the Member State will need to calculate a 'background level' (calculated according to Article 10 and Annex VI), based on the emissions from natural disturbances during the period 2000–2020. This background level will then be included in the FRL. The emissions exceeding this background level in the compliance period (and subsequent removals of greenhouse gases on the same areas) will then be excluded from accounting, provided that specific conditions are met (see Forsell et al. 2019 for details). Emissions resulting from harvesting and salvage logging that took place after the ND shall not be excluded from the accounts. On the other hand, if the Member State chooses to not use this provision, all emissions and removals occurring on managed forest land will be accounted for. Therefore, for the completeness of the accounts, also all biomass burning (incl. wildfires) should be included in the FRL.

As noted in section 3.4, only six Member States calculated a background level in their NFAPs at this stage, while several more indicated intention to apply the natural disturbance provision. For those already quantifying the background level, the calculation will need to be technically corrected once the entire time series 2000–2020 will be available. In any case Member States may decide later on if opting for the ND provision. In this latter case, a new background level may be added to the FRL through a technical correction.

6 Conclusions

The assessment concluded that for 17 Member States, the revised NFAP and the FRL proposed therein were sufficiently following the principles and criteria of the LULUCF regulation. After clarifications or corrections through addenda or corrigenda submitted by the Member State, also the NFAPs and FRLs of Ireland, Greece, France, Latvia, Malta and Finland were considered to be compliant with the Regulation. For Bulgaria, Czech Republic, Germany, Cyprus and Poland, the assessment identified a need for a recalculation to correct for a specific problematic assumption that was seen to not be in line with the Regulation. The details of the recalculations are provided in SWD (2020) 236 accompanying the delegated act.

The main novelty of the FRL exercise in technical terms is the consideration of age-related dynamics in setting the accounting baseline, while excluding assumptions on policies. By excluding the impact of national policies and other economic drivers from the FRL, this approach ensures not only the consistency with the other sectors, but also that any carbon loss due to a change in management and wood use, including the use of wood for energy, is fully accounted under the LULUCF sector. The comparison of the FRLs in the delegated act with the similar exercise done under the Kyoto Protocol - where policy assumptions were allowed when projecting the forest sink for the period 2013–2020 - suggests that Regulation 2018/841 was successful in introducing more stringent and environmentally credible criteria to set FRLs.

A crucial part in the process of setting the FRL was the active participation of the Member States, other experts and stakeholders, from the preparation of the technical guidance document to the assessment of the draft NFAPs and further discussions within the LULUCFEG. This notable effort by the Member States and Expert Group members was essential in clarifying questions for which the LULUCF regulation does not provide details on a technical level, and to find a common ground for the basis of the assessment. The peer review-like process encouraged also for identification of common challenges and mutual learning. We are confident that this experience can serve as a basis also for future collaboration towards the common goal of enhanced climate change mitigation.

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Links to the NFAPs submitted by the Member States, and to their addenda or corrigenda (where applicable) are provided in Table 10.

List of abbreviations and definitions

C	Carbon
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CP	Compliance Period
CRF	Common Reporting Format
DG CLIMA	Directorate General for Climate Action
EU	European Union
FLrFL	Forest Land Remaining Forest Land
FMRL	Forest Management Reference Level under the 2nd Commitment Period of the Kyoto Protocol
FRL	Forest Reference Level
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Inventory
HWP	Harvested Wood Products
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre of the European Commission
LULUCF	Land Use, Land Use Change and Forestry
LULUCFEG	Commission Expert Group on LULUCF
MFL	Managed Forest Land
Mm^3	Million Cubic Metres
MS	Member State(s)
Mt CO_2e	Million Tonnes Carbon Dioxide Equivalent
ND	Natural Disturbance
NFAP	National Forestry Accounting Plan
NFI	National Forest Inventory
NIR	National Inventory Report
N_2O	Nitrous Oxide
RP	Reference Period
SWD	Commission Staff Working Document
t	Tonne
UNFCCC	United Nations Framework Convention on Climate Change

EU country codes

When listing the countries, we use the alphabetical list of the EU Member States based on their national languages. The country codes and order of the countries is as follows:

BE	Belgium
BG	Bulgaria
CZ	Czech Republic (Czechia)
DK	Denmark
DE	Germany
EE	Estonia
IE	Ireland
EL	Greece
ES	Spain
FR	France
HR	Croatia
IT	Italy
CY	Cyprus
LV	Latvia
LT	Lithuania
LU	Luxembourg
HU	Hungary
MT	Malta
NL	Netherlands
AT	Austria
PL	Poland
PT	Portugal
RO	Romania
SI	Slovenia
SK	Slovakia
FI	Finland
SE	Sweden
UK	United Kingdom

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Annex 1: Member State-specific technical notes on the revised NFAPs and proposed FRLs

Introduction to the Member State-specific technical notes

In this Annex, the findings of the technical assessment of the NFAPs and the FRLs is documented in more detail for each Member State. Each country-specific fiche is structured as follows:

- General overview of the FRL proposed by the Member State and the FRL in the delegated act (if different), possible remaining issues identified in the assessment, and the conclusions of the assessment with regard to the principles, criteria and elements of the LULUCF regulation;
- Overview of the carbon pools and greenhouse gases included in the Member State's FRL, and their estimated contribution to the FRL compared to the historical development reported in the GHGI;
- Foreseen technical corrections on the Member State's FRL;
- Report on the assessment of the issues raised in the technical recommendations for the Member State.

The assessment is based on the revised NFAP as submitted by the Member State, and considers also the Addendum and/or Corrigendum submitted by the Member State, when applicable. In cases where the FRL was recalculated for the delegated act, this assessment gives an overview of the underlying reasons and provides a comparison between the FRL proposed by the Member State and the recalculation by the European Commission. The more detailed recalculations are documented in SWD (2020) 236.

A.1. Belgium

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 19 December 2019, Belgium proposes a FRL of -1 369 009 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using the SIMREG model.

In general, Belgium addressed or partially addressed the majority of the recommendations. However, the European Commission notes that:

- Belgium has a difference between areas of Managed Forest Land for the FRL and "land converted to forest land" in CRF Table 4.A.
- Belgium does not include the dead wood pool in the FRL, consistently with the GHGI (submission 2018).
- Belgium does not include CH_4 and N_2O emissions from biomass burning in the FRL.

The assessment concluded that the NFAP of Belgium is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and contains the elements required under Annex IV Part B. of the Regulation. The European Commission considers the FRL proposed by Belgium reasonable. However, 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" by a technical correction following Article 8(11) in the LULUCF compliance report (Article 14(1)). Other issues will be corrected by Belgium at the end of the compliance period.

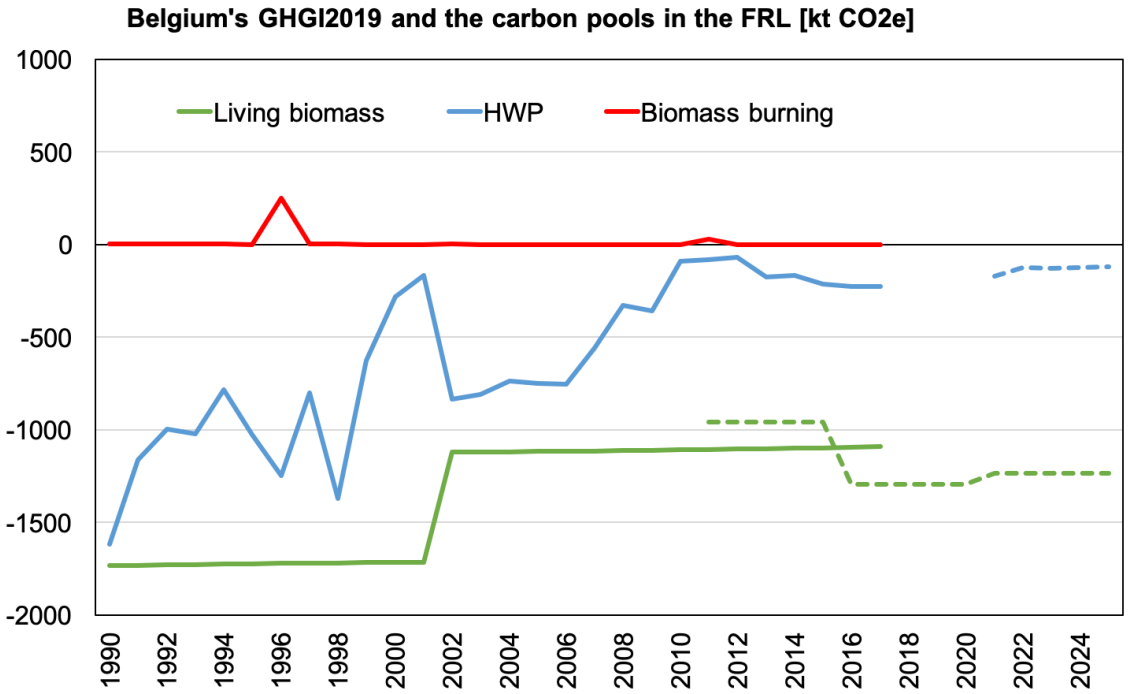
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Belgium's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 1. The carbon pools and other sources of GHG emissions included in Belgium's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Total living biomass	-1 235 641
Harvested wood products	-133 368
Total without HWP	**-1 235 641**
Forest reference level, incl. HWP	**-1 369 009**

Figure 1. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Belgium

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Belgium:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Belgium may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Belgium does not include the carbon pool of dead wood, because it is currently not included in Belgium's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.
- The FRL of Belgium does not include CH_4, N_2O emissions from biomass burning, creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for Belgium

The draft NFAP of Belgium, submitted on 21 January 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Belgium was -1 378 354 t CO_2e (-1 166 534 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Belgium on 6 criteria of Annex IV, Section A and 7 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Belgium and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Belgium after the submission of the revised NFAP.

	SWD recommendation	**Response from Belgium**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	As discussed during the review process, additional qualitative and quantitative information has been added in section 1.2.1.a), consistent with the forthcoming long term objective of achieving a balance between emissions and removals in the second half of the century (Paris Agreement).	**Partially addressed** See section 1.2.1.a. Long-term development description and explanation is only partially provided.
Annex IV.A(c)	Provide credible and robust evidence for the model to reproduce historical data. Assess if the increasing area of Douglas fir entering the size classes with high annual growth is the sole or key driver for the overall trends in growth and harvest. Provide information on projected growth in light of the projected increase in harvest	Additional explanation on the drivers of the observed trend in the modelled growth and harvest has been added in section 4.3.1.	**Addressed** See Figure 15, p. 45 and section 4.3.1: "we observed between 1995 and 2009 that the total area occupied by pure douglas-fir stands and mixed douglas-fir - Norway spruce stands increased from 16 500 ha to 31 000 ha. Thus, a significant proportion of these new plantations are composed of species that are more productive than the one they replaced. We believe these elements are the key driver for the overall simulated trends in growth and harvest."

	SWD recommendation	Response from Belgium	EC comments
Annex IV.A(d)	Provide information such as partitioned quantities of tree biomass felled / dead into e.g. dead organic matter, harvested timber, felling residues, fuel wood, industrial roundwood, and the into different product classes including energy wood, or any other class that is appropriate.	Information has been added in section 3.3.4.	**Addressed** See section 3.3.4
Annex IV.A(e)	Ensure the consistency and comparability of definitions such as 'timber', 'harvest' etc. and the grading of felling in the data sources used for the ratio calculated from these data.	Information has been added in section 3.3.4. The data in table 10 illustrate that the constant ratio between solid use and woodfuel has been applied both in the reference period and the FRL.	**Addressed** See section 3.3.4 and Table 10
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Additional information has been added in section 1.2.1.g). As explained in this section, the consistency with the national projections as submitted in 2019 cannot be demonstrated, but explanations for the differences and on the approach for future projection submissions are provided.	**Not addressed** Very little and only qualitative information is provided (p. p. 6 BE-NFAP).
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	As explained in section 4.2.1, the model has been revised, especially regarding the thinning model applied for Flanders. The consistency of modeled data with the 2019 GHGI submission is also analyzed in this section 4.2.1, both by figure and average mean value.	**Partially addressed** For area see recommendation on Annex IV, Part B (e)-i. The consistency between historical data from the national GHGI and modelled data is addressed within section 4.2.1. (see in particular Table 13 and Figure 15)
Annex IV.B(a)	Provide an estimate of the FRL with the correct sign. Provide information if and how natural disturbances have been taken into account	The sign has been corrected and FRL is provided on an annual basis, in section 1.2.1 d). Additional information on the treatment of natural disturbances has been added in a new section 2.2.	**Addressed** See section 1.2.1d and 2.2 - Natural disturbances are not considered in the FRL

	SWD recommendation	Response from Belgium	EC comments
Annex IV.B(b)	Include the carbon pools and greenhouse gases required by Regulation (EU) 2018/841 in the FRL and the national GHG inventory. Assure consistency for the starting point of projections for all carbon pools, including the HWP pool	All carbon pools reported in the national GHG inventory are included in the reference level Information on the other pools, assumed stable, (litter, deadwood, soil organic carbon) is also provided (section 3.3.2 and 3.3.3, sections 4.1.2 and 4.1.3). The starting point for the HWP projections has been corrected and is now 2010, as for the forest management (see section 3.3.4)	**Partially addressed** For SOC (section 3.3.2): "in the absence of updated values that would allow the calculation of updated estimates, the assumption of no stock change in SOC, following IPCC 2006 Guidelines Tier1 approach is applied for the FRL and is also applied since the 2019 GHGI submission, to ensure consistency and avoid any expectation of undue net credits." For Dead wood and litter (section 3.3.3): "In the GHGI submission, Belgium applies the Tier 1 approach of the IPCC 2006 Guidelines, assuming no change in carbon stock in managed forest land, for both litter and deadwood (notation key "NO" is used in the CRF tables). The same approach is applied for the FRL, assuming no change in carbon stock in managed forest land, for both litter and deadwood." For HWP (section 3.3.4): "In order to avoid any overestimation of the industrial roundwood (IRW) entering the HWP pool, the industrial round wood has been projected from 2010 by applying the modeled trend of the total harvest (as projected by the model) on the average IRW from FAO data for the period 2000-2009." Belgium does not include CH_4 and N_2O emissions from biomass burning in the FRL.
Annex IV.B(d)	Provide information on harvesting rates for at least one different policy scenario	Information is provided in section 2.4.3.	**Addressed** See section 2.4.3

	SWD recommendation	Response from Belgium	EC comments
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection	Consistency is explained in section 3.2.2	**Not addressed** Belgium has a difference between areas of Managed Forest Land for the FRL and "land converted to forest land" in the CRF Table 4.A. The area used for the FRL is equal to 612,978 ha (Appendix 2, p. 56), while the area reported within the CRF Tables is equal to 691 kha for 2009, assumed as starting year (Table 4.A, GHG Submission 2019).
Annex IV.B(e-ii)	Distribute simulated harvest data into HWP pools. Compare simulated harvests to reported historical harvest data.	Additional information is included in section 3.3.4	**Addressed** See section 3.3.4
Annex IV.B(e-iii)	Provide additional information on the characteristics of the virtual forests used by model and a verification with actual field data in order to improve the confidence on the modelling approach	Additional information is included in section 3.3.1, pp 33-34.	**Addressed** See p. 33-34
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Information is provided in section 3.3.4, table 10.	**Addressed** See table 10 and section 3.3.4

A.2. Bulgaria

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 20 January 2020, Bulgaria proposes a FRL of -3 021 110 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using an *ad hoc* FRL model. Due to issues identified in the revised NFAP, Bulgaria's FRL was recalculated for the delegated act. The final FRL in the delegated act is -5 105 986 tonnes $CO_2e\ y^{-1}$.

Bulgaria did not address most of the recommendations. In particular, the European Commission notes the following issues:

- Bulgaria calculates the FRL based on "harvest to biomass available for wood supply (BAWS) ratio". Bulgaria does not provide information on the evolution of BAWS by age-related dynamics over the reference period. Accordingly, it is not possible to evaluate whether Bulgaria maintains the "harvest-to-BAWS" ratio constant from the period 2000-2009 onward (Article 8(5); Annex IV.A(c)).
- Bulgaria does not demonstrate that the model is able to reproduce historical GHGI estimates, at least for biomass (Annex IV.A(h)).
- Bulgaria provides unclear information on which area is used in the determination of the FRL, consistently with the area of FLrFL as reported in the GHGI (Annex IV.A(h); Annex IV.B(e-i)).
- Bulgaria does not include the carbon pools of litter and mineral soil, and N_2O emissions from mineralization and CO_2 emissions from biomass burning in the FRL although these are reported in the GHGI.

Based on the information reported in the NFAP, the model's estimates for forest biomass for the period 2000-2009 are not calibrated against historical estimates as in 2018 GHGI submission. The assessment also concluded that the FRL proposed by Bulgaria is not set according to Article 8(5) and Annex IV.A(h). For these reasons, the European Commission decided to recalculate the FRL proposed by Bulgaria to ensure consistency of carbon pools and greenhouse gases with GHGI and methodological consistency with GHGI and to incorporate the litter and mineral soil pools (see SWD (2020) 236). Other issues will be technically corrected by Bulgaria at the end of the end of the compliance period.

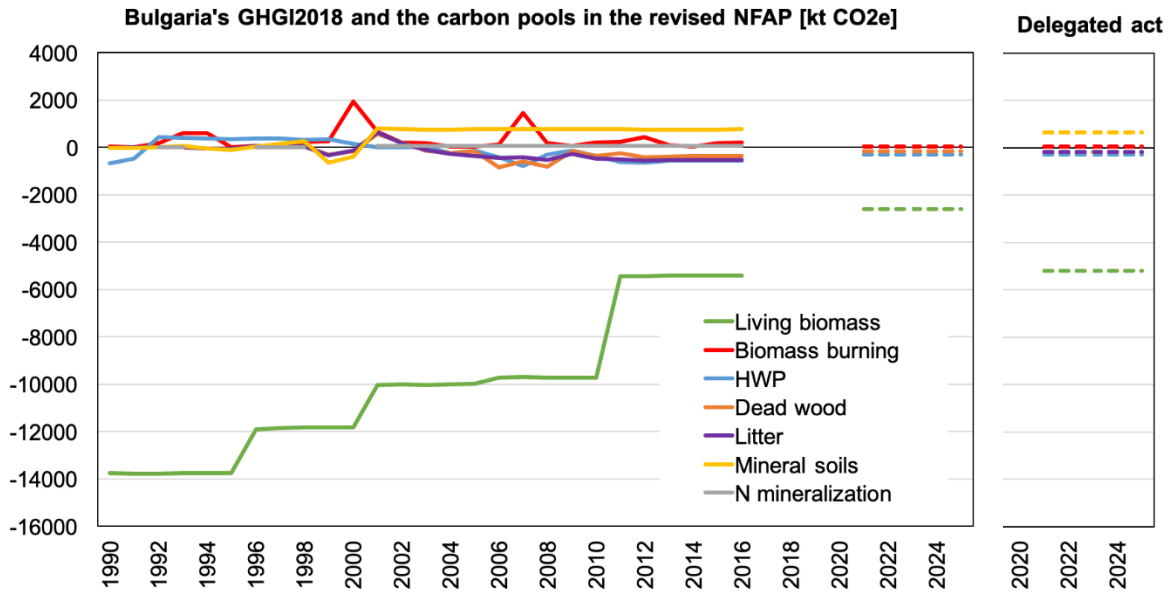
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Bulgaria' FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e. The right-hand column presents the final contribution of the carbon pools in the FRL, reflecting the recalculation by the Commission.

Table 2. The carbon pools and other sources of GHG emissions included in Bulgaria's FRL. The delegated act reflects the amendments made by the Commission in the Recalculation of Bulgaria's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**	
	Revised NFAP	**Delegated act**
Living biomass	-2 610 330	-5 188 984
Dead wood	-167 290	-167 290
Litter	--	-166 904
Mineral soil	--	+660 692
Harvested Wood Products (HWP)	-297 930	-297 930
Biomass burning	+54 430	+54 430
Total without HWP	**-2 723 190**	**-4 808 056**
Forest reference level, incl. HWP	**-3 021 110**	**-5 105 986**

Figure 2. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), as projected for the FRL in the NFAP (dashed lines, left-hand side), and as included FRL in the delegated act (dashed lines, right-hand side).



Foreseen technical corrections to the forest reference level of Bulgaria

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Bulgaria:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025, Bulgaria may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- The FRL of Bulgaria does not include N_2O emissions from mineralization and CO_2 from biomass burning, creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for Bulgaria

The draft NFAP of Bulgaria, submitted on 31 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Bulgaria was -5 905 700 t CO_2e (-5 589 170 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Bulgaria on subparagraph 1 of Art. 8(5), and on five criteria of Annex IV, Section A and 5 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Bulgaria and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Bulgaria after the submission of the revised NFAP.

	SWD Recommendation	**Response from Bulgaria**	**EC comments**
Art. 8(5)1	Provide information on the continuation of harvest levels by sustainable forest management practices and according to age-dynamics. Justify the reasons for the increase of the harvest during the projected period.	Bulgaria revised the model used to project FRL in order to better reflect the age-dynamics of some strata. These changes affected the FRL and thus new FRL is proposed in the resubmission of the NFAP. The change in the model in response to this recommendation is that: 1. The calculation of projected harvesting is made by maintaining the "harvest to biomass available for wood supply ratio" (Alternative 1 of TGD) instead of "harvest to total biomass ratio" as it was done in the previous submission of NFAP (2018). Like this the projections regarding conversion coppices and coniferous plantations reflect better the legacy effects in these forests. Together these forests account for ~50% and have unbalanced age structure. Concerning the conversion coppices this unbalanced age structure is due to an old policy to convert coppice forests into high stem forests by aging. This policy is due since 1960 and nowadays most of conversion coppices are entering its regeneration phase and are subject to harvesting. Regarding coniferous plantations most of the plantations are between 40 and 60 years which is due to intensive afforestation programme in Bulgaria in post war period (started 1950s and ended in late 1980s). Coniferous	**Partially addressed** Despite BG provides extensive information on harvest and growing stock in the period 2000-2009 (see section "Stratification of the managed forest areas. Documentation of the strata, p. 40"), there is no disaggregation by age-class, and missing information on BAWS in the period 2000-2009. Indeed, BWAS evolution is only reported from 2011, not disaggregated by stratum and age-class (Figure 38, p. 78). Based on the information provided, it is rather difficult to demonstrate that "The increase in harvest levels is justified with the increase in biomass available for wood supply" (see column "Response from BG").

	SWD Recommendation	Response from Bulgaria	EC comments
		plantations have lower rotation ages in Bulgaria compared to the natural coniferous stands. The increase in harvest levels is justified with the increase in biomass available for wood supply. [Information related to this change in the model is provided on p.49; p.55-58; p.62-64; More information on issues related to coniferous plantations and conversion coppices is provided on p.32; p.63-64; Information on projected harvesting levels is provided on Table 19 and figure 37. Information on development of harvest levels and BAWS is provided on Figure 38].	
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	This information is addressed in the resubmission of the Bulgarian NFAP. [Chapter II, p.33]	**Not addressed** The information provided (i.e. long-term development of growing stock) is not exhaustive.
Annex IV.A(c)	Clarify how the values of the actual harvest used for FRL have been produced. Describe data sources of harvests.	1. Data on actual harvest during the RP comes from forest fund reporting form (RF - 5) on annual base. 2. Actual harvest during simulation is estimated by applying the ratio of actual total harvest to biomass available for wood supply, estimated as an average for the RP. [1. Information on RF 5 on wood removals is provided on p. 37; Historical data on wood removals is provided on figure 20, 21, and table 8 and 9.; 2. Information on ratio of harvest to BAWS is provided on table 12.]	**Not addressed** BG provides information on harvest as for the period 2000-2009. However, such information is not transparently correlated to BAWS, nor disaggregated by age. There is (apparently) a discrepancy between the historical harvest rate as reported in Fig. 41 (actual harvest vs modelled harvest, on p. 89) and in Fig 38 (i.e., the projected development of harvest level since 2011, on p. 78). The difference on the absolute amount of harvest, equal to about 1 mil m3 in 2011 can affect the entire time series provided by the country and it is not in line with other

	SWD Recommendation	Response from Bulgaria	EC comments
			information reported within the plan (i.e., fig 40 p. 88). **See also comments to Article 8(5).**
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	All information regarding HWP is presented in Chapter III, p. 78-82. The information on ratio is presented on table 29. [Chapter III, p. 78-82. The information on ratio is presented on Table 29]	**Addressed** See Table 30, p. 84.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed Forest Reference Level.	This information is addressed in the resubmission of the Bulgarian NFAP. [Chapter III, p. 82-83. Possible reasons for the observed differences are explained on p. 83]	**Addressed** See Figure 39, p. 86.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i).	The model for projected development of the forest resources in Bulgaria, used to construct the FRL, works at the level of TFL. However, all estimates regarding the FRL as emissions and removals are estimated based on MFL which is consistent with FL-FL for 2010 under UNFCCC reporting since the starting year of projection for BG is 2011. The ability of the model to reproduce consistently historical data on GHG inventory for the reference period is presented in Chapter III. The reasons for inconsistency of the level are justified in the text. [p. 69 - Model results – development of age-related forest characteristics; Chapter III, p. 76, tables 20 - 23; Regarding Consistency - Chapter III, p. 83 - 86]	**Addressed**
	Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Part B (b).		**Partially addressed** BG adds non-CO2 emissions from biomass burning, consistently with the GHGI (2018 submission). BG is not consistent with 2018 GHGI submission (see CRF Table 4.A, FLrFL), as it excludes emissions and removals for litter and mineral soil from the FRL (see Table 33, p. 87).
	Demonstrate the ability of the model used to construct the FRL to reproduce consistently historical data from the national GHG inventory for the reference period.		**Not addressed** BG does not demonstrate that the model reproduces historical estimates consistently with the GHGI, at least concerning forest

	SWD Recommendation	Response from Bulgaria	EC comments
			biomass (see Figure 42, p. 90) (see Supporting documentation below).
Annex IV.B(b)	Include the carbon pools and greenhouse gases consistent with those applied in the latest national GHG inventory.	All mandatory pools and gases are included in construction of FRL. [p.12; the consistency with GHGI is provided on p.84]	**Not addressed** Bulgaria does not include N_2O emissions from mineralization and CO_2 emissions from biomass burning in the FRL. The European Commission notes that these inconsistencies have not been addressed in the recalculation of Bulgaria's FRL and that they need to be addressed in the future as technical correction. See also comments to Annex IV.A(h).
Annex IV.B(c)	Provide explanations on how harvest from illegal logging is considered in the adopted policies	Information is provided [Control system on tracing of harvested timber on p. 31; Information on consideration of illegal logging into FRL is provided on p. 49]	**Addressed** BG provides explanations at p. 51.
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	Information is provided [Table 20]	**Addressed**
Annex IV.B(e-iii)	Provide information about increments by forest management practice and age-class. Clarify how the values for the actual harvest used for the FRL has been produced.	Information is provided. [Table 19]	**Partially addressed** BG provides increments by stratum but not disaggregated by age class (see Table 20, p. 79). Actual harvest is retrieved from RF 5 (clear information on that; see p. 37).
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Information is provided. [Table 29]	**Partially addressed** The information can be only deduced from Table 30, p. 84.

A.3. Czech Republic

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 20 December 2019, the Czech Republic proposes a FRL of -3 801 350 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3). The Czech Republic published a corrigendum[1] to the NFAP on 27 May 2020 with a clarification of potential use of the natural disturbance provision. However, this corrigendum does not alter the FRL as proposed in the revised NFAP. Due to issues identified in the revised NFAP, the Czech Republic's FRL was recalculated for the delegated act. The final FRL in the delegated act is -6 137 189 tonnes CO_2e y^{-1}.

In general, the Czech Republic addressed or partially addressed all technical recommendations. The European Commission notes the following issues:

- When determining the continuation of forest management practice for the FRL, the Czech Republic considers salvage felling only from the period 2005-2009, while other harvests are considered from the full reference period 2000-2009. This results in stronger harvests than if the reference period 2000-2009 was considered consistently for all harvests. This assumption is considered to not be in line with the principles of article 8(5), and is addressed in the recalculation of the FRL.
- The Czech Republic does not include CH_4 and N_2O emissions from biomass burning in the FRL.
- The contribution of dead wood pool, while of a minor numerical impact on the FRL, is estimated in a way that creates an internal inconsistency between the different carbon pools considered within the modelling framework used by the country.

The assessment concluded that the the NFAP contains the elements required under Annex IV Part B of the Regulation, but the FRL of the Czech Republic is not set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841. The assessment found that the FRL proposed by the Czech Republic is based on an overestimation of harvests due to different reference periods used for different types of harvest. After discussions with the country, the Commission concluded that the evidence provided by the Czech Republic to support this approach is not sufficient to justify this choice. Therefore, the FRL of the Czech Republic was recalculated, to reflect the whole reference period consistently for all types of harvest. Other issues will be corrected by the Czech Republic at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

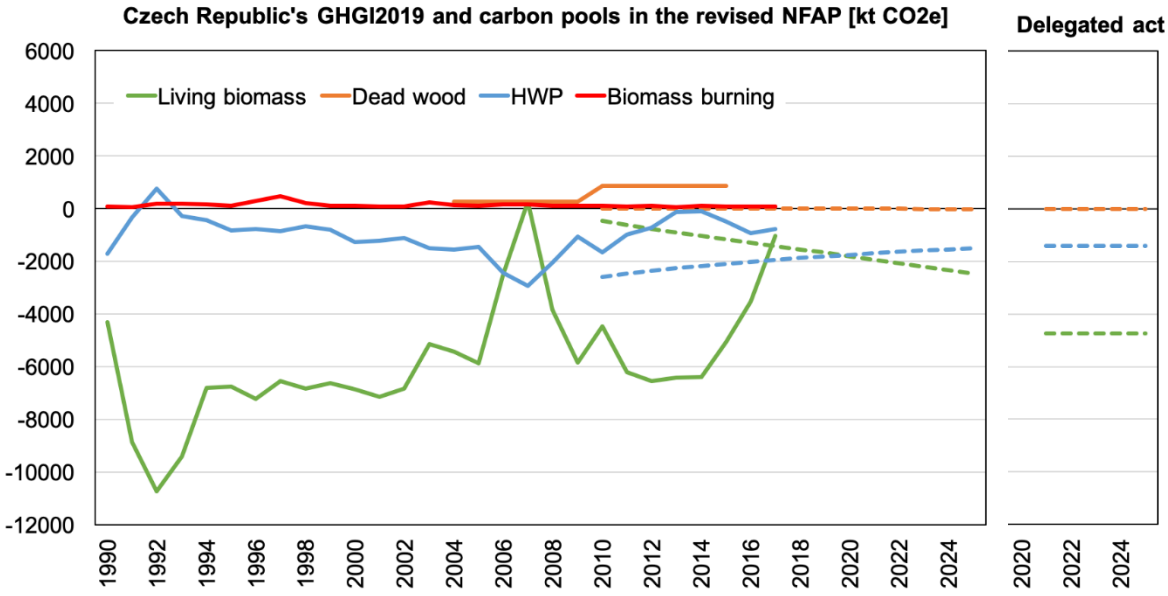
The following table presents an overview of the carbon pools included in the Czech Republic's proposed FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e. The right-hand column presents the final contribution of the carbon pools in the FRL, reflecting the recalculation by the Commission.

[1] https://www.mzp.cz/C1257458002F0DC7/cz/opatreni_v_ramci_lulucf/$FILE/OEOK-Corrigendum_to_the_Czech_NFAP-20200608.pdf

Table 3. The carbon pools and other sources of GHG emissions included in the Czech Republic's FRL. The delegated act reflects the amendments made by the Commission in the Recalculation of the Czech Republic's FRL.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]	
	Revised NFAP	**Delegated act**
Living biomass	-2 199 750	-4 730 955
Dead wood	-8 480	-8 480
Harvested wood products	-1 593 130	-1 397 764
Total without HWP	**-2 208 230**	**-4 739 425**
Forest reference level, incl. HWP	**-3 801 350**	**-6 137 189**

Figure 3. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), as projected for the FRL in the NFAP (dashed lines, left-hand side), and as included in the FRL in the delegated act (dashed lines, right-hand side).



Foreseen technical corrections to the forest reference level of the Czech Republic

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for the Czech Republic:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.

- At the end of the period 2021-2025, the Czech Republic may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of the Czech Republic does not include CH_4 and N_2O emissions from biomass burning (wildfires), creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.
- To ensure the consistency between the model's output and the GHGI for dead wood pool, the modelling framework used by the Czech Republic generated an internal inconsistency between different pools, moving part of living biomass to litter and other pools, currently not reported by the country. As a consequence, the contribution of the dead wood pool, while of a minor numerical impact on the FRL, should be re-estimated as a technical correction – eventually including also other pools currently not reported - to ensure the internal consistency between different pools."

Report on the assessment of the issues raised in the technical recommendations for the Czech Republic

The draft NFAP of the Czech Republic, submitted on 21 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for the Czech Republic was -7 685 130 t CO_2e (-6 585 640 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for the Czech Republic on five criteria of Annex IV, Section A and seven elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by the Czech Republic and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by the Czech Republic after the submission of the revised NFAP.

	SWD recommendation	**Response from the Czech Republic**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	In the case of the Czech Republic, the scenarios of harvest predictions until 2050 require including disturbance regimes, which are expected – based on the recent development - to affect both harvest rates and development of growing stock more strongly that the adopted policy scenarios. Two scenarios for development of the Czech forest resources and the likely wood removals were prepared and processed by the CBM model. They are described in detail in chapter 2.3.2 Description of the future harvest rates under different policy scenarios.	**Partially addressed**, as the discussion is more in the context of Annex IV.B(d) than Annex IV.A(a). The scenarios discuss reaction to expected disturbances, rather than proactive measures to enhance the forest sinks and its relation to overall balance between emissions and removals.
Annex IV.A(e)	Provide complete and transparent information on logging residues. Provide information on dataset used and methods applied to assess the use of the logging residues across the entire time series and on the method applied for projecting these quantities beyond 2017.	A detail information is in Chapter 3.3.2 Input data – harvest volumes. For the period 2000-2009, the extracted volume of logging residues was derived from the ratios of 5 and 15 % of the planned (thinning and final cut) and unplanned (i.e., salvage) harvest volume, respectively. This is identical approach as used in the NIR. The extracted logging residues are incorporated in average amount of salvage felling and planned cuts, which are used for CBM calibration runs (in RP) and implicitly also for projection estimates within P_Av (Section 3.2.3, Table 6), which drives harvest volume for the projection period (2010-2025).	**Addressed** Numerical data for logging residues for 2000-2009 provided in Table 9, and a description of the methods to estimate harvests and logging residue extraction provided in Ch. 3.3.2 and 3.2.3.
Annex IV.A(f)	Provide information on the provisions of the Czech Forest Act on sustainable management	The required information was added to a new chapter 2.4 The provisions of the Czech Forest Act on sustainable management and	**Addressed**

	SWD recommendation	Response from the Czech Republic	EC comments
	and biodiversity conservation together with a table that shows the evolution from 2000 to 2030 of the total forest growing stock.	biodiversity conservation. For the growing stock development, the official data from NDFMP were used for the period 2000-2018. For the period 2019-2030, results of the two defined scenarios described in Chapter 2.3.2 (Description of the future harvest rates under different policy scenarios) were used.	
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	The consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013 is demonstrated and described in Chapter 4.3.4.	**Addressed**
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i). Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period. Provide information on the changes in the level of agreement in the period 2000-2017 between the projected increment and the actual increment and assess its potential impact on the FRL.	Based on the recommendation from EU EG on LULUCF voiced in its 3rd meeting held on 2ndand 3rd October 2019, the modelling concept for the Czech Republic was changed accordingly, starting the projection estimates since 2010 (instead of 2018 earlier), just after RP. Hence, the consistency runs are limited to RP, not to 2017 as earlier. The current annual increment (CAI) based on the valid Czech Growth and Yield tables (Cerny et al. 1996) estimated for these strata, is shown (Figure 7). These tables are implemented on updated database NDFMP every year in order to evaluate changes in CAI on the national level. Annually updated CAIs has been used for GHG inventory reporting. Data for years 2000, 2004 and 2009 are shown, representing the development within RP. Year 2004 is the calibration year to represent RP in CBM (cf. Figure 2), while data of year 2000 are used to represent the area of FLrFL and the initial distribution of strata (Table 3), as recommended by h). The model reproduction of historical data and consistency of estimates is fully documented and discussed in Chapters 4.1, 4.3 and 4.4u.	**Addressed** Consistency demonstrated for the RP and for the different pools in chapters 4.1.1-4.1.4. However, to guarantee the consistency between the model's output and the GHGI for dead wood pool, where CZ reports a constant source equal to +258 Gg CO2e yr-1 (GHGI 2019) between 2004 and 2009, the assumptions defined within the disturbance matrices applied by the CBM model run were modified, moving part of the living biomass to litter and soil (see Supplementary material S1 for details). Because these last pools are not reported within the FRL proposed by CZ (nor in the GHGI), a fraction of the living biomass is improperly accounted as an outflow, instead of a transfer to other pools.

	SWD recommendation	Response from the Czech Republic	EC comments
Annex IV.B(b)	Noting the inclusion of additional carbon pools in the FRL, include those pools in the next submission of the national GHG inventory to ensure consistency between the FRL and the national GHG inventory.	The consistency between the carbon pools included in the FRL and those in the Czech emission inventory is fully retained. The consistency of emission and removal estimates and for the carbon pools included in the FRL and the contribution of HWP is detailed in section 4.3 Consistency between FRL and the latest NIR of this document.	**Addressed**
Annex IV.B(c)	Provide information if the factors used in the national GHG inventory have also been applied to the FRL. Assure that modelling starts the year after describing the state of the forest.	For the projection period 2010-2025, data of 2010 represent the initial model conditions for model estimation across this 16-year long period. A detail information is in Chapter 3.1 Description of the general approach as applied for estimating FRL.	**Addressed** Modelling now starts in 2010, and the state of the forest is calibrated to historical data until 2009.
Annex IV.B(d)	Provide detailed information on how harvesting rates are expected to develop under different policy scenarios.	Two scenarios for development of the Czech forest resources and the likely wood removals were prepared and processed by the CBM model. They are in detail described in Chapter 2.3.2 Description of the future harvest rates under different policy scenarios.	**Addressed**
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	An information is provided in Chapter 3.2.1 Data on forest land remaining forest land (category 4.A.1 in NIR) and stratification of the managed forest land, in detail in the Table 3: Adopted stratification of FLrFL area (as of 2000 used for calibration runs under RP and as of 2010 for the projection period 2010 to 2025) for the Czech FRL estimation.	**Addressed** CZ uses the area of FLrFL as of 2010 for the projection (2 614 224 ha) (p. 15). This is identical to the area reported for FLrFL for the year 2010 in the 2019 GHGI.
Annex IV.B(e-ii)	Harmonize the information for comparison between table 8 and figure 10.	The time scale of Figure 10 is set from year 2000 now, showing only data for RP, making the information fully harmonized with Table 8.	**Addressed**
Annex IV.B(e-iii)	Provide information on the use of the forest age to determine the current annual	The required information was added to Chapter 3.3 Detailed description of the modelling framework and estimation approaches, where a description of CBM instructions related to age class distribution and handling of defined natural (wildfires) and	**Addressed**, see p. 24-25.

	SWD recommendation	Response from the Czech Republic	EC comments
	increment and on how the annual area from an age-class to the following is calculated.	anthropogenic disturbances (felling, thinning), increment and growing stock was incorporated.	
Annex IV.B(e-iv)	Provide information on dataset used and methods applied to assess the use of the logging residues across the entire time series and on the method applied for projecting these quantities.	A detail information is in Chapter 3.3.2 Input data – harvest volumes. For the period 2000-2009, the extracted volume of logging residues was derived from the ratios of 5 and 15 % of the planned (thinning and final cut) and unplanned (i.e., salvage) harvest volume, respectively. This is identical approach as used in the NIR. The extracted logging residues are incorporated in average amount of salvage felling and planned cuts, which are used for CBM calibration runs (in RP) and implicitly also for projection estimates within P_Av (Section 3.2.3, Table 6), which drives harvest volume for the projection period (2010-2025).	**Addressed**

Other issues noted by the EC

The Czech Republic assessed the effect of natural disturbances (i.e., salvage fellings) only from the period 2005-2009 (when the intensity was considerably higher) instead of considering the entire RP (see Fig 8 on p. 27 of the NFAP). Other harvests were considered from the whole reference period 2000-2009. The approach used by the Czech Republic does not ensure the continuation of forest management practices as documented in the entire period 2000-2009, as required by Art 8(5), and directly affects the projected amount of harvest for the FRL modelling run for all pools (living biomass, dead wood and HWP). Based on the data provided in the NFAP, the Commission estimated the numerical impact of this issue on the carbon pool of living biomass and on HWP, as detailed in the recalculation of the Czech Republic's FRL (see SWD (2020) 236).

While the changed assumptions on future harvests also affect the carbon pool of dead wood, its dynamics are more complicated and its re calculation is not possible based on solely the information provided in the NFAP. In addition, the assessment noted that the non-CO_2 gases resulting from biomass burning (wildfires) are not included in the FRL (see supplementary material S1 of the NFAP). Both dead wood and biomass burning emissions should therefore be addressed as a technical correction of the Czech Republic's FRL.

The assessment also noted that The Czech Republic assumes the species composition to change during the compliance period, following the historical trend from the reference period. While this issue is assumed to have a smaller numerical impact on the FRL, it reflects a deviation from the continuation of the forest management practice as documented in 2000-2009.

A.4. Denmark

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 20 December 2019, Denmark proposes a FRL of +354 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected with the same methodology as in the GHGI of Denmark for the LULUCF sector, using a stock change model.

In general, Denmark addressed all the recommendations. However, the European Commission notes that Denmark has the following issues:

- A difference between areas of Managed Forest Land for the FRL and "land converted to forest land" in CRF Table 4.A.
- Denmark does not include non-CO_2 emissions from biomass burning in the FRL.

The assessment concluded that the NFAP of Denmark is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and contains the elements required under Annex IV Part B. of the Regulation. The European Commission considers the FRL proposed by Denmark reasonable. However, the European Commission requests Denmark to align the area of 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)). Other issues will be corrected by Denmark at the end of the compliance period.

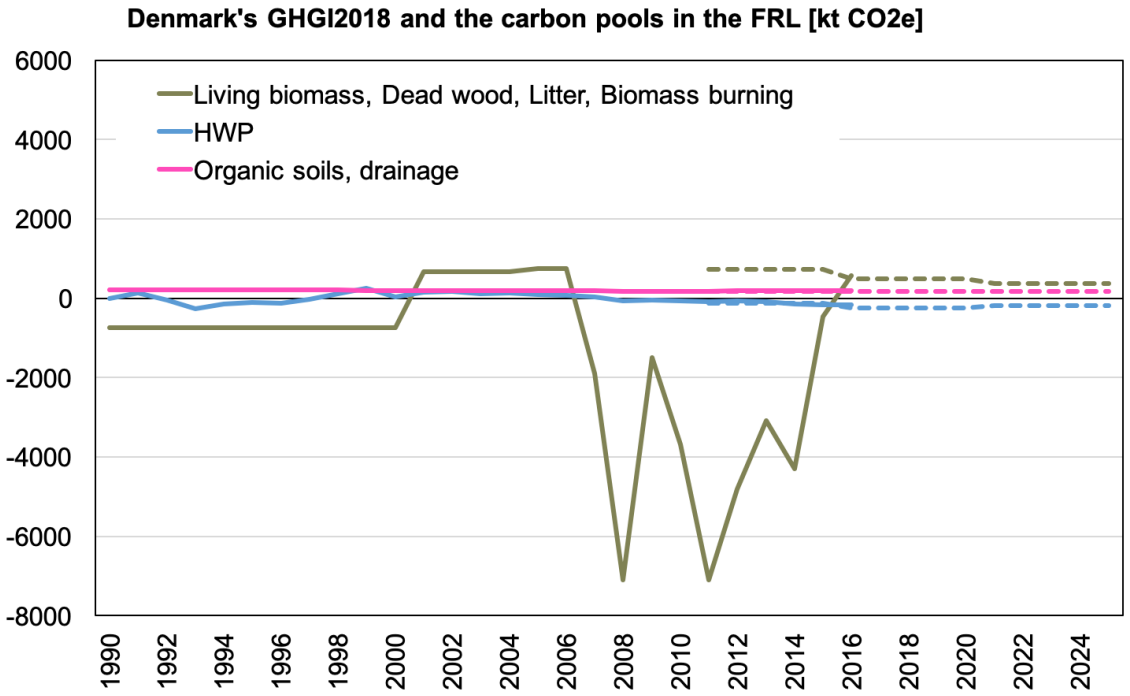
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents the average yearly contribution during 2021-2025 of the proposed FRL of Denmark, in tonnes CO_2e.

Table 4. The carbon pools and other sources of GHG emissions included in Denmark's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Above-ground biomass (AGB), Below-ground biomass (BGB), Dead wood (DW), Forest fires (FF)	+364 000
Of which:	
AGB+BGB+DW+FF on forest remaining forest	*+1 044 000*
AGB+BGB+DW+FF on afforested land converted to forest land, stock change	*-960 000*
AGB+BGB+DW+FF on afforested land converted to forest land, stock transfer	*+280 000*
Soil emissions	+181 000
Of which	
Soils emissions on forest land remaining forest land	*+168 000*
Soils emissions on afforested land converted to forest land remaining forest land	*+13 000*
Harvested wood products	-192 000
Total without HWP	**+545 000**
Forest reference level, incl. HWP	**+354 000**

Figure 4. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines). The carbon pools reported in the GHGI are aggregated to similar groups as modelled in the FRL to enable comparison.



Foreseen technical corrections to the forest reference level of Denmark

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical corrections to the FRL are foreseen for Denmark:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Denmark may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Denmark does not include CH_4 and N_2O emissions from biomass burning creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for Denmark

The draft NFAP of Denmark, submitted on 12 February 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Denmark was +868 000 t CO_2e (+1 048 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Denmark on subparagraph 1 of article 8(5), five criteria of Annex IV, Section A and six elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Denmark and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Denmark after the submission of the revised NFAP.

