Final Review Report

2025 Comprehensive Review of National Greenhouse Gas Inventory Data

pursuant to Article 38(1a) of Regulation (EU) No 2018/1999 and Article 4(4) of Regulation (EU) No 2018/841

Estonia

28 August 2025

European Environment Agency

Reference: No 3502/B2025/EEA.60384

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Introductions and conclusions from the 2025 comprehensive review

This Final Review Report presents the findings from the 2025 comprehensive review of the greenhouse gas (GHG) emission inventory of Estonia.

The comprehensive review was carried in accordance with Article 38(1a) of Regulation (EU) 2018/1999 ('Governance Regulation'). The purpose of the comprehensive review is to enable the Commission to set out the annual limit values of Estonia for the years from 2026 to 2030, in terms of tonnes of CO_2 equivalent, as required by Article 4(4) of Regulation (EU) No 2018/841 (the 'LULUCF Regulation').

The reviewers carried out checks to verify the transparency, accuracy, consistency, comparability and completeness of the national GHG inventory for the years 2016, 2017 and 2018 as well as 2021, 2022 and 2023 submitted in 2025 by Estonia pursuant to Articles 26(4) of the Governance Regulation.

The initial checks were carried out on the draft inventory submissions submitted pursuant to Article 26(3) of the Governance Regulation. The review builds on the initial checks performed by the EU inventory team (European Environment Agency (EEA) and the European Topic Centre on Climate Change Mitigation (ETC/CM)). The comprehensive review was performed by a Technical Expert Review Team (TERT).

More information on the procedures for the 2025 comprehensive review is presented in the annexes of this review report.

Initial check and comprehensive review conclusions

1. The reviewers raised 35 issues with Estonia during the initial check and comprehensive review (see Table 1). The TERT provided recommendations for 13 of these issues. Other issues raised during the comprehensive review were clarified and are considered resolved.
2. The TERT identified cases where inventory data were prepared in a manner which is inconsistent with UNFCCC guidance documentation or Union rules. In particular, the TERT identified a number of under-estimates or over-estimates exceeding the threshold of significance pursuant to Article 31 of Commission Implementing Regulation (EU) No 2020/1208.
3. Estonia provided 3 revised estimates. Table 2 below summarises the revised estimates and further information is provided in the respective chapter of this report. The TERT agreed to all revised estimates.
4. The TERT did not deem necessary any technical corrections in the meaning of Article 38(2)(d) of Regulation (EU) No 2018/1999.
5. The TERT identified recommendations in order to improve the national inventory data of Estonia (see Table 3).
6. The TERT considers that it received a response from Estonia that was sufficient in order to undertake the comprehensive review appropriately.

Table 1: Overview of issues raised with Estonia

	Issues raised during the initial check	Issues raised during the comprehensive review	Recommendations	Revised estimates[1]	Technical corrections[2]
LULUCF	**12**	**23**	**13**	**3**	**-**

[1] Revised estimates: changes in inventory estimates triggered by the review and provided by the country.
[2] Technical corrections: changes in inventory estimates triggered by the review and provided by the TERT.

National totals for the purpose of Article 4(4) of Regulation (EU) 2018/841 (LULUCF)

Table 2 Totals net LULUCF emissions for the purpose of Article 4(4) of Regulation (EU) No 2018/841

Emission source category	Reference	Emission estimates (kt CO_2 equivalent)[1]					
		2016	2017	2018	2021	2022	2023
Total net greenhouse gas emissions for the LULUCF sector, pursuant to Article 26(4) of Regulation (EU) No 2018/1999	EST-CRT-2025-V0-2-DataEntry-20250314-084216	1 637.949	1 550.818	3 300.015	848.480	198.204	2 130.794
Difference between revised estimates and original estimates provided by Estonia and accepted by the TERT[2]							
4 Land (All land conversions), Multiple GHG (CO_2, N_2O), Mineral soil	EE-4-2025-0006	-46.605	-43.946	-40.984	-31.533	-28.198	-25.331
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils, Multiple GHG (CH_4, N_2O), Organic soil	EE-4A-2