	SWD recommendation	**Response from Denmark**	**EC comments**
Article 8(5)1	Clarify which and how the different National Forest Inventory sources (i.e. 2002, 2012 and 2017) were used to develop the FRL; in particular, the time period, data source and method used to generate the survival curves and carbon stocks, and HWP projections could be clarified more clearly. Indicate if data outside the reference period (2000-2009) were used, and if so, provide a justification	Detailed information were added both within the revised NFAP (Chapter 6.1.1, 6.3.1, 9.6.1, 9.6.2) and the DK's reply to country's recommendations	**Addressed** "Estimation of the FRL is based on NFI data from the initiation of the Danish NFI in 2002 and until 2017. The reference period 2000-2009 poses some challenges, as the time interval for repeated measurement of permanent plots is 5 years, and hence the Danish NFI only now (in 2017) is on its third cycle, offering a maximum of 2 repeated measurements in each permanent plot."
Annex IV.A(c)	Clarify the period, data source and method used to generate the survival and growth models, in particular the number of national forest inventory cycles used to generate the models. In addition, demonstrate how the energy use of domestic harvest trend line endpoint is representative of the reference period and how consistency is assured in relation to the other elements of the reference period.	Detailed information were added both within the revised NFAP (Chapter 6.1.1, 9.6.1, 9.6.2) and the DK's reply to country's recommendations	**Addressed** see DK's reply to recommendations
Annex IV.A(d)	Clarify that the method employed to estimate the HWP pool to ensure that this is consistent with the stock change approach applied, and that the total amount of harvest is consistent with the assumptions made for the other pools.	See Chapter 6.3.1 and DK's reply to country's recommendations	**Addressed** The inflow to the HWP pool is based on resulting data from the prediction of the forest area stock and changes

	SWD recommendation	Response from Denmark	EC comments
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection	See Chapter 6.3 and DK's reply to country's recommendations	**Addressed** The mean value from the reference period 2000-2009, yielding a fraction for broadleaved of 0.65 and for conifer 0.39. To simplify the prediction a single value for the fraction of total harvest allocated to energy are estimated as a mean fraction based on the reference period 2000-2009 (0.44). The fraction is set at a constant value in the calculations.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	See Chapter 9.6.2 and DK's reply to country's recommendations	**Addressed** A comparison of the national projections under No 525/2013 and the estimation of the FRL in the present National Forest Accounting Plan are provided in the table 19 and figure 46 (p. 108).
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Use the conversion period for Land converted to forest land (Afforested Land) consistent with the latest national GHG inventory. Demonstrate the ability of the model used to construct the FRL to reproduce consistently historical data from the national GHG inventory for the reference period.	Detailed information were added both within the revised NFAP (Chapter 6) and the DK's reply to country's recommendations	**Partially addressed** For the area under forest management, see assessment of Annex IV, Part B (e-i). In the resubmission both the 20 year and the 30 year transition period are presented. The 20 year transition period is consistent with the latest GHGI. The ability of the model used to construct the FRL to reproduce consistently historical data from the national GHGI for the reference period is shown on Table 7 (p. 53), for the year 2015, specifying that NIR numbers are subsets of total reporting for the specific pools and that these numbers are not influenced by afforestation and transition age.

	SWD recommendation	Response from Denmark	EC comments
Annex IV.B(b)	Noting the inclusion of additional greenhouse gases in the FRL, include those greenhouse gases in the next submission of the national GHG inventory to ensure consistency between the FRL and the national GHG inventory. Assure consistency for the starting point of projections for all carbon pools, including the HWP pool.	See Chapter 3.1.2 and 6.3.1	**Partially addressed** The FRL does not include non-CO2 emissions from biomass burning. The HWP pool and projections are taking into account the same starting year.
Annex IV.B(d)	Provide information on harvesting rates for at least one different policy scenario	See Chapter 6.1.5 and 6.6.2	**Addressed** See also see DK's reply to recommendations
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Given the use of the dynamic area approach, provide a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since, at least, year 2000. Document and check the Forest Land area in the FRL, including how deforestation is addressed.	See Annex 9.3.4, the DK's reply to country's recommendations and the additional spreadsheets provided by country	**Partially addressed** Based on Table 1 (p. 37) the area considered for the calculation of FRL is equal to 529 kha (FRF) +22 kha (Afforestation after 1990, considering forests older than 20 yrs.). The area for 2010 in the CRF Table 4A from the 2018 GHGI is 542 kha. DK should align the area of MFL with the area reported in the CRF Table 4.A for "forest land remaining forest land". Detailed information on the dynamic area approach are provided
Annex IV.B(e-ii)	Explain more clearly the HWP pool computation methodology with respect to the fraction of biomass remaining for bioenergy use.	See Chapter 6.3.2 and 6.3.3	**Partially addressed** A single value for the fraction of biomass remaining for bioenergy use for the total harvest (broadleaved and coniferous combined), based on the mean for 2000-2009, has been applied in the estimation of the HWP component. The fraction of biomass remaining for bioenergy use is 0.44 for the entire period of the HWP pool computation.

	SWD recommendation	Response from Denmark	EC comments
Annex IV.B(e-iii)	Provide additional information on increments. Document the National Forest Inventory periods employed in the models and correct (see Table 2 of NFAP) the use of age class for stratification.	See Table 9 (pag 61), the DK's reply to country's recommendations	**Partially addressed** Estimates of gross increment for the forest area are now reported. Little information on how increment is used in the model for the stratification is provided.
Annex IV.B(e-iv)	In function of Annex IV, Part B (e-ii), revise historical and future harvesting rates disaggregated between energy and non-energy uses.	See Chapter 6.3.2 and 6.3.3	**Addressed**

A.5. Germany

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 20 December 2019, Germany proposes a FRL of -10 022 000 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). Germany published an Addendum/Corrigendum[2] to the revised NFAP on 13 May 2020, which provides important information on the methodology used to project the FRL, and corrects clerical errors regarding the projected forest area development. The FRL is projected using a specific matrix model developed for the FRL projection. Due to issues identified in the revised NFAP, Germany's FRL was recalculated for the delegated act. The final FRL in the delegated act is -34 366 906 tonnes $CO_2e\ y^{-1}$.

While Germany addressed or partially addressed many of the recommendations, the European Commission notes a number of important remaining issues that were not addressed in the revised NFAP:

- For living biomass, the approach used by Germany uses only the period from 2002 to 2007 as a basis for the FRL, instead of the full reference period 2000-2009. This deviation is not in line with the principle of continuation of sustainable forest management practice as documented in the period from 2000 to 2009 (Article 8(5)).
- For other carbon pools, the assessment identified substantial differences between the approaches used to estimate the FRL and the GHGI (submission 2019). In particular, inconsistencies were identified in the area of Managed Forest Land, starting years for the modelling of different pools, and methodologies and model output for net emissions from dead wood, mineral soil and litter, organic soil (incl. litter and drainage), and biomass burning.

The assessment concluded that the FRL proposed by Germany is not set according to the requirements of Article 8(5) and Annex IV.A(h). For this reason, the European Commission decided to recalculate the FRL proposed by Germany to consider the whole reference period 2000-2009 in the forest management practice reflected in the FRL, and to correct for the inconsistencies between the methodologies observed to estimate the contribution of the different carbon pools in the FRL and those used in the GHGI reporting (see SWD (2020) 236).

Overview of the carbon pools and greenhouse gases included in the forest reference level

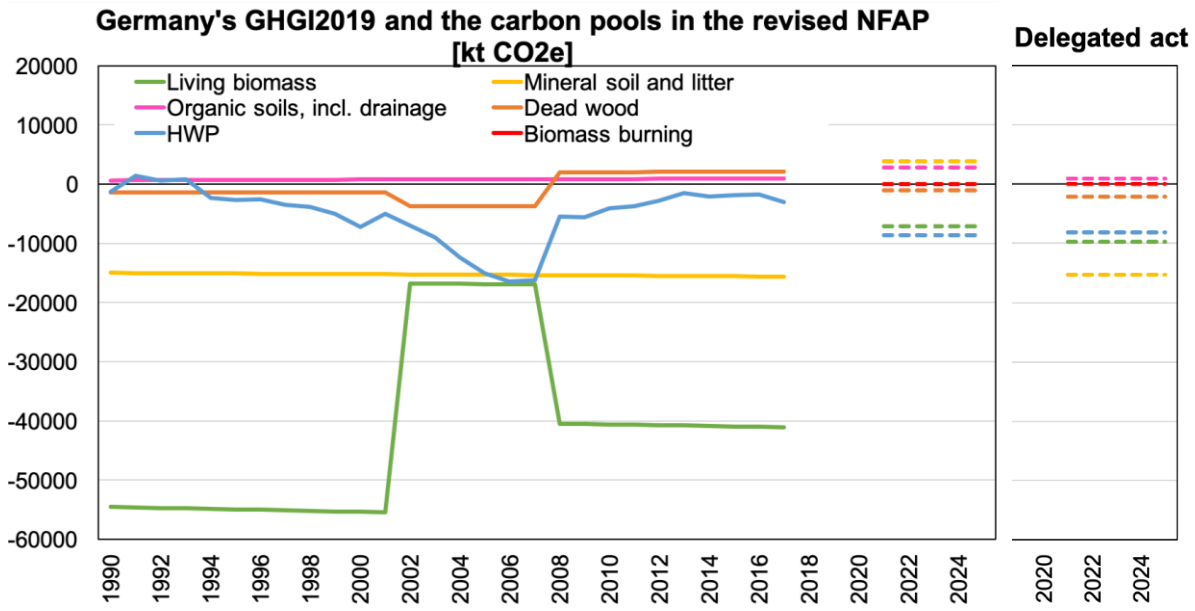
The left-hand column of the following table presents an overview of the carbon pools included in Germany's proposed FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e. The right-hand column provides the recalculated pools as included in the delegated act. The recalculation is detailed in SWD (2020) 236).

Table 5. The carbon pools and other sources of GHG emissions included in Germany's proposed FRL. The recalculation by the European Commission, changing values of all pools, is reported in SWD (2020) 236. The impact of this recalculation is reflected in the values of the FRL as in the delegated act.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**	
	Revised NFAP	**Delegated act**
Living biomass	-7 085 000	-9 680 607
Deadwood	-1 081 000	-2 135 723
Mineral soil and litter	+3 874 000	-15 309 647
Organic soil, including litter and drainage	+2 847 000	+912 138
Biomass burning	+30 000	+3 962
Harvested Wood Products (HWP)	-8 607 000	-8 157 029
Total without HWP	**-1 415 400**	**-26 209 877**
Forest reference level, incl. HWP	**-10 022 400**	**-34 366 906**

[2] https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Klimaschutz/addendum_nfap_bf.pdf

Figure 5. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), as projected for the FRL in the NFAP (dashed lines, left-hand side), and as included FRL in the delegated act (dashed lines, right-hand side).



Foreseen technical corrections to the forest reference level of Germany

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

Provided that Germany's FRL and the carbon pools contained therein changed notably in the recalculation by the Commission, the technical corrections foreseen to Germany's forest reference level are reported together with the recalculation in SWD (2020) 236.

Report on the assessment of the issues raised in the technical recommendations for Germany

The draft NFAP of Germany, submitted on 20 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Germany was -39 217 000 t CO_2e (-33 286 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Germany on the principles of Article 8(5), six criteria of Annex IV, Section A and four elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Germany and technical comments by the European Commission. Technical comments by the European Commission also consider the Addendum/Corrigendum published by Germany on 13 May 2020.

	SWD recommendation	**Response from Germany**	**EC comments**
Article 8(5)1	Provide qualitative and quantitative description of forest management practices for the period 2000-2009. Demonstrate that forest management practices as documented in the period 2000-2009 are captured by the stock changes measured from 2002 to 2008, in particular those related to natural disturbances. Ensure that changes in forest management practices are not internalized in the determination of the FRL after 2009.	The text of the NFAP has been amended (1.2, 3.1, 3.2.2, 3.3 – ND). In general, the approach chosen by Germany assures that all changes in the stock of Carbon in forest biomass are captured, without any bias concerning management practices or natural disturbances. Since Germany applies the „managed land proxy", all changes in C stocks in forests land remaining forest land are attributed to management. Since, in this approach, the net changes in stocks during the RP are measured and used for constructing the FRL, it is not necessary to identify or describe management practices in detail, and changes in FMP after the RP cannot be internalized in the determination of the FRL.	**Not addressed** An overall general description of forests and forest management practices is provided on section 2.3.1. Given the diversity of forest owner types and tree species, the provided information is not sufficient for documenting continuation of forest management practices in the FRL. The approach used by Germany relies solely on the information derived from the forest inventories of 2002 and 2008 (i.e. time period 2002-2007. While the approach ensures that changes after 2009 are not internalized in the determination of the FRL, the given time period happens to contain exceptional storms that caused exceptionally high harvests in Germany. Therefore, using only the period 2002-2007 for deriving the FRL is not representative of the forest management practice in the whole reference period 2000-2009.
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative	The Regulation demands for consistency with the goal, not a demonstration how this goal will be achieved. Since the FRL is to replicate the forest management of the RP in order to give a reference	**Not addressed** The NFAP refers to the Climate Action Plan (section 2.3.1), where LULUCF contribution is considered.

	SWD recommendation	Response from Germany	EC comments
	information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	the real development of emissions and removals in the CP is to be compared to, plans and actions to reach this goal are to be taken outside the FRL and are thus out of scope of the National Forestry Accounting Plan as it is worded in the Regulation. References to the respective plans and policies and where they can be found had already been included in the text. Additional references to the German climate, forest and biodiversity strategies have been included, demonstrating that Germany is aiming for an improved management of forests in line with the requirements of the Regulation.	However, no qualitative or quantitative information consistent with the long-term strategy is provided.
Annex IV.A(d)	Provide FRL by assuming instantaneous oxidation of HWP.	An additional row has been included in the respective table.	**Addressed** The FRL without HWP is provided in table 4.1.
Annex IV.A(e)	Check and correct the inconsistency about the harvest volume between the value reported at page 10, Annex I of the NFAP of Germany and the value reported in Table 6 of the NFAP of Germany.	The numbers had to be corrected due to a technical correction and are now consistent.	**Addressed**
Annex IV.A(f)	Improve the information on the consistency between the FRL and the objective of contributing to the conservation of biodiversity and sustainable use of natural resources, as set out in the EU forest strategy, national forest policies, and the EU Biodiversity Strategy.	The text of the NFAP has been amended. However, the FRL has to be estimated assuming forest management as conducted in the RP. The FRL can and will thus only be as consistent to any strategy or policy as the management in the RP was, and it will not be less consistent. The same applies to contribution to any strategies or plans. We now explain this in more detail. Since the approach chosen by Germany cannot include guidelines and strategies beyond trends observed in the reference period, any alteration or deviation from the historical management would constitute a breach of the requirements of the regulation („continuation of management").	**Partially addressed** Information on German policies on biodiversity protection reported in section 2.3.1, but the link to FRL is not clear. Furthermore, as shown with the heavily decreasing living biomass sink, the harvests increase heavily in the proposed FRL, raising concerns that the proposed FRL does not contribute to conservation of biodiversity and sustainable use of natural resources.

	SWD recommendation	Response from Germany	EC comments
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	The text has been amended and explanations have been included in the summary, in addition to the descriptions already included in the main text.	**Partially addressed** Submission under 525 is discussed in section 2.3.2 but it is not clear how FRL compares with these or where the differences stem from.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	The text has been clarified. As already explained in the first submissions' text, the area used for FRL estimation is the area of forest land remaining forest land reported in Table 4 A of the latest NIR, as requested by the Regulation, with the annual increase in area from afforestations 20 years prior to the respective year. The approach used is calculated from the data also used in the NIR and thus already is a reproduction of the NIR data of the RP - better consistency cannot be achieved. The text has been expanded to clarify this issue.	**Not addressed** A clerical error was identified in Germany's NFAPs with regard to area used for the FRL. This error is addressed in the Addendum/Corrigendum submitted by Germany. There are substantial inconsistencies between the contribution of several carbon pools on Germany's FRL and the GHGI reporting of Germany (submission 2019), which is not discussed in the NFAP. These inconsistencies are addressed in a recalculation of Germany's FRL.
Annex IV.B(a)	Clearly explain how the general criteria set out by the Regulation were taken into account in the determination of the FRL.	The text has been amended and expanded. In general, the FRL has been estimated based on historical management and all criteria can only be taken into account as far as this historical management considered them (or this would be a breach in the assumption of the continuation of management). The approach chosen here implicitly includes this consideration and the single criteria cannot be extricated, nor would this be necessary for any reason detailed in the Regulation. We now explain this relation in more detail and show that none of the criteria were left out of the consideration.	**Addressed** The criteria of Annex IV.A are discussed in section 1.2 of the NFAP.
Annex IV.B(c)	Provide information on sustainable forest management practices and intensity as used in the determination of the FRL.	The text has been amended. We now explain in more detail why a detailed description of management practices or harvest intensities is not necessary under the "alternative approach" chosen	**Partially addressed**

	SWD recommendation	Response from Germany	EC comments
		by Germany. These values are not used in the construction of the FRL. However, we do demonstrate that the management practices and intensities in the reference period were considered and how they enter the FRL. Against this background, we also explain why it is not necessary to describe these practices in detail – contrary to the "conventional approach" for the construction of FRLs as described in the guidance document.	It is not clear how sustainability of the forest management practice modelled in the FRL is ensured (see also Annex IV.A(f).
Annex IV.B (e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Clarify how the afforestation area less than 20-year transition period is excluded from managed forest land.	The text has been clarified. The area used for FRL estimation is the area reported in Table 4 A of the latest NIR and only area afforested 20 years ago is added to this, as was already detailed in the text. This implies that area afforested less than 20 years ago of course is excluded from MFL.	**Addressed** A clerical error was identified in Germany's NFAPs with regard to area used for the FRL. This error is addressed in the Addendum/Corrigendum submitted by Germany.
Annex IV.B (e-iii)	Provide information on increments and rotation lengths related to forest management activities.	The Regulation requires information how forest characteristics like e.g. rotation length were considered, and, as already explained in the NFAP and above, these characteristics were not considered separately in the determination of the FRL. Germany has deliberately chosen an approach that does not need any information on increments or rotation lengths, but captures changes in carbon stocks directly. Because the forests and forest management in Germany are so diverse and variable, e.g. a „rotation length" can not be given for most species, types of ownership and / or site conditions. For example, management schemes for oak species in Germany may cover production times ranging from 80 to 300 years, with broad overlap and shifts between systems. Information on increments or rotation lengths are thus not included in the NFAP, as they are not needed to calculate or to understand the FRL. However, links	**Partially addressed** While the methodology employed by Germany does not explicitly use increments and rotation lengths, the regulation requires documentation of them. The information provided in the explanatory note is not explained in the NFAP, as it is not clear in the NFAP how parameters related to increment and rotation lengths, i.e. the evolution of forest (transition between age classes), is modelled. The addendum/corrigendum provided by Germany explains the approach and its transition matrices in more detail, and helps to understand the rationale behind the model employed by Germany.

	SWD recommendation	Response from Germany	EC comments
		had already been provided that refer to the NFI, where information related to these topics may be retrieved. In addition, the NFAP now contains detailed information on the forest strata considered and on the carbon content per forest stratum. This makes the construction of the FRL very transparent and thereby fulfils a similar function in the "alternative approach" as the information on increments and rotation lengths in the "conventional approach", as demanded by the Commission SWD. Thus, we think that the information contained in the German FRL is equivalent to the information requested and thus sufficient.	

A.6. Estonia

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 16 January 2020, Estonia proposes a FRL of -1 750 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using an *ad hoc* FRL model.

In general, Estonia addressed or partially addressed the majority of recommendations. The European Commission notes the following major issues:

- Estonia does not provide information on the comparison between FRL and projections under Regulation (EU) 2018/1999.

The assessment concluded that the FRL of Estonia is set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission notes that the minor transparency issues related to Annex IV.A(g) in the revised NFAP do not have an impact on the FRL proposed by Estonia. The European Commission considers the FRL proposed by Estonia reasonable. Other issues will be corrected by Estonia at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

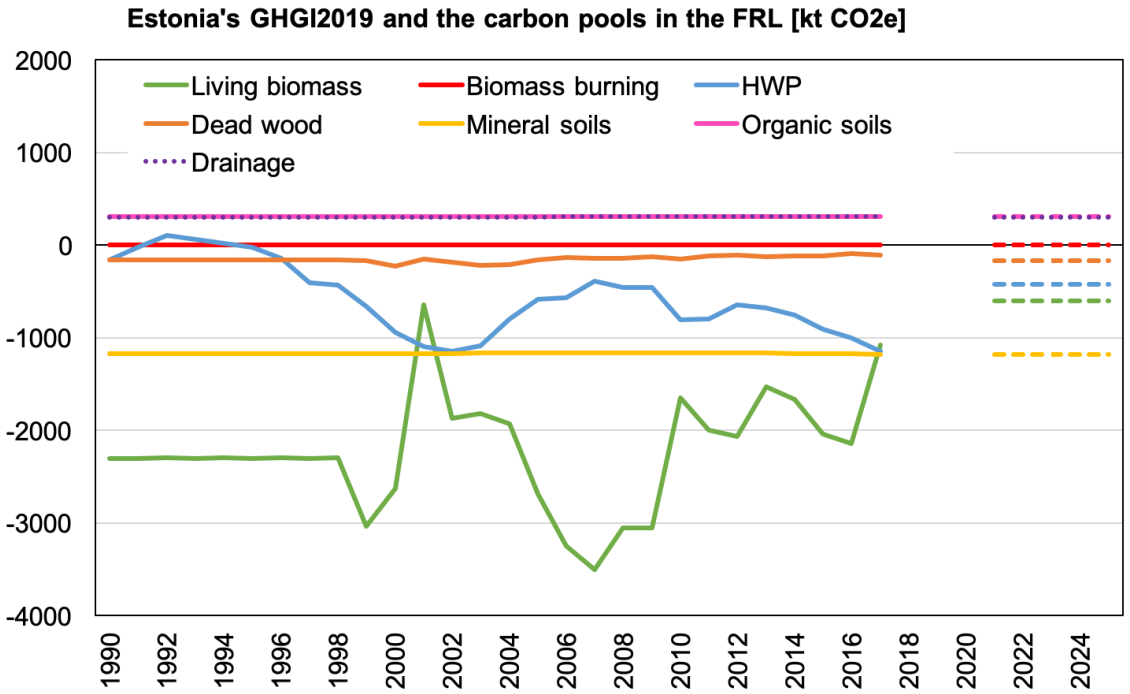
The following table presents an overview of the carbon pools included in Estonia's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 6. The carbon pools and other sources of GHG emissions included in the Estonia's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Living biomass	-600 000
Deadwood	-170 000
Mineral soils	-1 180 000
Drained organic soils	+310 000
Non-CO_2 emissions from drained forest	+300 000
Non-CO_2 emissions from biomass burning in forest areas	+1 400
Harvested wood products	-420 000
Total without HWP	**-1 338 600 (1)**
Forest reference level, incl. HWP	**-1 758 600 (1)**

(1) Corrections apply because of rounding adjustment and truncation of numbers reported in the revised NFAP. However, these corrections are considered negligible and thus not reflected in the final FRL value of Estonia as reported in SWD (2020) 236.

Figure 6. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines). Non-CO_2 emissions from drainage are shown in purple dotted lines for both GHGI and FRL projection for visualization, as they are of a similar magnitude to emissions from organic soils.



Foreseen technical corrections to the forest reference level of Estonia

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Estonia:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- The harvested wood products pool will need to be updated with actual data for the period 2018-2020.
- At the end of the period 2021-2025 Estonia may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).

Report on the assessment of the issues raised in the technical recommendations for Estonia

The draft NFAP of Estonia, submitted on 4 January 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Estonia was -1 890 000 t CO_2e (-1 480 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Estonia on subparagraph 1 of Art. 8(5), and on 5 criteria of Annex IV, Section A and 4 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Estonia and technical notes by the European Commission.

	SWD recommendation	**Response from Estonia**	**EC comments**
Art. 8(5)1	Noting the projected decrease in sink in the compliance period, demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, and revise the FRL if applicable. Clarify that those practices applies to all forest lands including those being subject to privatization. Provide detailed information on the consistency between the actual felling ages and the legally allowed felling ages.	For clarity in strata "forest category" the subcategories "strictly protected forest" and "forest land subject to privatization" were merged into subcategory "forest not available for wood supply (FNAWS)". It does not change the result. Verification on rotation ages is described in section 3.2.2. Although the model was controlled as described in section 3.3.1 subsection "controlling the model" If the rotation ages were wrong the model doesn't work properly.	**Partially addressed** Based on reported information, it is not possible to assess whether Harvest area per area available for harvest (i.e. harvest intensity) was maintained constant from the period 2000-2009 to the gap and simulation periods. Estonia merged "forest area under privatization" with "FNAWS", from 2000-2009 to 2017 (i.e. state of forest preceding the starting year of projection). The FAWS area (stratum where forest management is applied) increases from 68.9% to 86.9% (see Tables 3.3 and 3.4, p, 22-23). This results in an increase of the harvesting amount (final felling) because of the adopted area-based approach. It is therefore deduced that the area accumulation to FAWS is the land subject to privatization (see text at p. 19). Although Estonia provides some explanations regarding the chosen year to define the state of forest, i.e. 2017 (see p. 25), it is not clear whether or not the management practices change from 2000-2009 to 2017 in FAWS.

	SWD recommendation	Response from Estonia	EC comments
			Estonia does not provide quantitative description (i.e. comparison with actual data) on felling ages (see section 3.2.2, p. 24).
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Information added in section 1.2 and figure 1.1.	**Not addressed** Estonia does not provide information on the comparison between FRL and projections under Reg. 1999/2018.
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	Information added in table 3.9.	**Addressed** Estonia provides a ratio (77%) representing the "share of domestic industrial roundwood from total industrial roundwood" (see Table 3.9, p. 28). Despite the unclear message of the Table caption above, it is deduced that 77% corresponds to the solid use of forest biomass over the total production in the period 2000-2009. It is also noted that this value (77% non-energy use) differs from the value reported in Table 3.8 (72%).
Annex IV.A(f)	Provide information on how the projected increase in harvest rates is consistent with the objective of contributing to the conservation of biodiversity, in particular of old-growth forest stands.	Information added in section 1.2	**Addressed** Estonia provides some explanations on how biodiversity is considered in current forest policies (see p. 7). It is deduced that FNAWS area only contains strictly protected areas, thus being not subject to management in the simulation. Nevertheless, it is not clear how biodiversity conservation is treated in FAWS area, especially in older stands.

	SWD recommendation	Response from Estonia	EC comments
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Information added in section 1.2 and figure 1.1.	**Partially addressed** Estonia provides a comparison about emissions and removals in the forest sector, according to three scenarios, FRL projections, and national projections under Reg. 525/2013. However, it is not clear how emissions and removals according to the FRL projection will evolve beyond 2025 (see Figure 1.1, p. 8).
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV,	Section 3 Table 3.2 Information added in section 3.3.1.	**Addressed**
	Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Part B (b).		**Addressed** See comments to Annex IV.B(a)
	Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.		**Partially addressed** In Figure 3.3 (p. 3.3), Estonia shows the comparison about emissions and removals in living biomass pool between FRL (backward) projections and 2019 GHGI estimates. Despite Estonia argues that numbers (modelled and historical) are similar (see text in section 3.3.1, p. 29), there is no robust information demonstrating that level and trend of projected emissions and removals for living biomass are consistent with reported estimates in the GHGI in the entire time series (see also Figure 4.1, p. 31). Moreover, Estonia does not quantitatively demonstrate that the model is able to reconstruct historical data, since the chosen time elapse (2005-2009) seems to be not explanatory of the entire time series' fluctuations (see also Figure 4.1, p. 31). Likely, if discrepancies between modelled and historical data (over the entire time series) were detected (and

	SWD recommendation	Response from Estonia	EC comments
			shown), an ex-post calibration would affect the FRL (see justification for not applying an ex-post calibration at p. 29).
Annex IV.B(a)	Include the greenhouse gases consistent with those applied in the latest national GHG inventory.	Information added in table 1.1	**Addressed**
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	Updated table 3.2	**Addressed** Considering the starting year of projection (2018), the 2019 GHGI submission is used to retrieve the area of FLrFL in 2017.
Annex IV.B(e-iii)	Provide additional information on increments, dynamic age-related forest characteristics, actual management activities, harvesting rates and rotation lengths.	Information in tables 3.1, 3.2, 3.6, 3.7, 3.8; figure 3.1, 3.2; section 3.2.2.	**Partially addressed** Estonia provides information on increments (see Figures 3.1, p. 21, and 4.2, p. 32), management activities, and harvesting rates (see Figure 4.2). However, the latter information is not linked to strata. Estonia does not provide additional information on the development of age-related forest characteristics.
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Information added in table 3.8	**Partially addressed** Disaggregated historical and future harvesting rates disaggregated between energy and non-energy uses can be only deduced from information on p. 28.

A.7. Ireland

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 23 December 2019, Ireland proposes a FRL of +141 897 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). Ireland published a Corrigendum to the revised NFAP on 8 April 2020[3] with a corrected FRL of +112 670 tonnes CO_2e y^{-1} for the period 2021 to 2025, including HWP. This corrected FRL is used as a basis of this assessment. The Corrigendum to Ireland's revised NFAP also clarifies the GHGI submission used for comparison with the FRL and describes the differences in the area of managed forest land between the revised NFAP and GHGI. The FRL is projected using the CBM-CFS3 model.

Ireland addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issue:

- Ireland does not ensure the consistency about the area of managed forest land between the FRL and the GHGI (submission 2019), but provides adequate justification for such discrepancies in the Corrigendum[10].

The assessment concluded that the FRL of Ireland is set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Ireland reasonable. Minor issues will be corrected by Ireland at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Ireland's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e. The values are provided as reported in the revised NFAP, and as considered in the delegated act, reflecting the Corrigendum[4] submitted by Ireland.

Table 7. The carbon pools and other sources of GHG emissions included in Ireland's FRL. The delegated act reflects the amendments made by Ireland in the Corrigendum to the NFAP.

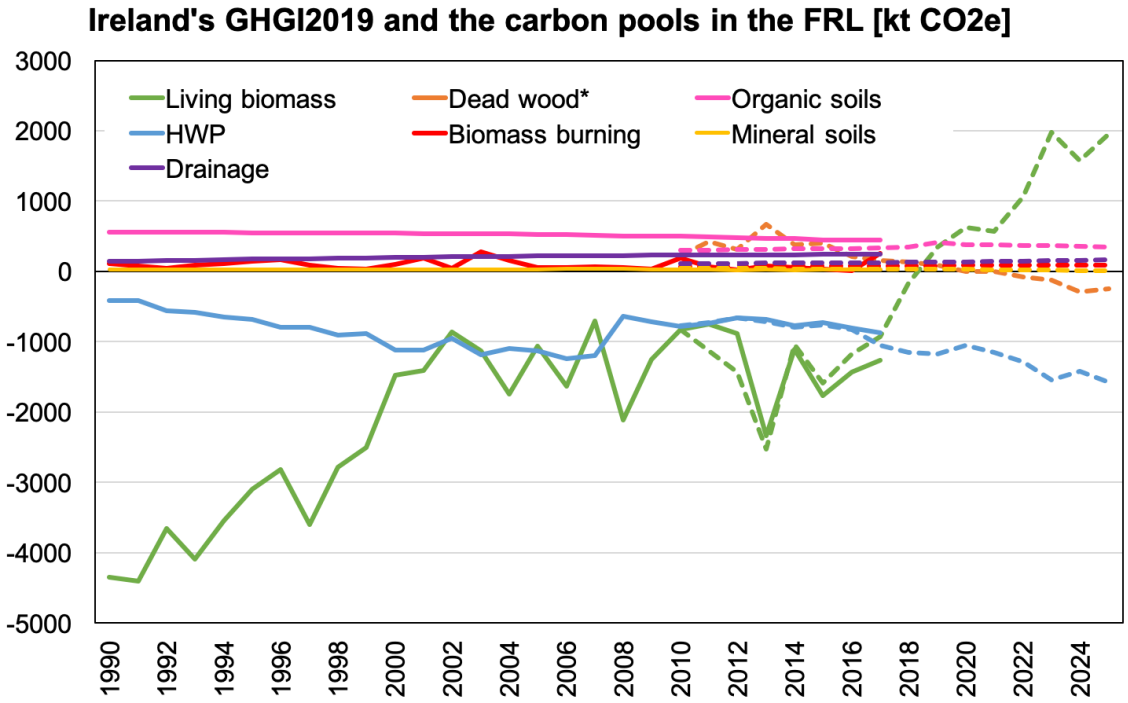
Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**	
	Revised NFAP	**Corrigendum and Delegated act**
Biomass	+1 427 437	+1 427 437
Deadwood	-149 625	-149 625
Litter	-398 389	-398 389
Mineral SOC	+16 296	+16 296
Organic soils	+364 433	+364 433
Fire	+90 532	+90 532
Non-CO_2 drainage	+155 408	+155 408
Harvested Wood Products (HWP)	-1 393 422	-1 393 422
Forest reference level without HWP	**+1 506 092 (1)**	**+1 506 092 (1)**
Forest reference level with HWP	**+141 867 (1,2)**	**+112 670 (2)**

(1) Corrections apply because of rounding adjustment and truncation of numbers reported in the revised NFAP and in the Corrigendum. However, these corrections are considered negligible and thus not reflected in the final FRL value of Ireland as reported in SWD (2020) 236.

(2) The FRL without HWP was entered incorrectly in the FRL summary table in the revised NFAP. The correct value was then provided in the Corrigendum.

[4] https://www.agriculture.gov.ie/ruralenvironmentsustainability/climatechangebioenergybiodiversity/lulucf/

Figure 7. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines).The carbon pools presented here are based on the revised NFAP , as the corrigendum submitted by Ireland did not change projected values for individual pools.



*Dead wood is reported as IE (included elsewhere) in the GHGI2019, while it is estimated separately in the FRL.

Foreseen technical corrections to the forest reference level of Ireland

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Ireland:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- The harvested wood products pool needs to be updated with actual allocation of harvest to sawnwood and wood-based for the period 2017-2020 (p. 35).
- The background level for natural disturbances now included in Ireland's FRL is based on the natural disturbances reported in 2001-2016 (p. 46). The background level will be updated using the full time series 2001-2020 before the natural disturbances provision (art 10 of the Regulation (EU) 2018/841) is used.

Report on the assessment of the issues raised in the technical recommendations for Ireland

The draft NFAP of Ireland, submitted on 20 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Ireland was +282 687 t CO_2e (+1 646 881 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Ireland on 5 criteria of Annex IV, Section A and 5 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Ireland and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Ireland after the submission of the revised NFAP.

	SWD recommendation	**Response from Ireland**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Long term projections up to 2050 were developed using the CBM modelling framework for the entire forest areas, as used for the FRL projections, which provides net removals (including HWP). The level of harvest was based on data derived from the 2016-2050 roundwood forecast. See Section 4.3 (Pg 65) and Figure 23 (Pg 69)	**Addressed** Ireland provides information on the development of the forest carbon sink by the middle of the century (see e.g. Fig. 23, p. 69), and demonstrates that the managed forest land develops as an increasing source from 2020 and slightly declines proximal to year 2050. If also afforestation / reforestation is considered, total forest land shows a decreasing sink up to 2035 and then an increasing sink by the middle of the century.
Annex IV.A(c)	Provide more information on the correlation between the reduced harvest levels (i.e.<70% of net growth) and the negative biomass stock changes (Table 19 at page 51 and Table C1 at page 66, NFAP of Ireland) in the period 2020-2025. Provide more information complementing the statement about the robust accounting system (Table 1, page 4, NFAP of Ireland). Provide detailed information of the implemented accounting system, in particular in relation to biomass and instantaneous oxidation assumption, in a dedicated section.	A) Further text has been added to the report to clarify the statement of <70% of net growth. Gross increment and harvest data will be provided. See Section 3.2.2.3 (Pg 28), Section 4.3.2.1 (Pg 67) and Figure 24 (Pg 69). B) Robust accounting, use of 2017 as a starting year provides a more robust accounting system because, the state of the forest is better defined due to (see Section 3.3.1 on Pg 30): -use of improved sampling data in the 2017 NFI better reflects biomass and CSC in the forest.	**Addressed** Ireland provides adequate information on the use of harvest levels (see section 3.2.2.3, p. 28, and Fig. 7 and Table 8, p. 29). Ireland also demonstrates consistency and robustness of the values through model calibration (see section 4.3.2.1, p. 67). Ireland provides an extensive justification on the use of year 2017 to describe the state of forest (see p. 31). However, it is noted that the justification provided on point b) in the list at p. 31 is contradictory with the LULUCF Regulation,

	SWD recommendation	Response from Ireland	EC comments
		-The accounting system using a forecast based on the most recent year to define the state of the forest is more robust than a system which uses data from 2010 or before because it may result in emissions and removals associated with assumptions of forest management (not actual harvests, age class structure, initial HWP pools, etc) prior to the 1st accounting period (2021-2025). This means that it is more likely to account for emission and removals due to legacy effect if the most recent year to define the state of the forest is not used. C) Table 26 in section 4.1 (Pg 57) provides information on emissions and removals for MFL assuming both a 1st order decay and instantaneous oxidation of HWP. All biomass harvests form deforestation are assumed to be instantaneous oxidation (Table 23 pg 55). In addition the mass balance between transfers form harvest of biomass in AR and MFL and HWP inflow is maintained (Figure 9 Pg 39) to ensure robust accounting.	because "best available" data does not necessarily correspond to the latest data or the data closest to the commencement of the compliance period. On the contrary, the state of forest should reflect the management practices as in the period 2000-2009, based on age-related dynamics. Ireland provides information on the robustness of the adopted accounting system (see revised Table 2, p. 8). In particular, Ireland provides details on the biomass use and the assumptions related to instantaneous oxidation (see Table 26, p. 57, and explanatory text at p. 55).
Annex IV.A(f)	Provide information on the consistency between forest management practices and the objectives set by the European Biodiversity and Forest Strategies. Provide further information on how the biodiversity issues associated with the conversion of grasslands and wetlands into forest land are taken into account.	Comprehensive text has been added to the NFAP which describes the statutory licensing processes. In addition, further information is also provided on policy formulation and the implementation of schemes incentivising forest activities. (Section 2.3.5 Pg 16)	**Addressed**
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible	In 2018, Ireland adopted the CBM modelling approach in preparing its latest national GHG inventory. The estimates prepared in the NFAP also use the same CBM modelling approach. The current national GHG inventory that is published is for the	**Addressed** Ireland provides a comparison between national projections and the proposed FRL (see Fig. 20, p. 64), and explains the related differences (see section 4.2.5, p. 64).

	SWD recommendation	Response from Ireland	EC comments
	differences between national projections and the proposed FRL.	year 2017. This 2017 report is not consistent with the NFAP as the NIR at that time was based on an earlier modelling approach referred to as CARBWARE. However, the data contained in the NFAP is consistent with the latest national GHG inventory for 2018 which has been submitted and will be published in 2020. (Section 4.2 on Pg 57) The projection reported under the MMR used the CBM projections for all forest land this includes MFL and AR for the 30yr transition. The data for 2015-2017 uses the NIR data. There is an error in the 2019 NIR submission, where HWP were included in the forest land figure and again under HWP. This will be corrected in 2020 submission. A section outlining differences between MMR and the FRL projections. (Section 4.2.5 on Pg 64)	
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Use the conversion period for Land converted to forest land (Afforested Land) consistent with the latest national GHG inventory.	The area under forest management has been adjusted to ensure consistency with the latest national GHG inventory submission. Ireland's NIR for the year 2019 will include 30 year transitions which are consistent with the FRL. A table has been prepared showing the relationship between the current NIR the FRL and the future NIR submission. (Section 4.2.3 on Pg 60 and Table 28)	**Not addressed** See Annex IV, Part B (e-i) for clarification on the area. In the determination of the FRL, Ireland uses a 30 years transition period for area converted to forest land. Ireland clarifies in the Corrigendum that the GHGI (submission 2019) does not apply a 30 year transition period for forest land remaining forest land. This explains the actual area inconsistency. However, Ireland demonstrates that there will be a full matching among the areas for the reporting year 2019 (see text at p. 60, Table 28, p. 62). This means that the 30 years transition period will be fully implemented in the GHGI submission 2021 (see further details in the Corrigendum).

	SWD recommendation	Response from Ireland	EC comments
Annex IV.B(b)	Noting the inclusion of additional carbon pools in the FRL, include those pools in the next submission of the national GHG inventory to ensure consistency between the FRL and the national GHG inventory.	The 2019 NIR submission now also uses the CBM modelling framework so mineral soils are now reported for the FRL and in the latest NIR. In addition, comparisons between SOC stock changes in the GHG inventory and the FRL are shown in Figure 19 (Pg 59). Also see the explanatory noted for any differences in section 4.2.2 (Pg 58).	**Addressed** It is noted that in the GHGI submission 2019, "litter and deadwood are reported together as dead organic matter (DOM)" (p. 172, NIR 2019).
Annex IV.B(c)	Provide a justification for a different starting year of projection than 2010. Provide information on the forest model.	The FRL Technical Guidelines recommend using data from 2010 to describe the "state of the forest". Failing this Member States are requested to justify the use of later data as the "best available". Ireland's has adopted to use the latest NFI data from 2017 for the following reasons (Section 3.3.1 on Pg 30): a. Ireland's NFI methodology was amended and improved between the second (2012) and third (2017) cycles. For the third cycle, sampling intensity was increased through the expansion of the central con-centric sample plot specifically to increase the accuracy of sampling of smaller diameter trees (i.e. ≤12cm in DBH). Given the age-structure of Ireland's forests, the cohort of forests with a DBH ≤12cm is significant. The ingrowth effect associated with the NFI concentric plot design on emission/reduction estimates is also reduced. This change makes the third NFI (2017) the most accurate inventory that has been conducted to date and therefore the most appropriate measure of the state of the forest. b. Earlier data is not considered to be consistent with Article 8(5) of the LULUCF regulation because the state of the forest in 2010 will not reflect the state of the forest prior to the commencement of the CP. Therefore, the state of the forest that reflects dynamic age class characteristics is best	**Addressed** Ireland provides an extensive justification for the use of year 2017 to describe the state of forest (see p. 31). See also the recommendations related to Annex IV.A(c). Ireland provides a detailed model description in section 3.3, p. 30.

	SWD recommendation	Response from Ireland	EC comments
		defined using data closest to the initiation of the CP ("best available data" (see Article 8(5)) age class of the FRL). This approach is considered to represent the primary goal of employing forest references levels which is to factor out management induced age class legacy effects in the accounting process. c. The state of the DOM pool at initiation of the simulation (i.e. CBM initiation of the DOM pool) is also better defined using the state of the forest in 2017. d. Calibration of sampling factors used in CBM (section 3.3.5 eq 10) could not be performed without including data form the 2017 NFI.	
Annex IV.B(d)	Provide information on harvesting rates for at least one different policy scenario.	An alternative harvesting rate scenario has been included looking at the impact on harvesting rates and the availability of pulpwood for biomass. (Section 2.3.4.2 on Pg 15)	**Addressed** Ireland provides a comparison about the harvest trends between including and excluding forest road grants and early thinning grants (see section 2.3.4.2, p. 14, and Fig. 4).
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Given the use of the dynamic area approach, provide a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since, at least, year 2000.	This information has been included in the NFAP in a new table which details the forest category areas reported in the current GHG INVENTORY, future UNFCC submissions and those presented in the FRL projection. (Section 4.2.3 on Pg 60 and Table 28)	**Not addressed** Ireland does not ensure a perfect match between the area of managed forest land as used in the determination of the FRL, and the area reported for forest land remaining forest land as in the GHGI (submission 2019) for the year 2016 (see Table 28, pp. 62-63). Ireland provides explanation that this difference is within the uncertainty range of the estimates (pp. 60-61), and it derives from different transition periods used in NFAP and GHGI 2019 (see further explanations in the Corrigendum).

	SWD recommendation	Response from Ireland	EC comments
			Ireland provides a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since 1990 (for afforestation, since 1960) (see Table 28, pp. 62-63).
Annex IV.B(e-ii)	Annex IV.B(e-iii) Provide additional information on increments.	Gross biomass increment, harvest, and biomass stock changes for MFL (2010-2025) have been added to the NFAP. (Section 4.1 on Pg 50 & Table 24) Additional information on increment is provided through the inclusion of forest age class frequency distributions derived from the CBM model simulations for AR and FM areas. (Section 4.3.2.1 on Pg 67)	**Addressed** Ireland provides information on gross increments (see Table 24, p. 55) for the period 2010-2025, including the area distribution by age-class (see Fig. 16, p. 54, and Fig. 22, p. 68).
Other issues noted by the EC: The EC considers the justification provided by Ireland as on point b), p. 31 of the revised NFAP, not acceptable and inconsistent with the principles of the LULUCF Regulation.			

A.8. Greece

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 13 March 2020, Greece proposes a FRL of -3 038 670 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). Greece published a Corrigendum[5] to the revised NFAP on 25 April 2020 addressing a methodological inconsistency through ex-post calibration, and correcting the proposed FRL to -2 337 640 tonnes CO_2e y^{-1} for the period 2021 to 2025, including HWP. This corrected FRL is used as a basis of this assessment. The Corrigendum to Greece's revised NFAP regards the ex-post calibration to ensure time series consistency with the GHGI. The FRL is projected using a simplified modelling approach.

In general, Greece addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issues:

- Greece does not include CO_2 emissions from biomass burning in the FRL.
- Greece does not include the deadwood pool in the FRL.

The assessment concluded that the FRL of Greece is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Greece reasonable. Other issues will be corrected by Greece at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Greece's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

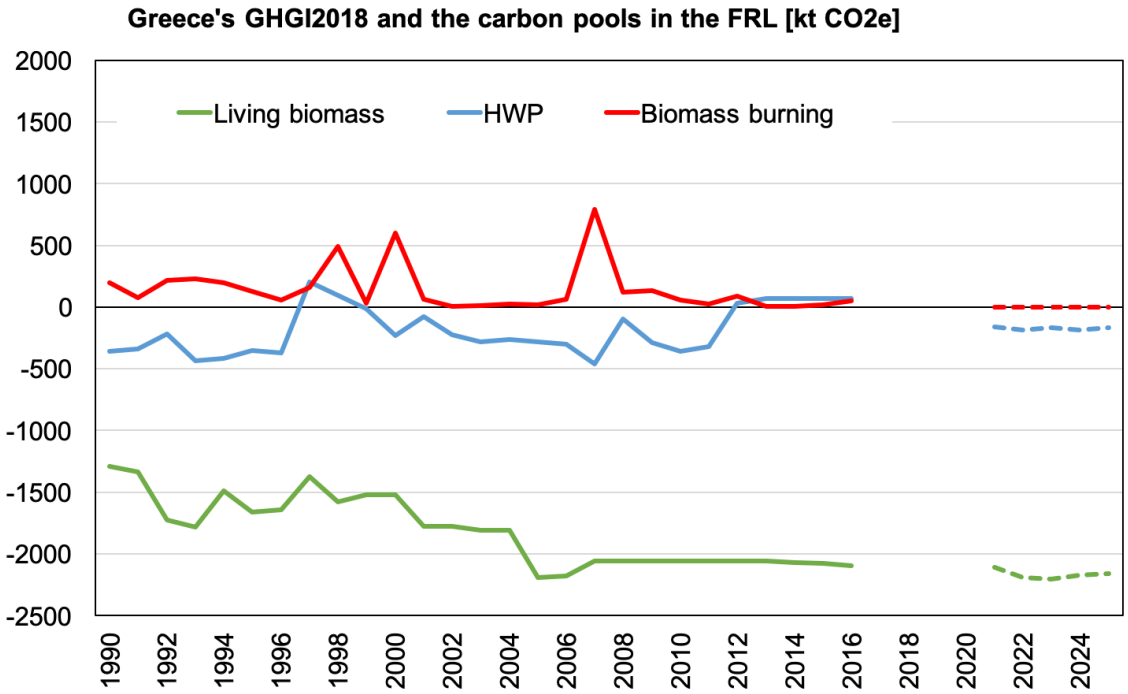
Table 8. The carbon pools and other sources of GHG emissions included in Greece's FRL. The delegated act reflects the amendments made by Greece in the Corrigendum to the NFAP.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**	
	Revised NFAP	**Corrigendum and Delegated act**
Living biomass	-2 866 230	-2 165 210
CH_4	+1 150	+1 150
N_2O	+10	+10
Harvested Wood Products (HWP)	-173 590	-173 590
Total without HWP	**-2 865 070**	**-2 164 050 (1)**
Forest reference level, incl. HWP	**-3 038 670**	**-2 337 640 (1)**

(1) Values provided in the Corrigendum.

[5] https://ekpaa.ypeka.gr/wp-content/uploads/2020/04/Corrigendum-to-the-NFAP.pdf

Figure 8. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines).The carbon pools presented here are based on both the revised NFAP and, where applicable, the corrigendum submitted by Greece.



Foreseen technical corrections to the forest reference level of Greece

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Greece:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Greece may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Greece does not include the carbon pool of dead wood, because it is currently not included in the Greece's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.
- The FRL of Greece does not include CO_2 emissions from biomass burning, creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for Greece

The draft NFAP of Greece, submitted on 4 April 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Greece was -13 864 580 t CO_2e (-13 677 070 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Greece on subparagraphs 1 and 2 of Art. 8(5), and on 6 criteria of Annex IV, Section A and 5 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Greece and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Greece after the submission of the revised NFAP.

	SWD Recommendation	**Response from Greece**	**EC comments**
Art. 8(5)1	Demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, and revise the FRL if applicable.	The approach used in the determination of the FRL takes into account significant parameters of sustainable management and practices that are used. These are increment, harvest rate, production etc. This ensures the continuation of forest management practices. See chapters: 2.3.1 Overall description of the forests and forest management in Greece and the adopted national policies, pg. 9 - 3.2 Description of future harvesting rates under different policy scenarios, pg. 16- 3.2.2 Documentation of sustainable forest management practices as applied in the estimation of the Forest Reference Level, pg. 22- 4.1 Forest reference level and detailed description of the development of the carbon pools, pg. 27	**Addressed** Greece simulates the forest growth by adopting a gain-loss method based on historical annual harvest, mortality and increment-to-growing stock ratio (see section 3.3, p. 23-27). It is noted that Greece does not provide transparent information on demonstrating that the approach used to determine the FRL ensures the continuation of forest management practices as documented in the period 2000-2009. Nevertheless, Greece applies an ex-post adjustment of modelled emissions and removals to ensure the alignment with historical data (see also comments to Annex IV.A(h) and Corrigendum).
Art. 8(5)2	Demonstrate how dynamic age-related forest characteristics have been taken into account and revise the FRL, if applicable.	Dynamic age-related forest characteristics are not applicable to Greek FRL due to lack of data from the national Forest Service. There are no age related data disaggregated amongst different vegetation types and by prefecture. See chapters: 3.1 Description of the	**Addressed** In the determination of the FRL, Greece adopts an increment-to-growing stock ratio to simulate forest growth (see section 3.3, pp. 23-27). Considering the

	SWD Recommendation	Response from Greece	EC comments
		general approach as applied for estimating the Forest Reference Level, pg. 18 & 3.2 Documentation of data sources as applied for estimating the Forest Reference Level, pg. 19	contextualized impact of natural disturbances on forest structure, it is noted that Greece could not robustly correlate the dynamics of forest characteristics to age, and therefore the approach adopted is considered acceptable.
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999	In terms of the contribution of the different land categories in the GHG emissions/removals, forest land (mainly forest land remaining forest land) plays the prominent role in the LULUCF. The share of the forest land category to the total emissions/removals of the sector is projected to fluctuate between 55% and 70% approximately during the period 2020-2035. Grassland category is projected to act as a sink in the period 2020-2035 mainly due to conversion of cropland to grassland. The share of emissions/removals from grassland category is projected to be at approximately 10% of the total emissions/removals. The different policies and measures currently in place that arise from the rural development program, the public investment program, the regular budget and the special body of forests (Green Fund) of the Ministry of Environment and Energy are expected to continue to fund and support actions for the enhancement of the removals in the LULUCF sector in the future. In the overall Greek fiscal deficiency, policies implemented, adopted and measures taken aim at preserving and strengthening forest services, such as maintaining and enhancing biodiversity, increasing their contribution to the mitigation of climate change, along with strengthening their resilience to the impacts of climate change. Furthermore, in accordance with the most recent Greece's submission of information under articles 12, 13, and 14 of the Monitoring Mechanism Regulation	**Not addressed** Greece provides very limited information on the long-term development of the forest sink (p. 5). Greece provides only some information on the national projections for the LULUCF sector under the Regulation 525/2013 (p. 6-7). From the available explanation, it is deduced that the forest sink will be maintained at least up to 2030.

	SWD Recommendation	Response from Greece	EC comments
		(EU) 525/20131 the LULUCF sector is projected to be a net sink of removals up to 2030 (https://cdr.eionet.europa.eu/gr/eu/mmr/art04-13-14_lcds_pams_projections/projections/envxkn1eg/). It should be highlighted also that with Law 4414/2016 (OGG A'149) Greece adopted the first National Strategy for Adapting to Climate Change/NSACC (http://www.ypeka.gr/LinkClick.aspx?fileticket=crbjkiIcLlA%3d&tabid=303&language=el-GR, available in Greek only, for the time being). In the NSACC, a special focus is given to agriculture and forestry sectors with regard to the sectoral policies for adaptation to the impacts of climate change. In this context, a series of actions and measures by sector are listed providing the general strategic and guidance orientation. In a further stage, it is expected that the definite selection, prioritization, and the timetable scheduling of the specific actions and measures will be conducted through the Regional Plans for Adapting to Climate Change, in each of the thirteen Regions of Greece. The primary role of the NSACC of course is to contribute to the increase of the country resilience to climate change. However, the synergies between adaptation and mitigation actions are also strengthened through the preservation and sustainable use of land resources, and land management practices. Moreover, recently, with the Ministerial Decision 170195/758/2018, the National Forest Strategy (NFS) has been published (Official Governmental Gazette, 5351/B/28.11.2018). The NFS defines the principles and guidelines of forest policy for the period 2018-2038, identifies specific objectives of this policy as well as the necessary resources and the means of its implementation. It endorses also the "Mediterranean forestry model" in Greece's management of forest ecosystems, adapted to the living and abiotic conditions of Greece, implemented at national and regional level, with clear	

	SWD Recommendation	Response from Greece	EC comments
		technical and economic planning, increased flexibility, which will strengthen the multifunctional role of forest ecosystems and identify their key features. Articles 5 and 6, define the three Horizontal and four Vertical Axis, respectively, with their general objectives, action directions and monitor indicators. Climate Change is the second vertical axis, while the NFS stresses the obligation for interconnecting with relevant national, international and European strategies for forest ecosystems (Art. 8). It promotes: forest ecosystem climate change vulnerability assessments; management to adapt forest ecosystems to climate change; land use and land use change policies to preserve forest ecosystems services (i.e. microclimate, water detention, soil protection); increase of carbon sequestration; maintenance of forest land coverage and connectivity to preserve habitants and biodiversity; afforestation and restoration of degraded forests; assessment and management of Greek forest genetic diversity; and use of climate resilient genetic material. The implementation of the NFS will take place through the Forest Action Plan (FAP). The implementation of the FAP is the responsibility of the MEE, as well as of the involved Ministries and Bodies, however in any case, the Central Forest Service has the overall coordination and supervision of the NFS and FAP implementation. The timeframe of the NFS and FAP is set at 20 years (2018-2038). Until the final assessment and review of the NFS and FAP in 2037, a mid-term assessment is foreseen with the possibility of a complete revision within the decade (2028) and further mid-term assessment every five years (2023 and 2033) subject to partial revisions. The final assessment of the NFS will be conducted in 2037 in order in the same year to start the process of the next NFS for the period 2038-2058. The next NFS should be institutionalized by 2038. All assessment and revision procedures are	

	SWD Recommendation	Response from Greece	EC comments
		accompanied by public consultation procedures with all stakeholders and society. Consequently, within the context of the NFS, the role of carbon sequestration from the LULUCF sector in the context of the climate change mitigation and the obligation for interconnecting with national and European strategies are explicitly foreseen. Finally, in the context of a more robust monitoring system of Greek forests, the Ministry of Environment and Energy has already started the planning for the second national forest inventory (NFI) (the first national forest inventory of Greece was published in 1992). The preparation works are already advanced and the NFI project is expected to start soon.	
Annex IV.A(c)	Provide a justification for the harvest fraction used as biomass for energy.	All available information is provided. See chapter: 4.13 Documentation on historical and future harvest disaggregated between energy and non - energy wood, pg.44	**Addressed** The harvest fraction used for energy corresponds to 76% (deduced from Table 20, pp. 45-46).
Annex IV.A(d)	Revise the HWP estimates, taking into account also paper and paperboard data for 2000-2009, ensuring consistency with the national GHG inventory estimates.	It is revised. See chapter: 4.1.5 HWP pool, pg. 48	**Addressed** HWP estimate now includes paper and paperboard, consistently with GHGI, independently from the submission year. HWP estimates reported in Table 22, p. 50 are consistent with the GHGI, but should read kt CO_2 instead of kt C.
Annex IV.A(e)	Provide a ratio between solid (HWP) and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection	It is provided. See chapter: 4.1.5 HWP pool, pg. 48	**Partially addressed** The ratio between solid and energy use of forest biomass can be calculated from Table 20, pp. 45-46, and corresponds to 31%. From the same table, it is also deduced that this ratio is maintained constant in the projection. However, 24% of the total harvest for solid use in the

	SWD Recommendation	Response from Greece	EC comments
			period 2000-2009 (Table 20, pp. 45-46) does not correspond to the total harvest associated with HWP in Table 23, p. 50. Therefore, it is not clear whether the HWP inflow is applied robustly in the projection.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL	The national projections reported under Regulation (EU) No 525/2013 are referred to the whole LULUCF sector. The LULUCF sector comprises six land use categories. In terms of the contribution of the different land categories in the GHG emissions/removals, forest land (mainly forest land remaining forest land) plays the prominent role in the whole sector. According to the national report on projections submitted in 2019, net removals from the Forest land show an upward trend that is attributed mainly to the reduction in fellings and the afforestation programmes started in 1994. The upward trend is projected to continue until 2035, with a lower rate however. The share of the forest land category to the total emissions/removals of the sector is projected to fluctuate between 55% and 70% approximately during the period 2020-2035. The level and the trend of the net removals from the forest land are the same for the proposed FRL and the national projections.	**Partially addressed** Greece reports some information in the revised NFAP (pp. 6-7) and in the explanatory notes.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i).	In consistency with national GHG inventory only the area of managed forest land is used for the estimation of FRL. The consistency of historical data (RP) and period 2010-2017 is presented. See chapter: 4.2 Consistency between the forest reference level and the latest national inventory report, pg. 50	**Addressed** See Annex IV.B (e-i).
			Addressed After ex-post calibration (see Corrigendum), Greece demonstrates that the model used to determine the FRL is

	SWD Recommendation	Response from Greece	EC comments
	Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period		able to reproduce the level and trend of historical estimates. **Addressed** Greece performs ex-post calibration of the FRL by adopting the overlap method in order to ensure consistency in level and trend between modelled and historical estimates (see Corrigendum).
Annex IV.B(b)	Include the carbon pools required by Regulation (EU) 2018/841 in the FRL and the national GHG inventory	In accordance to the national GHG inventory the same carbon pools have been used. See chapter: 2.1 Carbon pools and greenhouse gases included in the forest reference level, pg. 8	**Addressed** Despite deadwood is not included in the FRL, Greece ensures consistency with the GHGI (submission 2018).
Annex IV.B(c)	Justify why best available Forest Management Plans data, as used in national GHG inventory, have not been used in the area assessment for FRL Demonstrate the validity of the applied modelling framework for the estimation of the increment	The best available Forest Management Plans data have being used, acquired by the national Forest Service. Slight differences may occur due to update of data or correction of data. See chapter: 3.3 Detailed description of the modelling framework as applied in the estimation of the Forest Reference Level, pg. 22 & 4.1.2 Documentation on increment, pg.34	**Addressed** Greece clarifies that only managed forests are used for the determination of the FRL, consistently with the area-based estimates of emissions and removals in the GHGI 2018 (See comments to Annex IV.B(e-i) for area consistency). Greece also clarifies that forest area and related dataset (new forest maps and the use of the second NFI) will be updated in the future, and that technical corrections to the FRL will apply to ensure consistency with GHGI estimates (see p. 22). **Partially addressed** Greece does not provide a validation of the model outcomes against real data for the estimation of the increment However, Greece provides further details

	SWD Recommendation	Response from Greece	EC comments
			on the modelling framework, including data refinement and normality tests on increment distribution (see pp. 24-25, and Table 8, p. 25). Moreover, Greece provides detailed information on the state and evolution of growing stock and increment (see also Annex IV.B(e-iv)).
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection Explain and justify why the class of "other wooded Land" and "unmanaged forest" is included in the managed forest land area estimate for the FRL	In consistency with national GHG inventory only the area of managed forest land is used for the estimation of FRL. See chapter: 3.2.1 Documentation of stratification of the managed forest land, pg. 19	**Addressed** Greece states that "In accordance to Greek NIR, the forest areas that will be used to calculate the Greek FRL will only be those under Permanent Management" (p. 20), which correspond to 1,247,686 ha in 2009 (year preceding the starting year of projection). Greece maintains area consistency with the GHGI (submission 2018) because it excludes the unmanaged forest area from the accounting. This area does not have associated emissions and removals in the GHGI (submission 2018). For this reason, Greece is considered an exception in ensuring the area consistency between the managed forest land and the forest land remaining forest land as in the GHGI (submission 2018).
			Addressed The area of unmanaged forests is not included in the determination of the FRL (cf. total area for "permanently sustainably managed forests" in Table 6, p. 21, vs. total area conifers and broadleaves as in Table 7, p. 21-22, and Table 13, p. 30, vs). There are errors in

	SWD Recommendation	Response from Greece	EC comments
			totals, respectively for conifers and broadleaves in Table 13, p. 29-30. These should match the values in the other Tables as above. Based on Table 2, p. 10, and subsequent area-related information, it is deduced that Greece excludes "Other Wooded Land" from the FRL determination.
Annex IV.B(e-iii)	Provide information on forest characteristics, such as increments, rotation lengths and dynamic area characteristics	All available information is provided. See chapters: 4.1.1 Documentation of forest characteristics at the beginning of the FRL projection, pg.28 & 4.1.2 Documentation on increment, pg.34	**Addressed** Greece provides very detailed information on carbon density, growing stock, and increment by stratum for both the reference and simulation periods (pp. 29-44).
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses	All available information is provided. See chapter: 4.13 Documentation on historical and future harvest disaggregated between energy and non - energy wood, pg.44	**Addressed** Greece provides very detailed information on the historical and future harvesting rates disaggregated between energy and non-energy uses (see Table 20, pp. 45-46).

A.9. Spain

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 15 January 2020, Spain proposes a FRL of -32 833 000 tonnes carbon dioxide equivalent per year (tonnes $CO_2e y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected with the same methodology as in the GHGI of Spain for the LULUCF sector, using the VAEL model.

In general, Spain addressed the majority of the recommendations. However, the European Commission noted that:

- Spain does not report emissions and removals for the deadwood pool in the proposed FRL, consistently with the GHGI.

The assessment concluded that the NFAP of Spain is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and contains the elements required under Annex IV Part B. of the Regulation. The European Commission considers the FRL proposed by Spain reasonable Minor issues will be corrected by Spain at the end of the end of the compliance period.

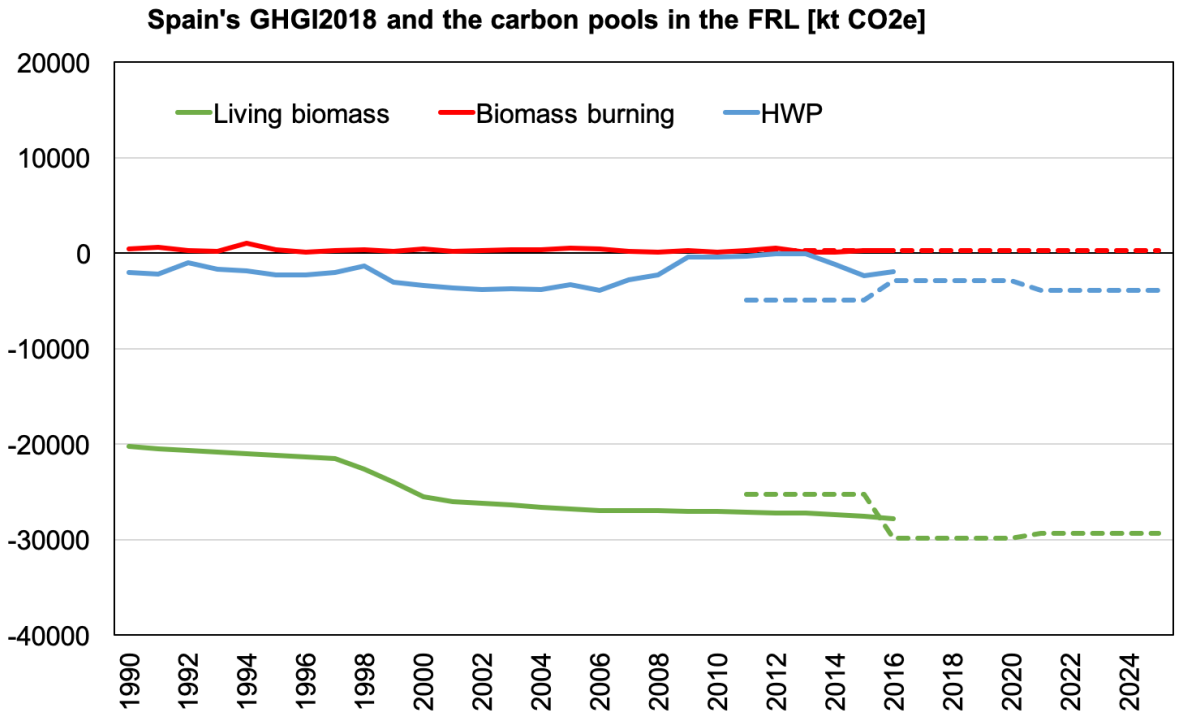
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Spain's proposed FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 9. The carbon pools and other sources of GHG emissions included in Spain's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**
Living biomass	-29 303 000
Harvested wood products	-3 862 000
Forest fires	330 000
Prescribed burning	2 000
Total without HWP	**-28 971 000**
Forest reference level, incl. HWP	**-32 833 000**

Figure 9. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Spain

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical corrections to the FRL are foreseen for Spain:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025, Spain may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- The FRL of Spain does not include the carbon pool of dead wood, because it is currently not included in Spain's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.

Report on the assessment of the issues raised in the technical recommendations for Spain

The draft NFAP of Spain, submitted on 31 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Spain was -30 703 000 t CO_2e (-1 732 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Spain on five criteria of Annex IV, Section A and eight elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Spain and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Spain after the submission of the revised NFAP.

	SWD recommendation	**Response from Spain**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Section 1.3.a. of the NFAP has been rewritten in order to address this recommendation.	**Addressed** In section 1.3, p. 5, and more precisely in Figure 1, p. 6, ES shows a comparison about emissions and removals in "forest land" (presumably similar to the FRL simulation) and LULUCF sectors in both WEM and WAM scenario.

	SWD recommendation	Response from Spain	EC comments
Annex IV.A(c)	Provide credible and robust evidence for the use of the model for the FRL and revise the FRL, if applicable, including a complete and transparent description of the model, a demonstration of its performance over the period 2010-2017, and an explanation on the discrepancies between projected harvest and historical data.	Section 3 ("Description of the modelling approach") has been rewritten with the goal of providing a credible and robust evidence for the use of the model for the FRL and a transparent description of the model. A link to the website in which the FRL model explanation document is posted has been included. A demonstration of the performance of the model over the period 2010-2017, as well as an explanation on the discrepancies between projected harvest and historical data, can be found in sections 1.3.h and 4.2.	**Addressed** ES provides a more detailed description of the modelling tool compared to the previous submission (see section 3.3, p. 37-40). The ES model has an inertia issue (2011) and the FRL during the compliance period tends to bounce back (Fig 3). Yet, this does not appear to be problematic for the 2021-2025 FRL. ES provides a comparison of emissions and removals in living biomass between the model outputs and the GHGI estimates for the period 2011-2016 (see Figures 4 and 5, p. 13). ES provides a comparison about harvest between modelling framework and GHGI estimates (see section "Consistency of modelled harvests results", p. 14-, and Figure 6, p. 15).
Annex IV.A(e)	Provide a ratio between solid (HWP) and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	Section 1.3.e. of the NFAP has been rewritten in order to address this recommendation. The new approach results in a different projected HWP deposit in the FRL (-3.862 kt CO2/yr instead of -1.732 kt CO2/yr in 2021-2015).	**Addressed** See in particular, Tables 2 and 3, p. 8.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Further explanations and a new figure added in section 1.3.g.	**Addressed** See in particular, Table 4 and Fig. 2, p. 10.

	SWD recommendation	Response from Spain	EC comments
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	The FRL model is built to calculate and reproduce historical data from 2010 onwards. An explanation of the compliance with this criteria has been included in section 1.3.h.	**Partially addressed** For the area, see comments related to Annex IV.B(e-i). ES provides comparison about emissions and removals of living biomass between GHGI and FRL for the period 2011-2016, only (Figure 5, p. 12). It seems that a backward (back to 2000) trend line is quantitatively added to Figure 3, p. 12, to explain that likely the model would be able to reproduce emissions and removals in previous years. ES explains this choice at p. 11.
Annex IV.B(a)	Correct header information in Tables 14 and 15 of the NFAP (2025 instead of 2015). Provide information if and how natural disturbances have been taken into account.	Header corrected (note that former tables 14 and 15 are tables 15 and 16 now). Natural disturbances have not been taken into account in the FRL. Further explanations have been incorporated in section 3.1.	**Addressed** Revised tables are now 12 and 13, p. 48. ES provides Information on the treatment of natural disturbances at p. 30.
Annex IV.B(b)	Include the carbon pools required by Regulation (EU) 2018/841 in the FRL and the national GHG inventory.	A more detailed explanation of the included carbon pools is provided in section 2.1 and (new) Annex II.	**Not addressed** To guarantee consistency with the GHGI (see text at p. 18), ES does not report the deadwood pool (see Table 5, p. 18). ES provides extended justification in Annex II. The recommendation is not addressed, but Spain currently maintains consistency with the GHGI.

	SWD recommendation	Response from Spain	EC comments
Annex IV.B(c)	Provide a complete and transparent description of the FRL model including a validation during the reference period.	Section 3 ("Description of the modeling approach") has been rewritten with the goal of providing a complete and transparent description of the model for the FRL. Information on the model during the reference period has been included in section. 1.3.h. A link to the website in which the FRL model explanation document is posted has been included.	**Partially addressed** Model validation is not robustly carried out, and does not comprise the reference period (see also comments to Annex IV.A(h)).
	Demonstrate how the modelled forest management approach is consistent with the forest management approach observed during the reference period. Provide a full and transparent description of the calibration process and the results.	The demonstration on how the modelled forest management approach is consistent with the forest management approach observed during the reference period has been extended in sections 3.22 and 4.2. Further details on the calibration process have been described in section 3.3 (module 8).	**Partially addressed** ES provides a very detailed description of management practices (see e.g., Annex I). However, ES performs model calibration only for the period 2012-2016 (see "Consistency of the living biomass stock"; p. 12).
	Provide more information on the National Forest Inventory such as the number of sample plots in each maturity class.	More information on the National Forest Inventory has been included in sections 3.2.1 and 3.3.	**Not addressed** The information (sample plots by maturity class) is not disclosed. ES did not improve the information provided in sections 3.2.1 and 3.3, as well as in Annex I.
	Explain the unexpected behaviour of harvest early in the historic period.	A new explanation of the unexpected behavior of harvest early in the historic period has been provided in section 1.3h (after figures of "Consistency of the living biomass stock"), which also supports that the increase in harvest projected over the commitment period is not influenced by the projected harvest in the beginning of the projection period	**Addressed** ES provides extensive explanation on p. 12-14.

	SWD recommendation	Response from Spain	EC comments
	Review the accuracy of the input data to the projection model, in particular for the total biomass in a Eucalyptus plantation at maturity in the northern region.	New tables 9-14 (formerly tables 8-13) provide corrected values of the input data to the projection model.	**Addressed** However, it is relatively strange that in the case of *Eucalyptus spp.*, harvesting operations (and associated rates, as inputs for the model) are historically concentrated in "conservation" stands and not in "production" stands (see Table 10, p. 42).
	Describe the evolution of growth and harvest across the projected period.	New figures in section 4.1 provide data on the evolution of growth and harvest across the projected period.	**Addressed**
	Provide evidence that the increase in harvest projected over the commitment period is not influenced by the projected very high harvest in the beginning of the projection period.	A new explanation of the unexpected behavior of harvest early in the historic period has been provided in section 1.3h (after figures of "Consistency of the living biomass stock"), which also supports that the increase in harvest projected over the commitment period is not influenced by the projected harvest in the beginning of the projection period.	**Addressed**
	Clarify if the model takes natural disturbances into account.	Natural disturbances have not been taken into account in the FRL. Further explanations have been incorporated in section 3.1.	**Addressed**
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	The area under forest management is taken from GHG inventory table 4.A (2018 edition) corresponding to year 2010. New explanation provided in section 1.3.h, "Consistency of the living biomass stock".	**Addressed** References on p. 32.

	SWD recommendation	Response from Spain	EC comments
Annex IV.B(e-ii)	Provide detailed data on the evolution of HWP for the historical and the projection period and on the evolution with time of the harvest rate. Specify the half-life values used for the HWP categories.	New information added in section 2.3.2 and new figures in section 4.1 provide data on the evolution of harvest and HWP across the projection period. The default half-live values used for HWP categories mentioned in section 3.3 (module 7) are now explicitly referred.	**Addressed**
Annex IV.B(e-iii)	Provide more information on the modelled increment and harvest.	New information added in section 2.3.2 and new figures in section 4.1 provide data on the evolution of growth and harvest across the projected period. Section 3 describes the modelling approach to obtain increments and harvests.	**Partially addressed** Check for negative increments (or negative change in living biomass, i.e. see previous submission) in Northern region (green bars) in 2011 as reported in Figure 13 (p. 49).
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Section 1.3.e. of the NFAP has been rewritten in order to address this recommendation. The new approach results in a different projected HWP deposit in the FRL (-3.862 kt CO2/yr instead of -1.732 kt CO2/yr in 2021-2015).	**Addressed** Historical harvest rates in Table 2, p. 8. Future harvest rates in Figure 14, p. 49.

A.10. France

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 31 December 2019, France proposes a FRL of -55 399 290 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). France published a Corrigendum[6] on 10 July 2020, with a corrected area value for managed forest land and additional explanations concerning the ex-post adjustment of model outcomes. Information reported in the Corrigendum does not alter the proposed FRL in the revised NFAP of France. The FRL is projected using the MARGOT model.

In general, France addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issue:

- France does not include CO_2 emissions from biomass burning in the FRL.

The assessment concluded that the FRL of France is set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by France reasonable. Minor issues will be corrected by France at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in France's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

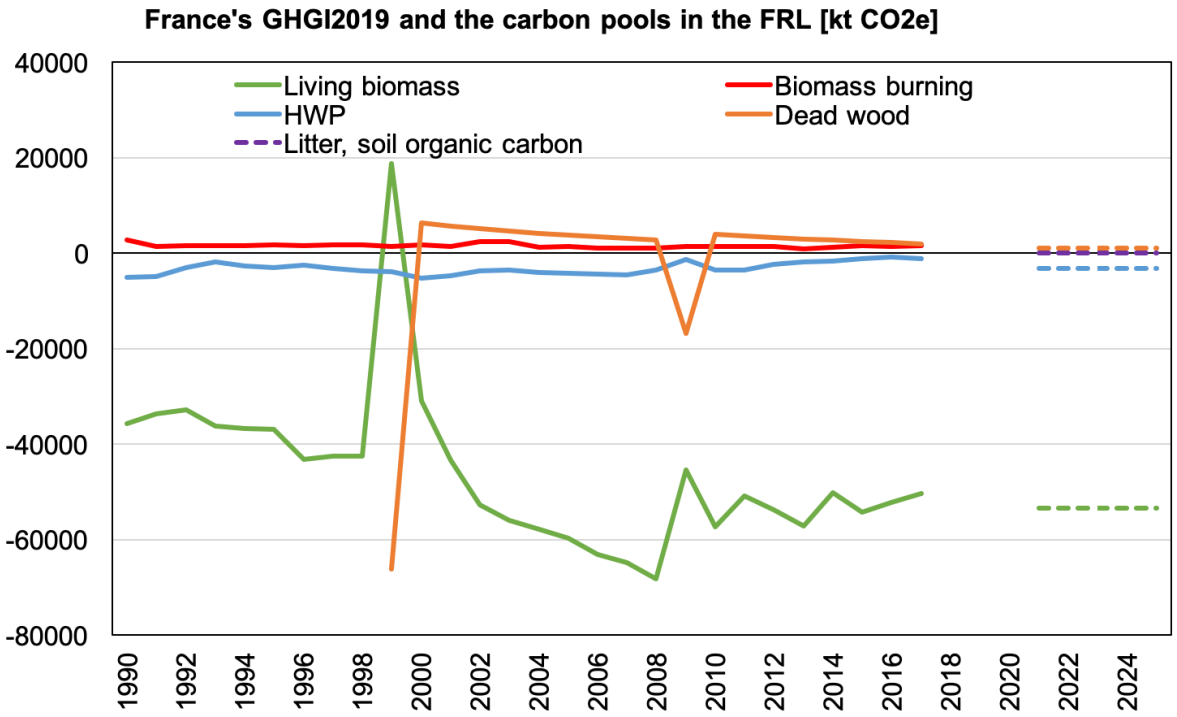
Table 10. The carbon pools and other sources of GHG emissions included in France's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Living above-ground biomass	-42 197 829
Living underground biomass	-12 193 153
Deadwood	+1 106 878
Litter	0
Soil organic carbon	0
CH_4	+652 327
N_2O	+339 227
Harvested Wood Products (HWP)	-3 106 740
Total without HWP	**-52 292 550[(1)]**
Of which:	
- *Mainland France*	*-52 475 084[(1)]*
- *Overseas territories*	*+182 535*
Forest reference level, incl. HWP	**-55 399 290**
Of which:	
- *Mainland France*	*-55 581 825*
- *Overseas territories*	*+182 535*

[(1)] Corrections apply because of rounding adjustment of numbers reported in the revised NFAP. However, these corrections are considered negligible and thus not reflected in the final FRL value of France as reported in SWD (2020) 236.

[6] https://www.ecologique-solidaire.gouv.fr/sites/default/files/Corrigendum%20and%20Addendum%20National%20Forest%20Accounting%20Plan%20for%20France%20%202019.pdf

Figure 10. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of France

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for France:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 France may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of France does not include CO_2 emissions from biomass burning, creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for France

The draft NFAP of France, submitted on 14 March 2019 (English courtesy version), was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for France was -58 295 181 t CO_2e (-54 036 784 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for France on subparagraph 1 of Art. 8(5), and on 5 criteria of Annex IV, Section A and 5 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by France and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by France after the submission of the revised NFAP.

	SWD Recommendation	**Response from France [1]**	**EC comments**
Art. 8(5)1	Demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, and revise the FRL if applicable. Demonstrate how dynamic age-related forest characteristics have been taken into account and revise the FRL, if applicable. Specifically, clarify why there is a discrepancy in biomass gain between model output and greenhouse gas inventory for the period 2010-2016. Describe how the model used input data and model calibration, thereby minimizing this gap.	Points 1-3 in the explanatory note(s) (p. 73-77).	**Addressed** France adopts a conservative approach, as it excludes exceptional harvest due to Lothar and Martin storms in years 2000, 2001, and 2002 from the definition of extraction rates related to the period 2000-2009 (see section 3.2.3, p. 31). France also excludes the so-called "accidental products" due to the Klaus storm in 2009 (see section 3.2.3, p. 31). France provides extraction rates by stratum in Annex, p. 55-58. It is also noted that France seems to reduce the impact of harvesting on forest growth of about 4% from the period 2000-2009 to the period 2021-2025 (see *prélèvement* vs. *croissance* table in annex, p. 65 and 62, respectively).
			Addressed France provides robust explanations in Section 3.3.1.1 (p. 34-35).
			Addressed France provides adequate explanations of the possible reasons behind the observed discrepancy in the trends of biomass gain between modelled and GHGI estimates for the period 2010-2016 (see section 4.2.1.1, p. 41-44).

	SWD Recommendation	Response from France [1]	EC comments
			France readjusted the modelled estimates to minimize their gap with the GHGI estimates during the projection in the period 2010-2016 (see section 4.2.1.2, p. 44-46). France readjusted the modelled estimates of about 1.7 tC yr-1 in the period 2010-2030 (see text at p. 45, and Table at p. 71 for further details). France provided further clarifications and explanations on model calibration and readjustment of modelled estimates in the Corrigendum[1]. See also comments to Annex IV.A(c) and Annex IV.A(h).
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Point 4 in the explanatory note(s) (p. 77-79).	**Addressed** France provides detailed information in section 1.2.1, p. 6-9.
Annex IV.A(c)	Provide data from the reference period to the dataset used for the ex-post adjustment, since this has an impact on the accuracy of the FRL. As France did not use the entire reference period consistently, additional available data from the reference period to the dataset used for the ex-post adjustment should be used.	Point 5 in the explanatory note(s) (p. 79-80).	**Addressed** Within the ex-post adjustment framework, France provides complete information on data for the period 2000-2009 (i.e. living biomass sink), and justifications for using the period 2010-2017 for ex-post adjustment (see section 4.2.1.2 and related annexes, p. 71). France provided further clarifications and explanations on model calibration and readjustment of modelled estimates in the Corrigendum[1]. See also comments to Art. 8(5)1.
Annex IV.A(e)	Provide more detailed documentation of data source(s) used for the ratio between solid and energy use of forest biomass.	Point 6 in the explanatory note(s) (p. 80-86).	**Addressed** France provides very detailed information on data sources, calculation, and results concerning the constant ratio between solid and energy use of forest biomass

	SWD Recommendation	Response from France [1]	EC comments
			(see Point 6 in the explanatory notes, p. 80-86; section 1.2.5, p. 10-11; Table at p. 69).
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Point 7 in the explanatory note(s) (p. 86-87).	**Partially addressed** France provides only qualitative information in section 1.2.7, p. 13.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	Points 8-10 in the explanatory note(s) (p. 87-90).	**Addressed** See comments to Annex IV.B(e)-i.
			Partially addressed The model is not completely able to reproduce the historical trend in biomass gains, mortality and extraction, at least for the period 2000-2011 (see p. 43-44). In this period, the difference between modelled and historical biomass gains is about 10 million t CO_2 e yr^{-1}. However, it is noted that France provides detailed justification for such discrepancy (see explanatory notes and section 4.2.1.1, p. 41), and that the ex-post adjusted living biomass balance seems to fit the level of estimates in the period 2000-2009 (see p. 41). France provided further clarifications and explanations on model calibration and readjustment of modelled estimates in the Corrigendum[1]. See also comments to Art. 8(5)1 and Annex IV.A(c) for further explanations on ex-post adjustment.
			Partially addressed France does not ensure the consistency about the trend between modelled and historical data in the period 2000-2009 (see p. 41). However, it is noted that the level

	SWD Recommendation	Response from France [1]	EC comments
			of ex-post adjusted living biomass balance seems to fit the level of reported estimates in the period 2000-2009 (see p. 41).
Annex IV.B(b)	Ensure consistent modelling of carbon pools, in particular across the time series and between Metropolitan France and Overseas Territories.	Point 11 in the explanatory note(s) (p. 90).	**Partially addressed** France does not ensure consistency in the calculation of emissions and removals in considered pools between mainland France and Overseas Territories (see section 2.1, p. 15). However, it is noted that France adopts a conservative approach for estimating emissions and removals in forest pools in Overseas Territories, consistently with the GHGI (see extract from NIR 2019 as reported in the explanatory notes at point 11). France provides additional clarifications in the Corrigendum[1].
Annex IV.B(c)	Provide complete data on historical and projected harvest levels. Provide more detailed description of sustainable forest management practices used in the determination of the FRL.	Point 12 in the explanatory note(s) (p. 91).	**Addressed** FR provides detailed information on historical and projected harvest levels in Annexes (see p. 65-66, and 68). FR provides information on FMP as used in the baseline scenario (p. 55-58).
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Given the use of the dynamic area approach, provide a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since, at least, year 2000. Provide more complete information regarding managed and unmanaged forest area to	Point 13 in the explanatory note(s) (p. 91-92).	**Addressed** To ensure area consistency with GHGI (submission 2019), France corrected the area under forest management with no impact on the FRL value in the Corrigendum[1]. **Addressed** France provides detailed calculation of area by annual time step (see Table at p. 31). **Addressed** France provides information about the treatment of area in the FRL calculation (see section 3.2.2, p. 29-31), and

	SWD Recommendation	Response from France [1]	EC comments
	guarantee that the same information is used for the FRL and the national GHG inventory.		provides further explanations as well as a corrected area value to ensure consistency with the GHGI (submission 2019) (see Corrigendum[1]).
Annex IV.B(e-iii)	Provide data on increments, dynamic age-characteristics and rotation length. Provide a more detailed description on the share of even and uneven-aged forests and the related information for the strata.	Point 14 in the explanatory note(s) (p. 92).	**Partially addressed** France provides partial information on transition and recruitment rate, mortality rate, and extraction rate for some strata (see p. 59-61). France does not provide information on the development of age-related forest characteristics. France provides more detailed information on the volume distribution considering the even-/uneven aged sharing by strata in the Table at p. 56-58).
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Point 15 in the explanatory note(s) (p. 92).	**Addressed** France provides very detailed information on historical and future harvesting rates disaggregated between energy and non-energy uses in Tables at p. 69-70.

[1] For the sake of simplicity, only the references to pages and sections of the revised NFAP provided by France in the explanatory note are reported.

A.11. Croatia

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 31 December 2019, Croatia proposes a FRL of -4 368 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using the HS-MODEL.

In general, Croatia addressed or partially addressed the majority of the recommendations. However, the European Commission notes that:

- Croatia estimated zero carbon stock change for dead wood while this pool is not estimated in the GHGI. Even though the quantitative impact is zero, there is an inconsistency.

The assessment concluded that the NFAP of Croatia is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Croatia reasonable. Minor issues will be corrected by Croatia at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

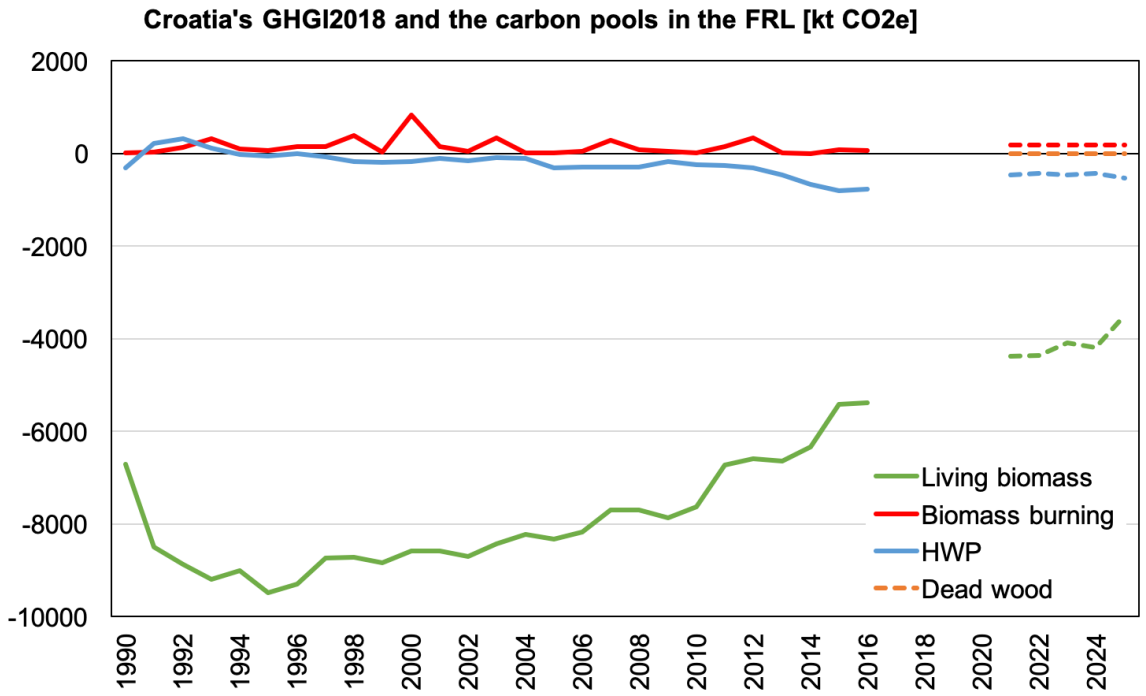
The following table presents an overview of the carbon pools included in Croatia's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 11. The carbon pools and other sources of GHG emissions included in Croatia's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Above-ground biomass	-3 285 200[(1)]
Below-ground biomass	-810 800[(1)]
Dead wood	0[(1)]
Harvested wood products	-462 400[(1)]
Forest fires	189 875
Total without HWP	**-3 906 130**
Forest reference level, incl. HWP	**-4 368 530**

[(1)] Average for 2021-2025 derived from yearly values reported in the revised NFAP

Figure 11. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Croatia

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Croatia:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025, Croatia may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Croatia does not include the carbon pool of dead wood, because it is currently not included in Croatia's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.

Report on the assessment of the issues raised in the technical recommendations for Croatia

The draft NFAP of Croatia, submitted on 20 March 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Croatia was -4 533 000 t CO_2e (-4 091 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Croatia on 6 criteria of Annex IV, Section A and 7 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Croatia and technical comments by the European Commission.

	SWD recommendation	**Response from Croatia**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Chapter 1.2, pag 5	**Addressed**
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Chapter 5.3.4, pag 75-76	**Addressed**
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B(e-i). Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Section B (b). Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Compare historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period by using, for information only, the same harvest intensities applied in line with Article 8(4).	Chapter 4.2, pag 48-49 Chapter 1.1, pag 1 Chapter 5.3.1, pag 67-68 Chapter 5.3.3, pag 75-76 Chapter 5.2, pag 67-68	**Partially addressed** See in particular p. 67-68, providing a comparison with historical GHGI. See comments to sections IV.B(b) and IV.B(e-i).

	SWD recommendation	Response from Croatia	EC comments
Annex IV.B(b)	Include the greenhouse gases consistent with those applied in the latest national GHG inventory. Include the carbon pools required by Regulation (EU) 2018/841 in the FRL and the national GHG inventory.	Chapter 1.1, pag 3 Chapter 5.3.1, pag 69 Chapter 5.3.1, pag 74	**Partially addressed** HR included living biomass, and HWP. Carbon stock changes in the dead wood pool for FRL are reported as zero, the same as in the NIR 2018. New estimation of carbon stock changes of dead wood will be performed in the following years and afterwards FRL technical correction will be performed (see p. 3). Non-CO2 emissions are taken into account as described at p. 3.
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	Chapter 4.2.2, pag 48-49	**Addressed** Area (equal to 2312 kha) corresponds to the category Forest Land remaining Forest land as defined in NIR 2018. For the modelling purpose, the forest areas for 2016 are kept unchanged and constant during the period 2021-2025
Annex IV.B(e-ii)	Provide a calculation of GHG emissions and removals during the reference period using harvest intensities as elaborated for the FRL estimation for a fictive no-war scenario and include this assessment in the NFAP	Chapter 5.2, pag 67-68	**Addressed** See p. 67-68, providing a comparison with historical GHGI
Annex IV.B(e-iii)	Provide complete information on age-class distribution including an aggregation for country level. Describe the "normal area" concept and its use.	Chapter 4.3, pag 51-60	**Addressed** On p. 51 a specific explanation of the concept of "uniform area" is provided
Annex IV.B(e-iv)	Provide detailed information on the historical and future harvesting rate disaggregated between energy and non-energy uses.	Chapter 5.3.2, pag 74	**Addressed** See table 5.3.4 on p. 74.

A.12. Italy

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 8 January 2020, Italy proposes a FRL of -19 656 100 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using the *for-est* model.

In general, Italy addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issue:

- Italy reports zero emissions/removals for the deadwood and litter pools. This triggers an inconsistency with both 2018 and 2019 GHGI submissions (Annex IV.A(h); Annex IV.B(b)).

The assessment concluded that the FRL of Italy is set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Italy reasonable. Minor issues will be corrected by Italy at the end of the compliance period.

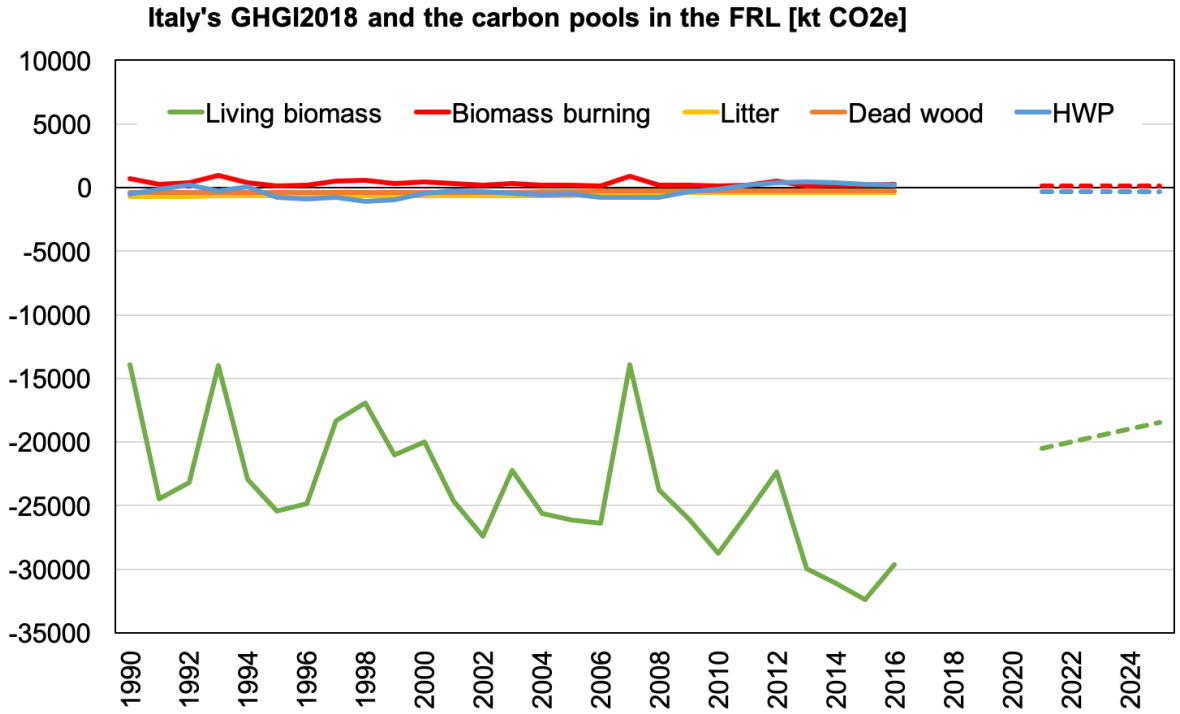
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Italy's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 12. The carbon pools and other sources of GHG emissions included in Italy's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Living biomass	-19 574 600
Deadwood and litter	0
CH_4	+139 700
N_2O	+500
Harvested Wood Products (HWP)	-320 700
Total without HWP	**-19 335 400**
Forest reference level, incl. HWP	**-19 656 100**

Figure 12. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines). In the FRL, Italy included estimated the contribution of both dead wood and litter to be 0 t CO_2e; these pools are not visible in the graph due to scale.



Foreseen technical corrections to the forest reference level of Italy

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Italy:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- The background level for natural disturbances now included in Italy's FRL is based on the natural disturbances reported in 1990-2016. The background level will be updated using the full time series 2001-2020 before the natural disturbances provision (art 10 of the Regulation (EU) 2018/841) is used.
- The FRL of Italy does not include the carbon pool of dead wood, because it is currently not included in Italy's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.

Report on the assessment of the issues raised in the technical recommendations for Italy

The draft NFAP of Italy, submitted on 21 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Italy was -19 656 100 t CO_2e (-19 335 400 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Italy on subparagraph 1 of Art. 8(5), and on four criteria of Annex IV, Section A and four elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by France and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Italy after the submission of the revised NFAP.

	SWD Recommendation	**Response from Italy**	**EC comments**
Art. 8(5)1	Demonstrate how dynamic age-related forest characteristics have been taken into account and revise the FRL, if applicable. Specifically, demonstrate the linkage between biomass density and age-class distribution. Provide additional information on forest management practices, including rotation length and thinning intensity and demonstrate how these have been taken into account.	The FRL has been estimated using the *for-est* model; the model estimates the annual growing stock per hectare, adding to the final growing stock volume of the previous year the increment calculated for the current year and subtracting the losses occurred in the year as due to harvest, fires and mortality. Information related to rotation length and thinning intensity have not been explicitly taken into account Additional information are provided in the relevant section of NFAP [Chapter 3, paragraph 3.3. Appendix A, B, I, II, III, IV]	**Addressed** IT does not provide exhaustive explanations supporting the assumption of the use of biomass densities, and related harvest ratio, as a proxy for age-related characteristics. It remains in the sentence: "Note that the aboveground biomass density is an age-related variable, which therefore changes year by year according to forest ageing as well as the impact of human activities and disturbances, including natural disturbances" (see section 4.1.1, p. 27). As a consequence, IT does not provide additional information on FMP, which in turn depend on current biomass densities. Considering the contextualized impact of natural disturbances on forest structure, it is noted that Italy could not robustly correlate the dynamics of forest characteristics to age, and therefore the approach adopted is considered acceptable.
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term	Addressed. The requested information has been included in NFAP. [Chapter 1, paragraph 1.2, criterion (a)]	**Addressed** IT shows a graph reporting the comparison between the FRL and the long term strategy up to 2050 (Figure 1, p. 7). IT adds some explanation for levels and trends but not extensively.

	SWD Recommendation	Response from Italy	EC comments
	strategy required under Regulation (EU) 2018/1999.		
Annex IV.A(f)	Provide additional information on existing biodiversity goals and strategies, including on protected areas and endangered endemic species.	Addressed. The relevant information and references are included in NFAP. [Chapter 1, paragraph 1.2, criterion (f)]	**Partially addressed** IT does not provide additional information on existing biodiversity goals and strategies, including on protected areas and endemic species compared to the draft NFAP. However, on p. 8 and Appendix III, IT clarifies that protective forests (riparian) and areas under rejuvenation are excluded from harvest activities in the FRL. References to national biodiversity goals and strategies are made on p. 11.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Addressed. The requested information has been included in NFAP. [Chapter 1, paragraph 1.2, criterion (g)]	**Addressed**
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i).	Addressed. The FRL has been assessed on the area under forest management and on carbon pools and GHG gases, as indicated in Annex IV, Section B (e-i), and Annex IV, Section B (b).	**Addressed** However, IT provide little explanations on how the mistake in the area of Managed Forest Land as reported in the previous submission, now corrected, would affect (or not) the proposed FRL value (see explanatory notes for Annex IV.A(h) and Annex IV.B(e-i).
	Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Section B (b).		**Not addressed** IT reports zero emissions/removals in dead wood and litter pools. This is not consistent with the 2018 GHGI (2018 submission, year 2016).

	SWD Recommendation	Response from Italy	EC comments
Annex IV.B(b)	Include the carbon pools and greenhouse gases consistent with those applied in the latest national GHG inventory.	Addressed. The FRL includes the same carbon pools and GHG gases applied in the national GHG inventory.	**Not addressed** See comments to Annex IV.A(h)
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	Addressed. The area under forest management has been provided consistently with the forest land remaining forest land area reported in the CRT table 4.A (submission year 2018, reporting year 2009)	**Addressed** See comments to Annex IV.A(h)
Annex IV.B(e-ii)	Include a description of imports and exports in the HWP pool and apply changes to the FRL, if applicable. Assure consistency for carbon stock change in living biomass derived from table 6 and final FRL estimates. Correct editorial mistakes in table 7, 36 and 37 of the NFAP. Provide national totals and units in tables of NFAP.	Addressed. The time series of HWP, produced, imported and exported, has been included. No changes affected the FRL, since the same data has been used. Editorial mistakes have been fixed. The national totals, as well as the regional ones, have been added in each reported table. [Chapter 4, paragraph 4.1., table 36, NFAP tables]	**Addressed**
Annex IV.B(e-iii)	Provide information on age-class structure and additional information on rotation length.	Not applicable	**Addressed** Considering the adopted approach, it is noted that Italy could not directly correlate the forest dynamics with age. See also comments to Article 8(5)1 about age-related forest characteristics.

A.13. Cyprus

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 31 December 2019, Cyprus proposes a FRL of -122 400 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using a simplified modelling approach. Due to issues identified in the revised NFAP, Cyprus's FRL was recalculated for the delegated act. The final FRL in the delegated act is -155 779 tonnes $CO_2e\ y^{-1}$.

Cyprus did not address most of the recommendations[7]. In particular, the European Commission notes the following issues:

- Cyprus does not ensure consistency between the area of managed forest land and the area of forest land remaining forest land as reported in the GHGI (submission 2019) for the inventory year 2010.
- Cyprus does not ensure consistency with the GHGI (submission 2019) for mineral soil, and CO_2 and non-CO_2 emissions related to biomass burning.
- Cyprus does not include the deadwood pool in the proposed FRL.

The assessment concluded that the NFAP of Cyprus does not provide transparent information or documentation related to Art. 8(5), Annex IV.A(a-g) and Annex IV.B(a, c, d, e-iii, e-iv). The assessment also concluded that the FRL proposed by Cyprus is not set according to the requirements of Annex IV.A(h), Annex IV.B(b) and Annex IV.B(e-i). For these reasons, the European Commission decided to recalculate the FRL proposed by Cyprus to correct for the area of managed forest land, incorporate the mineral soil pool, and include the emissions from biomass burning (see SWD (2020) 236. Other minor issues will be technically corrected by Cyprus at the end of the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Cyprus' FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

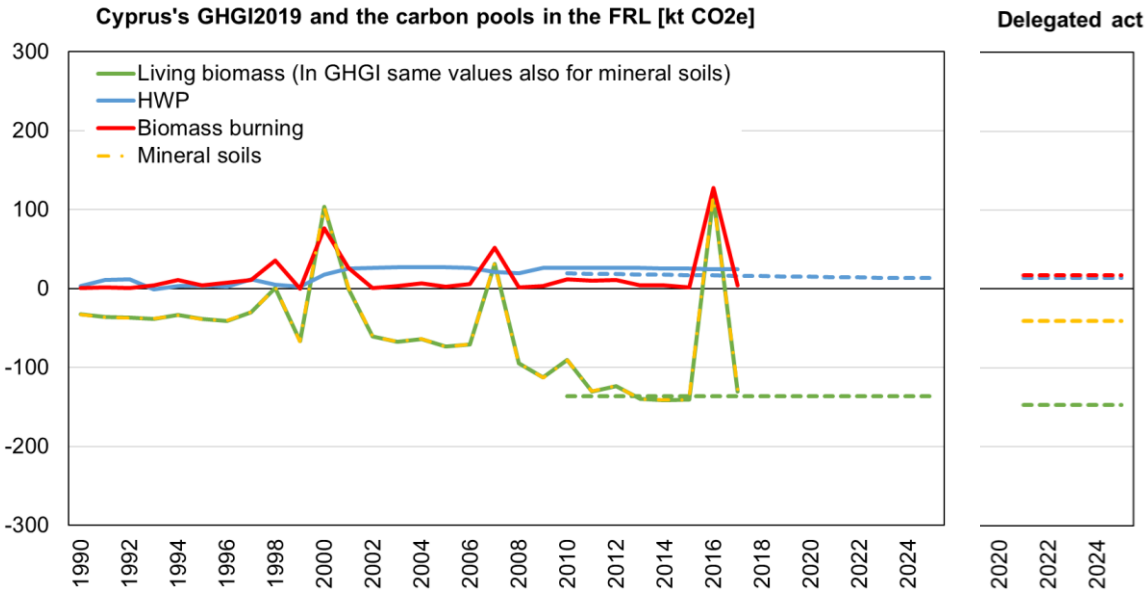
Table 13. The carbon pools and other sources of GHG emissions included in Cyprus's FRL. The delegated act reflects the corrections made by the Commission in Recalculation of Cyprus's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**	
	Revised NFAP	**Delegated act**
Living biomass	-136 200	-146 478
Mineral soils	--	-40 792
Harvested Wood Products (HWP)	+13 790	+13 790
Biomass burning, CO_2	--	+15 455
Biomass burning, CH_4	--	+1 663
Biomass burning, N_2O	--	+583
Total without HWP	**-136 200**	**-169 569**
Forest reference level, incl. HWP	**-122 410(1)**	**-155 779**

(1) Corrections apply because of rounding adjustment and truncation of numbers reported in the revised NFAP. However, these corrections are considered negligible and thus not reflected in the final FRL value of Cyprus as reported in SWD (2020) 236.

[7] The Commission notes that Cyprus did not provide explanatory notes on how the recommendations were addressed.

Figure 13. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), as projected for the FRL in the NFAP (dashed lines, left-hand side), and as included FRL in the delegated act (dashed lines, right-hand side).



Foreseen technical corrections to the forest reference level of Cyprus

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Cyprus:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Cyprus may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Cyprus does not include the carbon pool of dead wood, because it is currently not included in Cyprus's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.

Report on the assessment of the issues raised in the technical recommendations for Cyprus

The draft NFAP of Cyprus, submitted on 21 March 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Cyprus was -120 280 t CO_2e (-136 200 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Cyprus on subparagraph 1 of Art. 8(5), and on 7 criteria of Annex IV, Section A and 7 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Cyprus and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Cyprus after the submission of the revised NFAP.

	SWD Recommendation	**EC comments**
Art. 8(5)1	Demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, and revise the FRL if applicable. Demonstrate how dynamic age-related forest characteristics have been taken into account and revise the FRL, if applicable. Provide information justifying the use of a constant harvest rate for the reference period in the determination of the FRL.	**Partially addressed** Cyprus simulates forest growth by adopting a gain-loss method based on historical average harvest, implicit mortality and average increment by species. Considering the contextualized impact of natural disturbances on forest structure, it is noted that Cyprus could not robustly correlate the dynamics of forest characteristics to age, and therefore the approach adopted is considered acceptable. Cyprus provides very limited information on forest management practices by forest function as documented in the period 2000-2009 (see sections 3.2.2, p. 14, and 3.2.3, p. 16).
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	**Not addressed** Cyprus does not provide information related to Annex IV.A(a).
Annex IV.A(c)	Provide transparent information ensuring that emissions and removals resulting from biomass use are properly accounted for, including those related to natural disturbances.	**Not addressed** Cyprus does not provide information on the impact of natural disturbances on the FRL.
Annex IV.A(d)	Provide differentiation of the HWP pool at the level of products' group. Provide a comparison of the FRL between assuming	**Partially addressed**

	SWD Recommendation	EC comments
	instantaneous oxidation and applying the first-order decay function and half-life values.	Cyprus provides a differentiation of the HWP pool – in terms of amount – at the level of products' group up to 2017 (see Table at p. 23-24). Cyprus does not explicitly provide the FRL value assuming instantaneous oxidation.
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	**Not addressed** Cyprus does not provide a clear indication of which ratio between solid and energy use of forest biomass was used in the determination of the FRL, and whether this ratio is kept constant in the simulation.
Annex IV.A(f)	Provide further explanation on how non-exploitable forests were considered in the determination of the FRL.	**Partially addressed** Cyprus provides a limited explanation of how non-exploitable forests are treated (p. 19), but there is no robust linkage with management practices and harvest rates as used in the determination of the FRL.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	**Not addressed** Cyprus does not provide information related to Annex IV.A(g).
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i).	**Not addressed** See comments to Annex IV.B(e-i).
	Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Part B (b).	**Not addressed** See comments to Annex IV.B(b).
	Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory.	**Not addressed** Cyprus does not demonstrate that the adopted modelling approach is able to reproduce historical data from the GHGI.
	Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	**Partially addressed** Cyprus does not robustly demonstrate the consistency between modelled estimates and reported estimates in the period 2000-2009. Cyprus only

	SWD Recommendation	EC comments
		provides a qualitative comparison between modelled and reported estimates in the simulation years (see Table on p. 25).
Annex IV.B(a)	Provide a description of how the criteria of the Regulation were taken into account. Provide information if and how natural disturbances have been taken into account.	**Partially addressed** Cyprus only provides a broad description of how criteria and elements of the Regulation were taken into account (see p. 5).
Annex IV.B(b)	Include the carbon pools and greenhouse gases consistent with those applied in the latest national GHG inventory. Include the carbon pools required by Regulation (EU) 2018/841 in the FRL and the national GHG inventory.	**Not addressed** Cyprus does not include the deadwood pool in the FRL. Cyprus does not include mineral soils, and CO_2 and non-CO_2 emissions from biomass burning in the FRL, as instead reported in the GHGI (submission 2019).
Annex IV.B(c)	Assure that modelling starts the year after describing the state of the forest. Provide a quantitative description of sustainable forest management practices and intensity. Check and further explain the information provided for carbon stock changes for coniferous species, including harvest (pages 18-19 in the NFAP of Cyprus).	**Not addressed** Cyprus provides unclear information on the state of forest year.
		Partially addressed Cyprus does not provide quantitative information on forest management practices (p. 19). Cyprus provides transparent information on average harvest by species in the reference period (see Tables on p. 22-23).
		Addressed
Annex IV.B(d)	Provide information on how harvest rates are expected to develop under different policy scenarios.	**Not addressed** Cyprus does not provide information related to Annex IV.B(d).
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	**Not addressed** The area of MFL (147,726 ha; p. 25) is different than the area of forest land remaining forest land as reported in the GHGI, submission 2019, inventory year 2010 (158,843 ha).
Annex IV.B(e-iii)	Provide information on increments, rotation lengths and dynamic age-related characteristics.	**Partially addressed**

	SWD Recommendation	EC comments
		Cyprus provides information on average increment by species in the reference period (see Tables on p. 22-23). Cyprus does not provide information on rotation length. See comments to Article 8(5)1 about age-related forest characteristics.
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	**Partially addressed** Cyprus only shows the historical (1990-2017) harvest rates disaggregated between fuelwood and roundwood. See also comments to Annex IV.A(e).

A.14. Latvia

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 30 December 2019, Latvia proposes a FRL of -1 709 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). Latvia published an Addendum[8] to the revised NFAP on 6 April 2020, which provides a number of important clarifications and background data for the NFAP, and a correction of a clerical error in the NFAP with regard to the forest area used in the FRL. However, the Addendum does not alter the FRL as proposed in the revised NFAP. The FRL is projected using the AGM and EPIM models.

In general, Latvia addressed or partially addressed the majority of technical recommendations. The European Commission notes the following minor issue:

- Latvia does not ensure consistency of the greenhouse gases from drainage between FRL and GHGI reporting, and there may be an inconsistency with the reporting of litter. The FRL includes litter estimates for organic soils, while no emissions or removals are reported in the GHGI.

The assessment concluded that the FRL of Latvia is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The Commission has reservations towards the methodology used to determine harvest rate in the reference period, as detailed in the assessment table (see Art. 8(5)2) below. However, the choice by Latvia was concluded to be within the legal boundaries of the Regulation. Other issues will be corrected by Latvia at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Latvia's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

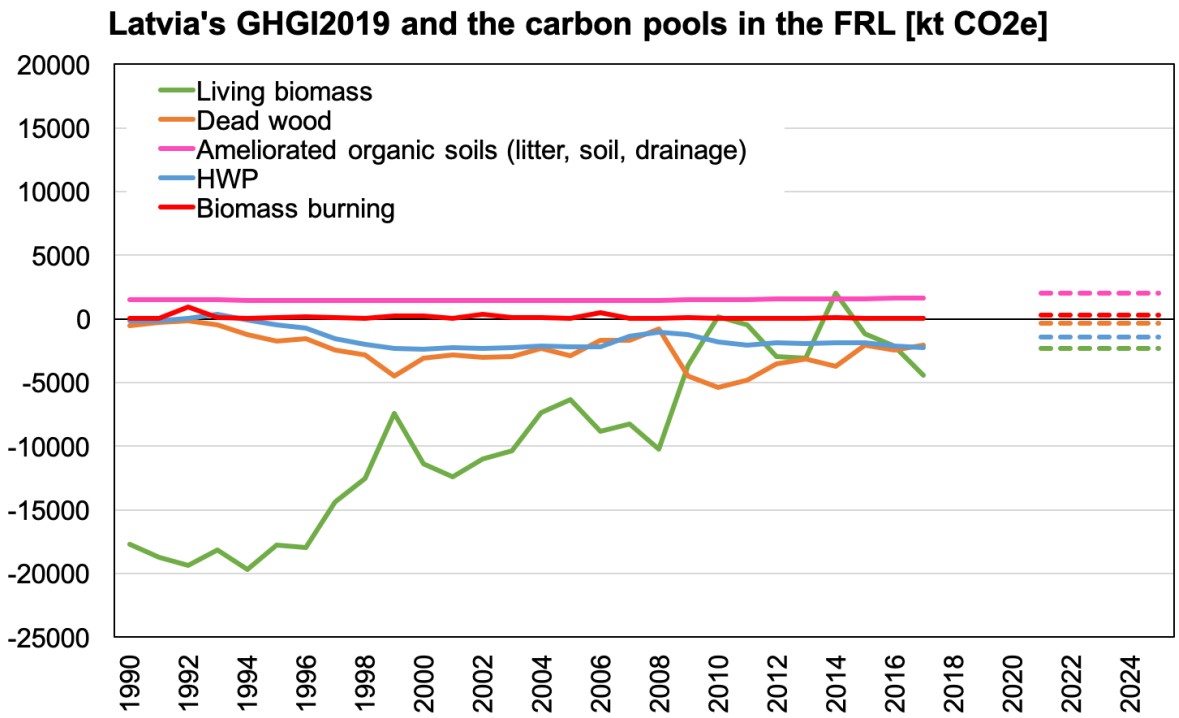
Table 14. The carbon pools and other sources of GHG emissions included in Latvia's FRL. The values are derived from Table 1 in Latvia's NFAP, where they were provided as the sum of the five-years period 2021-2025. The FRL in the delegated act is the annual value provided by Latvia, -1 709 000 t CO_2e^{-yr}. The differences in the values are caused by rounding.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]
Living biomass	-2 326 600
Dead wood (from ameliorated and other soils)	-335 100
Ameliorated organic soils (incl. litter, soil, drainage)	2 039 000
Harvested wood products	-1 411 000
Biomass burning	+324 840
Sum of the pools, without HWP	**-297 860**
Sum of the pools, with HWP	**-1 708 860***
Forest reference level, incl. HWP	**-1 709 000**

*Corrections apply because of rounding of numbers reported in the revised NFAP. However, these corrections are considered negligible and thus not reflected in the final FRL value of Latvia as reported in SWD (2020) 236.

[8] https://www.zm.gov.lv/public/ck/files/Addendum_to_NFAP_and_FRL.pdf

Figure 14. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines). For 'ameliorated organic soils', the values from GHGI reporting show the reporting for soil organic carbon on organic soils and drainage. Litter is not reported in Latvia's GHGI.



Foreseen technical corrections to the forest reference level of Latvia

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Latvia:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Latvia may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Latvia does not include CO_2 emissions from drainage, creating an inconsistency between the FRL and the GHGI reporting. The contribution of this gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.
- The FRL of Latvia includes the contribution of litter pool in the modelling of organic soils. As litter is not reported in Latvia's GHGI, there may be an inconsistency between the FRL and the GHGI that should be amended before the compliance check.

Report on the assessment of the issues raised in the technical recommendations for Latvia

The draft NFAP of Latvia, submitted on 25 March 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Latvia was -54 000 t CO_2e (+1 495 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Latvia on the principles of Article 8(5), five criteria of Annex IV, Section A and six elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Latvia and technical notes by the European Commission. The table below details the technical recommendations, responses provided by Ireland and technical comments by the European Commission. Technical comments by the European Commission also consider, where applicable, the updated or more detailed information provided by Latvia in the *Addendum to Latvia's National Forestry accounting Plan (NFAP) and Forest Reference Level (FRL)*, published on 6 April 2020.

	SWD recommendation	**Response from Latvia**	**EC comments**
Art. 8(5)1	Demonstrate how dynamic age-related forest characteristics have been taken into account and revise FRL, if applicable.	Age structure dependant variable in the AGM growth model is probability of regenerative felling; the rest of variables are determined by growth conditions (site index) and management practices, e.g. thinning intensity. Detailed description of the modelling approach is provided in research report by Šņepsts et al. (2018), as well as in Annex 3 of this document. Age structure of forests is shown in Figure 8 and 9 (page 29).	**Addressed** Latvia shows the age class structure development (for three forest development classes) in Fig. 9, and the area development of mature forests in Fig. 8. The model is described in detail in Annex 3. The modelling of harvests in the FRL is further elaborated in the Addendum.
	Demonstrate that the FRL is based on the continuation of sustainable forest management practices from the reference period specifically for harvest rates.	Projections of harvest rates are recalculated by exclusion of policies related impact. Projections of harvest rate is provided in chapter 'Harvest projections under Latvia's FRL scenario' (page 32).	**Partially addressed** Figure 10 shows a clear increase in total harvest rate from ca. 13 Mm^3 in 2010 to ca. 16.5 Mm^3 in the CP (22%). Latvia explains in the Addendum (p. 5) that the harvest rate for the FRL is determined by the average proportion of [(volume extracted in regenerative fellings in 2000-2004)/ (volume of trees available for regenerative felling in the beginning of 2000)], and similarly for the second part of the reference period, 2005-2009. This assumption explains why the harvested volume (table 7 of the NFAP) increases more in the FRL than the harvested

	SWD recommendation	Response from Latvia	EC comments
			area (figure 8 of the NFAP). This choice may result in an inconsistent representation of harvest intensity as core element of documented management practices in the period 2000-2009. However, the chosen approach is considered within the legal boundaries of the LULUCF Regulation.
	Specifically, exclude policy assumptions from the FRL calculation.	Current version of NFAP is based on assumption that harvest rate follows to intensities documented in 2000-2009 and modelling is started from 2010 thus excluding impact of policies implemented after the reference period. Projections of harvest rate is provided in chapter 'Harvest projections under Latvia's FRL scenario' (page 32).	**Addressed** LV states that policies are excluded from the FRL projection. However, the NFAP is not clear on why the harvest rates in the FRL projection and in the scenario that continues FMP of 2013-2017 is practically the same (p. 33-34). This issue is clarified in the Addendum.
	Explain the change and indicate drivers for living biomass converting from a sink in the reference period to a source during the compliance period.	NFAP is supplemented with Figure 22 (page 57) demonstrating increments, mortality and harvest rate in forest lands remaining forest lands in 2010 according to the most recent inventory.	**Addressed** In the revised submission, living biomass is no longer a source.
	Indicate if data outside the reference period (2000-2009) were used, and if so, provide a justification.	No data outside the reference period (2000-2009) are used in calculation of the Latvia's FRL.	**Addressed** The NFAP states clearly that data from only 2000-2009 is used in the determination of the FRL, and the Addendum provided by Latvia provides further documentation on the data used as basis for the FRL.
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century.	The GHG projections are provided in NFAP in Figure 1 (page 7). The calculation period is extended to 2100 using updated information on harvest intensities. Following to the previous response period of projections is extended to 2100; assumptions on forest management practices applied in the FRL scenario ensures that forest	**Partially addressed** Figure 1 shows a rapidly diminishing sink (zero by the second CP), with a small increase toward the second half of the century. The FRL projection is now extended up to 2100.

	SWD recommendation	Response from Latvia	EC comments
	Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	land remaining forest land is net sink of CO2 removals in the second half of 21st century (2051-2100, Figure 1 in page 7).	However, it is not clear how this is consistent with the long-term strategy.
Annex IV.A(c)	Provide a detailed description of forest management practices as documented in the reference period (2000-2009). Exclude policy assumptions from the FRL calculation and revise the FRL accordingly.	The information on forest management practices is provided in NFAP and sources of information listed in this document in chapters 'Description of future harvesting rates under different policy scenarios' (page 32) and 'Detailed description of the modelling framework as applied in the estimation of the forest reference level' (page 39). Detailed description of stand characteristics and age related probabilities of various forest management measures (Annex 3 'Description of the AGM model'). To simplify description of the measures number of strata is reduced in NFAP to 2 – state owned and other forests, including private and municipality owned forests (chapter 'Documentation of stratification of the managed forest land', page 38) Policy assumptions are excluded from calculation of FRL in current version of NFAP by recalculation of harvest intensities in the reference period (chapter 'Harvest projections under Latvia's FRL scenario', page 32).	**Addressed** See also the Addendum provided by Latvia.
Annex IV.A(e)	Provide a ratio between solid (HWP) and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	-	**Addressed** Latvia has calculated the share of energy wood from the total roundwood per tree species (Fig. 2), and keeps this share constant in the projection. As a result, the total share changes over time (Fig. 3), which is justified by the evolution of the tree species shares.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas	The consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013 is ensured by transferring	**Partially addressed**

	SWD recommendation	Response from Latvia	EC comments
	emissions reported under Regulation (EU) No 525/2013.	calculations of land use changes to 20 years period. In both cases historical datasets until 2009, including it, are equal. Comparison of the projections and FRL scenario is provided in chapter 'Integrity with the national projections of anthropogenic GHG emissions by sources and removals by sinks reported under Regulation (EU) No. 525/2013' and Figure 14 in page 15.	Fig. 4 on p. 15 shows almost identical development between "projections" and "FRL scenario". In the NFAP, it is not clear if this means that the FRL is almost identical with policy scenarios of the 525/2013.
	Provide explanations for possible differences between national projections and the proposed FRL.	The national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013 differs from modelling results in NFAP due to different forest management intensities applied in FRL scenario in 2010-2017 according to the intensities as documented in 2000-2009 and actual forest management characteristics, as well as due to different forest land remaining forest land area (Figure 17, page 53), which increased in the GHG inventory due to completion of 20 years transition period. Carbon stock changes and GHG emissions due to afforestation are accounted under forest lands within the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013, in NFAP afforestation is not accounted. Deforestation after 2009 is not considered in NFAP due to use of fixed land use approach, thus significantly affecting carbon stock changes and GHG emissions in the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Management practices including harvest rate in the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013 are considered according recent data (2013-2017) and market driven projections of wood demand. Forest management in 2000-2009 positioned as 'business as usual' according to LULUCF regulation represents outdated forest management practices, hardly comparable with actual forest management practices.	**Partially addressed** There is little discussion in the NFAP itself, but the differences are discussed in the explanatory notes to the revised NFAP recalled here. The difference in forest area development shown in Fig 17 (p. 53) is very small.

	SWD recommendation	Response from Latvia	EC comments
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i). Use the conversion period for Land converted to forest land (Afforested Land) consistent with the latest national GHG inventory. Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	Area of forest land is recalculated using 20 years transition period for conversion of other land use categories to forest land; no land use changes are considered after beginning of 2010. Land use changes are recalculated using 20 years transition period instead of 30 years; however, it is planned to apply 30 years transition period in GHG inventory and calculation of NFAP using technical corrections. Ability of the model to recalculate historical data (2000-2009) is demonstrated in chapter 'Integrity of applied models with the historical data from the national GHG inventory', page 16. According to results summarized in Figure 5, page 16. The most recent GHG inventory and the NFI data applied in the GHG inventory are used for calculation of the FRL.	**Partially addressed** The clerical error in the NFAP is corrected in the Addendum. See also Annex IV.B(e-i). There may remain a small inconsistency with regard to litter and CO_2 emissions from drainage with a minor numerical impact that should be clarified before the compliance check, see Annex IV.B(b).
Annex IV.B(a)	Ensure consistency of values throughout the NFAP specifically between table 1 and the text, e.g. on page 6.	Contents of NFAP is corrected accordingly to ensure consistency of text and tables.	**Addressed** The clarity and internal consistency of the NFAP have been considerably improved.
Annex IV.B(b)	Noting the inclusion of additional carbon pools in the FRL, include those pools in the next submission of the national GHG inventory to ensure consistency between the FRL and the national GHG inventory.	-	**Partially addressed** In the FRL, Latvia includes litter as a part of the emissions from organic soils. Furthermore, Latvia states in the NFAP (p. 22) that CH_4 and N_2O emissions from ameliorated and rewetted organic soil is included in the FRL. The GHGI reporting of Latvia does not report emissions from litter, and does report emissions from drainage also as CO_2. While the Addendum provided by Latvia describes the modelling of these soils in detail, it should be assured before the compliance check that all pools and

	SWD recommendation	Response from Latvia	EC comments
			gases are consistently included in both the FRL and the GHGI.
Annex IV.B(c)	Provide additional data on harvest assumptions, specifically on harvest intensity and harvest frequency. Demonstrate the exclusive use of data from the reference period for modelling the FRL.	Harvesting assumptions are provided in NFAP. The FRL scenario intensities of regenerative felling is determined by age of stands and probability (according to intensity tables, chapter 'Final felling', page 48). A figure demonstrating changes in growing stock available for regenerative felling since 1990 is included in NFAP to make information on harvest projections more transparent (Figure 22, page 57).To exclude policy assumptions the harvest intensities in the reference period are recalculated considering the intensities as documented in 2000-2009. Modelling is started from 2010. It is mentioned in NFAP that only data characterizing forest management in the reference period (2000-2009) are used in calculation.	**Addressed** The information provided in the NFAP is not very clear on this matter, but Latvia provides more data and a thorough description of the assumptions in the Addendum.
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Given the use of the dynamic area approach, provide a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since, at least, year 2000. Specifically, provide information on change in area for each age class using sufficiently disaggregated age-classes, e.g. 10-20 years.	Land use is recalculated in NFAP using 20 years transition period ensuring consistency of land use with the most recent GHG inventory report (2019) until beginning of 2010. Land use changes including those determined by completion of transition period are avoided and will be included in NFAP with technical corrections. Dynamic area approach is not any more used in calculation of FRL. Fixed area of forests is used staring with 2010. A figure demonstrating land use changes due to conversion of forest lands to other land uses and conversion of non-forest lands to forest lands from 2000 to 2017 will be added with technical corrections to NFAP. A figure demonstrating species specific changes of distribution of age classes (young forests, middle age forest and mature forests) are provided in chapter 'Overall description of the forests and forest management in Latvia and the adopted national policies', page 28.	**Addressed** There is a clerical error in the NFAP, which is corrected by Latvia in the addendum (p. 42). The NFAP refers to an area of MFL of 3180 kha, which corresponds to total forest land area in 2009. However, Latvia states in the Addendum that in reality, the area used for estimating the FRL was 3 071 kha, which corresponds to the FLrFL area reported for the year 2009. 3 071 132 ha (GHGI 2019, CRF table 4A, cell C11). Latvia's revised FRL is calculated using the static area approach.

	SWD recommendation	Response from Latvia	EC comments
		According to the assumptions used in FRL scenario area of mature forests in Latvia continue to grow in the commitment period (Figure 8 and 9).	
Annex IV.B(e-iii)	Provide detailed information on increments, age structure and harvesting rates for estimating the FRL. Exclude policy assumptions on harvests in the reference period to balance age-structure. Avoid contradictions in the NFAP such as between Figures 4 and 5 regarding reference period and harvesting rates or table 7 and Figure 4 regarding the share of harvest.	Information is provided in description of AGM model in Annex 3 'Description of the AGM model'. Only regenerative felling is determined by age structure and probability models, other management activities are determined by stand characteristics and probability models. Policy assumptions are excluded from calculation of the FRL by modelling of FRL from 2010 and by using of forest management intensities as documented in 2000-2009, including harvesting intensity. Charts and tables are updated to ensure consistency of the projections in the FRL scenario	**Partially addressed** Annex 3 provides very detailed information on the model and its parameters, but is not linked to the forest data from LV. The age structure does not seem to change much over time (figs. 8 and 9), and the increment stays the same (fig. 22). The harvest rates are however further elaborated in the Addendum, which explains the increase in harvest rate as discussed under Art. 8(5).
Annex IV.B(e-iv)	Provide information about the future harvesting rates disaggregated between energy and non-energy uses. Provide additional information on the assumptions used to allocate round wood to each HWP category.	The future harvesting rates disaggregated between energy and non-energy uses is provided in Figure 10 (page 33). The disaggregation is done at species level, respectively, changes in species composition in harvest rate may change proportion of wood for energy wood and other assortments. Additional tables are included in chapter 'Integrity of applied models with the historical data from the national GHG inventory' (Table 3, 4 and 5) to demonstrate production of different types of HWP. No changes are considered in proportion of imported and exported roundwood at species level.	**Addressed**

A.15. Lithuania

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 2 February 2020, Lithuania proposes a FRL of -5 164 640 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using the European Forestry Dynamics Model (EFDM) and the same calculation spreadsheets as in the GHGI of Lithuania for the land use, land use change and forestry (LULUCF) sector.

In general, Lithuania addressed or partially addressed the majority of technical recommendations. The European Commission notes the following issues:

- There is a small inconsistency between FRL and the GHGI with regard to greenhouse gases from wildfires, which are reported in the GHGI but not included in the FRL. This discrepancy is however estimated to have a minor numerical impact on the FRL and can be amended as a technical correction, as Lithuania also proposes in the explanatory note.
- Lithuania does not provide comparisons between the FRL and other national projections, or information on harvest rates' development under different policy scenarios. This issue is considered a problem for transparency, but is not considered to have a numerical impact on the FRL.

The assessment concluded that the FRL of Lithuania is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission notes that the minor transparency issues identified in the revised NFAP do not have a notable impact on the FRL proposed by Lithuania. The European Commission considers the FRL proposed by Lithuania reasonable. Minor issues will be corrected by Lithuania at the end of the compliance period.

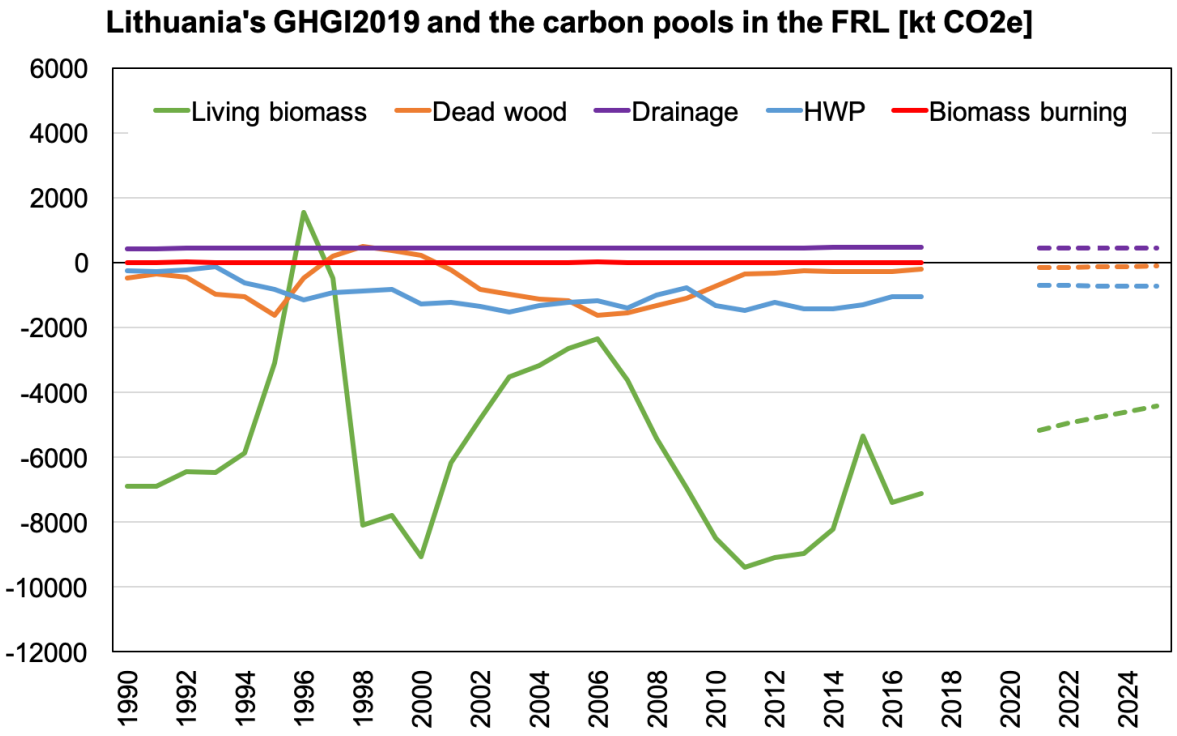
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Lithuania's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 15. The carbon pools and other sources of GHG emissions included in Lithuania's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**
Above-ground biomass	-3 866 020
Below-ground biomass	-910 840
Dead wood	-127 490
Organic soils (N_2O from drainage)	+449 020
Harvested wood products	-709 320
Total without HWP	**-4 455 320**
Forest reference level, incl. HWP	**-5 164 640**

Figure 15. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Lithuania

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Lithuania:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Lithuania may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- The FRL of Lithuania does not include CO_2, CH_4, and N_2O emissions from wildfires, creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for Lithuania

The draft NFAP of Lithuania, submitted on 31 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Lithuania was -2 272 240 t CO_2e (-1 429 400 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Lithuania on five criteria of Annex IV, Section A and five elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Lithuania and technical notes by the European Commission.

	SWD recommendation	**Response from Lithuania**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	National Climate Change Management Policy Strategy was taken into account, setting the aim to increase forest land area of the country in the future up to 35 percent from total country area in order to enhance carbon sequestration in forest land (described in the revised NFAP, Ch. 1.2).	**Partially addressed** The role of forests in the National Strategy for Climate Change Management Policy has been added on p. 5-6. Brief description of the forest policies under the National Environment Protection Strategy provided on p. 14-15, and the role of biomass in the national energy strategy for 2050 discussed on p. 16. No quantitative information beyond 2025 is provided in the plan.
Annex IV.A(c)	Clarify the discrepancies between national GHG inventory data and the projections used to set the FRL or revise the application of the model Demonstrate that the model's outcomes can capture actual emissions and removals as reported in GHGI in both level and trend.	Lithuania has revised its FRL, updating projections used for its estimation, as briefly described in this explanatory note and revised NFAP, Ch. 3.	**Addressed** Model results have been revised, and Figs. 4-1 and 4-2 updated accordingly (p. 33).
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	Lithuania has provided historical ratio between solid and energy use of forest biomass and applied average value of the period 2000 – 2009 constantly for the estimation of FRL (provided in the revised NFAP, Table 1-3).	**Addressed** The ratio between solid and energy use provided on p. 6. The demonstration that this ratio remains constant is partially missing, but can be derived from the information provided in the NFAP. The amount of wood used for different HWP categories provided on p. 30; comparing this information to harvest volumes

	SWD recommendation	Response from Lithuania	EC comments
			in 2020 and 2025 (table 4-5 on p. 27) shows that the ratio used for the different HWP categories remains constant throughout the projection.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Lithuania has explained in its revised NFAP that the projections of GHG emissions, reported under Regulation (EU) No 525/2013 has been prepared applying the same model for projections of growing stock volume change and methodology to calculate GHG emissions and removals (2006 IPCC Guidelines), as used for FRL estimation. Description of the consistency is included in the revised NFAP, Ch. 1.2.	**Partially addressed** LT reports on p. 7 that the FRL and reporting under 525/2013 is consistent in terms of carbon pools and greenhouse gases, as well as the modelling framework used. No explicit comparison between the projections is provided.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, part B (e-i). Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Part B (b). Demonstrate the ability of the model used to construct the FRL to reproduce the historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	The information of the area under forest management included in the estimation of FRL is provided in Table 2-2 of the revised NFAP. Lithuania has included all pools and gases in the estimation of its FRL, except for GHG emissions from forest wildfires, which constitute a minor share in total GHG emissions and removals from forest land remaining forest land. Lithuania will include emissions from forest wildfires during the technical correction of its FRL before the compliance procedure. Consistency between historical data, reported in National GHG Inventory 2019, and modelled for the FRL estimation is provided in the revised NFAP, Ch. 4.2.	**Partially addressed** For area, see Annex IV.B(e-i). The pools included in the FRL are reported on p. 4, and correspond to those reported for FLrFL in the GHGI 2019. Emissions from wildfires are missing, creating an inconsistency with the GHGI. Reproduction of growing stock volume is shown in figs. 1-1 and 1-2 for years 2000-2017 using "EFDM test" (explained on p. 11). Reproduction of AGB and BGB for the years 2007-2017 is shown in Fig. 4-2, and for total FLrFL in Fig. 4-1 (i.e. including three years of the RP 2000-2009). The model results are similar for year 2007, but the model projects a lower sink for other years. This is explained by the harvest intensity assumptions, which are based on the historical data of the RP 2000-2009, instead of the actual harvest that occurred over 2007-2017. The overall trend is more similar between the modelled

	SWD recommendation	Response from Lithuania	EC comments
			results and the GHGI, when looking at AGB and BGB separately. As shown in Table 1-2, the increment modelled for the FRL was slightly lower than that reported in NFI in 2007, but notably lower in the later years. Total harvest was closer to the harvest reported in the NFI. Consequently, the growing stock volume change is modelled smaller in the FRL than what is observed in the NFI. However, it should be noted that Lithuania has not used the mean increment in the modelling, but instead increments defined separately for each tree species and age class (p. 26). Lithuania reports on p. 25 that the projected growing stock change was corrected by a "correction factor" of 1.95 mill. m^3, derived from the difference between the NFI 2005-2009 and EFDM results, and applied for the whole projection. This correction is not presented visually in the NFAP, but it explains the very close match of the FRL projection and NIR 2019 results for the year 2007 shown in figs. 1-1 and 1-2.
Annex IV.B(b)	Include the greenhouse gases consistent with those applied in the latest national GHG inventory.	Lithuania has included all gases in the estimation of its FRL, except for GHG emissions from forest wildfires (described in revised NFAP, Ch. 1.1), which constitute a minor share in total GHG emissions and removals from forest land remaining forest land. Lithuania will include emissions from forest wildfires during the technical correction of its FRL before the compliance procedure.	**Not addressed** LT includes CO_2 and N_2O (from drained organic soils) in its FRL. CH_4 is reported in the GHGI only as emissions from wildfires (resulting in a small amount of emissions). Wildfires are not included in the LT FRL, creating an inconsistency with the GHGI with a minor numerical impact.
Annex IV.B(c)	Address the inconsistencies in input data used in setting the FRL and the national GHG inventory and provide an explanation for the differences observed	Lithuania has revised its FRL, applying changes in modelling structure as described in this explanatory note and the revised NFAP, Ch. 3. The consistency between historical data, reported in National GHG Inventory 2019, and	**Addressed** LT has updated Fig. 1-1 (now Fig 1-2), and added a new figure 1-1, which are now more consistent with the information provided in NIR 2019.

	SWD recommendation	Response from Lithuania	EC comments
	in data of the NFAP and those reported in the NIR of 2018.	modelled for the FRL estimation is provided in the revised NFAP, Ch. 4.2. The largest difference (2010 – 2014) between projected GHG removals used for FRL estimation and GHG removals reported in NIR 2019 is highly influenced by the variation of harvest for the period 2007 - 2017, caused by the economical (2008-2010 economical crisis) and nature protection (enhanced limitations of forest use for protective purposes) reasons. Projected GHG removals in forest land takes into account forest management intensities as observed in 2000 – 2009, therefore gradual increase in harvest is projected due to the increase in area of mature stands, while actual harvest intensities significantly decline, which has a significant influence for the increase of GHG removals in forest land, as reported in Lithuania's NIR 2019. Actual and projected harvest intensities are provided in the Table 1 below.	
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	Consistent area used for the projections of FRL and reported in National GHG Inventory 2019 CRF Table 4.A Forest land remaining forest land is provided in the revised NFAP, Table 2-2.	**Addressed** The area of FLrFL reported in Table 2-2 for year 2010 corresponds with the reported FLrFL area in GHGI 2019 for the year 2010. Note that the area is aligned with the reported area in the midpoint of the first modelled time step. The projections start in 2007, and 2010 is the midpoint of the five-year time step.
Annex IV.B(e-iii)	Provide more accurate information on the total increment associated with the projected FRL (both for the reference and compliance period) and transparently explain how this increment is	The information about the increment is provided in Table 1-2. Actual increment change (increment accumulated in forest), observed from NFI measurements, was used to calculate adjustment for the projected	**Addressed** Mean increment provided in table 1-2 (p. 5), fig. 2-1 (p. 10) and age class development detailed in Annex

	SWD recommendation	Response from Lithuania	EC comments
	incorporated in the applied modelling approach. Provide information on the projected harvests in the compliance period.	growing stock volume change, used for the estimation of FRL (described in this explanatory note and the revised NFAP, Ch. 4.1). Projected total harvest values are provided in the Table 4-5 of the revised NFAP. Information about projected harvest is also provided as a ratio of projected felled volume to historical felled volume for HWP stock changes estimation and activity data in Table 4-6 of the revised NFAP. Historical felled volume in this case is an average of 2000 – 2009.	I for five-year periods within 2007-2025. Harvest for years 2020 and 2025 provided in Table 4-5 (p. 27).
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Information about projected harvest is provided as a ratio of projected felled volume to historical felled volume for HWP stock changes estimation and activity data in Table 4-6 of the revised NFAP. Historical felled volume in this case is an average of 2000 – 2009.	**Partially addressed** The harvest rates for five-year periods in 2007-2025 are provided in table 1-2 (p. 5), and the ratio between forest biomass used for solid and energy production is given in table 1-3 (p. 6). The development of harvesting rates disaggregated between energy and non-energy uses is not provided.

Other information provided by the MS: the following table was provided by Lithuania together with the response to technical recommendations.

Table 1. Projected and reported (NIR 2019) harvested wood volume, mln. m^3

Harvested wood volume	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Reported in NIR 2019	9.65	9.51	9.07	8.35	8.06	8.05	8.13	8.67	9.09	9.86	10.15
Projected for FRL estimation	9.14	9.22	9.30	9.38	9.46	9.54	9.68	9.82	9.95	10.1	10.23

	SWD recommendation	Response from Lithuania	EC comments
Other issues noted by the EC.			
In Figure 2-3, the harvest volume for year 2001 is missing. In the corresponding figure in the draft NFAP submitted in 2018, the total harvest volume for 2001 was reported 5.7 Mm3.			

A.16. Luxembourg

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 31 December 2019, Luxembourg proposes a FRL of -426 000 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using a national model for the NFAP.

In general, Luxembourg addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issues:

- Luxembourg has calculated the FRL as the average over 2020-2025 (six years), as stated and shown on p. 31. However, as there is no visible change in the carbon pools over time, this error has likely no impact on the FRL value.
- The value for the HWP pool is not reported explicitly in the revised NFAP. Instead, the NFAP states that the value of HWP pool may be derived as the difference between the FRL in the draft plan (where instantaneous oxidation was assumed) and the FRL in the revised plan (when the HWP pool was included).
- Luxembourg is clear about the carbon pools and greenhouse gases included in the FRL and provides disaggregated information by carbon pools in form of figures but does not state specific values in the text or tables. In this respect, the analysis of consistency of carbon pools and greenhouse gases included in the FRL and GHGI can be completed.

The assessment concluded that the FRL of Luxembourg is set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Luxembourg reasonable. Minor issues will be corrected by Luxembourg at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

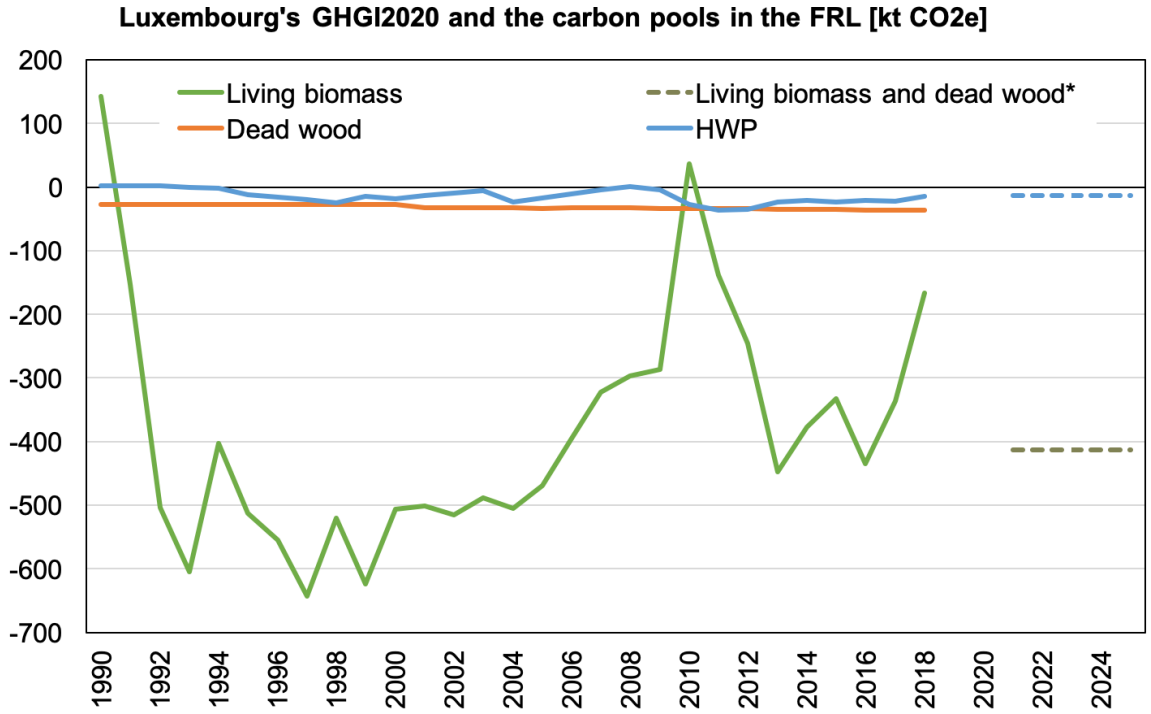
The following table presents an overview of the carbon pools included in Luxembourg's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 16. The carbon pools and other sources of GHG emissions included in Luxembourg's FRL.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]
Living biomass and dead wood	-413 000
Harvested Wood Products (HWP)	-13 000[(1)]
Total without HWP	**-413 000**
Forest reference level, incl. HWP	**-426 000**

[(1)] The value for the HWP pool is not reported in the revised plan, but is derived from the difference between the FRL in the draft NFAP submission (where instantaneous oxidation was assumed) and the FRL in the revised NFAP (where the HWP pool is included).

Figure 16. The carbon pools included in the FRL as reported in the GHGI (submission 2020; solid lines), and as projected for the FRL (dashed lines).



*Luxembourg models living biomass and dead wood separately, but does not provide separately their exact values in the FRL. Therefore, the contribution of living biomass and dead wood is here visualized jointly.

Foreseen technical corrections to the forest reference level of Luxembourg

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Luxembourg:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- The background level for natural disturbances now included in Luxembourg's FRL is based on the natural disturbances reported in 1990-2014. The background level will be updated using the full time series 2001-2020 before the natural disturbances provision (art 10 of the Regulation (EU) 2018/841) is used.

Report on the assessment of the issues raised in the technical recommendations for Luxembourg

The draft NFAP of Luxembourg, submitted on 21 January 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Luxembourg was -413 000 t CO_2e (instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Luxembourg on subparagraph 1 of Art. 8(5), and on 5 criteria of Annex IV, Section A and 5 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Luxembourg and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Luxembourg after the submission of the revised NFAP.

	SWD Recommendation	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	**Not addressed** No changes to previous submission
Annex IV.A(d)	Include the carbon pool of HWP in the FRL, and thereby provide a comparison between assuming instantaneous oxidation and applying the first-order decay function and half-life values in the NFAP.	**Partially addressed** HWP is now included and its estimation is described. The FRL with instantaneous oxidation is not provided. However, it becomes clear, when comparing the numbers to the draft submission, that the only change is the addition of HWP, i.e. the size of the HWP pool is the difference between the draft and revised NFAP submissions (p. 28).
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	**Addressed** It is mentioned under disaggregated harvesting rates that energy and non-energy use ratio was kept constant at 15% (p. 27). Fig. 4-12 shows a more or less constant share between sawnwood and panel production during the CP.

	SWD Recommendation	EC comments
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	**Not addressed** Despite LU makes reference to submission of national projections under Regulation 525/2013, including FRL projections (p. 28), LU does not provide explicit information and additional explanations on the possible differences among the two sources.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i).	**Addressed** The MFL area reported by LU in Table 4-1 of the NFAP matches the FLrFL reported in GHGI2019 and GHGI2020 for year 2010 (88205 ha).
	Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Part B (b).	**Addressed** HWP pool has been added.
	Check (and possibly correct) the sign of the FRL value, noting in accordance with Regulation (EU) 2018/841 Art 5(1), removals (or sink, in CO2 equivalent) are denoted with a negative sign.	**Addressed**
	Demonstrate the ability of the model used to construct the FRL to reproduce consistently historical data from the national GHG inventory for the reference period.	**Partially addressed** No quantitative or qualitative analysis was added to the relevant sections. However, Figure 4-18 graphically demonstrates similarity between the model output and the GHGI between 2000 and 2018 with notable divergence for years 2010, 2011 and 2018. As the consistency displayed in the graphs is high for the entire RP and acceptable for the gap period (2010-2018) the recommendations is considered to be met.
Annex IV.B(b)	Include the greenhouse gases required by Regulation (EU) 2018/841 in the FRL and the national GHG inventory.	**Addressed** The LU GHGI does not include emissions by CH4 and N2O, consequently they are also not included in the FRL.

	SWD Recommendation	EC comments
	Noting the inclusion of additional carbon pools in the FRL, include those pools in the next submission of the national GHG inventory to ensure consistency between the FRL and the national GHG inventory.	**Addressed** GHGI 2020 includes DW estimates for FLrFL.
	Provide an estimation of HWP pool, instead of the current assumption of zero.	**Addressed**
	Provide further justification on the meaning and implications of "Considered with LUC" for litter and SOC on Table 2.1.	**Not addressed**
Annex IV.B(c)	Provide information on the biomass module used for the estimation of FRL, including clear descriptions of forest management practices, and demonstrate consistency with the national GHG inventory.	**Not addressed** No changes to the previous submission.
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	**Addressed** The MFL area used by LU matches the FLrFL reported in Table 4.A of the GHGI2019 submission for year 2010.
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	**Partially addressed** Harvest level shown in Fig. 4-9, but not split to energy/non-energy (no changes to previous submission). Energy use instead said to be 15% of the harvest (p. 27).

A.17. Hungary

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 23 December 2019, Hungary proposes a FRL of -48 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using the CASMOFOR model.

In general, Hungary addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issues:

- Hungary does not ensure consistency between the area of managed forest land and the area of forest land remaining forest land as reported in the GHGI, submission 2020, for the inventory year 2009.

The assessment concluded that the FRL of Hungary does not meet the requirements of the Regulation (EU) 2018/841 related to Annex IV.A(h), and that the NFAP does not contain the element required under Annex IV.B(e-i) of the Regulation. The European Commission 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)) (see also SWD (2020) 236.

The European Commission also notes that Hungary defines the harvest intensity (i.e. thinning and final harvest) in Norway spruce stands by using the maximum value of the distribution of harvest intensity in absence of a clear trend. The Commission notes that the definition of this specific forest management practice could not properly reflect the forest management practices as documented in the entire period 2000-2009. However, the Commission considers the impact of this choice on the FRL proposed by Hungary negligible. Minor issues will be corrected by Hungary at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

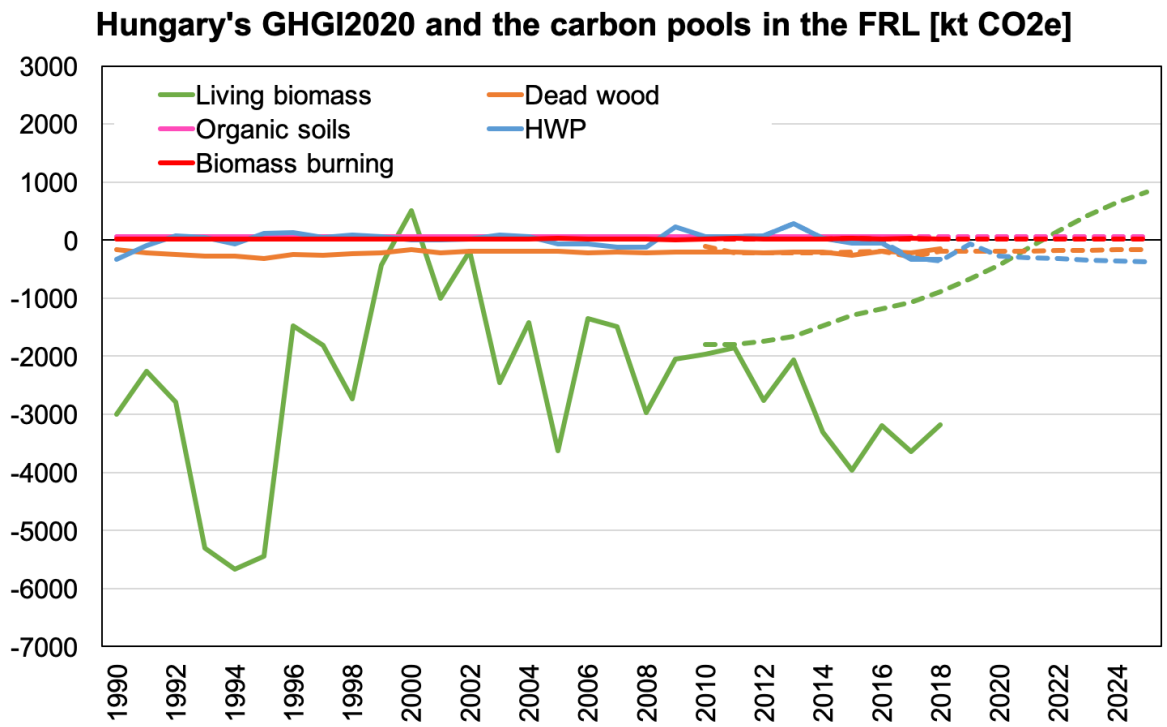
The following table presents an overview of the carbon pools included in Hungary's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 17. The carbon pools and other sources of GHG emissions included in Hungary's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Biomass	+381 000
Deadwood	-173 600
Organic soils	+62 000
Non-CO_2 emissions	
CH_4	
- Slash burning	+8 060
- Wildfires	+4 980
N_2O	
- Slash burning	+5 300
- Wildfires	+3 280
Harvested Wood Products (HWP)	-339 000
Total without HWP	**+291 020 (1)**
Forest reference level, incl. HWP	**-47 980 (1)**

(1) Corrections apply because of rounding adjustment and truncation of numbers reported in the revised NFAP. However, these corrections are considered negligible and thus not reflected in the final FRL value of Hungary as reported in SWD (2020) 236.

Figure 17. The carbon pools included in the FRL as reported in the GHGI (submission 2020; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Hungary

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Hungary:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- The background level for natural disturbances now included in Hungary's FRL is based on the natural disturbances reported in 2000-2018. The background level will be updated using the full time series 2001-2020 before the natural disturbances provision (art 10 of the Regulation (EU) 2018/841) is used.

Report on the assessment of the issues raised in the technical recommendations for Hungary

The draft NFAP of Hungary, submitted on 21 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Hungary was -474 000 t CO_2e (-354 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Hungary on subparagraphs 1 of Art. 8(5), and on 6 criteria of Annex IV, Section A and 4 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Hungary and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Hungary after the submission of the revised NFAP.

	SWD Recommendation	**Response from Hungary**	**EC comments**
Art. 8(5)1	Demonstrate how dynamic age-related forest characteristics have been taken into account. Provide information on modelling of growing stock during the reference period.	Our original NFAP, on page 7 under section 1.2. B. (iii), has indeed an incomplete reference to the section relevant to age-related forest characteristics. However, it is reported in section 2.7.1 of the original submission that "the modelling of dynamic age-related forest characteristics was ensured by using a dynamic model in which forest characteristics are the functions of age (in 150 age classes…)". There are separate subsections in section 2.7.2 in the original submission with subtitles "Forest area (A) by age class and yield class", "Area of final harvest and regenerations (AFH) by age class and yield class, "Woody volume (V) and its change (ΔV) by age class and yield class", "Thinnings (TH)" and "Final harvests (FH)" that all discuss age-related forest characteristics and how they are considered in modelling. For example, the algorithm to calculate net growth is described in section 2.7.2. Model parameters are described in section 2.7.4. Because of the above, we believe that our original submission does not need to be changed concerning "how" the age-related forest characteristics have been taken into	**Addressed** Hungary further clarifies how age-related characteristics were taken into account during the simulation (The added section "2.9. General settings during simulations", p. 74). Hungary also provides information on growing stock and increment by species/species group for the reference period (see Table 13, p. 45).

	SWD Recommendation	Response from Hungary	EC comments
		account. For the sake of transparency, however, we added some information on the evolution of these characteristics over time (see below). When modelling stand characteristics, the same algorithms were used for years both during the RP and later. We added a separate new section (section 2.9) to say this in the modified NFAP. In the new submission, we have also added a table (Table 13(a)) demonstrating the distribution of volume by species and species groups for each calendar year of the RP.	

	SWD Recommendation	Response from Hungary	EC comments
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Hungary reported in the original submission (page 4 under section 1.2. A. a) how this criterion was taken into account. To improve transparency in the revised submission, we added information in section 1.6.2 on how our recent long-term projections are consistent with the FRL. In section 1.6.1 of our original submission we provided information on our current National Forest Strategy, and in section 1.6.2 we provided information on future harvest rates and afforestation rates as well as projected emissions and removals (under Regulation (EU) 525/2013 as reported in 2017) until 2035. In section 1.6.2 of the revised submission, we added both qualitative and quantitative information on our most recent projections up to 2050. (As we note there, we do not think it appropriate to make projections beyond 2050 because of the high uncertainties involved.) This information includes an analysis of the effects of deviating from FRL.	**Partially addressed** Hungary does not provide explicit information demonstrating that a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Hungary provides adequate information on the net annual carbon balance under the "FRL" scenario up to 2050 (see Figure 2(b), p. 13, and text under section 1.6.2, p. 11).
Annex IV.A(c)	Provide data and information on all HWP uses.	In sections 1.2 A. d) and c) of our original submission we provided information on sections that deal with modelling, data and other information on HWP uses. We added a new section, i.e. section 2.2.6, to provide more information on the data source of historical HWP use.	**Addressed** Hungary provides transparent information on data sources used for HWP calculation (see section 2.2.6; p. 23), and extends the information to all biomass uses, including the energy purposes (see Table 16, p. 50).

	SWD Recommendation	Response from Hungary	EC comments
Annex IV.A(d)	Provide the FRL by assuming instantaneous oxidation of HWP.	Section 1.2 A. d) of our original submission states that: "Our FRL includes projected carbon stock changes in the harvested wood products (HWP) pool (see sections 1.3, 2.6, 2.7.2, 2.7.4, 3.2 and 3.3). In our summary table of the components of the FRL (see Table 20 in section 3.3), we provided the above comparison by reporting values with and without carbon stock changes in the HWP pool. "Without carbon stock changes in the HWP pool" in the table is equivalent to assuming instantaneous oxidation of HWP. By adding/improving the text in sections 1.1 and 3.3, we made Table 20 in section 3.3 even more transparent and understandable and to make it clearer what the FRL values with and without HWP are.	**Addressed**
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	We reported in our original submission that: "In our FRL, we apply a constant ratio for the share of the harvests which enters the HWP pool relative to the amount of total harvest and which is considered as solid use of biomass. The rest of the harvested forest biomass, i.e., that does not enter the HWP pool, is assumed to be burnt and used for energy. It follows from this that the ratio of solid and energy use of forest biomass is also constant (see section 2.7.4)." The method of the calculation of the annual values is provided in the text for Equation (10) in section 2.7.2. For the sake of transparency, we provide the historical time series of the ratios on Figure 13 (b) (section 2.7.4) and the data during the simulation on Figure 22 (b) (section 3.2)of our modified submission.	**Partially addressed** Hungary provides two ratios between solid and energy use of forest biomass in the simulation period (2010 onward), i.e. for thinning and final felling (see Fig. 22 (b), p. 82). However, it is noted that only one ratio is reported as representative of the historical period (around 0.25) (see Fig. 13(b)). For these reasons, it is not completely clear which ratio was maintained constant from the reference period onward.

	SWD Recommendation	Response from Hungary	EC comments
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	We provide additional text in section 3.2 of the modified submission both to demonstrate methodological consistency and to discuss the difference between results on one hand as well as the possible causes of these differences on the other.	**Addressed** Hungary provides textual explanations in section 1.6.2, p. 11. On the contrary, the reference to section 3.2, p. 79, as in the explanatory note refers to the consistency about historical and modelled volume stock changes between FRL and GHGI.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Part B (b). Ensure that the model used to construct the FRL is able to reproduce historical data from the national GHG inventory.	As mentioned in section 2.7.2 of our original submission, the intention was to use the same area as in the GHG inventory. Future land use changes are uncertain and what can be done at this point is to report that, whenever historical land use change information will have become available in future, we will conduct the necessary technical correction. We added text (in section 2.7.2 of the modified submission) clarifying that this area is the same for all years of the simulation and is equal to the area in our GHG inventory of 2018. Section 3.3 of our original submission reports all components (both by pool and GHG) of the FRL. The same section of our original submission reports the values of these components as well as the FRL values (both with and without HWP) for all years of the simulation. The same section also reports that some components (e.g., total forest area) will change in future and these changes could not be taken into consideration in the development of the FRL but will duly be considered when they will be known. An updated version of the table in section 3.3 of our modified submission (Table 20) reports	**Not addressed** See comments to Annex IV.B(e-i). **Addressed** **Addressed** Hungary provides detailed explanations of the consistency between FRL and historical GHGI estimates (see section 3.1, p. 75, and in particular Fig. 19, p. 78).

	SWD Recommendation	Response from Hungary	EC comments
		all updates in a similar structure and in the same details. In our original submission, consistency with our National GHG inventory was demonstrated in section 3.1 in detail. It was also reported in our original submission that "The consistency between modelled and historical values of ΔV, TH, FH, M, current annual increment (CAI) and V is analysed in sections 2.7.5 and 2.8." We nevertheless improved the methodology of our consistency check based on the notes by Somogyi (2019). Due to reasons related to the above improvement for the biomass pool, we had to improve the adjustment factor (section 2.7.5) for some species. In general, the revised simulation for the reference period resulted in similar data as in the GHG inventory before the improved consistency check. The revision of the model parameters nevertheless improved consistency with the revised historical baseline. For FL, this revision resulted in the decrease of the projected sink on FL by 166 $ktCO_2eq/yr$ for the compliance period (see Annex 1). To account for residual differences for the biomass pool, we introduced an offset in our original submission for the calculation of the FRL, which was discussed in sections 3.1.2 and 3.3. Because of all the above, we had to recalculate the above offset (see sections 3.1 and 3.3) and the FRL. The recalculated value is very small and is smaller than the original one (see Table 20 in section 3.3).	

	SWD Recommendation	Response from Hungary	EC comments
		Finally, to further improve consistency for the FRL, we recalculated the emission estimates for the HWP and L-FL pools, and included estimates for the DW pool, in line with the inclusion of such estimates in the GHG inventory (see Annex 1).	
Annex IV.B(b)	Include the carbon pools consistent with those applied in the latest national GHG inventory. Noting the inclusion of additional carbon pools in the FRL, include those pools in the next submission of the national GHG inventory to ensure consistency between the FRL and the national GHG inventory.	As reported in our original submission, the FRL will be fully consistent with the then-official national GHG inventory by the time the FRL will have to be applied, and it is a future task (through appropriate technical corrections) to develop information that will enable full consistency. Some of this information (e.g., the future development of forest area) is not currently known. Until the above later time, we submit a modified table (Table 20) in section 3.3 of our new submission. This modified table is a step toward to full consistency in that, in addition to the FRL, this table includes all mandatory pools, partly as reported in the original submission and, additionally, the DW pool that will be added to the 2020 submission of our GHG inventory. Concerning the comment by the Reviewers of the Synthesis Report that our NFAP did not "include a justification for the assumption to leave out the non-mandatory pools of mineral soils and litter, apart from a reference to the NIR" and the request that "once information is available, Hungary include in its NFAP information that explains this assumption", we provide some additional text in section 1.3 of the new submission, and confirm here that, due to lack of additional data since the latest NIRs, the assumptions and calculations use in the justification cannot be revisited.	**Addressed**

	SWD Recommendation	Response from Hungary	EC comments
Annex IV.B (e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Given the use of the dynamic area approach, provide a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since, at least, year 2000. Check and correct reference in Table 3 (page 21 in the NFAP of Hungary) to Table 6.5.1 in the NIR (2018 submission).	Due to an editing error, instead of Table 6.5.1 of our NIR, another table was included in our original submission. It is for this reason that incorrect and incomplete information was reported. The modified submission includes the correct table. The modified submission also includes a new table (Table 3 (b)) demonstrating the evolution of the area of managed forest land at annual time steps for the entire time series. It is clear from these tables that the area of managed forest (FL-FL) is calculated according to Equation (1) (already in our original submission) for the starting point of the projection (i.e., 2010).	**Not addressed** The area of Managed Forest Land is not consistent with the GHGI, submission 2020, for the inventory year 2009. Hungary does not apply a dynamic area approach.

	SWD Recommendation	Response from Hungary	EC comments
Annex IV.B(e-iii)	Provide additional information on dynamic age-related forest characteristics in the projection period. Provide clarification on the repetition of pattern in annual increment by species in the reference period as reported in Table 8 (page 37 of the NFAP of Hungary). Clarify how forest management practices are distributed by yield class, and with regards to L-FL.	Already the original submission provided information on how dynamic age-related forest characteristics were considered. The modified submission includes additional information on dynamic age-related forest characteristics in Annex II. This information includes pairs of the distributions of area and standing volume by species / species group for the start (i.e., 1 Jan 2010) and end (i.e., 31 Dec 2025) of the projection period and their analysis. Linkages between these variables, i.e., how they were calculated from the initial (historical) values over time are described by the algorithms used (see sections 2.1 and 2.7). Table 8 of the original submission included incorrect numbers due to an editing problem. The modified submission reports the correct numbers. We have added a detailed table in Annex I of the new submission with details by yield class, and text in section 2.5 (including a note of L-FL).	**Partially addressed** Hungary provides detailed information on the evolution (two time steps; 2010 and 2025) of area and volume of growing stock by species/species group depending on age class (see Annex II). Information previously reported in Table 8 about increment by species/species group was then corrected (see Table 13(b), p. 45). Hungary provides information on forest management practices disaggregated by yield class (see Annex I). Information on forest management practices in land converted to forest land is not provided.
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Table 16 of the original submission reported the total amount of wood harvested partitioned into various HWP categories and wood used for energy. In the modified submission, a new figure (Figure 13 (b)) is included in section 2.7.4 to also demonstrate the harvesting rates over	**Partially addressed** The information is fragmented. Hungary provides historical harvest disaggregated between energy and non-energy uses in Table 16, p. 50. HU provides aggregated numbers of total harvest, both historical and projected

	SWD Recommendation	Response from Hungary	EC comments
		time disaggregated between energy and non-energy uses for the RP. Finally, yet another new figure (Figure 22 (b)) has been added in section 3.2 of the new submission to also report on similar statistics for the projection period.	in Table 19, p. 81, and projected volume of HWP (solid use) in Figure 22(a), p. 81.

A.18. Malta

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 9 January 2020, Malta proposes a FRL of +37.6 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, without the carbon pool of harvested wood products (HWP). Malta published a Corrigendum[9] to the revised NFAP on 22 January 2020, correcting the sign of the FRL. For the delegated act, Malta's FRL was rounded to tonnes, and the final FRL laid out in the delegated act is -38 t CO_2e y^{-1}. The FRL is projected using an ad-hoc FRL model.

In general, Malta addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issues:

- There is a difference in the area reported for the FRL and the area in the GHGI. Malta 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 GHGI and estimated emissions and removals from land use categories as required for compliance with the LULUCF Regulation.
- There are currently no estimates for emissions and removals in the GHGI of Malta. Therefore, in principle, the estimate of living biomass is marked as an inconsistency, but will not be considered as such with a view to forthcoming emissions estimates by the Member State.
- Malta does not report emissions and removals on forest land remaining forest land, hence consistency with the GHGI could not be ensured. The European Commission notes that this inconsistency will be assessed at the time of compliance, and where necessary, be subject to a technical correction according to art 8(11).

The assessment concluded that the FRL of Malta is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Malta reasonable. Other issues will be corrected by Malta at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Malta's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 18. The carbon pools and other sources of GHG emissions included in Malta's FRL. The delegated act reflects the amendments made by Malta in the Corrigendum to the NFAP.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]	
	Revised NFAP	**Corrigendum and Delegated act**
Living above-ground biomass	-37.6	-37.6
Forest reference level	**+37.6**	**-38**(1)

(1) Mathematical rounding was used as the smallest unit considered in the delegated act is the tonne.

Foreseen technical corrections to the forest reference level of Malta

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the

[9] http://cdr.eionet.europa.eu/mt/eu/mmr/lulucf/envxibwdg/Corrigendum_to_Revised_NFAP_21012020.pdf

reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Malta:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025, Malta may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Malta does not include the carbon pool of dead wood, because it is currently not included in Malta's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.

Report on the assessment of the issues raised in the technical recommendations for Malta

The draft NFAP of Malta, submitted on 4 January 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Malta was +37.6 t CO_2e (HWP is not applicable). Following the assessment, the European Commission issued technical recommendations for Malta on two criteria of Annex IV, Section A and one element of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Malta and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Malta after the submission of the revised NFAP.

	SWD Recommendation	**Response from Malta**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Identified and presented in Section 1.3, p. 6-7 Several afforestation projects were announced in the months of summer 2019 that are aimed to enhancing the potential removals and lead to its long-term development of its few forest sinks, as well as continue the sustainable forest management practices of existing woodlands and future plantations. The upcoming projects are described in detail in Section 1.3. Moreover, further information is presented in Section 1.3 with reference to Malta's Sustainable Development vision for 2050 indicating the aims and objectives for Maltese biodiversity for future years, to support further addressing the recommendation on Annex IV, Section A Criteria a.	**Partially addressed** Note that the page reference should be 3-4. Qualitative discussion added to describe future afforestation projects (p. 3-4). Quantitative information not provided.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i).		**Partially addressed** See Annex IV.B(e-i).

	SWD Recommendation	Response from Malta	EC comments
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	Technical recommendations on Annex IV, Section A criteria h) and Annex IV Section B element e) i reflects the provision of the area data of forest management considered in the NFAP for the establishment of the FRL in consistency with the areas present in the GHGI. As already stated, the updates to be made in the GHGI to reflect these recommendations will be present in future submission noting the extent of the updates to be performed	**Partially addressed** In 2020 GHGI, MT reports 72 ha FLrFL for the year 2010. For the FRL, MT considers 40.89 ha (Table 4), leaving the Mizieb area aside because "no information was provided" (p. 29). In light of improving GHG reporting and estimations of forest areas, this solution is considered acceptable for MT.
	Assure consistency between forest areas reported in Tables 2 and 15 of the NFAP.	Section 3.2.1 page 32-33: small textual update in last paragraph of page 32 Section 3.2.1 page 35: Addition of Table 4	**Addressed** The text update is found on p. 29-30.

A.19. Netherlands

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 18 December 2019, the Netherlands proposes a FRL of -1 531 397 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using the EFISCEN Space model.

In general, the Netherlands addressed or partially addressed all the recommendations. However, the European Commission notes the following aspects:

- The Netherlands does not include emissions from biomass burning in the FRL.

The assessment concluded that the FRL of the Netherlands is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by the Netherlands reasonable. Minor issues will be corrected by the Netherlands at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

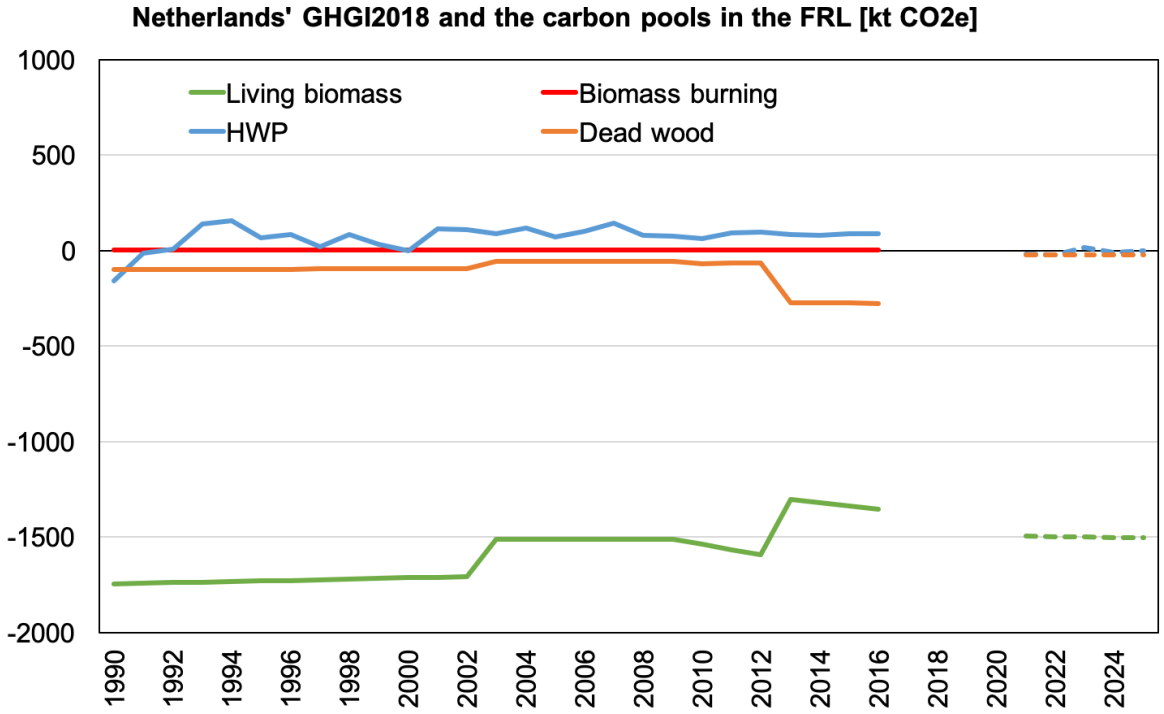
The following table presents an overview of the carbon pools included in the Netherlands' FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 19. The carbon pools and other sources of GHG emissions included in the Netherlands' FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Living biomass	-1 501 000
Deadwood	-23 600
Harvested Wood Products (HWP)	-7 000
Total without HWP	**-1 524 600 (1)**
Forest reference level, incl. HWP	**-1 531 600 (1)**

(1) Corrections apply because of rounding adjustment and truncation of numbers reported in the revised NFAP. However, these corrections are considered negligible and thus not reflected in the final FRL value of the Netherlands, as reported in SWD (2020) 236.

Figure 18. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Netherlands

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for the Netherlands:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Netherlands may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- The FRL of Netherlands does not include CO_2 and non-CO_2 emissions from biomass burning, creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for the Netherlands

The draft NFAP of the Netherlands, submitted on 28 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for the Netherlands was -1 531 397 t CO_2e (-1 524 424 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for the Netherlands on 4 criteria of Annex IV, Section A and 4 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by the Netherlands and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by the Netherlands after the submission of the revised NFAP.

	SWD Recommendation	**Response from the Netherlands**	**EC comment**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	In sections 1.2 (part on criterion a) and 2.3.1 we provide more information on the policy developments in the Netherlands related to the recently concluded National Climate Agreement, the national Climate Act and the Climate Plan that need to be developed. In its Climate Plan and consequently the long-term strategy Netherlands aims at reducing emissions by 95% by 2050. Increasing removals in the land-use sector are an important component of this strategy. The agreed set of measures aim at preventing deforestation, increasing carbon removals in existing systems and expansion of forests and trees outside forests. Practical climate smart forest management principles aiming at increasing removals by managed forest land are being tested in a number of pilots. Eventually, depending on the outcomes, these pilots will be further scaled up. [Section 1.2, page 13 and Section 2.3.1, page 21.]	**Partially addressed** The Netherlands provides extensive explanations on climate strategies for mitigation in the forest sector (p. 13-14), and a comparison among the two studies used respectively for FRL (NFAP) and Regulation 2018/1999 (p. 16). The comparison among these two sources is provided in Figure 1.1, but only refers to the period 2021-2025.
Annex IV.A(e)	Demonstrate how harvest statistics, information from the forest inventory, the ratio between energy and solid biomass use	Appendix 2 provided detailed information on how harvest statistics and information from forest inventories were used to calculate HWP effects. In section 1.2 (part on criterion e) we have now provided a summary on how harvest information	**Addressed**

	SWD Recommendation	Response from the Netherlands	EC comment
	and HWP projection were considered in elaborating the NFAP.	from forest inventories and harvest statistics are used. The full description is still provided in Appendix 2. Also in section 1.2 (part on criterion e) we have now provided information on the calculation of the ratio of energy and solid biomass use of wood. Table A2.2. in Appendix 2 now provides the used values for production, import and export for the various HWP categories. [Section 1.2, Page 14. Appendix 2, page 67.]	
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	In section 1.2 (part on criterion g) we have detailed how the FRL is only partly consistent with the submitted projections under regulation (EU) No 525/2013 up to 2019, but will be consistent with forthcoming similar projections as required under the governance regulation. [Section 1.2, page 15.]	**Addressed**
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i).	In section 1.2 (part on criterion h) we now explicitly provide the area of Managed Forest Land and relate this to the area of Forest Land remaining Forest Land as provided in the NIR2018. [Section 1.2, page 17.]	**Addressed**
Annex IV.B(c)	Provide a justification for allocating 100% of "unknown management objective" to category "multifunctional"	We have added further explanation in section 3.2.3. When no subsidy scheme is present the management objectives are unknown. Because only in case of a Nature subsidy scheme there are legal restrictions on the harvest, for cases without a subsidy scheme and hence unknown management objective, a multifunctional objective is assumed. This also is the most common management objective in Netherlands. We additionally corrected the final classifications in rows 5 and 12 of Table 3.2. This had no influence	**Addressed**

	SWD Recommendation	Response from the Netherlands	EC comment
		on the projections because the classifications were applied correctly in the analysis. [Section 3.2.3, page 31.]	
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection	In section 1.2 (part on criterion h) we now explicitly provide the area of Managed Forest Land and relate this to the area of Forest Land remaining Forest Land as provided in the NIR2018. In section 3.1.2 the area was correct, but referred to the wrong starting date. This was corrected to 1 January 2009 instead of end of 2009. This is consistent with the area from Table 4.A. from the 2018 GHG inventory using the year preceding the starting point of the projection (i.e. 2008). [Section 3.1.2, page 28]	**Addressed**
Annex IV.B(e-iii)	Provide additional information on age-class structure and rotation length. Correct editorial changes such as in Table 3.2	We have added section 3.3.2 with information on size (age related) class structure of the starting situation based on data from the NFI6 for transparency reasons. The EFISCEN space model that we use for age dependent projections of forest structure, however, uses diameter classes, not age classes. [Section 3.3.3, page 38.] Also the age dependent projections of forest structure and forest management practices are based on actual harvesting probabilities as derived from the National Forest Inventories. In section 3.3.5 we have now explicitly explained that the modelling approach does not include specific rotation lengths. Moreover, we have also explained why this is consistent with practice in Dutch forests. For a long time wood harvesting in Dutch forests was usually limited to thinnings and small group fellings without prescribed rotation lengths.	**Addressed**

	SWD Recommendation	Response from the Netherlands	EC comment
		Only more recently also larger regeneration fellings are applied, but since these have been highly criticised in public opinion, this practice was abandoned again. The modelling approach that is used in the EFISCEN space model is consistent with this practice. Harvesting is implemented as the removal of a certain fraction of trees of a certain species in a certain diameter class, where the annual harvesting probabilities were derived from NFI data. As a result neither information on rotation length is needed as an input, nor will it be possible to provide information on rotation lengths from the model output. [Section 3.3.5, page 45.]	
Annex IV.B(e-iv)	Provide explicit information on allocation of future harvest to specific HWP categories. Provide information on import and export of HWP	We have included a description in the allocation in section 3.3.10 and provide the information on production, import and export in Table A2.2 in Appendix 2. [Section 3.3.10, page 51 and Appendix 2, page 72.]	**Addressed**

A.20. Austria

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 19 December 2019, Austria proposes a FRL of -4 533 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected with the same methodology as in the GHGI of Austria for the LULUCF sector, using the CALDIS-VB V0.1 model.

In general, Austria addressed all the recommendations. However, the European Commission notes that:

- Austria does not include CH_4 and N_2O emissions from biomass burning in the FRL.
- Austria does not ensure consistency between GHGI and the FRL for litter and soil. However it is noted in the NFAP that the complete historic time series of the GHGI for litter and soil will be recalculated with the Yasso**15** version following the same approach used for the FRL.

The assessment concluded that the NFAP of Austria is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Austria reasonable. Other issues will be corrected by Austria at the end of the compliance period.

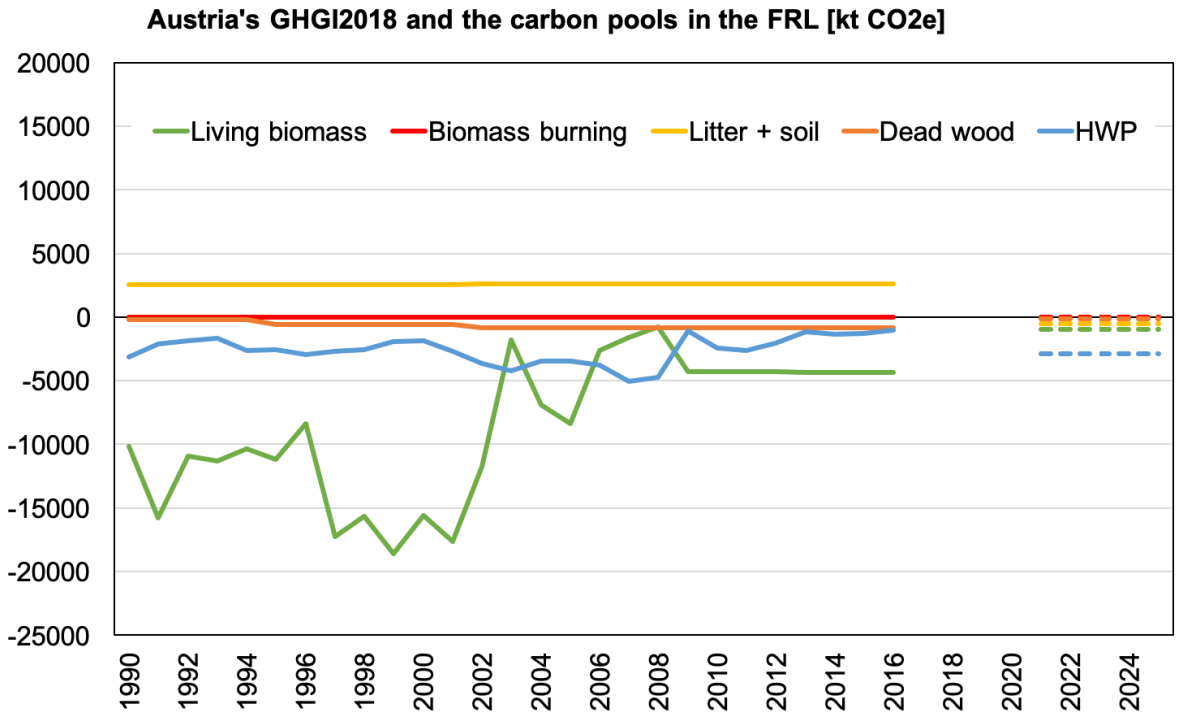
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Austria's proposed FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 20. The carbon pools and other sources of GHG emissions included in Austria's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**
Above-ground biomass	-1 149 000
Below-ground biomass	+207 000
Litter + soil carbon	-548 000
Dead wood	-169 000
Harvested wood products	-2 874 000
Forest fires	+270
Total without HWP	**-1 659 000**
Forest reference level, incl. HWP	**-4 533 000**

Figure 19. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Austria

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical corrections to the FRL are foreseen for Austria:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025, Austria may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The FRL of Austria does not include CH_4 and N_2O emissions from biomass burning creating an inconsistency between the FRL and the GHGI reporting. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.
- Austria will need to ensure consistency between the GHGI and the FRL with regard to methodological consistency for estimates of litter and soil before the compliance check.

Report on the assessment of the issues raised in the technical recommendations for Austria

The draft NFAP of Austria, submitted on 26 March 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Austria was -4 663 000 t CO_2e (-1 467 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Austria on three criteria of Annex IV, Section A and five elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Austria and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Austria after the submission of the revised NFAP.

	SWD recommendation	**Response from Austria**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Additional information of the development of the Forest Land and HWP sink in Austria until 2050 and beyond on basis of a recently finished modelling project was included in section 2.3.2.	**Addressed** See p. 13-16 and Fig 1
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Quantitative information on the Forest Land and HWP sink in the FRL period on basis of the Austrian projections under Regulation (EU) No 525/2013 and submitted in 2019 was added in chapter 1.2 and the reasons for the differences between projections under Regulation (EU) No 525/2013 and FRL projections were more thoroughly explained.	**Addressed** See p. 7-8

Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e)- i. Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period. Noting the limited information given in the NFAP concerning the interlinked models used to develop the FRL (CALDIS-VB V0.1, YASSO and HWP models), it is recommended that Austria uses consistent models and provides additional information to demonstrate how such models are able to reproduce historical national GHG inventory data for the reference period 2000-2009.	The FRL for this NFAP submission was calculated for a constant area of Managed Forest Land as reported in the Austrian GHG inventory (submission 2018) for the year 2009. The approach and details are described in detail in chapter 3.1 and this is mentioned at several other places of chapters 3 and 4. For the first NFAP submission of Austria the FRL was estimated for total Forest Land including the deforestation harvest in the year of conversion. This is the way the Austrian NFI assesses the stocks and stock changes in the Austrian Forests. It was indicated in Austria's first NFAP that revisions of the FRL will be needed to adjust for the future C stock changes of Afforested land and deforestation harvest as well as for the development of the area of Managed Forest Land. In the review and related documents Austria was asked to calculate the FRL for the area of Managed Forest Land only. The FRL estimate for this second submission of the NFAP was adjusted accordingly. This change (and further reasons explained under other points of this explanatory note) leads to different FRLs as in the first submission of the NFAP. The review by the Expert Group addressed with a question a slight step of increase in the increment from the GHG inventory results for the year 2009 to the first modelled year 2010 as a potential inconsistency between measured and modelled results. We revisited therefore the modelled results for the FRL of the first version of the Austrian NFAP and decided to adjust the model so that it perfectly matches the increment in the historic reference period (this adjustment caused a slight decrease of the modelled deciduous increment and a slight increase of the modelled coniferous increment). Increment has an impact on drain because the trees reach dimensions of harvest at a different point of time. Drain itself has an impact on the HWP production. And, different increment and drain lead to different developments of the biomass stocks and mortality which are influencing the C flux to the soil. As a consequence increment as well as drain, dead wood stock changes, soil C stock changes and HWP stock changes were recalculated for the whole time series until 2030 for this submission of the revised NFAP. This re-estimate (and further reasons explained under other points of this explanatory note) leads to different FRLs as in the first submission of the NFAP.	**Partially addressed** (see p. 17): The FRL was estimated for a constant area of Managed Forest Land as in 2009 which represented 3.822 Mio ha (subcategory 4.A.1 "Forest land remaining forest land", Austria's GHG submission in 2018). However, consistent with the Austrian GHGI, GHG emissions and removals were calculated for the Managed Forest Land 0f the forests-in-yield only (3.307 Mio ha in 2009). So far, only for these forests carbon stock changes are reported in the Austrian GHGI. A direct comparison with historical data from GHGI (2018) is missing, but detailed comparisons between model's output and NFI+GHGI data are reported for standing stock, total annual increment, total drain and dead wood standing stock, below- and above-ground biomass. (see section 4, p. 38). Based on these information, we may note that the DW C stock change estimated by model, as reported in Fig 22 (p. 46) is not fully consistent with GHGI data. Additional information on the interlinked between different model used to develop the FRL, including Yasso model, are reported in section 3.3 (p. 28) and 4.1.4 (p. 46). Austria does not ensure consistency between GHGI and the FRL for litter and soil because a different version of the Yasso model was used. However it is

	SWD recommendation	Response from Austria	EC comments
		Additional information and evidence by quantitative comparison was provided to give evidence that the model outputs perfectly match the historical data in the reference period from the national NFI and GHG inventory and that they also fit very well to the measured intermediate results by the currently running NFI for the period after the reference period. In addition, the comparison is provided for the stemwood results in m3 and for the total tree results in t CO2. A comparison of model results by model version Yasso07 (used for the GHG inventory) and the successor version Yasso15 was provided which shows that the use of these two versions lead to comparable results. The listed additional information is provided at various parts of chapters 3 and 4.	noted in the NFAP, that the complete historic time series of the GHGI for litter and soil will be recalculated with the Yasso15 version following the same approach used for the FRL.
Annex IV.B(b)	Assure consistency for the starting point of projections for all carbon pools, including the HWP pool.	The HWP C stock changes of the first NFAP submission were the only modelled results which started at a different year than the biomass, dead wood, litter and soil C stock changes. Therefore, the HWP projections for this NFAP submission were recalculated to start consistent with the other pools in the year 2010. This re-estimate (and further reasons explained under other points of this explanatory note) leads to different FRLs for HWPs as in the first submission of the NFAP.	**Addressed** See p. 35 – 37
Annex IV.B(d)	Provide a table on harvest intensity, for the reference period and as applied for the projection, disaggregated by forest type, growth regions or equivalent.	This table of harvest intensity in the reference period and in the projection period is provided in the same disaggregation as for the Austrian GHG inventory in coniferous and deciduous share in chapter 4.	**Addressed** See p. 41, Table 6

	SWD recommendation	Response from Austria	EC comments
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	See under 1.3 above	**Addressed** The FRL was estimated for a constant area of Managed Forest Land as in 2009 which represented 3.822 Mio ha (subcategory 4.A.1 "Forest land remaining forest land", Austria's GHG submission in 2018). However, consistent with the Austrian GHGI, GHG emissions and removals were calculated for the Managed Forest Land of the forests-in-yield only (3.307 Mio ha in 2009). So far, only for these forests carbon stock changes are reported in the Austrian GHGI.
Annex IV.B(e-iii)	Provide additional information on rotation length.	In the Review by the Expert Group as well as in the consultations with EC it was explained that the Austrian NFI does not provide information for rotation length and that the model for harvest used for the Austrian NFI does not model harvest on basis of rotation length but on basis of various other parameters (as in other countries like in Switzerland and Netherlands). This was understood by the experts. Alternatively, Austria agreed to provide more details and information on the parameters which are used for modelling harvest and their correlation to harvest. Consequently, this version of the NFAP, chapter 3.2.1.2 includes several details and figures which show and explain the correlation of harvest to the input parameters for the harvest model.	**Addressed** See p. 20 - 27
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Chapter 3.3.3 and Table 5 of the revised NFAP includes this information.	Addressed See p. 36

A.21. Poland

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission in 17 January 2020, Poland proposes a FRL of -27 888 000 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). Poland published a Corrigendum and Addendum to the revised NFAP[10] on 11 August 2020, which corrects clerical errors in the English courtesy translation of the NFAP and in the Polish version of the NFAP, and provides additional information on the development of the area and volume of different forest age classes. Also, the contribution of the living biomass pool was reported incorrectly in the revised NFAP, and corrected in the Corrigendum and Addendum. These corrections did not alter the FRL proposed in the revised NFAP. However, due to issues identified in the revised NFAP, Poland's FRL was recalculated for the delegated act. The final FRL in the delegated act is -28 400 000 tonnes $CO_2e\ y^{-1}$. The FRL is projected using the CBM-CFS3 model.

In general, Poland addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issues:

- The FRL proposed by Poland includes the carbon pools of dead wood and litter, but those pools are not reported in GHGI2019. This discrepancy leads to an inconsistency between the FRL and the GHGI.
- The estimate for removals by the mineral soils is ten times smaller in the FRL than in the GHGI, indicating a notable methodological inconsistency.

The assessment concluded that the inconsistency between the FRL proposed by Poland and the GHGI submission 2019 with regard to carbon pools does not comply with the requirements of Article 8(5) and Annex IV.A(h). For this reason, the European Commission recalculated the FRL proposed by Poland to ensure consistency of carbon pools and greenhouse gases with GHGI through setting the net emissions from mineral soils to correspond to the average net emissions of the reference period, and to remove the dead wood and litter pools from the FRL, in line with Poland's GHGI reporting (see SWD (2020) 236). Furthermore, the Commission has reservations towards the methodology used to determine harvest rate in the reference period, as detailed in the assessment table (see Art. 8(5)1) below. However, the choice by Poland was concluded to be within the legal boundaries of the Regulation.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Poland's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e. The values are provided as reported in the revised NFAP, the Corrigendum and Addendum submitted by Poland, and as considered in the FRL for the delegated act.

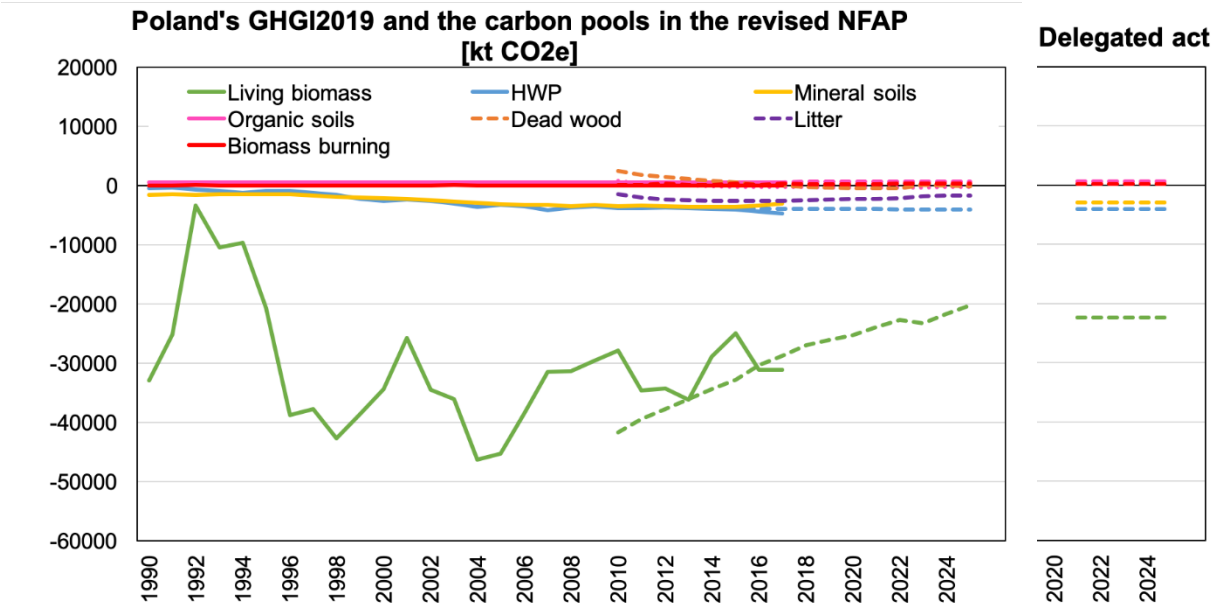
[10] https://www.gov.pl/web/srodowisko/krajowy-plan-rozliczen-dla-lesnictwa

Table 21. The carbon pools and other sources of GHG emissions included in Poland's FRL. The delegated act reflects the amendments made by Poland in the Corrigendum and Addendum to the NFAP, and the corrections made by the Commission in Recalculation of Poland's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]**		
	Revised NFAP	**Corrigendum and Addendum**	**Delegated act**
Biomass	-24 783 000	-22 402 000[(1)]	-22 402 000
Deadwood	-186 000	-186 000	--
Litter	-1 906 000	-1 906 000	--
Mineral SOC	-289 000	-289 000	-2 892 000
Organic soils	+638 000	+638 000	+638 000
Fire	+272 000	+272 000	+272 000
Harvested Wood Products (HWP)	-4 016 000	-4 016 000	-4 016 000
Total without HWP	**-23 872 000**	**-23 872 000**	**-24 384 000**
Forest reference level, incl. HWP	**-27 888 000**	**-27 888 000**	**-28 400 000**

[(1)] Biomass was reported incorrectly in the summary table in the revised NFAP. The correct value was provided in the Corrigendum and Addendum.

Figure 20. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), as projected for the FRL in the NFAP (dashed lines, left-hand side), and as included FRL in the delegated act (dashed lines, right-hand side). The projections of carbon pools in both diagrams reflect also the Corrigendum and Addendum submitted by Poland.



Foreseen technical corrections to the forest reference level of Poland

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Poland:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Poland may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841).
- The recalculated FRL of Poland does not include the carbon pool of dead wood, because it is currently not included in Poland's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, it will need to be reported in the future greenhouse gas inventories. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.

Report on the assessment of the issues raised in the technical recommendations for Poland

The draft NFAP of Poland, submitted on 18 January 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Poland was -29 433 000 t CO_2e (-24 612 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Poland on the principles of Article 8(5), four criteria of Annex IV, Section A and six elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Poland and technical comments by the European Commission. Technical comments by the European Commission are based on the English translation of Poland's NFAP (courtesy of Poland), and also consider the Corrigendum and Addendum released by Poland after the submission of the revised NFAP.

	SWD Recommendation	Response from Poland	EC comments
Art. 8(5)1	Demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, and revise the FRL if applicable.	In its NFAP, Poland applied the indicators related to forest management (species composition, age structure by age classes, felling age, harvesting intensity) for the historical period of 2000-2009. The quantified practices were maintained in the modeling after 2009. In addition, Poland adopted 2010 as the starting year for the stock development projection. Poland has also applied fixed parameters for the species composition of tree stands, the division of biomass for energy and non-energy purposes, and surface areas of managed forest land. According to Poland, all the conditions of the LULUCF Regulation concerning "continuation of the sustainable forest management practice documented between 2000 and 2009 in relation to the dynamic age-related forest characteristics of national forests using the best available data" have thus been met. Compliance with this principle is demonstrated in sections 2.3, 3, and 4 and Annex I of the NFAP.	**Addressed** Poland provides more detailed information in the revised NFAP and the Addendum and Corrigendum to the NFAP. The harvest rate in the FRL is determined by "intensity indicators", based on harvests in each age class compared to the growing stock. The parameter values for these indicators are derived based on the total harvest during the reference period 2000-2009 and the growing stock in 2000 (p. 7). The tables on the projected age class development provided in the Corrigendum and Addendum correspond to the reported intensity indicators derived from reference period data. However, we note that choosing the parameters from different points in time (harvests from the whole reference period, while growing stock from the start of the reference period) leads to a higher harvest rate in the FRL, compared to if both parameters were chosen based on the whole reference period. This choice may result in an inconsistent representation of harvest intensity as core element of documented management practices in the period 2000-2009. Nevertheless, based on the information reported in the NFAP, this choice is considered within the legal boundaries of the LULUCF Regulation.

	SWD Recommendation	Response from Poland	EC comments
Art. 8(5)2	Document the (quantitative) description of sustainable forest management practices for the period 2000-2009, detailing those parameters used as model input data, so as to demonstrate how dynamic age-related forest characteristics have been taken into account.	Two stratification groups have been introduced and described in detail. In the stratification groups, species and age composition was distinguished, together with forest management activities (felling and pre-felling cutting). The NFAP also describes the applied growth curves, the felling ages, and the growth rate. A changing structure of age classes in the CBM model is also demonstrated. Compliance with this principle is demonstrated in sections 2.3, 3, and 4 and Annex I of the NFAP.	**Addressed** The intensity indicators of final felling and pre-final cuts by age classes and subclasses are provided in Table 3, and described in section 2.3.2.2 of the NFAP. The English translation of the revised NFAP had clerical errors in the caption of Table 11, which have been corrected in the Corrigendum and Addendum.
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999	The LULUCF Regulation states: "the reference level shall be consistent with the goal of achieving a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, including enhancing the potential removals by ageing forest stocks that may otherwise show progressively declining sinks." Poland has met this criterion in the NFAP by demonstrating an increase in wood resources despite an increase in harvesting in the FRL scenario. There is no requirement in the LULUCF Regulation to provide data until at least 2050 as the criterion concerns the FRL itself, which ends in 2025, and does not concern the way to achieve a balance between emissions and removals in the second half of the century. The coherence of the FRL after this date cannot thus be demonstrated because the FRL after 2025 has not been calculated. Fulfillment of this criteria is demonstrated in section 1.2 of the NFAP.	**Not addressed** Poland discusses the general criteria for setting the FRL in section 1.2, and notes that long-term growth of forest carbon stocks make it possible that the FRL is consistent with the goal of achieving balance between anthropogenic emissions and removals in the second half of the century. However, no qualitative or quantitative information is provided beyond 2025.
Annex IV.A(e)	Clarify that the (constant) ratio between solid and energy use for forest biomass assumed in the modelling of the FRL is the value presented	Poland adopted a fixed ratio of solid biomass to biomass used for energy purposes based on the average from the period of 2000-2009. This information is contained in Tables 11 and 12.	**Addressed**

	SWD Recommendation	Response from Poland	EC comments
	in row 1 (2000-2009) of that Table 12.		
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Consistency between the FRL and the national projections made in accordance with Regulation (EU) 525/2013 has been demonstrated. The trends observed in data time series show consistency, both in terms of trend heights and trend patterns. This information is shown in Figure. 5.	**Addressed** See section 4.4, fig. 6.
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Demonstrate the consistency between the amount of harvest used as input to calculate the FRL and relevant historical data on harvest, including the reference period 2000-2009	The area of managed forest land used in the calculation of the FRL is consistent with the area included in the greenhouse gas inventory. In its NFAP, Poland applied the indicators related to forest management (species composition, age class structure, felling age, harvesting intensity) for the historical period of 2000-2009. The harvest data used in the calculation of the FRL are from the period of 2000-2009 and have been broken down into specific activities (felling and pre-felling cuts) for the two stratification groups. This information is contained in Tables 14, 16, and 17 and section 3.2.1 Modeling of carbon stock changes in forest ecosystems.	**Addressed** In the starting year of the FRL simulation, the managed forest land area is 8 664 kha. This corresponds to the area of forest land remaining forest land reported in the GHGI2019 for the year 2009 (the year preceding the starting year of the projection). There is a clerical error in Section 2.3.3 (p. 23) on forest area, which is corrected in the Corrigendum and Addendum.
Annex IV.B(b)	Noting the inclusion of additional carbon pools in the FRL, include those pools in the next submission of the national GHG inventory to ensure consistency between the FRL and the national GHG inventory.	This recommendation does not refer to the NFAP itself and is not a mandatory review element. Member States are required to maintain methodological consistency between successive inventories and this consistency will be maintained.	**Not addressed** The FRL proposed by Poland includes the carbon pools of dead wood and litter, but those pools are not reported in GHGI2019. This discrepancy leads to an inconsistency between the FRL and the GHGI. Furthermore, the estimate for removals by the mineral soils is ten times smaller in the FRL than in the GHGI, indicating a notable methodological inconsistency.

	SWD Recommendation	Response from Poland	EC comments
Annex IV.B(c)	Provide information on the age structure module, demonstrating age class transition from 2000 to 2020 and 2025 (e.g. in the structure of Table 15 in the NFAP).	More detailed data is presented in the NFAP and can be found in Fig. 2 and in section 3.2.1 Modeling of changes in carbon stocks in forest ecosystems.	**Addressed** Additional information provided in the Addendum/Corrigendum.
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	The area of managed forest land used in the calculation of the FRL is consistent with the area included in the greenhouse gas inventory. This information is included in section 2.3.3 Area of managed forest land.	**Addressed** The clerical error in the English translation is corrected in the Corrigendum and Addendum.
Annex IV.B(e-ii)	Clarify that HWP is estimated based on managed forest land only, assuming that the FRL is based on managed forest land only (thereby not including afforested land). Clarify any inconsistency between the estimates of HWP in the reference period as reported in the National Inventory Report 2018, under the Convention and KP, and those used for the FRL in the NFAP.	Poland has no data distinguishing between harvested wood products originating from the accounting category afforested land and managed forest land and, therefore, pursuant to Annex V of the LULUCF Regulation, harvested wood products are accounted for assuming that all emissions and removals occurred on managed forest land. This information is provided in section 3.2.2 Modeling of the evolution of emissions from harvested wood products.	**Addressed**
Annex IV.B(e-iii)	Provide information on increments, dynamic age characteristics and rotation length. Provide information about growth curves used in NFAP based on WISL (i.e. for each strata actually considered in the model) and	There is detailed information in the NFAP, in particular in Annex I, and can be also found in the following sections: 3.2.1 Modelling of changes in carbon stocks in forest ecosystems; 3.1.3 Documentation of sustainable forest management practices used in estimating the reference level for forests; and 2.3.2.1 Fraction of felling residues and bark.	**Partially addressed** Dynamic age-related characteristics (development of the forest age structure over time) is reported in figure 2 and in the tables provided in the Corrigendum and Addendum. Information on rotation lengths is missing (the plan refers to section 2.3.5, which refers to section 5,

	SWD Recommendation	Response from Poland	EC comments
	a reference for the bark fraction value applied for Poland and clarification what the "bark fraction" includes.	Information on growth curves is presented in Annex 1, section 3.2.1 Modelling of carbon stock changes in forest ecosystems and section 3.2 Detailed description of the modelling framework used for estimating the forest reference level. The conversion coefficients of volume "in bark" to volume "without bark" used in the Polish forestry practice are documented in the successive Forest Management Instructions. This information is presented in section 2.3.2.1 Fraction of felling residues and bark, and section 3.2.1 Modelling of carbon stock changes in forest ecosystems.	where no specific information is reported on this topic). Fig. 4 (p. 42) reports an overview of the increment (delta) of carbon stocks at national level, but specific data on increment evolution (in cubic meter) for the historical period and as estimated by the model, are missing. Detailed data on the growth curves applied by the model are reported in Annex 1, but model results for increment is only provided as a national average. More detailed information (e.g. disaggregation per strata or the increment's evolution over time) is not provided. Detailed information and reference to the bark fraction are reported in section 2.3.2.1
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Historical and future harvesting rates by energy and non-energy applications are presented in section 2.3.6 Historical and future harvest rates by energy and non-energy uses and section 5.2 Energy and non-energy harvest in the current scenario.	**Addressed**

A.22. Portugal

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 27 January 2020, Portugal proposes a FRL of -11 165 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using a simplified modelling approach.

Portugal addressed or partially addressed the majority of recommendations. The European Commission notes the following issues:

- Portugal demonstrates that the ratio between solid and energy use of wood remains constant in the FRL projection, but does not provide the numerical value of this ratio (Annex IV.A(e)).
- The information requested in the recommendations under Annex IV.A(h) is not reported completely and transparently; in particular, the area of Managed Forest Land used in the projection is not specified.

The assessment concluded that the FRL of Portugal is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. However, the European 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)). The European Commission notes that the transparency issues related to Annex IV.A(e) and Annex IV.A(h) in the revised NFAP do not have an impact on the FRL proposed by Portugal. The European Commission considers the FRL proposed by Portugal reasonable. Other issues will be corrected by Portugal at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

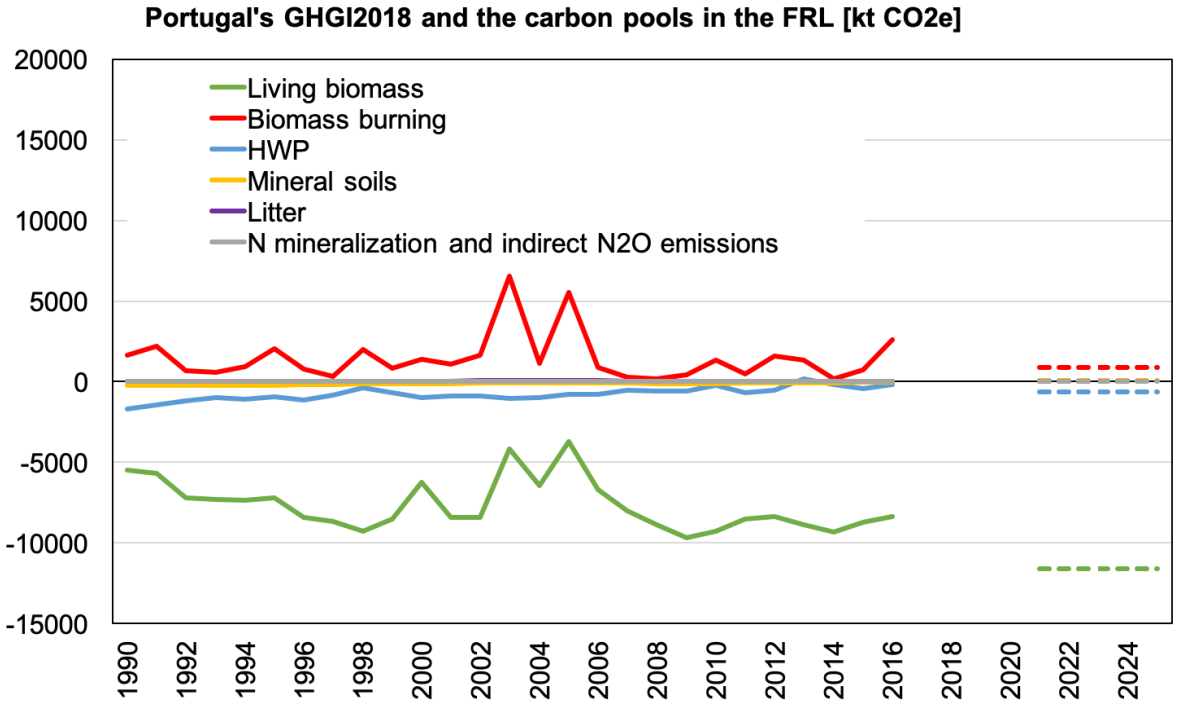
The following table presents an overview of the carbon pools included in Portugal's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 22. The carbon pools and other sources of GHG emissions included in Portugal's FRL.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]
Living biomass	-11 581 000
Deadwood	*Included elsewhere* [1]
Litter	+26 000
Mineral soils	+87 000
N inputs to managed soils – N_2O emissions	*Included elsewhere* [2]
N mineralization – N_2O emissions	+13 000
Indirect N_2O emissions	+2 000
Forest fires (CO_2, CH_4, N_2O emissions)	+897 000
Harvested Wood Products (HWP)	-609 000
Total without HWP	**-10 556 000**
Forest reference level, incl. HWP	**-11 165 000**

[1] included into biomass losses as harvest residues and dead trees from fires (p. 54).
[2] emissions reported in the agriculture sector (p. 62).

Figure 21. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines). Minor amounts of emissions from litter and mineral soils are reported in the GHGI and included in the FRL, but are not visible in the graph due to graph resolution.



Foreseen technical corrections to the forest reference level of Portugal

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Portugal:

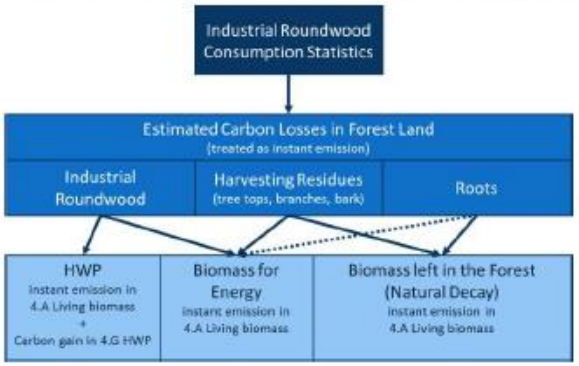
- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- The background level for natural disturbances now included in Portugal's FRL is based on the natural disturbances reported in 2001-2016. The background level will be updated using the full time series 2001-2020 before the natural disturbances provision (art 10 of the Regulation (EU) 2018/841) is used.

Report on the assessment of the issues raised in the technical recommendations for Portugal

The draft NFAP of Portugal, submitted on 6 March 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Portugal was -11 165 000 t CO_2e (-10 556 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Portugal on subparagraphs 1 and 2 of Art. 8(5), and on 6 criteria of Annex IV, Section A and 6 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Portugal and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Portugal after the submission of the revised NFAP.

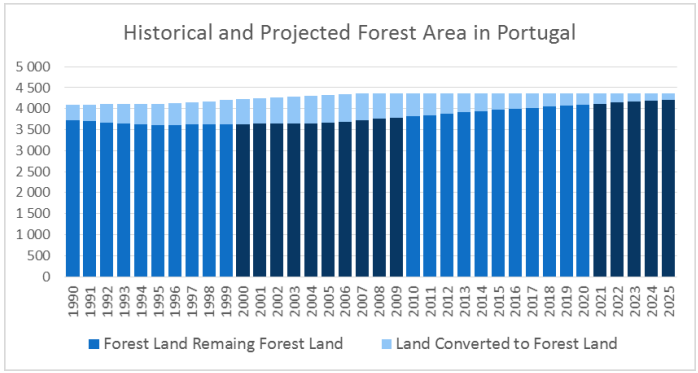
	SWD Recommendation	**Response from Portugal**	**EC comments**
Art. 8(5)1	Demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, and revise the FRL if applicable. Demonstrate how dynamic age-related forest characteristics have been taken into account and revise the FRL, if applicable.	A new section detailing the management objectives per forest stratum was added. Please refer to section 2.2 Forest management practices and context. These are considered to be the same as in the compliance period 2021-2025. The indicators used to ensure that the management intensity remains unchanged per emission source are presented in sections 3.3 to 3.14.	**Addressed** Portugal demonstrates that the approach used in the determination of the FRL ensures the continuation of forest management practices as for the period 2000-2009, because the same harvest intensities as documented in the historical period are used (see section 3.4; 46).
			Addressed Considering the contextualized impact of natural disturbances on forest structure, it is noted that Portugal could not robustly correlate the dynamics of forest characteristics to age, and therefore the approach adopted is considered acceptable. See also comments to Article 8(5)2.
Art. 8(5)2	If no dynamic age characteristics were used, provide evidence that such information has no impact on	The text under section 3.2.7 Age Structure of Main Strata and Rotation Length was extensively revised, including the addition of quantitative data on age class structure. However, sections 2.2.1 to 2.2.8 explain	**Addressed** Portugal demonstrates that the projected forest carbon sink by 2050

	SWD Recommendation	Response from Portugal	EC comments
	the FRL and long term carbon sinks will be maintained or enhanced.	why age class structure is not considered a good predictor of Carbon Losses in the case of Portuguese Forests. Further, in Annex 1, text was added under Part A, point (g), containing data on projections from the Portuguese Long-Term Strategy on Carbon Neutrality of the Portuguese Economy by 2050, which shows that the long-term carbon sinks will be maintained or enhanced.	will be enhanced (see Table 55, p. 73). See also comments to Annex IV.A(a).
Annex IV.A(a)	Given the absence of age-related characteristics in the FRL modelling, demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Please refer to Annex 1, where text was added under Part A, point (g), containing data on projections from the Portuguese Long-Term Strategy on Carbon Neutrality of the Portuguese Economy by 2050, which shows that the long-term carbon sinks will be increased.	**Addressed** Portugal provides qualitative and quantitative information on achieving a balance between anthropogenic emissions and removals by 2050, through comparing alternative emissions scenarios, according to both Regulation 525/2013 and National Long Term GHG Development Strategy (see p. 70 and 71-74).
Annex IV.A(c)	Provide data on harvest for solid biofuel production, and clarify how wood removals are derived from the industrial roundwood statistics and thus how all harvests are included (i.e. wood removals, solid wood and wood for bioenergy) in the estimate of carbon stock change in the FRL.	A new section on the use of biomass for energy was added. Please refer to section 2.5 Forests and biomass for energy. In particular, Figure 23 (reproduced below) was added to clarify "how wood removals are derived from the industrial roundwood statistics".	**Addressed** Portugal provides data on wood removals, disaggregated in industrial roundwood and wood fuel in Figure 22, p. 28). In section 2.5.1 (p. 28) supported by Fig. 23 (p. 29), Portugal provides detailed explanation on how wood for energy is treated in the GHGI, and implicitly in the FRL determination.

	SWD Recommendation	Response from Portugal	EC comments
		Figure 23: Illustration on how Industrial Roundwood Statistics are used in the GHG In 	
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection. Evaluate whether the HWP pool needs to be recalculated (and subsequently, the FRL).	As explained in section 2.5, most all of the biomass used for energy results from forestry and industry wastes or by-products, and not from "wood removals" made specifically for that effect. However, and as explained in section "3.9 CRF 4.G Wood Use and Harvested Wood Products", the indicator used to "predict" the evolution of the HWP pool in the FRL period is the share of HWP/unit of industrial roundwood removed from the forests, which means that there is no change in how wood is used (i.e. how much biomass is used for HWP versus other uses) in the FRL period compared to the reference period.	**Not addressed** Portugal does not provide explicit ratios between solid and energy use of forest biomass.
Annex IV.A(f)	Confirm the information provided showing that the reference level is consistent with the objective of contributing to the conservation of biodiversity and the sustainable use of natural resources.	A new section "2.4 Forest Management and Biodiversity" has been inserted and the text on links between forest policy and biodiversity now provides more detail and provides these explanations.	**Addressed**

	SWD Recommendation	Response from Portugal	EC comments
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Please refer to Annex 1, where text was added under Part A, point (g), which provides these explanations.	**Addressed** See comments to Annex IV.A(a).
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Provide (numerical) information for the period 2010-2016 demonstrating that the modelling approach used to construct the FRL is comparable and consistent (i.e., showing	The FRL uses the GHG Inventory model, i.e., the same activity data, emission factors and data handling techniques. Hence there is a perfect match in historical data. As the projection for the FRL starts in 2017, this "perfect match" is valid also for the period 2010-2016.	**Not addressed** See comments to Annex IV.B(e-i). **Addressed** Based on the adopted approach (same activity data, methodologies, conversion factors and emissions factors), it is deduced that the NFAP matches the GHGI in the period 2000-2016 (p. 65).

	SWD Recommendation	Response from Portugal	EC comments
	justified differences) with the national GHG inventory.		**Not addressed** Portugal reports disaggregated estimates of annual GHG emissions and removals by pool for the period 2000-2009, but does not show numerical information for the period 2010-2016.
Annex IV.B(c)	Explain how the requirement to consider age-class dynamic is considered in the applied approaches, methods and models, and provide explicit information on forest management practices including references to data sources and background information, used for expert judgements cited in the NFAP.	A new section "2.2 Forest management practices and context" was added providing information on the most common management practices in each forest stratum. Section "3.2.7 Age Structure of Main Strata and Rotation Length" was redrafted to include quantitative information on age class distribution in each forest stratum, but also to explain further why age class is not considered a good predictor of future carbon losses in Portugal.	**Partially addressed** Portugal provides extensive information in section 3.2.7 (p. 39) supporting the statement: "…age class is not considered a good proxy for estimating future carbon losses" (p. 39). Portugal also reports background information on FMP by main species in section 2.2, p. 9). Portugal does not provide additional information on expert judgment for "Other Wood Uses" (p. 50). See also comments to Article 8(5)2.
Annex IV.B(d)	Provide information on harvesting rates for at least one different policy scenario.	Please refer to Annex 1, where Table 56 was added under Part A, point (g), providing the harvesting rates considered in both the FRL and the Portuguese Long-Term Strategy RNC2050.	**Addressed**

	SWD Recommendation	Response from Portugal	EC comments
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Given the use of the dynamic area approach, provide a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since, at least, year 2000.	The area in the reference period and in the FRL area presented, respectively in Table 1and Table 2. For information only and to improve transparency the total area of "forest land" and the area of "land converted to forest" is also presented in Table 3 to Table 6, although these values are not used in the construction of the FRL. The full time series 1990-2016 and the projection for the years 2017-2025 is presented in the figure below. 	**Not addressed** Portugal does not provide the exact value of the area for Managed Forest land for 2016, i.e. the year preceding the start of the FRL projection (difficult to extrapolate the area value from Fig. on p. 79). **Addressed** Portugal provides detailed information on dynamic area calculation (see section 3.2.5, p. 36).
Annex IV.B(e-ii)	Clarify the estimation of HWP, the computation of GHG emissions and removals using the production approach and how double counting of harvest is avoided considering that different sources are used for estimating industrial harvest, salvage logging and information related to burned area and forest conversion.	As described in section "3.9 CRF 4.G Wood Use and Harvested Wood Products", HWP is estimated using the "production approach". The activity data for that estimation of HWP is only the harvest described in section "3.4.1 Harvesting for Industry". There is no double counting since the Carbon losses related to "Other Wood Uses", "Salvage Wood", "Forest Conversions" and "Natural Mortality" are all additional to the Carbon losses from "Harvesting for Industry".	**Addressed** Portugal provides extensive information on the calculation of emissions and removals in the HWP pool (see section 3.9, p. 58-61). Portugal also describes the diverse allocations of harvest depending on forest management practice (see section 3.4, p. 46).
Annex IV.B(e-iii)	Provide additional information on dynamic age-characteristics and rotation length.	This has been provided in section "3.2.7 Age Structure of Main Strata and Rotation Length". Additional data and information of forest	**Partially addressed** Portugal does not provide information on the development of

	SWD Recommendation	Response from Portugal	EC comments
		management practices per forest stratum can be found in the new sections 2.2.1 through 2.2.8.	age-related forest characteristics. However, considering the adopted approach, it is noted that Portugal could not directly correlate the forest dynamics with age (see also comments to Article 8(5)2). For the same reason, it is noted that Portugal could not define specific years for rotation length or additional age-based characteristics of forest management practices by stratum (see details in section 3.4, p. 46).
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Please refer to the explanations provided in the Technical recommendations on Annex IV, Section A Criteria, points c) and e).	**Partially addressed** Portugal only provides harvesting rates for HWP, corresponding to non-energy uses (see section 3.9, p. 58). It is therefore deduced that the counterpart over the total round wood is then used for energy purposes. See also comments to Annex IV.A(c) and Annex IV.A(e).

A.23. Romania

In its National Forestry Accounting Plan (NFAP) submitted to the European Commission on 13 December 2019, Romania proposes a FRL of -24 068 200 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using an ad hoc age-dynamic model.

In the NFAP submitted in December 2019, the European Commission notes the following issues:

- Romania does not include sufficient information on harvesting rates and on policy scenarios in the NFAP;
- Romania includes the dead wood pool in the FRL while it is not included in the GHGI;
- Romania does not ensure consistency with the GHGI for emissions from organic soil stock change, N_2O emissions from drainage and rewetting and non-CO_2 emissions related to biomass burning.

The assessment concluded that the FRL of Romania is mostly set according to the principles of article 8(5) and is of a reasonable quantitative value compared to the GHGI. There were a number of discrepancies between the pools and gases included in the FRL and those reported in the GHGI that are of a minor quantitative impact, but lead to a clear inconsistency that needs to be amended as a technical correction. There were also some criteria under Annex IV Part A of the Regulation (EU) 2018/841, and elements required under Annex IV Part B of the Regulation that are not transparently reported or are missing completely. As many issues stem from challenges with data availability or data reliability, the Commission urges Romania to improve its GHGI reporting for managed forest land, and to reflect the improvements in the FRL as technical corrections.

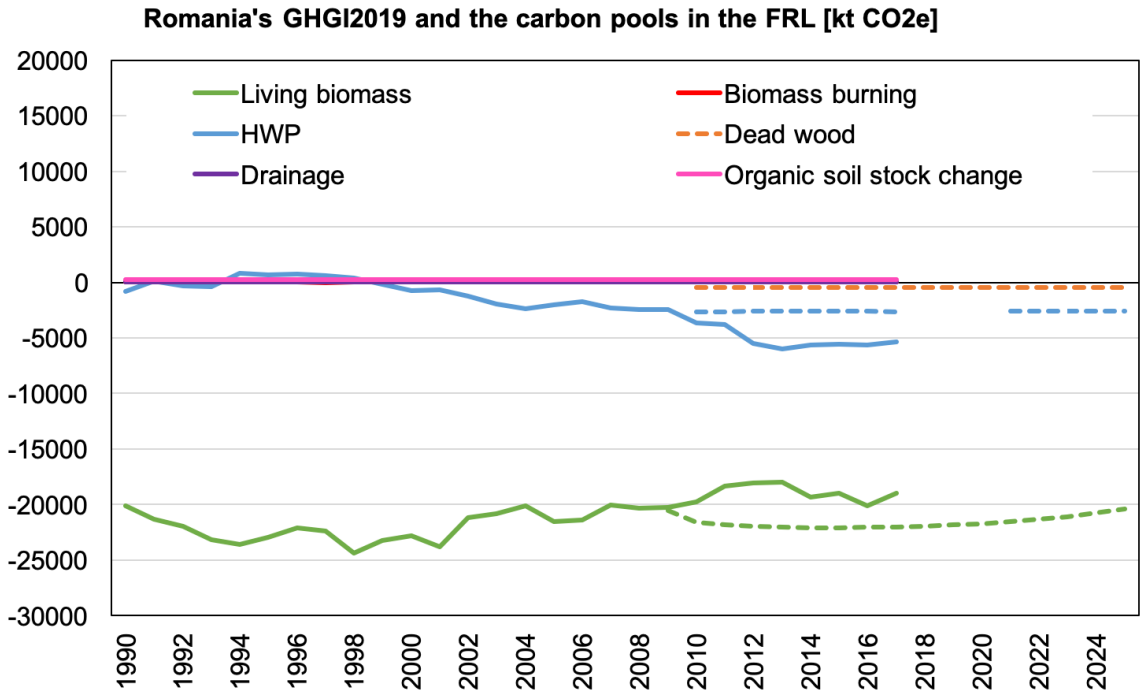
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Romania's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 23. The carbon pools and other sources of GHG emissions included in Romania's FRL.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]
Living biomass	-21 021 000
Dead wood	-454 600
Harvested wood products (HWP)	-2 592 600
Total without HWP	**-21 475 600**
Forest reference level, incl. HWP	**-24 068 200**

Figure 22. The carbon pools included in the FRL as reported in the GHGI (submission 2019, solid lines), and as projected for the FRL (dashed lines). The emissions from drainage are reported as a constant value of +26.8 kt CO_2e y^{-1} in 1990-2017; they are not clearly visible in the graph due to scale.



Foreseen technical corrections to the forest reference level of Romania

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Romania:

- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Romania may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- The FRL of Romania includes the carbon pool of dead wood, inconsistently with Romania's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841 consistently with GHGI, the carbon pool of dead wood will need to be reported in the future GHGIs. At the time of compliance, the consistency between FRL and GHGI must be ensured.
- The FRL of Romania does not include greenhouse gas emissions from organic soil stock change, N_2O emissions from drainage and rewetting, and CH_4 and N_2O emissions from biomass burning, creating an inconsistency between the FRL and the GHGI reporting. The contribution of these emissions to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the NFAP submitted by Romania

The table below details the technical comments by the European Commission on the NFAP submitted on 19 December 2019, with regards to the principles, criteria and elements of the Regulation (EU) 2018/841. Technical comments by the European Commission may also refer to updated or more detailed information released by Romania after the submission of the NFAP. No technical recommendations were issued for Romania in the *Assessment of the National Forestry Accounting Plans*, SWD (2019) 213 final, published on 18 June 2019, as no NFAP was received at that time.

	Regulation principle, criterion or element	**EC comments**
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. Forest reference levels as determined in accordance with the first subparagraph 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. 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.	The approach proposed by RO is based on the continuation of forest management practices, as detected within the RP and it takes into account age-related forest characteristics. Some concern, however, remain on the input data used by country (notably for determining harvest and increment). These aspects were also partially highlighted within the NFAP. See B(b) and B(c), below. See also comments on A(c) and p. 22 on NFAP, discussing reliability of input data, with particular attention to illegal logging.

	Regulation principle, criterion or element	EC comments
Annex IV.A(a)	The reference level shall be consistent with the goal of achieving a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, including enhancing the potential removals by ageing forest stocks that may otherwise show progressively declining sinks.	See p. 5 and Chapter 2.3, NFAP: Romania's carbon stock in Living Biomass on forest land (LB) have increased according to the last 3 forest inventories (Fig. 1 and Fig. 2). The vast majority of Romania's forests are between 40 and 80 years old (fig. 1), as a result of historical events (Marinescu et al., 2013; Nita et al., 2018; Olofsson et al., 2011), meaning that it is in the most productive age now. The increase of forest harvest in the last years is directly related to the forest increment, as it has been found to other areas in Europe (Levers et al., 2014) and the world (Brown et al., 2018). Even so, the harvest didn't exceed the increment and indeed the actual felling was lower than the planned felling." A description of long term forest strategy is reported on section 2.3
Annex IV.A(b)	The reference level shall ensure that the mere presence of carbon stocks is excluded from accounting.	See p. 6, NFAP: The proposed Romanian FRL takes into account the net changes in forest carbon stocks as only annual removals will reduce the atmospheric carbon. The mere presence of carbon stock was not taken into account when projecting FRL. The amount of C accumulated in forest soils in Romania according to both national forest inventories (2012, 2018), 158.2 t/ha, shows an equilibrium between inputs and outputs and hence this stock was not accounted. Available data do not confirm either reject an active role of litter pool in C sequestration in the Reference Period (RP) and thus they got apart from the accounting. In addition, the protected forest according to the management plans and also the ones located in the National parks where no intervention is allowed were removed from the accounting process.
Annex IV.A(c)	The reference level should ensure a robust and credible accounting system that ensures that emissions and removals resulting from biomass use are properly accounted for.	See p. 7, NFAP: The FRL estimation includes all emissions and removals from LB (aboveground biomass and belowground biomass), HWP (Harvested Wood Products) and DW (Deadwood). They are taken into account for projecting FRL in the first compliance period 2021-2025 assuming the continuity of Forest Management Practices (FMP) in the Reference Period.
Annex IV.A(d)	The reference level shall include the carbon pool of harvested wood products, thereby providing a comparison between assuming instantaneous oxidation and applying the first-order decay function and half-life values.	See p. 7 and Chapter 4, NFAP: The annual harvest was disaggregated into energy wood and HWP, which were subjected to the first-order decay function for the calculation of the carbon pool following Forsell et al., 2018. HWP were split into a) Sawnwood, b) Wood-panels and c) Paper and paperboard, as having clearly differentiated half-life values (IPCC, 2019)(IPCC 2013).The comparison between instant oxidation and first-order decay function of the HWP is covered in Chapter 4.

	Regulation principle, criterion or element	EC comments
Annex IV.A(e)	A constant ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 shall be assumed.'	See p. 8 and Table 1: A constant ratio between solid and energy use of forest biomass as documented in 2000-2009 period (equal to 0.47) was assumed. National consumption for energy and export was calculated for each of three HWP categories Sawnwood, Wood-based panels and Paper and paperboard. The average ratio for each category was then used in the commitment period 2021-2025. The HWP for exports were taken into account in the FRL for excluding a double counting problem.
Annex IV.A(f)	'The reference level should be consistent with the objective of contributing to the conservation of biodiversity and the sustainable use of natural resources, as set out in the EU forest strategy, Member States' national forest policies, and the EU biodiversity strategy.	See Chapter 2.3, NFAP
Annex IV.A(g)	'The reference level shall be consistent with the national projections of anthropogenic greenhouse gas emissions by sources and removals by sinks reported under Regulation (EU) No 525/2013.'	See p. 9, NFAP: Romania's projections reported under Regulation (EU) No 525/2013 consider all policies and measures undertaken at the national level (the EU ETS, the renewable energy target, the energy efficiency target, the promotion of clean an energy efficient road transport, etc.) as well as the GHG emission evolution established for non-EU ETS sectors. The projection built under the Regulation (EU) No 525/2013, which accounts for the whole LULUCF sector does not consider forest alone but the overall trend of FRL is in accord with it.
Annex IV.A (h)	'The reference level shall be consistent with greenhouse gas inventories and relevant historical data and shall be based on transparent, complete, consistent, comparable and accurate information. In particular, the model used to construct the reference level shall be able to reproduce historical data from the National Greenhouse Gas Inventory.'	The Romanian FRL includes the following carbon pools: Living Biomass, Deadwood, and Harvested Wood Products. According to the NFAP, FRL is based on the same definitions, methodologies and historical data as applied in the national GHGI. However, we note that DW is currently not reported for FLrFL within the GHGI 2019. Furthermore, Romania reports emissions from organic soil stock change, N2O emissions from drainage and rewetting and non-CO2 emissions related to biomass burning, which are not included in the FRL. This creates an inconsistency between the FRL and the GHGI that will need to be addressed before the compliance check. The model's output was calibrated against the GHGI 2019 (see Tab 18 p. 42), however, it is not fully clear which calibration factor was derived to calibrate the overall estimates provided for the FRL.

	Regulation principle, criterion or element	EC comments
Annex IV.B(a)	'A general description of the determination of the forest reference level and a description of how the criteria in this Regulation were taken into account.'	See Chapter 1 and chapter 3 NFAP
Annex IV.B(b)	'Identification of the carbon pools and greenhouse gases which have been included in the forest reference level, reasons for omitting a carbon pool from the forest reference level determination, and demonstration of the consistency between the carbon pools included in the forest reference level	See Chapter 2 NFAP
Annex IV.B(c)	'A description of approaches, methods and models, including quantitative information, used in the determination of the forest reference level, consistent with the most recently submitted national inventory report, and a description of documentary information on sustainable forest management practices and intensity as well as of adopted national policies.'	See Chapter 3, NFAP: Forest age structure, the available growing stock, the stocking level and the yield class for the reference period were reconstructed from 2008-2012 NFI data using a regressive model considering the NFI as the state of the forest in 2010 (starting year of the simulation). This inventory was assumed as the best available data on forest structure. The input data on harvest were obtained from the NFI and the MEWF. Harvest data were also stratified on the main species and group of species in Romania. Data input of volume harvested and the surface covered by each silvicultural system applied in Romania in the reference period was stratified in the same manner. Yield tables (Giurgiu & Draghiciu, 2004) are considered the best available data at the moment and hence the forest growth for each stratum was predicted using the functions under the official Romanian yield tables. Natural disturbances and illegal logging are taken into account at forest district level to correct harvested volume and forest stock. The FRL is estimated based on a modeling algorithm build in Python programming language. The model simulates the ageing process of the forest, forest growth and harvest. The length of the time-step of the simulation is one year. The model output is the area, LB volume, harvested volume and DW for the different silvicultural systems applied and each species group, the overall HWP were also computed. Detailed information of the modelling framework for each of the modules is described in section 3.3.

	Regulation principle, criterion or element	EC comments
Annex IV.B(d)	Information on how harvesting rates are expected to develop under different policy scenarios	See chapter 2.3.3 NFAP: Romania has not considered building future scenarios as the method used in the management plans to set the level of harvest adapts to the state of the forest condition
Annex IV.B(e-i)	i) the area under forest management	See chapter 3.2.1 NFAP (Table 9): the area of MFL used for building the FRL is equal to 6,639 kha, that is consistent with the FLrFL reported within the CRF Table 4.A for 2009
Annex IV.B(e-ii)	ii) emissions and removals from forests and harvested wood products as shown in greenhouse gas inventories and relevant historical data	Note that DW is currently not reported for FLrFL within the GHGI 2019 The Romanian FRL includes the following carbon pools: Living Biomass, Deadwood, and Harvested Wood Products. According to the NFAP, FRL is based on the same definitions, methodologies and historical data as applied in the national GHGI.
Annex IV.B(e-iii)	iii) forest characteristics, including dynamic age-related forest characteristics, increments, rotation length and other information on forest management activities under 'business as usual'	The NFAP report information on dynamic age-related forest characteristics, however, detailed information on increment, as reported by different data sources (i.e., from different NFIs or as estimated by model) are missing. This is quite important, considering the ongoing discussion on input data at country level. Information on forest management practices are reported on section 3.2.2, an overall description of forests is reported in chapter 2.3.2,
Annex IV.B(e-iv)	iv) historical and future harvesting rates disaggregated between energy and non-energy uses	See Table 15, p. 40 Detailed information on the expected amount of harvest within the compliance period are missing.

A.24. Slovenia

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 24 December 2019, Slovenia proposes a FRL of -3 270 000 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using a combination of linear modelling and GHGI parameters.

In general, Slovenia addressed or partially addressed the majority of recommendations. However, the European Commission notes the following issues:

- Slovenia does not provide robust demonstration that there is a continuation of forest management practices as documented in the period 2000-2009 (Article 8(5)1,2).
- Slovenia provides inconsistent information related to net CO_2 removals for living biomass between modelled and GHGI estimates for the years 2010-2012 (Annex IV.A(h)).
- Slovenia does not provide complete and transparent information related to the long-term development of the forest sinks (Annex IV.A(a)), and national policy projections (Annex IV.A(g)). The information provided on increments and modelling parameters by stratum is incomplete (Annex IV.B(e-iii)).
- Slovenia does not ensure consistency in forest definition between NFAP and GHGI (submission 2019).

The assessment concluded that the choices made in the FRL are on the borderline of following the principles of article 8(5) and some criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP of Slovenia has notable transparency issues related to some elements required under Annex IV Part B of the Regulation. Despite these issues, the European Commission considers the FRL proposed by Slovenia within the legal boundaries of the LULUCF Regulation. Additional issues will be corrected by Slovenia at the end of the compliance period.

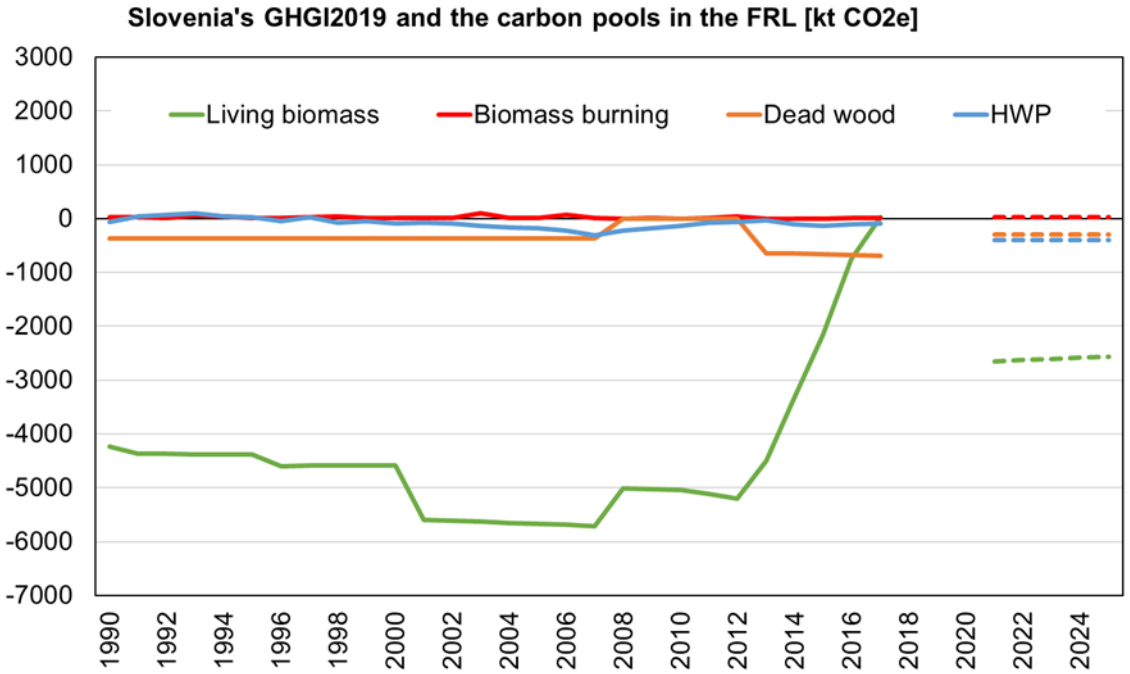
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Slovenia's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 24. The carbon pools and other sources of GHG emissions included in Slovenia's FRL.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]
Above-ground biomass	-2 119 000
Below-ground biomass	-486 000
Dead wood	-294 000
Harvested wood products	-394 000
Biomass burning	+22 000
Total without HWP	**-2 877 000**
Forest reference level, incl. HWP	**-3 270 000**

Figure 23. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Slovenia

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical corrections to the FRL are foreseen for Slovenia:

- The adopted forest definition is not consistent with the GHGI (submission 2019). The European Commission requests Slovenia to align the forest definition between Annex II and the GHGI 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 (see also SWD (2020) 236).
- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Slovenia may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- At the end of the period 2021-2025, Slovenia may correct the FRL by including the effects of climate in the modelling approach to simulate the evolution of forest carbon pools.

Report on the assessment of the issues raised in the technical recommendations for Slovenia

The draft NFAP of Slovenia, submitted on 31 December 2018 (translated thereafter to English by the EC), was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Slovenia was -2 582 720 t CO_2e. The FRL value assuming instantaneous oxidation of HWP was not provided explicitly in the draft NFAP. Following the assessment, the European Commission issued technical recommendations for Slovenia on the principles of article 8(5), 6 criteria of Annex IV, Section A and 7 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Slovenia and technical comments by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Slovenia after the submission of the revised NFAP.

	SWD recommendation	**Response from Slovenia**	**EC comments**
Art. 8(5)1	Demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, including private forests, and revise the FRL if applicable. Provide further information on whether the correction factor used to simulate harvest intensity is based on the continuation of forest management practices as documented in the reference period, and how this correction factor is incorporated in the determination of the FRL. Indicate if data outside the reference period (2000-2009) were used, and if so, provide a justification.	The FRL was recalculated without the correction factor, taking into account the total area of managed forest land (private and state forests). The forest management practices under business-as-usual (BAU) were redefined and elaborated as an average annual harvest ratio (in %) of the initial growing stock of the corresponding DBH classes in the period 2000-2009. The BAU ratios were determined for each forest management practice (FMP) and all forests for five DBH classes and separately for conifers, broadleaves and all tree species together. The average annual harvest ratio was developed based on the NFI data from the period 2007-2012 in combination with harvesting records from the Slovenian Forest Service for the period 2000-2009 structured by the five DBH classes, tree species and FMPs. Although the NFI was launched in 2000, the data on harvest, mortality and	**Partially addressed** It is not clear whether the forest management practices as documented in the period 2000-2009 in terms of harvest to growing stock ratio (i.e. harvest intensity) continue as such in the period 2021-2025. Indeed, it is noted that Slovenia uses harvest data from 2007-2012 (mid-year 2010), and defines harvest level based on growing stock in 2000. This choice may result in an inconsistent representation of harvest intensity as core element of documented management practices in the period 2000-2009. Nevertheless, based on the information reported in the NFAP, this choice is considered within the legal boundaries of the LULUCF Regulation. Slovenia includes private forests in the determination of the FRL in the revised NFAP.

	SWD recommendation	Response from Slovenia	EC comments
		increment for the period 2000-2007 were found to be biased because the NFI was subject to changes in methodology. As explained in Ch. 3.2.2 and 3.3, the best available data in the reference period are therefore the data between the 2007 and 2012 NFI.	**Addressed** Slovenia does not adopt correction factors and includes private forests in the determination of the FRL in the revised NFAP.
			Addressed It is noted that Slovenia provides robust justification of the use of data from a period which is partially outside the period 2000-2009 (p. 26). It is also acknowledged that Slovenia uses 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.
Art. 8(5)2	Clarify whether the correction factor is introduced to reflect the need not to unduly constrain forest management intensity. Ensure that the increase in harvest volumes projected in the FRL is in line with Art 8(5), reflecting the evolution of dynamic age-related forest characteristics, and revise the FRL if applicable.	The FRL was revised, and the correction factor, which was previously applied to balance DBH structure, was excluded from the calculation. The updated FRL takes into account the continuation of sustainable forest management practices in the period 2000-2009 and dynamic age-related forest characteristics (i.e. changes in DBH structure). Therefore, we believe that the increase in harvest volumes projected in the FRL of the 2019 NFAP is fully in line with Art 8(5).	**Partially addressed** Slovenia does not adopt correction factors in the revised NFAP. It is not clear whether the modelled harvest intensity in the period 2021-2025 robustly reflects the continuation of the same harvest intensity as documented in the period 2000-2009 with regards to age-related dynamics. See also comments to Article 8(5)1.
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second	The FRL projection for Slovenia shows that managed forest land will act as a net sink of CO2 emissions in the period 2021-2030 (see	**Partially addressed** Slovenia provides only qualitative information to argue that a balance

	SWD recommendation	Response from Slovenia	EC comments
	half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Figures 4 - 8 in the NFAP). This projection is based on the assumption that biomass growth will be larger than harvest, and no large-scale natural disturbances will occur in this period. However, it is expected that the sink in forests will temporarily decrease in the period after 2030 or even before in the case of the "high harvest" scenario, which assumes a harvest level of between 90% and 100% of the annual increment. The harvest intensity should be increased sooner or later in order to balance the age/diameter structure, ensure sufficient regeneration, sustain the yield and increase resilience against calamities in the long term. It is essential to reach the optimal diameter structure to achieve a balance between emissions and removals in the second half of the century. See more information in Ch. 1.2.1 of the revised NFAP.	between anthropogenic emissions and removals will be achieved by the half of the century (see section 1.2.1, p. 8).
Annex IV.A(c)	Ensure a robust and credible accounting system based on forest management practices documented in the reference period for all managed forest land and without the use of a correction factor.	The revised FRL takes into account the SFM practices of all managed forest land, including private forests, and does so without the use of a correction factor. The FRL construction is based on the same sources of emissions and removals as estimated in the GHG inventory for managed forest land, including biomass use. The latter refers to living biomass and dead wood as well as HWP, whereas the use of biomass for energy is calculated as instantaneous oxidation. These considerations will be consistently respected in the period 2021-2030, which will ensure a robust and credible accounting and environmental integrity.	**Partially addressed** It is not clear whether the harvest to growing stock ratios (i.e. harvest intensity) as used to determine the FRL ensure that all biomass removals are properly accounted for in the period 2021-2025. See also comments to Article 8(5)1.
Annex IV.A(d)	Provide a specific value for the HWP pool. Provide a comparison of the FRL between	The value of the HWP pool for the period 2021-2025 is provided in Table 1 of the	**Addressed**

	SWD recommendation	Response from Slovenia	EC comments
	assuming instantaneous oxidation and applying the first-order decay function and half-life values.	NFAP. The FRL value for the period 2021-2025 in the same table is specified including HWP and assuming instantaneous oxidation.	
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	The average ratio between solid and energy use of forest biomass as documented in the reference period was included in Table 10 of the NFAP. The average carbon inflow differentiated to HWP commodities in the period 2000-2009 is subsequently multiplied by the ratio between the modelled harvested volumes in the projection and the average harvest documented in the period between 2000 and 2009. The C input quantities in the carbon pool of HWP are proportionate to the increase/reduction in harvest throughout the entire period of the projection.	**Addressed** Slovenia provides the ratio between HWP and total harvest (0.22, see Table 10, p. 25). Slovenia shows that this ratio is maintained constant in the projection (see Table 5, p. 13).
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	To date, Slovenia has not estimated the GHG emissions and removals of the LULUCF sector as part of its national projections which are being reported under Regulation (EU) No 525/2013. In Ch. 1.2.1 of the NFAP, it is explained that the WEM projection was made for managed forest land in accordance with the reporting obligation under Decision No 529/2013/EU (Art. 10) and that the projection is consistent with the FRL.	**Partially addressed** Slovenia provides a very short explanation of the possible differences between national projections and the proposed FRL (p. 10).
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i). Estimate the FRL based on carbon pools and greenhouse gases as indicated in Annex IV, Part B (b).	The information on the area of managed forest land used in the calculation of the FRL was included in Ch. 1.2.2 of the NFAP and is consistent with that in Table 4.A, which is used as the area of "Forest land remaining forest land" in the latest national GHG inventory under the UNFCCC.	**Addressed** **Addressed**

	SWD recommendation	Response from Slovenia	EC comments
	Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory. Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period. In particular, provide explanation of the trends and data about harvest levels (Table 8 in the NFAP of Slovenia) and emissions and removals (Figure 7 in the NFAP of Slovenia), and reduce discrepancies between FRL projections and national GHG inventory estimates (Figure 7 in in the NFAP of Slovenia).	The following carbon pools and GHG emissions were included in the FRL: above-ground and belowground living biomass, dead wood, harvested wood products and emissions from biomass burning (wildfires) that occurred on managed forest land. The reasons why soil organic carbon and litter were not included in the FRL are explained in Ch. 2.1 of the NFAP. The ability of the model used to construct the FRL to reproduce historical data is demonstrated in Ch. 4.2. The model was able to reproduce historical growing stocks as observed in the 2000, 2007 and 2012 NFI as shown in Figure 9 of the NFAP. The consistency in the trend of net emissions between the model and historical data for the period 2000-2012 is shown in Figure 10 of the NFAP.	**Partially addressed** Slovenia shows that the model is able to reproduce historical estimates (National Forest Inventories) for growing stock in years and net CO_2 removals for living biomass in years 2000-2012 (Fig. 9 and 10, p. 33). However, it is also noted that Slovenia does not provide coherent information on the consistency about net CO_2 removals for living biomass between modelled and GHGI estimates for the years 2010-2012 (Fig. 4-5, p. 30-31 and Figure 10, p. 33).
Annex IV.B(a)	Provide a description of how the criteria of the Regulation were taken into account	An additional description of how the criteria of the LULUCF Regulation were taken into account was included in Ch. 1.2.1.	**Addressed**
Annex IV.B(b)	Include the greenhouse gases consistent with those applied in the latest national GHG inventory.	The greenhouse gases were considered consistently with those applied in the latest national GHG inventory. All greenhouse gases, such as CO2, CH4 and N2O, were taken into account in the construction of the FRL and are expressed in units of CO2 equivalent.	**Addressed**
Annex IV.B(d)	Provide information on harvesting rates for at least one different policy scenario.	Information on harvesting rates was included in Ch. 2.3.2 of the NFAP. Moreover, the development of the age/diameter structure of the forest in the period 2010-2050 under different policy scenarios is provided in Annex 2 of the NFAP.	**Addressed**
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest	Please see the comment under "h)", which refers to the same issue.	**Addressed**

	SWD recommendation	Response from Slovenia	EC comments
	national GHG inventory using the year preceding the starting point of the projection.		
Annex IV.B(e-ii)	Provide further information on historical and future HWP outflows.	Annual carbon outflows from the HWP pool are calculated using first order decay (FOD) and half-lives as defined in the LULUCF Regulation. Calculations of future emissions and removals originating from the HWP pool are consistent with the GHG inventory reporting, thus ensuring methodological consistency between the HWP contribution to the FRL and GHG HWP reporting. HWP carbon stocks are based on historical detailed data from 1900 onwards according to the best available real production data for the selected HWP commodities (sawnwood, WBP, pulp production). The concept of using historical datasets supports efforts to improve the accuracy of HWP carbon stock dynamics estimation. The historical and future HWP inflows as well as outflows were included in Annex III of the NFAP.	**Addressed**
Annex IV.B(e-iii)	Provide information on increments, rotation lengths and dynamic age-related characteristics. Provide further information on the use of forest management strata in the FRL, forest management practices, diameter class distribution, and harvest in privately owned forests. Check for consistency between Table 5 figures in the NFAP of Slovenia and the treatment of protected forests.	Further information was included in the NFAP, as follows: • increments (Ch. 1.2.2) • rotation lengths (Ch. 3.3.2, Table 8) • dynamic age-related characteristics (Annex 2) • use of forest management strata (Ch. 3.2.1, Table 7) • forest management practices (Ch. 3.2.2) • diameter class distribution (Figure 1) • harvest ratio and amount of all forests (Table 9, Annex 1)	**Partially addressed** Slovenia provides only limited information on increments in the reference period (Table 4, p. 12) and harvest, such as e.g. time series in cubic meters (Table 5, p. 13). Slovenia does not provide information on input parameters by stratum (Table 11, p. 26).

	SWD recommendation	Response from Slovenia	EC comments
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses.	Historical and future harvesting rates disaggregated between energy and non-energy are provided in Table 5 of the NFAP.	**Addressed**
Other issues noted by the EC. - Related to the EC comments to Annex IV.A(h), it is noted that the decreasing growing stock from GHGI after 2016 in Fig. 9, p. 33, mathematically would suggest a source, which is currently not reflected in both Fig. 4, p. 30 and Fig. 10, p. 33.			

A.25. Slovakia

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 13 January 2020, Slovakia proposes a FRL of -4 827 630 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected with the same methodology as in the GHGI of Slovakia for the LULUCF sector.

In general, Slovakia addressed or partially addressed all recommendations. However, the European Commission notes the following aspects:

- Slovakia does not include the dead wood pool in the FRL, consistently with the GHGI (submission 2018).
- Slovakia does not provide information on the development of age-related forest characteristics (Annex IV.B(e-iii)).
- Slovakia does not provide adequate information on the harvest rates disaggregated between solid and energy uses (Annex IV.B(e-iv)).

The assessment concluded that the FRL of Slovakia is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP mostly contains the elements required under Annex IV Part B of the Regulation. The European Commission notes that the transparency issues related to Annex IV.B(e-iii, e-iv) in the revised NFAP of Slovakia have no impact on the proposed FRL. The European Commission considers the FRL proposed by Slovakia reasonable. Other issues will be corrected by Slovakia at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Slovakia's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

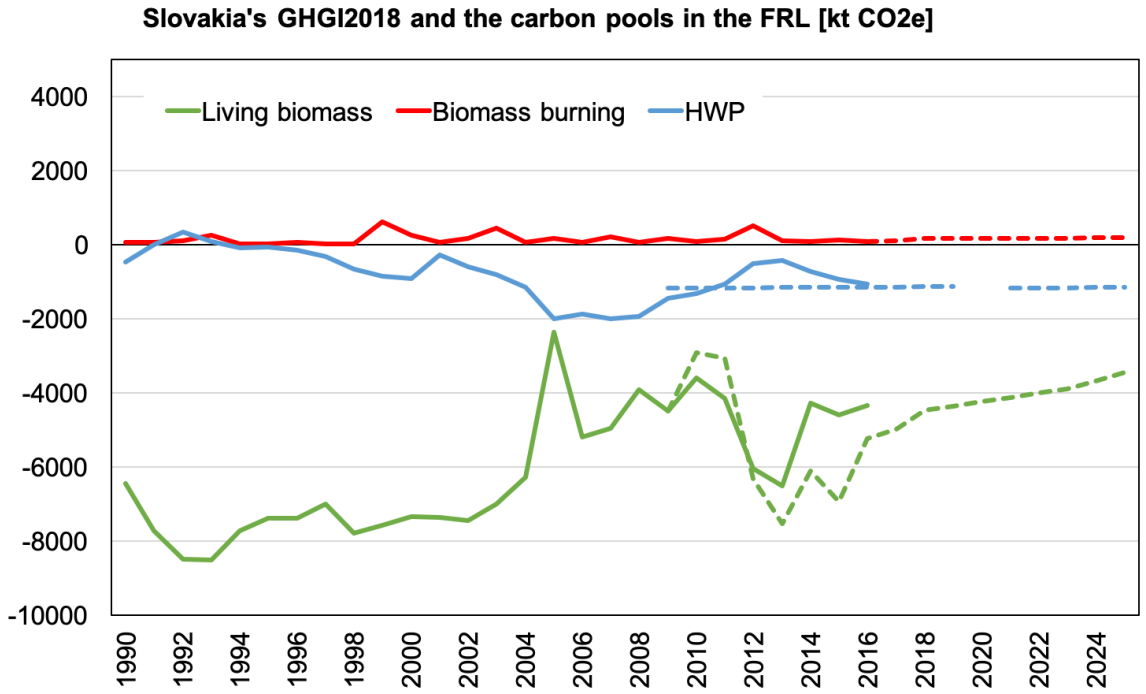
Table 25. The carbon pools and other sources of GHG emissions included in Slovakia's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**
Living biomass	*-3 836 486* [(1)]
Biomass burning	*+175 056* [(1)]
Harvested wood products	*-1 166 198* [(1)]
Total without HWP	**-4 827 628** [(2)]
Forest reference level, incl. HWP	**-3 661 430**

[(1)] Calculated average of annual values as reported in Table 4.4, p. 52 of the revised NFAP.

[(2)] Corrections apply because of rounding adjustment and truncation of numbers reported in the revised NFAP. However, these corrections are considered negligible and thus not reflected in the final FRL value of Slovakia as reported in SWD (2020) 236.

Figure 24. The carbon pools included in the FRL as reported in the GHGI (submission 2018; solid lines), and as projected for the FRL (dashed lines).



Foreseen technical corrections to the forest reference level of Slovakia

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical corrections to the FRL are foreseen for Slovakia:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Slovakia may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- The FRL of Slovakia does not include the carbon pool of dead wood, because it is currently not included in the Slovakia's GHGI. As dead wood is an obligatory carbon pool under the Regulation 2018/841, the carbon pool of dead wood will need to be reported in the future GHGIs. A technical correction to the FRL will need to be submitted accordingly, to add the contribution of the dead wood pool on the FRL.
- At the end of the period 2021-2025, Slovakia may correct the FRL by including the effects of climate in the modelling approach to simulate the evolution of forest carbon pools.

Report on the assessment of the issues raised in the technical recommendations for Slovakia

The draft NFAP of Slovakia, submitted on 20 March 2019 (incl. corrections to the first submission), was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. The corrected draft FRL proposal for Slovakia was -4 827 630 t CO_2e (-3 661 430 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Slovaki a on the principles of article 8(5), 4 criteria of Annex IV, Section A and 3 elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Slovakia and technical comments by the European Commission.

	SWD recommendation	**Response from Slovakia**	**EC comments**
Art. 8(5)1	Provide more detailed information on harvest rates in the compliance period. Describe more thoroughly forest management practices in a disaggregated way and in qualitative terms, describing different forest stands and forest functions.	To provide harvest rates applied in FRL simulation, table A.19 was included in Annex, containing projected values of growing stock available for wood supply, harvested volumes and resulting harvest rates in period 2010 - 2025. The forest management practices were thoroughly described in a disaggregated way and in qualitative terms were added to table 3.3. The description of principal functions of Slovak forests has been added also to chapter "2.3.1: Overall description of the forests and forest management in Slovakia and the adopted national policies" on page 17.	**Addressed**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	The goal of achieving a balance between anthropogenic emissions and removals will be achieved by using continuing sustainable forest management in the second half of the century. The Slovak longterm forest strategy is defined in the National Forest Programme of the Slovak Republic (NFP). Sustainable forest management is the basic principle of the NFP. It assumes development of an economic system on satisfying the societal requirements for nature-protective and other ecological and social functions of forests and forestry services. The policies that lead to those developments are provided in chapter "2.3: Description of the long-term forest strategy". The new Figure 1.1 was added in Chapter 1.2 to provide qualitative and quantitative information on the expected future emissions in the category Managed Forest Land until the year 2050.	**Addressed**
Annex IV.A(f)	Explain how biodiversity goals and in particular conservation of older forest stands are taken into account in constructing forest reference levels and	Explanation has been added to chapter 1.2, paragraph f), on pages 8-9: Requirements to ensure the conservation of biodiversity, including the conservation of old forests, are accepted in the forest	**Addressed**

	SWD recommendation	Response from Slovakia	EC comments
	past management practices. Describe how harvest levels are consistent with EU Nature & Biodiversity policies goals, in particular in National Parks, Nature Reserves, Nature 2000 sites, Sites of Community Interest, Special Protection Areas.	management plans (FMPs), which are the State's tool for ensuring sustainable forest management and nature conservation documentation. FMPs are being prepared and approved in the process of administrative proceedings for all forests regardless of ownership under the provisions of the Forest Act and the Nature and Landscape Protection Act. In Act No. 326/2005 Coll. on forest, in particular the provisions of Articles 40, 41, 43 and 59. 543/2002 Coll. on nature and landscape protection, these are mainly the provisions of Articles 9, 28, 54, 65a, 67, 81, 103. These provisions ensure that in the process of preparing and approving FMPs, the competent nature conservation authorities issue binding statements and endorsements, including NATURA 2000 national network of protected areas. The FMPs are binding on the extent of harvesting, the economic method and the target species composition. Forest owners cannot exceed prescribed fellings, have to keep silviculture system or manage forests more close to nature and have to meet target tree species composition prescribed in forest models, which reflects tree species composition of original natural / primeval forests. Figure 3.2 has been added on p. 30. Figure provides age structure at the beginning of simulation (end of 2009) and end of the first half of commitment period (end of 2025). The area of the oldest age classes increased as a result of ageing in natural reserves (unmanaged forests) and other protected areas. Also this new paragraph has been added to chapter 2.3 on page 17: By 2050, the natural capital of the SR – biodiversity, ecosystem services and goods – is adequately protected, regularly evaluated, wisely used and restored as appropriate, because of its intrinsic value and for its considerable contribution to the well-being and economic prosperity of the SR. Measures and policies adopted at a national level prevent unfavourable changes which the loss of natural capital would result in. (Updated National Strategy for the Protection of Biodiversity to 2020, 2014). https://www.cbd.int/doc/world/sk/sk-nbsap-v3-en.pdf	
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under	The reasons for the differences between national projections and the proposed FRL were explained in the Chapter 1.2, paragraph g).	**Addressed**

	SWD recommendation	Response from Slovakia	EC comments
	Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.		
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Part B (e-i).	Forest Reference Level was based on the area of Forest Land remaining Forest Land consistent with GHGI. The values of area under forest management were provided in Table A.20 in Annex, reference to the table was included in Chapter 3.3, part „Assumptions applied in projecting FRL", page 43. The real development of the area will be applied in technical corrections of FRL.	**Addressed** See comments to Annex IV.B(e-i).
Annex IV.B(b)	Include the carbon pools required by Regulation (EU) 2018/841 in the FRL and the national GHG inventory.	The first two paragraphs in the chapter "2.1: Carbon pools and greenhouse gases included in the forest reference level" were modified to provide explanation on the inclusion of carbon pools required by Regulation (EU) 2018/841.	**Not addressed** Slovakia does not include the dead wood pool in the FRL and in the GHGI. Slovakia assumes zero changes in emissions and removals in the deadwood pool for the FRL (see p. 41). The recommendation is not addressed, but Slovakia currently maintains consistency with the GHGI. The same approach is adopted for litter and soil, not mandatory for the LULUCF Regulation.
Annex IV.B(d)	Include information on harvesting rates for at least one different policy scenario in the revised NFAP. Translate relevant information of studies in Slovak into English.	The information on harvesting rates for three different policy scenarios of the future harvesting (R – harvest realistic, O – harvest optimistic, P – harvest pessimistic) has been added to	**Addressed**

	SWD recommendation	Response from Slovakia	EC comments
		subchapter 2.3.2 on page 19. The relevant information of studies in Slovak into English was translated and included to the NFAP.	
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection.	The Table A.20 „Area of Forest Land (FL), Land converted to or from FL and area of FL remaining FL as reported in GHGI and projected" was added to Annex, containing values from GHGI as well as values used in FRL simulation. The area under forest management, consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection, is included and it was used as a starting point for simulation.	**Addressed** The area of MFL is consistent with the area of forest land remaining forest land as reported in the GHGI, submission 2018, inventory year 2009.

A.26. Finland

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 20 December 2019, Finland proposed a FRL of -27 640 000 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). Finland published an Addendum/Corrigendum[11] to the revised NFAP on 18 June 2020, with a corrected FRL of -29 386 695 tonnes CO_2e y^{-1} for the period 2021 to 2025, including HWP. This corrected FRL is used as a basis of this assessment. The FRL is projected using the MELA and Yasso07 models.

In general, Finland addressed or partially addressed the majority of technical recommendations. The European Commission notes the following issues:

- There is a small inconsistency between FRL and the GHGI with regard to greenhouse gases from wildfires, which are reported in the GHGI but not included in the FRL. This discrepancy is however estimated to have a minor numerical impact on the FRL and can be amended as a technical correction, as proposed by Finland in the Addendum/Corrigendum.

The assessment concluded that the FRL of Finland is set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. The European Commission considers the FRL proposed by Finland reasonable. Other issues will be corrected by Finland at the end of the compliance period.

Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools projected for Finland's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e, before ex-post calibration. It is important to note that the ex-post calibration was applied on the total FRL with and without HWP, and the estimates for individual pools need to be adjusted to consider this ex-post calibration. As shown in

Figure 25 below, the main discrepancy between the GHGI reporting and the FRL projection in the starting year projection (2011) was due to estimates of living biomass. Therefore, the ex-post calibration mainly affects the estimates of living biomass, with only minor impact on other pools.

[11] https://mmm.fi/documents/1410837/1888935/Suomen+muutokset+vertailutasoraporttiin+18062020.pdf/ece4a930-1508-8aeb-c815-d72ae2285d3b/Suomen+muutokset+vertailutasoraporttiin+18062020.pdf?t=1593079763105

Table 26. The carbon pools and other sources of GHG emissions included in Finland's FRL. The delegated act reflects the amendments made by Finland in the Addendum/Corrigendum to the NFAP.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**	
	Revised NFAP	**Addendum/Corrigendum and Delegated act**
Living biomass (CO_2)	-17 710 000	
Mineral soils, including dead wood and litter (CO_2)	-4 890 000	
Organic soils, including dead wood and litter (CO_2)	+900 000	
Harvested wood products	-5 850 000	
N_2O emissions from drainage	+1 890 000	
CH_4 emissions from drainage	+91 000	
Prescribed burning (CO_2, CH_4, N_2O)	0.00	
N fertilization (N_2O)	+10 000	
Total without HWP, prior to ex-post calibration	-18 883 837	
Total with HWP, prior to ex-post calibration	-24 729 344	
Ex-post calibration factor for FRL without HWP[1]	1.121	1.244
Ex-post calibration factor for FRL with HWP[1]	1.118	1.188
Total without HWP, after ex-post calibration	-21 160 000	**-23 490 244**
Forest reference level, incl. HWP	-27 640 000	**-29 386 695**

Figure 25. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines). The emissions from N fertilization are not visible in the graph due to graph resolution. Note that the development of the pools is shown before ex-post calibration of Finland's FRL.

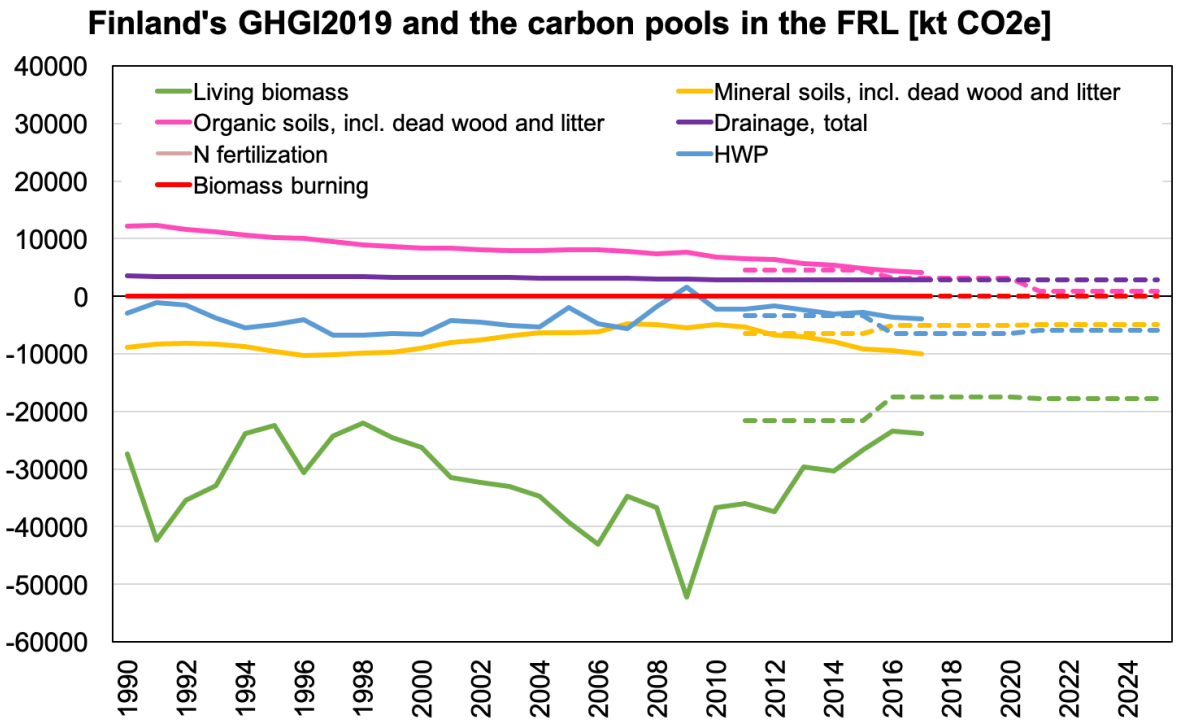
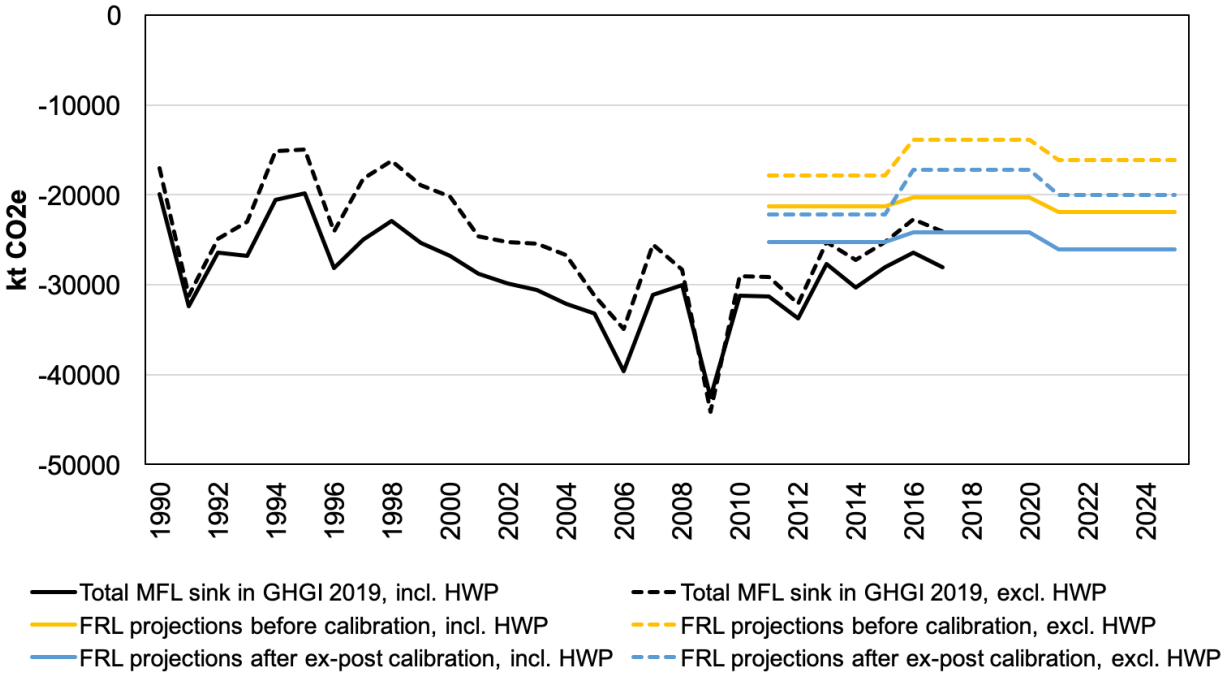


Figure 26. The sum of carbon pools included in Finland's FRL as reported in the GHGI (submission 2019) (black lines), projected for the FRL before the ex-post calibration (yellow) and after calibration (blue; considering the amendments submitted by Finland in the Addendum/Corrigendum). The ex-post calibration was done for the total FRL with and without HWP, so it is not possible to disentangle its exact impact on other pools.



Foreseen technical corrections to the forest reference level of Finland

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Finland:

- The definition of forest used in Finland's reporting for the UNFCCC has a different minimum patch size than the forest definition proposed by Finland in Annex II of the Regulation (EU) 2018/841. Finland explains in the NFAP (p. 12) that the MELA results for the FRL were downscaled to match the GHGI area reported to the UNFCCC for the year 2010 (submission 2019). The European Commission requests Finland to align the forest definition between Annex II and the GHGI 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 (see also SWD (2020) 236).
- The forest area is assumed to stay constant over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- At the end of the period 2021-2025 Finland may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)
- The FRL of Finland does not include CO_2, CH_4, and N_2O emissions from wildfires, creating an inconsistency between the FRL and the GHGI reporting with a very minor numerical impact. The contribution of these gases to the FRL will need to be added through a technical correction, to ensure consistency with the GHGI.

Report on the assessment of the issues raised in the technical recommendations for Finland

The draft NFAP of Finland, submitted on 20 December 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Finland was -34 770 000 t CO_2e (-27 880 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Finland on two principles of Article 8(5), six criteria of Annex IV, Section A and four elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Finland and technical notes by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Finland after the submission of the revised NFAP.

	SWD recommendation	**Response from Finland**	**EC comments**
Art. 8(5)1	Demonstrate that the approach used in the determination of the FRL ensures the continuation of forest management practices as documented in the period 2000-2009, and revise the FRL if applicable. Demonstrate how dynamic age-related forest characteristics have been taken into account and revise the FRL, if applicable.	Where in NFAP: Section 3.2.2 (which has been updated since 2018 submission), 4.2 The consistency check (Section 4.2) demonstrates that MELA model produces close to reported loggings for 2006-2010 when applied with equivalent constraints and with interest rate of 3.5%. This ensures the continuation of FMPs as documented in the period 2000 to 2009. The continuation of forest management practices in the Finnish case considering the "dynamic age-related forest characteristics" has been done by using the areas of thinnings and final fellings compared to the potential areas during 2000 to 2009. The ratio of actual thinning and final felling areas compared to the potential is kept constant during FRL simulation with constraints (Table 9). The qualitative forest management practices applied for 2021-2025 are the same as for 2000-2009 (Tapio 2006 complemented with forest act 224 from 1997).	**Addressed** As explained by Finland, it is demonstrated that the interest rate and harvest area constraints applied in the MELA model can reproduce the harvest level for the period 2006-2010 (p. 48). Finland has chosen to use the percentage of thinning and final felling area from the total area of thinning stands and mature stands, respectively, as a proxy for forest management practice during the RP. As explained in Ch. 3.2.2 and demonstrated in Tables 9 and 11, this percentage is kept constant in the FRL projection for the years 2021-2025, at the level of the RP (2000-2009).
Art. 8(5)2	Provide information on forest dynamics for/by development classes and demonstrate that the increase in harvest volumes	Where in NFAP: Table 9 and Table 11 and Appendix 6	**Partially addressed** Finland uses stand diameter as a proxy for dynamic age-related forest characteristics, which is in line with the Technical Guidance. However, it is noted that Finland only

	SWD recommendation	Response from Finland	EC comments
	projected in the FRL is in line with Art 8(5), reflecting the evolution of dynamic age-related forest characteristics, and revise the FRL, if applicable.	The table describing the areas of development classes (in this case areas available for thinnings or final fellings) has been updated (Table 9). The determination of classes is based on diameter (as proposed by Tapio 2006 and forest 224/1997), because it can be easily and reliably measured in the field. Stand age is not a reliable measure in for example organic soils; it is laborious to measure and it is not unambiguous. This is why the forest classification is based on diameter. The table includes the intensity percentages and how they evolve (kept constant), and how the areas and volumes develop have been provided. For future development of these areas see Table 11. For development of area and stem volume estimates based on NFI data and MELA prediction for 2000 to 2051 see Appendix 6.	defines two broad 'development classes' (thinning stands and mature stands). As shown in Table A1.1., the definitions of the thinning stands and mature stands are broad (thinning stand is defined as a stand with mean diameter between 8 - 22/27 cm, and a mature stand is defined through only a single minimum diameter per region and site type). The FRL is shown to be based on the same relative shares of fellings in these classes as in the reference period 2000-2009 (Tables 9 and 11, and Appendix 6).
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999.	Where in NFAP: Section 2.3.2 Under section "2.3.2: Description of forest carbon sinks and harvesting rates under different policy scenarios" latest projections prepared for the long-term strategy in accordance with the Government's objective of carbon neutrality by 2035 have been provided	**Addressed** Note that all policy scenarios seem to provide at least a sink as strong as the FRL for 2021-2025 (Fig. 1). This seems to be explained by the different methods (see Fig. 2).
Annex IV.A(c)	Provide additional information to clarify how future harvests (as presented in Table 12) are related to the existing scenarios	Where in NFAP: Section 2.3.2 Section 2.3.2 has been updated with the latest scenarios (see previous recommendation) and re-written.	**Addressed** Roundwood removals in Table 4 are in all scenarios smaller than the loggings in the FRL for the period 2021-2025 (see table 14, which is an update of Table 12 of the draft submission). This is not discussed.

	SWD recommendation	Response from Finland	EC comments
	presented in Section 2.3.2 of the NFAP.		
Annex IV.A(e)	Provide a ratio between solid (HWP) and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection. Present the ratio together with information in Table 12 of the NFAP.	Where in NFAP: Table 14 The ratio has been added into Table 14. Note that period between 2011-2015 has been simulated with best available data, here being actual loggings and therefore this ratio has been 23.2 % for 2011-2015.	**Addressed** The ratio in Table 14 is presented as [(wood chips + domestic fuelwood)/timber]. Furthermore, Box 1 on p. 41 reports the ratio of harvest to production of different HWP categories. We note that the numbers presented in Box 1 do not result in the presented ratios; however, this may be due to the precision of the numbers.
Annex IV.A(f)	Provide information on how the projected increase in harvest rates is consistent with the objective of contributing to the conservation of biodiversity. Clarify if the projected increase in harvest rates affects northern Finland more than southern Finland (see Table 9 of the NFAP).	Where in NFAP: Text was modified in chapter 2.3.1 and it includes description of biodiversity maintenance measures. At the end of section "3.1.2 MELA forestry model" text was added describing how MELA model takes biodiversity into account on lands available for wood supply. Appendix 2 The relative areas of thinnings and final fellings are kept as they were in 2000 to 2009 ensuring that land area under operations does not increase in relative terms. Harvesting is done according to Tapio 2006 Guidance and forest act 224/1997 which have recommendations for protection of biodiversity. In MELA calculations no dead wood is harvested. Also no harvesting is conducted on protected areas. More information has been provided in the NFAP. The Forest Act takes into account for example the protection of biological diversity. Harvesting in Northern Finland increases by stem volume more than in Southern Finland, which is due to the structure of development classes	**Partially addressed** Finland relies on the management guidelines and the forest decree in safeguarding biodiversity. The relationship between increase of the harvest rate and protecting biodiversity is discussed shortly on p. 16, but not explicitly in the FRL context, and only in terms of possible ways to ensure biodiversity protection under increasing harvest rates. It is unclear whether the FRL is consistent with these considerations. A brief description of biodiversity consideration in the MELA model, taking into account the management guidelines and forest decree, is provided on p. 28. The harvests seem to increase more in northern Finland (felling areas presented in table 14).

	SWD recommendation	Response from Finland	EC comments
		(note that relative areas of thinnings and final fellings are kept as they were in 2000 to 2009). The large percentage of protected forests in Northern Finland (19.4% of the nationally defined forest & scrubland https://stat.luke.Finland/metsien-suojelu) will also protect the biodiversity.	
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Where in NFAP: Sections 2.2, 2.3 and 4.2 There is a section in the NFAP demonstrating the consistency (Section 2.2). The section has been re-written, the conformities and differences between FRL and projections reported under the MMR (Regulation (EU) No 525/2013) have been described more detailed. In the scenarios prepared for the long-term strategy consistency with the GHG inventory has been further improved (Koljonen et al. 2020). Consequently, the new scenarios, were also based on more recent NFI data, and therefore differ from those reported under Regulation (EU) 525/2013.	**Addressed**
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i).	Where in NFAP: Section 2.2.6 Recalculations with the corrected area have been made and have been included in the revised NFAP.	**Addressed** For area, see Annex IV Part B (e)-i.
	Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period, through the provision of backcasting information from the modelling framework.	Where in NFAP: Sections 4.2 and 4.3 Appendix 3 The consistency between historical data from the GHG inventory and modelled data is presented for the years 2006 to 2010. Data from NFI9 (1996-2003) was applied here. Article 8, item 5 in the regulation sets the requirement that MS shall demonstrate consistency between the methods and data used to determine the FRL	**Addressed in the addendum/corrigendum submitted by Finland.** Finland has done substantial effort to address this recommendation. However, the reproduction of historical data is made against modified GHGI data, as detailed below. Furthermore, the FRL projection seems now to be inconsistent with the GHGI for the years 2011 onwards (i.e. when using the data and assumptions used to model

	SWD recommendation	Response from Finland	EC comments
		and those used in the GHG inventory. With our data and models (MELA and Yasso07 and others) we can demonstrate this consistency numerically for the period 2006-2010. According to our results FRL is within the uncertainty of the GHG inventory. We assume this fulfils the requirement of the Article 8, item 5.	the actual FRL). The technical guidance for the FRL advised MSs to demonstrate consistency for the period 2000-20XX, where 20XX is the latest inventory year available in the national GHGI at the time the FRL is constructed (p. 70 of TGD). Table 18 in the NFAP presents the modelling results for 2006-2009, and GHGI information for the same period (with modifications, see the illustration below). Based on these, a calibration factor (sum of GHGI / sum of MELA) is calculated. The FRL is adjusted by this factor, increasing the sink somewhat. In Table 18, the GHGI for 2006 and 2007 are modified because of a change of methodology to measure natural mortality and wastewood (App. 5). This change was employed in the GHGI from 2008 onwards, but the time series has not been recalculated. Finland argues that modelling cannot reproduce such "artificial changes due to updates in the statistics". In addition, an average for 2008 & 2010 is used to represent 2009. Year 2009 is not used because it was an "exceptional year", due to economic conditions (App. 4). The EC notes that modifications of the GHGI reporting is not justified for economic reasons (year 2009) or for methodological issues in the GHGI (years 2006-2007). Possible future methodological corrections to the GHGI time series may lead to a technical correction of the FRL before the compliance check, but they cannot be anticipated when setting the FRL. Therefore, the approach proposed in the NFAP is not acceptable, but the EC agrees with Finland's proposal in the addendum/corrigendum to the NFAP submitted on 18 June 2020. It is also noted that Table 18 contains a typo (a negative sign is omitted on row 3). This does not seem to have an

	SWD recommendation	Response from Finland	EC comments
			impact in the numerical values derived from Table 18 information.
	Demonstrate that the interest rate used by the model can reproduce the harvest documented in the reference period.	Where in NFAP: Text has been modified in section 3.2.2, see also section 4.2 and Appendix 3 The consistency check (Section 4.2) demonstrates that MELA model produces close to reported loggings for 2006-2010 when applied with equivalent constraints and with interest rate of 3.5%, and moreover estimates for forest GHG exchange is within the uncertainty of GHG inventory. The only purpose for utilization of interest rate was to allocate the harvests in MELA modelling. To define the level of interest rate, Capital Market Line (CML) theory (e.g, Sharpe, 1964) was applied. CML describes interdependency between risk and return, which are fundamental in finance (incl. privately owned forests, which cover more than 80% of the harvesting volume). For MELA, interest rate was calculated according to CML as a function of parameters illustrating stock market risk premium, risk difference between for forest ownership returns and the stock market returns, and risk-free rate of investments. The detailed calculus with the data sources for CML parameters are explained in detail in section 3.2.2.	**Addressed** Finland provides the results of a sensitivity analysis, where MELA was run with four different interest rates for the years 2006-2010. Comparing to harvest statistics, the interest rate of 3.5% was the closest to the actual harvests in 2006-2010. (Average fellings 2006-2010: 57.4 Mm3; MELA modelling result with 3.5% was 56 Mm3; see p. 47-48)
Annex IV.B(c)	Clarify the NIR submission (year) from which data was used for the FRL calculation and the (partial, 2011 to 2016) comparison between the FRL and the national GHG inventory.	The NFAP has been revised to more clearly state the submission year applied for the calculation and the comparison (submission 2019).	**Addressed**

	SWD recommendation	Response from Finland	EC comments
	Provide evidence that the actual management practices of Sustainable Forest Management guidelines (e.g. Tapio 2001) and the forest decree 224/1997 are relevant to describe practices in the period 2000-2009.	Where in NFAP: See sections 3.2.2 and 4.2 The consistency check (Section 4.2) demonstrates that MELA model produces close to reported loggings for 2006-2010 when applied with equivalent constraints and with interest rate of 3.5%. This provides evidence that the actual management practices are equivalent to those described in the Tapio Guidance (complemented with forest act 224/1997). The Tapio Guidance provides the minimum size limits, for example for harvesting. It does not mean that the forests are treated using the minimum size limits, not in reality or in the modeling. The Guidance only sets the limits to the harvesting potential. Only a share of the possible harvesting amount is actually harvested annually. In addition, it is not reasonable or technically possible to apply two different sets of guidance for one reference period. Also forest act from 1997 has been taken into account with 2006 guidelines and stricter one from these has been applied with each forest type and region in question.	**Addressed**
	Clarify which forest management practices are used in the model.	Where in NFAP: See section 3.2.2 The Guidance from 2006 complemented with forest act 224/1997 are used in the model as described in the NFAP.	**Addressed**
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the	Where in NFAP: See section 2.2.6 The area and the forest definition have been corrected to correspond with the latest GHG inventory and this information has been included	**Addressed** A description of inconsistencies added on p. 11-12, with intent to ensure consistency in the future stated on p. 49. Finland reports to use the GHGI area for the MELA projections, which in Table 3 is stated to be 21 780 765

	SWD recommendation	Response from Finland	EC comments
	year preceding the starting point of the projection.	in the revised NFAP including the definition of forest.	ha. This corresponds to FLrFL in 2010 in the 2019 submission to the UNFCCC.
	Provide a definition of forest and information on the total area under forest management to resolve inconsistencies in total areas in Table 3 and Table 5 of the NFAP.		**Partially addressed** There are remaining inconsistencies, which Finland states that will be corrected in the future as a technical correction – see Annex IV.A(h)
Annex IV.B(e-iii)	Provide information concerning: (Stand, category) development classes for time periods comparable to Table 5 (e.g. NFI9 and NFI11); Information on the standing volume per development class in the compliance period in order to relate the area to the standing volume;	Where in NFAP: Table 7 and Appendix 6 This information is produced for the thinning and final felling forests plus seedling stands and shelter wood stands.	**Addressed** While providing the requested information, the level of detail has decreased from the draft NFAP. Table 5 seems to have been replaced with Table 7 and App. 6, which now present only three development classes instead of eight. The information is however now presented more clearly and over time.
	Documentation on the way the estimate of the interest rate was derived, including more specific references and demonstrating that it is representative for the entire forest area and the reference period; Additional information on the impact of the interest rate in the model outcomes for harvest volume by period;	Where in NFAP: See section 3.2.2 The impact of the interest rate in the model outcomes can be found at Lehtonen et al. 2019.This reference has been added into NFAP. Also the text and justification of the current interest rate was modified as a result of discussions with various forest economists.	**Addressed** The harvest volume for the simulations with four different interest rates is provided on p. 47-48, showing results for 2006-2010.
	A clarification on the impact of assuming 'non-declining' industrial roundwood removals,	Where in NFAP: Section 3.1.2 "Non-declinining industrial roundwood removals" in the context of MELA modelling is a	**Addressed**

	SWD recommendation	Response from Finland	EC comments
	in relation to Article 8(5) Paragraph 1 of the Regulation.	sustainability measure which refers to future harvesting possibilities. This measure ensures that the long-term cutting possibilities are kept at least at the same level as they are now. As explained before, the technical potential for harvesting according to Tapio guidance diameter limits is very large, but harvesting all potential at once would mean lower harvesting potentials in the future, and it would result also a declining sinks. This is clarified also in the revised NFAP.	
Annex IV.B(e-iv)	Provide historical and future harvesting rates disaggregated between energy and non-energy uses. Provide information on harvest volume development through periods up to 2060 to improve the understanding of the long-term development, consistent with Table 14 of the NFAP.	Where in NFAP: Table 17. Historical and future harvesting rates up to 2050 according to forest reference level scenario (management as in 2000-2009) have been included disaggregated between energy and non-energy uses.	**Addressed** Finland reports total drain and stemwood removals, incl energy use of stemwood, in Table 17 for 2011-2050. Table 14 information is now reported in Table 16, and the related harvest volume development in Table 17.

Other issues identified by the MS

- The model is able to produce historical data that is consistent with GHG inventory.
  - This was corrected by the methodological change, where increment – drain method has been also applied with MELA results. Also ex-post calibration ensure that results are consistent between modeling and GHG inventory. Differences are explained in the revised NFAP. See Sections 3.3.1 and 4.2.
- The definition of development classes of forests in NFI are such (based on plot level measurements of growth, diameters, silviculture and age) that those are impossible to reproduce with MELA model.
  - A correction has been made to the areas available for final felling. The areas are now defined consistently with NFI in the MELA modelling. This definition is based on mean diameters of trees. See Section 3.2.2.
- Minimum diameters for forest stratification and for management chains.
  - Forest act from 1997 has been taken into account together with 2006 guidelines. Harmonizing age-related forest classes by using diameter based thresholds with NFI and MELA to determine areas for thinning and mature stands (those used as constraints in MELA). See Section 3.2.2.

A.27. Sweden

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 31 December 2019, Sweden proposes a FRL of -38 721 000 tonnes carbon dioxide equivalent per year (tonnes $CO_2e\ y^{-1}$) for the period 2021 to 2025, including the carbon pool of harvested wood products (HWP). The FRL is projected using Heureka RegVis and Q models.

In general, Sweden addressed or partially addressed all technical recommendations. The European Commission notes the following issue:

- There is a considerable discrepancy between the area of managed forest land projected in the FRL, and the area reported in Sweden's GHGI, explained by areas of mountain forests that are reported in the GHGI but not included in the FRL modelling. Sweden reports that these forests are near steady-state, and that the discrepancy will be attended to before the compliance check.

The assessment concluded that the FRL of Sweden is mostly set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. However, the European Commission requires 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)). The European Commission considers the FRL proposed by Sweden reasonable. Other issues will be corrected by Sweden at the end of the compliance period.

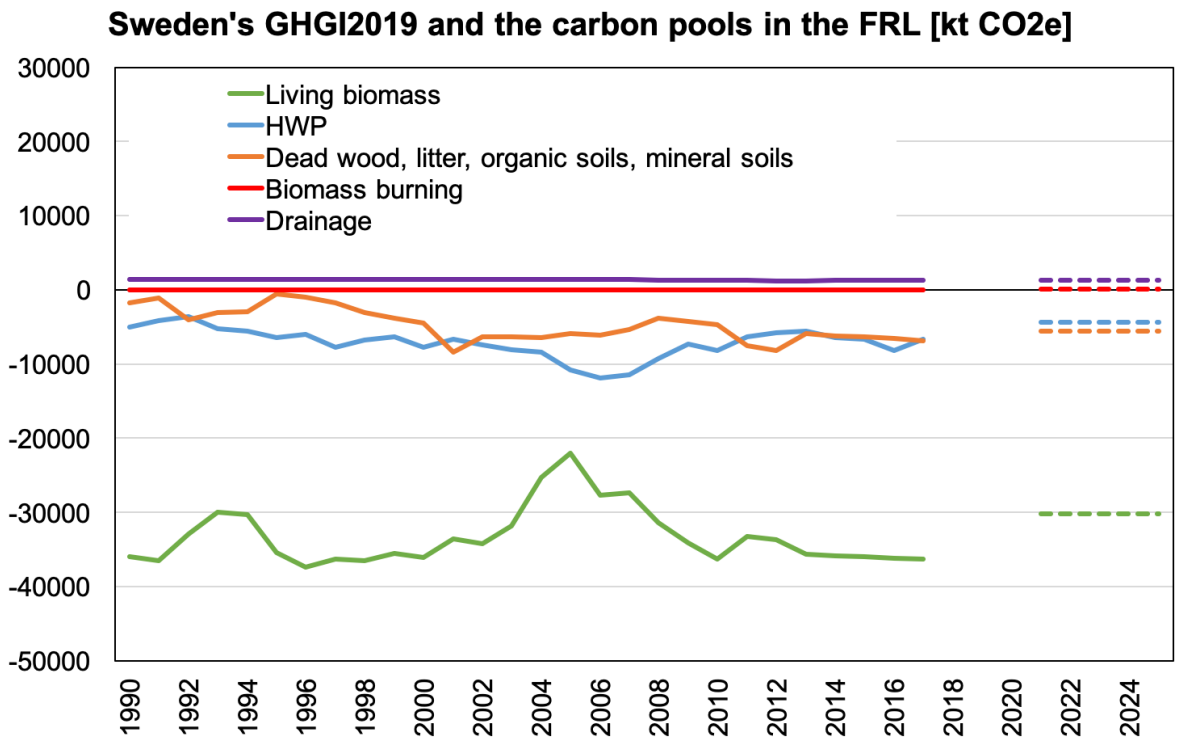
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in Sweden's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 27. The carbon pools and other sources of GHG emissions included in Sweden's FRL.

Source of contribution to forest reference level	**Emissions or removals (+/-) [tonnes $CO_2e\ yr^{-1}$]**
Living biomass	-30 236 000
Mineral soils	-11 039 000
of which:	
Dead wood	*-2 394 000*
Litter (incl. stumps), Soil	*-8 644 000*
Organic soils	+6 831 000
of which:	
Dead wood	*-334 000*
Litter, Soil (CO_2 + DOC from drained soils)	*+5 855 000*
Drained organic soils (N_2O, CH_4)	*+1 310 000*
Harvested wood products	-4 373 000
N_2O Fertilization	+23 000
Mineralization (N_2O)	0
Indirect emissions (N_2O)	+4 000
Prescribed burning (CO_2, N_2O, CH_4)	+69 000
Total without HWP	**-34 348 000**
Forest reference level, incl. HWP	**-38 721 000**

Figure 27. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines). The carbon pools of dead wood, litter, organic soils and mineral soils were disaggregated differently in the FRL projection than in the GHGI. Here they are shown as a total sum to enable comparison between the GHGI and the FRL.



Foreseen technical corrections to the forest reference level of Sweden

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for Sweden:

- The forest area is assumed to develop over time in the FRL. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025. When correcting the area, the present discrepancy in forest area between the FRL and the GHGI with regard to the mountain areas is to be corrected as well.
- At the end of the period 2021-2025, Sweden may exclude from its FRL greenhouse gas emissions resulting from natural disturbances that exceed the average emissions caused by natural disturbances in the period from 2001 to 2020, excluding statistical outliers (art 10 of the Regulation (EU) 2018/841)

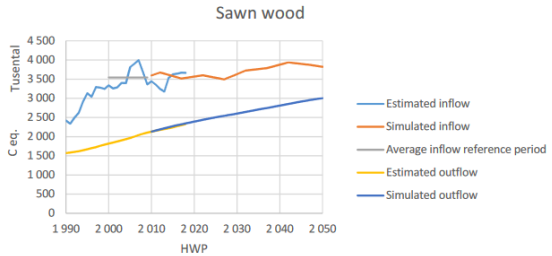
Report on the assessment of the issues raised in the technical recommendations for Sweden

The draft NFAP of Sweden, submitted on 25 March 2019, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for Sweden was -30 556 000 t CO_2e (-25 061 000 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for Sweden on two principles of Article 8(5), six criteria of Annex IV, Section A and three elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by Sweden and technical notes by the European Commission. Technical comments by the European Commission may also refer to updated or more detailed information released by Sweden after the submission of the revised NFAP.

	SWD recommendation	**Response from Sweden**	**EC comments**
Art. 8(5)1	Provide transparent documentation of forest management practices in the reference period. Ensure that the approach used in the determination of the FRL reflects the continuation of sustainable forest management practices as documented in the reference period, excluding policy assumptions on harvest rates from the FRL calculation. Provide transparent information on harvest-to-growth ratio from the reference period. In light of 100% harvest rate of net biomass increment applied in the FRL on productive forest land managed for wood supply regardless of age-class distribution, explain how this is applied to modelling of the FRL and revise the FRL accordingly.	Sustainable forest management in Sweden is fulfilled by promoting a sustainable growth of trees on managed forest land (MFL) used for wood supply. This is e.g. supported by the Forestry act that makes regeneration after final felling mandatory and sets a minimum age for final felling. Managed forest land set aside mainly for nature conservation is protected according to relevant national environmental quality objectives in line with commitments to the Convention on Biological Diversity. This is in line with e.g. Annex IV (f) of regulation EU/2018/841. Sweden expects that the net removals on MFL not used for wood supply will be similar in the compliance period as for the FRL. In the revised FRL, Sweden is following the recommendation by the EU Commission and has revised the assumptions for the simulations of the FRL. Sweden simulates a continuation of the actual management practices as documented in the reference period, excluding policy assumptions on future harvest rates. The harvest-to-growth ratio in the simulations now reflects the average conditions during the reference period 2000-2009. Statistics of harvest and growth during the reference period has been documented based on the Swedish NFI (table 12) and the statistics	**Partially addressed** We note that the information on rotation times and harvest intensities per age class is not reported in detail, but only as national aggregates. These are also used to model the FRL. We understand that the Heureka model is a detailed modelling tool and applies harvest rules based on the age-related characteristics of the forests, so implicitly age class structure and its evolvement are taken into account to some extent. However, to ensure transparent documentation of the forest management practices in the reference period, more detailed documentation of the modelling parameters and their continuation from the reference period would have been desirable.

	SWD recommendation	Response from Sweden	EC comments
		has been adopted to the definitions used in the forest model (Heureka). The age-class distribution is controlled by simulating harvests that fulfils the minimum age for final felling and according to a model that prioritize which stands that will be harvested. The change in the harvest rate is the only major change in settings arising from the revised simulation along with an updated priority model. The age class distribution of the forests will likely not influence the accounting much.	
Art. 8(5)2	Ensure that harvest volumes projected in the FRL are in line with Art 8(5), reflecting the evolution of dynamic age-related forest characteristics, and revise the FRL accordingly.	Swedish forests have a relatively even aged structure and we do not expect that Sweden will gain or lose in the accounting due to skew age class distribution. The projected harvest volumes are presented in figure 4 with an explanation how Article 8(5) influence on harvest volumes. The results demonstrates that the model projects the development accurately. Sweden has revised its application of Article 8(5) regarding the management practises documented in the period 2000 to 2009, also including harvest intensity as documented in table 12.	**Addressed** Age class distributions for 2010, 2020 and 2030 are reported in Figs 7-9.
Annex IV.A(c)	Justify how the proposed FRL ensures a robust and credible accounting system in light of documented forest management practices during the reference period.	Harvest-to-growth ratio has been adjusted to the historical level during the reference period, see response to technical recommendations on Article 8(5) above. The resulting FRL is presented along with historical data from the GHG-inventory (table 2 and table 11), where categories in the GHG-inventory have been reorganized in order to be comparable to those applied in the modelling of the FRL. Overall, there is good agreement between the FRL 2021-2025 and the averages for the reference period 2000-2009 for the overlapping subcategories (table	**Addressed**

	SWD recommendation	Response from Sweden	EC comments
		11), which implies that a robust and credible modelling system is used. The forest simulation has been updated with a function for the priority of harvesting objects that better reflects the forestry practises during the reference period, which is based on actual forest owner behaviour. This has resulted in less frequent harvests in old forests (figure 7-9) and older age classes are maintained or increases compared to the previous FRL.	
Annex IV.A(d)	Provide an explanation on the decreasing trend of HWP sink and include the projected shares of different HWP categories while harvests are increasing.	The revised FRL is recalculated based on updated harvest levels and the trend in HWP now follows the harvest rates more closely, see figure 10 and the figure supplied below. The change in the HWP pool is based on inflow and outflow from the pool. The recalculated HWP inflow per sub-category (sawn wood, wood based panels and paper and paper products) is based on the simulated harvested volumes of sawlogs and pulpwood. Since harvest of fuelwood cannot be simulated by the Heureka-system, fractions of the simulated volumes of sawlogs and pulpwood were transferred into fuelwood at the same rate as during 2000-2009 before the sawlogs and pulpwood entered the HWP-calculations. Sawlogs were transferred into sawn wood at the same rate as during 2000-2009, while the remaining part of the sawlogs were added to the volume of pulpwood, which in turn was allocated to wood based panels, energy and pulp and paper as during 2000-2009. The initial stock in 2010 of each product category was taken from the GHG-inventory calculations. There was a large input of products during the reference period due to increasing harvest rates and	**Addressed**

	SWD recommendation	Response from Sweden	EC comments
		forest industry production in the reference period and in the period before the reference period. Since the main part of the outflow is calculated as a fraction of this large pool, the outflow does not react rapidly to sudden inflow changes as exemplified with sawn wood in the figure below. Thus, the rapid harvest increase before and during the reference period resulted in a large difference between in- and outflow and thereby a large reported HWP-sink. In the simulations the harvest of saw logs do not increase during the first 20 years. So the inflow of sawn wood remain rather constant while the outflow from the pool increase as the HWP pool grow larger, which results in a lower HWP-sink compared to the reference period. Since the revised FRL assumes a lower harvest rate, the HWP sink has decreased accordingly, as compared to the FRL in the original NFAP. Sawn wood is the most important pool (net removal) and the strong positive trend in inflow 1990-2008 was due to expanding forest industry capacity in combination with natural disturbances 2005-2008. 	
Annex IV.A(e)	Provide a ratio between solid and energy use of forest biomass as documented in the period from 2000	The ratio between solid and energy use of forest biomass has been documented in the report in a transparent way as noted by in the synthesis report	**Addressed**

	SWD recommendation	Response from Sweden	EC comments
	to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection.	of the LULUCF expert group. In figure 10 the development and relative distribution of the harvest of different HWP subcategories are presented for the historical period 1990-2017 and for the FRL simulation.	Sweden provides the shares of solid use of raw material separately for sawnwood, pulp and panels, and the share of raw material/energy (p. 15-16). While these shares are not given as a percentage of total roundwood use as was advised in the TGD, it is noted that the shares of sawlogs, pulpwood and fuelwood from total harvest volume (Fig. 10) stay constant. The recommendation and the underlying criterion are therefore considered to be fulfilled.
Annex IV.A(f)	Provide more information on the projected development of total forest area of old forest stands (>80 years).	Harvests are only simulated in MFL used for wood supply and since harvest rate in the revised FRL is less than 100% - and harvests are not allowed in forest not used for wood supply - the proportion of older tree stands will most likely increase. The forest simulation has been updated with a function for the priority of harvesting objects that better reflects the forestry practises during the reference period, which is based on actual forest owner behaviour. As a result more old forests is maintained in the production land in the simulations compared to the previous FRL, especially forest older than 140 years. The documentation of age class distributions in the simulations show that old forest >120 years are increasing in the FRL (figure 7-9), mainly due to the contribution from areas protected from forestry. Even though the principle forest management practises remain constant, the predicted increase in forest growth has implications on the outcome of the simulations, e.g. regarding harvesting age. The increased growth leads to a more rapid basal area development and consequently the forests tend to	**Addressed**

	SWD recommendation	Response from Sweden	EC comments
		become harvested at a younger age. This means that the diameter distribution in the forests will be maintained, but there will be a trend towards slightly younger stands in the managed forest land used for wood supply.	
	Provide additional information on the impact of projected increased harvest on biodiversity.		**Addressed** through other recommendations; the harvests do not increase similarly to the draft submission in this submission.
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013.	The purpose of the two projections are not the same and are not necessarily supposed to be similar. The national simulation under Regulation EU/2013/525 is a prognosis of the actual development to follow up whether Sweden will fulfil its commitment according to Regulation EU/2013/525, while the FRL is a scenario used in the accounting according to Regulation EU/2018/841.	**Partially addressed** P. 17 states that the FRL is consistent with the projections under 525/2013 in terms of carbon pools. The consistency is not demonstrated quantitatively.
	Provide explanations for possible differences between national projections and the proposed FRL.	The principle methodology used in the two projections are the same, although the harvest rates assumed after 2010 are quite different in the two simulations, since the FRL rely on conditions during the reference period 2000-2009. Model development in the period after 2013 has resulted in different changes that have improved the estimates and enables a more complete representation corresponding to the GHG inventory.	**Addressed**
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i).		**Partially addressed** For area, see Annex IV.B(e-i)
	Use the conversion period for Land converted to forest land (Afforested	Afforested Land (AL) is now assumed AL 20 years after land use conversion.	**Addressed**

	SWD recommendation	Response from Sweden	EC comments
	Land) consistent with the latest national GHG inventory.		
	Demonstrate the ability of the model used to construct the FRL to reproduce historical data from the national GHG inventory.	Simulation of the development during 1990-2010 has been carried out based on the modelling framework applied for the FRL for living biomass, see section 1.6 (under Annex IV, section A (h)). The simulation was based on historical data of the forest state and documented historical forest management practises and the same principles for land conversion as the GHG inventory. The results are presented as changes in GHG emissions as CO2 equivalents for living biomass and related to historical data from GHG inventory (figure 4a). Annual net forest increments and harvests for the period 1990-2010 are presented along with standing volumes (figure 4b).	**Addressed** See Fig. 4 on p. 19.
	Demonstrate the consistency between historical data from the national GHG inventory and modelled data for estimating the FRL for the reference period.	The initial state of the simulations in 2010 is based on data (and data base) used for the climate reporting. The net removals for living biomass during the reference period is reported using the stock difference method and does not separate growth and harvest. Reported and simulated changes in living biomass are compared in figure 2 of the report. A comparison about growth and harvests has to be made using alternative estimates from the same source (The national Forest Inventory), see figure 4 in the report. Observe that e.g. harvest represent annual values while the net removals (figure 2) is reporting a trend (due to stock difference method, a five-year inventory cycle recommended by IPCC is used).	**Addressed** Note that Sweden refers in this response to Figure 2, but likely means Figure 4 instead.
	Specifically, information is required on 1) the validation of simulated increments for all stands and present		**Addressed** See Fig. 4.

	SWD recommendation	Response from Sweden	EC comments
	values of increment instead of total volume,		
	2) the demonstration of the modelling framework to reproduce historical harvest data,		**Addressed** See Fig. 4.
	3) the bias between measurements and model estimates for mineral soils.	A former research study was used as reference for the validation of the soil model. However, it was based on simulations over very long time-span (1926-2000) using historical forest data reflecting the long term development. The short term changes in the latter part of the simulation period are rather uncertain. A direct validation of the model with regards to mineral soil carbon is conceptually difficult since the humus and mineral soil pools are not differentiated. The resulting FRL is compared to the GHG-inventory data and presented for harmonised reporting categories (table 11), which means that litter, soil and stumps (normally reported as Dead wood) are combined. The results shows a rather good agreement between the litter/soil/stump pool and the GHG-inventory data considering the uncertainties and does not indicate the presence of any strong bias in the modelling.	**Addressed** As shown in Figure 27 of this document, the mineral soil emissions (shown as an aggregated figure for SOCmin, SOCorg and LT due to data presentation in the NFAP) are projected to stay on the same level as in the RP.
Annex IV.B(c)	Document sustainable forest management practices in the reference period, including information on harvesting intensities per strata, using consistent sources, definitions and units, and apply those to the forest development during the simulation, and subsequently the calculation of the FRL.	Table 10 in the National Forest Accounting Plan presents the document sustainable forest management practices in the reference period for different regions (strata). These settings have been applied in the simulation of the FRL for the different regions. Additional information on forest management practises in the reference period – harvesting intensities (for different strata) are found in table 2, table 12, figure 1, and figure 4.	**Partially addressed** Table 10 provides information on forest management practices, but only on regeneration modalities and not on harvest intensities as requested in the recommendation. Table 12 documents the used harvesting intensities for three strata (production land, reserves, and low-productive forest land). However, given the extent of the production land in Sweden, more detailed

	SWD recommendation	Response from Sweden	EC comments
			description of the applied intensities in e.g. different parts of the country, different tree species, and different age classes would be desirable.
Annex IV.B(e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection, and the future development of the managed forest land area, including afforested and deforested land.	The area of Forest land remaining Forest land 2010 reported in Submission 2019 was 27 877 000 ha and formed the basis for the simulations. The Forest land area at the start of the simulation was 27 479 000 ha and the difference compared to the reported value is that an area of ca 400 000 ha in the mountain region was included in the reported value, this difference will be adjusted for in the coming reports to the UNFCCC. These unmanaged forests in the mountain region are low productive and near steady state, which means that they have an insignificant influence in the GHG-reporting. After 2010 the area of managed forest land increased by the inflow from afforested land (in average 18 000 ha per year) and decreased by the outflow of deforested land (in average 12 600 ha per year) so the areas of Forest land 2015, 2020 and 2025 were 27 506 000, 27 531 000 and 27 560 000 ha respectively.	**Addressed** We note a difference of 398 000 ha (1.4 %) with the GHGI. The difference was explained and justified by Sweden as low productive forests and are considered as having a very marginal impact on the FRL. Sweden will correct the forest area during the compliance period in its GHGI; or applies a technical correction at the end of compliance.
Annex IV.B(e-iii)	Provide information on increments, age-related dynamics and rotation length.	General information on increments are given in figure 1 and figure 3 Information on age related dynamics are given in figure 7, figure 8, and figure 9 Increment for the compliance period are given in table 3 and figure 16	**Partially addressed** Rotation lengths are not provided in detail (only broad ranges mentioned on p. 22). This lack of detail is considered acceptable as Figs. 7-9 indicate that there is no clear trend of changing the rotation length from 2010 onwards.

	SWD recommendation	Response from Sweden	EC comments
	Provide the projected increment per strata for historic data and the compliance period.	Information on increment for historic data are given in figure 3 and figure 4b	**Partially addressed** The information is only provided for the whole country, although the model description shows that Sweden has used at least stratification based on four geographic regions, different soil classes, and different tree species (table 10), as well as the main function of forests (table 9).

Other issues noted by the MS

- In the work on the revised FRL, a number of technical updates of the modelling system have been made. These updates were partly made in order to meet the requests from the EU technical recommendations and partly to improve the quality in the simulations.
- In the Swedish GHG-inventory the uptake in small trees (<10 cm diameter) is based on a constant value calculated based on NFI data from a long time period. This approach was chosen since the measurements were deemed too uncertain for annual follow-up. In order to achieve better consistency between the FRL and the GHG-inventory, the same methodology has been introduced in the revised FRL and the smaller trees are not handled by the forest model anymore.
- The forest simulation has been updated with a function for the priority of harvesting objects that better reflects the forestry practises during the reference period. The previous FRL showed an initial decline in the amount of older (spruce) forests as a result of the previously applied model. Now, the amount of old forests is maintained or increases in the simulation.
- The area and volume of pre-commercial thinning was decreased slightly compared to the previous FRL, due to an observed overestimation found in the simulations.
- The initialization of the model for litter and soil was improved by applying a spin-up period during 1990-2009, assuming an annual litter input that was increasing up to the same level as the first period of the forest simulation (2010-2014) at a similar rate as the growth.

Other issues noted by the EC

The projection of the development of different harvest assortments (sawlogs, pulpwood and fuelwood) shows almost no change compared to the reference period average (Fig. 10 of the NFAP). This is inconsistent with the increase in total harvest level reported in table 12, and suggests a potential methodological inconsistency between the modelling of forest management and the modelling of HWP in the FRL.

A.28. United Kingdom

In its revised National Forestry Accounting Plan (NFAP) submitted to the European Commission on 20 December 2019, the United Kingdom proposes a FRL of -20 701 550 tonnes carbon dioxide equivalent per year (tonnes CO_2e y^{-1}) for the period 2021 to 2025. The FRL is projected using the CARBINE forest sector accounting model.

The United Kingdom addressed all technical recommendations. The assessment concluded that the FRL of the United Kingdom is set according to the principles of article 8(5) and criteria under Annex IV Part A of the Regulation (EU) 2018/841, and that the NFAP contains the elements required under Annex IV Part B of the Regulation. Based on the information reported in the revised NFAP, the United Kingdom proposes a reasonable FRL.

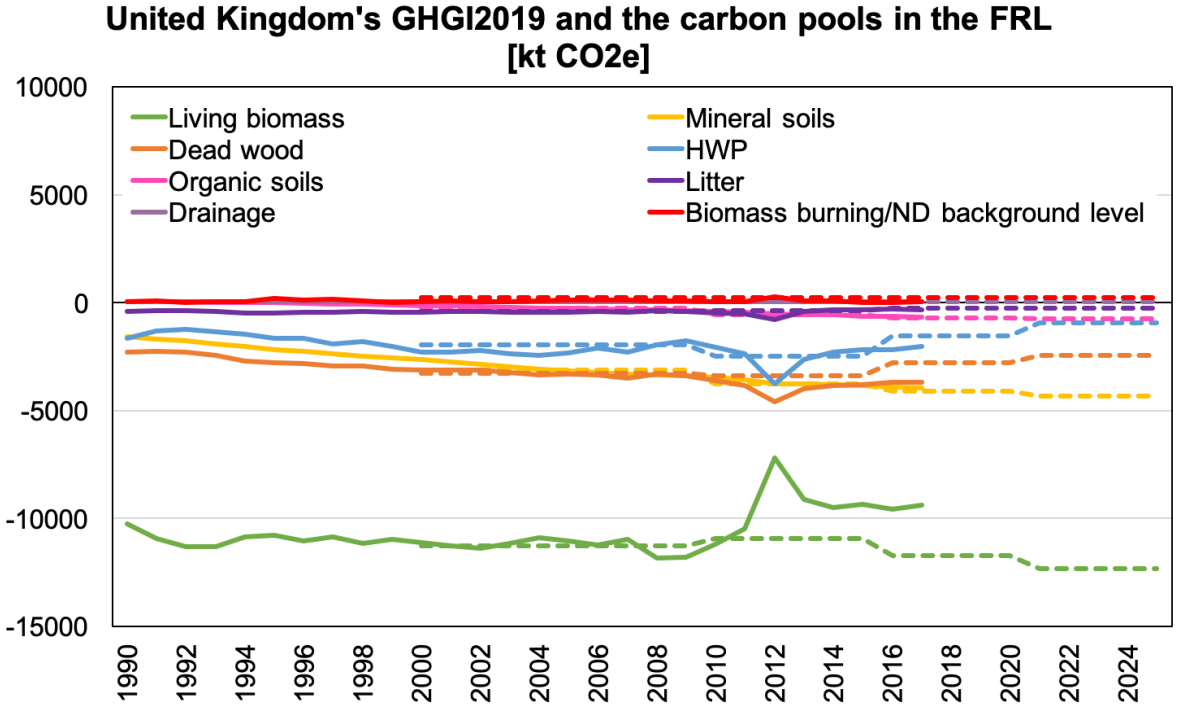
Overview of the carbon pools and greenhouse gases included in the forest reference level

The following table presents an overview of the carbon pools included in the United Kingdom's FRL and their average yearly contribution during 2021-2025, in tonnes CO_2e.

Table 28. The carbon pools and other sources of GHG emissions included in the United Kingdom's FRL.

Source of contribution to forest reference level	Emissions or removals (+/-) [tonnes CO_2e yr^{-1}]
Above-ground biomass	-9 361 500
Below-ground biomass	-2 947 290
Litter	-257 830
Dead wood	-2 438 660
Soil organic carbon, organic soil	-742 160
Soil organic carbon, mineral soil	-4 320 300
Harvested wood products	-946 290
N_2O emissions from drainage	+53 470
Natural disturbance background level (incl. CO_2, N_2O, CH_4)	+249 000
Total without HWP	**-19 755 260**
Forest reference level, incl. HWP	**-20 701 550**

Figure 28. The carbon pools included in the FRL as reported in the GHGI (submission 2019; solid lines), and as projected for the FRL (dashed lines). The projections for living biomass include above- and below-ground biomass.



Foreseen technical corrections to the forest reference level of the United Kingdom

As stipulated by art 8(11) of the Regulation (EU) 2018/841, the Member States shall, where necessary, submit technical corrections to the FRL to ensure consistency between the FRL and the methods and data used in the reporting for managed forest land. Therefore, the need of a technical correction to the FRL should be evaluated whenever a methodological change is made in the LULUCF GHGIs.

In addition, the following technical correction to the FRL is foreseen for the United Kingdom:

- The forest area is assumed to develop over time in the FRL, following the annual rates of afforestation and deforestation as applied in the GHGI 2019. The forest area will need to be corrected to correspond to the reported managed forest land area in 2021-2025.
- The background level for natural disturbances now included in the United Kingdom's FRL is based on the natural disturbances reported in 2001-2017. The background level will be updated using the full time series 2001-2020 before the natural disturbances provision (art 10 of the Regulation (EU) 2018/841) is used.

Report on the assessment of the issues raised in the technical recommendations for the United Kingdom

The draft NFAP of the United Kingdom, submitted on 5 February 2018, was assessed by the European Commission and a Commission Expert Group on LULUCF during 2019. In the draft submission, the proposed FRL for the United Kingdom was -16 657 070 t CO_2e (-14 174 560 t CO_2e if instantaneous oxidation of HWP was assumed). Following the assessment, the European Commission issued technical recommendations for the United Kingdom on four criteria of Annex IV, Section A and five elements of Annex IV, Section B of the Regulation (EU) 2018/841, as detailed in the *Assessment of the National Forestry Accounting Plans*, SWD(2019) 213 final, published on 18 June 2019. The table below details the technical recommendations, responses provided by the United Kingdom and technical comments by the European Commission.

	SWD recommendation	**Response from the United Kingdom**	**EC comments**
Annex IV.A(a)	Demonstrate how the goal of achieving a balance between anthropogenic emissions and removals will be achieved in the second half of the century. Provide qualitative and quantitative information until at least 2050 consistent with the long-term strategy required under Regulation (EU) 2018/1999	Addressed through providing additional information in Section 4.2, sub-section entitled, "Consistency of FRL projection with long-term emissions goal", including new Figure 4.3 (pages 66 to 68), showing the development of CO2 removals on Managed Forest Land from 2000 to 2050 under a "business as usual" scenario, noting that Managed Forest Land is consistently a net sink over this period.	**Addressed**
Annex IV.A(e)	Provide a ratio between solid (HWP) and energy use of forest biomass as documented in the period from 2000 to 2009 used for the estimation of the forest reference level and demonstrate it remains constant throughout the projection. Present the ratio together with information in Table 12 of the NFAP.	Section 3.3, sub-section entitled "Allocation of harvested wood to product types (energy and solid wood)", including new Tables 3.12 and 3.13 (pages 49 to 52). It is confirmed that a constant ratio between solid (HWP) and energy use of forest biomass as documented in the period from 2000 to 2009 was used for the estimation of the forest reference level Relevant additional supporting information and discussion is now provided in the NFAP.	**Addressed** Note that the percentage allocations to the solid wood product types vary slightly from year to year, depending on the relative contributions to harvested wood from softwoods and hardwoods, as simulated for the FRL projection. (p. 50-52).
Annex IV.A(g)	Demonstrate the consistency with the national projections of anthropogenic greenhouse gas emissions reported under Regulation (EU) No 525/2013. Provide explanations for possible differences between national projections and the proposed FRL.	Section 4.2, sub-section entitled, "Consistency of FRL projection with Regulation (EU) 525/2013", including new Figure 4.2 (pages 65 and 66). The methodology for constructing the FRL has been revised and improved to ensure better consistency between the FRL projection and national projections of anthropogenic greenhouse gas emissions reported	**Addressed**

	SWD recommendation	Response from the United Kingdom	EC comments
		under Regulation (EU) No 525/2013. Remaining differences between the projections are due to improvements made to modelling methodologies applied in producing GHG Inventories, as explained in an updated and expanded discussion.	
Annex IV.A(h)	Estimate the FRL based on the area under forest management as indicated in Annex IV, Section B (e-i). Use the conversion period for Land converted to forest land (Afforested land) consistent with the latest national GHG inventory. Explain the difference of approximately 2 Mt CO2 between the national GHG inventory and FRL for the reference period (Figure 4.1 in the NFAP). Demonstrate possible impacts of the different age-class structures used in the FRL and national GHG inventory in the reference period and on the trends during the years 2010-2016.	Section 3.1, Box 3.2 and associated discussion (pages 20 and 21). Section 3.2.1, including Table 3.2 (total areas of forest strata, pages 21 to 23). Section 3.2.2, sub-section entitled, "Projected forest area", including revised (corrected) Table 3.10 and corrected and expanded Table 3.11 (pages 38 to 40). The calculation of the FRL projection has been updated to ensure that forest areas referred to are consistent with the National GHG Inventory and that a transition period of 20 years has been used for the conversion of "Afforested land" to Managed Forest Land. Relevant discussion, tables and figures have been updated. Section 4.2, includes a revised Figure 4.1 (pages 63 to 65). Figure 4.1, which was not consistent with Table 4.1 has been corrected. Section 3.1, Box 3.2 and associated discussion (pages 20 and 21).Section 3.2.2, sub-section entitled, "Projected forest area", including revised Figures 3.3 and 3.4 (pages 38 to 40). The calculation of the FRL projection has been updated to ensure that age class distributions of forest areas in the FRL projection are consistent with the National GHG Inventory up to the end of the Reference Period (2009).	**Addressed**
Annex IV.B(b)	Provide missing information on non-CO2 emissions from drained organic soils for the FRL, which are reported in the GHG inventory.	Section 3.3, sub-section entitled, "Natural Disturbances", including Tables 3.14 and 3.15 and Figure 3.9 (pages 53 to 58).	**Addressed**

	SWD recommendation	Response from the United Kingdom	EC comments
		More detailed information describing the calculation of the background level for natural disturbances has been included.	
Annex IV.B(c)	Provide more detailed information on the calculation of the background level for natural disturbances, consistent with Regulation (EU) 2018/841.	Section 3.3, sub-section entitled, "Natural Disturbances", including Tables 3.14 and 3.15 and Figure 3.9 (pages 53 to 58). More detailed information describing the calculation of the background level for natural disturbances has been included.	**Addressed**
Annex IV.B (e-i)	Provide the area under forest management consistent with Table 4.A ("Forest land remaining Forest land") from the latest national GHG inventory using the year preceding the starting point of the projection. Given the use of the dynamic area approach, provide a detailed disaggregated calculation of the managed forest land area at annual time steps for the entire time series since, at least, year 2000.	Section 3.1, Box 3.2 and associated discussion (pages 20 and 21).Section 3.2.1, including Table 3.2 (total areas of forest strata, pages 21 to 23).Section 3.2.2, sub-section entitled, "Projected forest area", including revised (corrected) Table 3.10 and in particular corrected and expanded Table 3.11 (pages 38 to 40). The calculation of the FRL projection has been updated to ensure that forest areas referred to are consistent with the 2019 National GHG Inventory submission (1990-2017) and that a transition period of 20 years has been used for the conversion of "Afforested land" to Managed Forest Land. Relevant discussion, tables and figures have been updated and elaborated	**Addressed** The United Kingdom states that "data sources have been adjusted for a consistent reporting year of 2011 and to ensure compatibility with forest areas reported in the CRF in the UK 1990-2017 GHGI." (p. 22) Managed forest area reported in Table 3.10 is 3 120 779 ha, which corresponds to the area reported as Forest Land remaining Forest Land in the UK (excl. overseas territories) in 2011 (GHGI 2019).
Annex IV.B(e-iii)	Provide additional information on increments.	Section 3.2.1, sub-section entitled, "Stratification with respect to potential stand increment" and discussion in this and ensuing sub-sections (pages 24 to 29). Section 3.2.2, sub-section entitled, "Comparison of forest increment and harvest levels", including Figure 3.7 (pages 44 and 45). New discussion has been included clarifying the link between "yield class" as defined in UK forestry and	**Addressed** See esp. Fig. 3.7.

	SWD recommendation	Response from the United Kingdom	EC comments
		potential forest increment, and the relevance of this to the definition of forest strata. Information has been included about UK forest increment relative to harvesting over the period 2000 to 2050.	
Annex IV.B(e-iv)	Provide additional information on disaggregation of energy and non-energy uses for historical and future harvesting rates.	Section 3.3, sub-section entitled, "Allocation of harvested wood to product types (energy and solid wood)", including Tables 3.12 and 3.13 (pages 49 to 52).	**Addressed**
Other issues noted by the Member State. In the revised UK NFAP, the Forest Reference Level has been calculated by assuming that the transition to managed forest land occurs 20 years after the date of conversion from non-forest land use to ensure consistency with emissions and removals reported for forest land remaining forest land in the existing greenhouse gas inventories. In the draft NFAP a transition period of 30 years was used. Following article 6(2) of the LULUCF Regulation, the UK intends to categorise cropland, grassland, wetland, settlements or other land converted to forest land as making the transition to managed forest land from 30 years after the date of conversion. It will be realised through a future technical correction to the Forest Reference Level. Information relevant to this point has been provided in Section 4.1 and Table 4.2 (pages 60 and 61).			
Other issues noted by the EC. The cover page of the revised NFAP is dated to January 2020.			

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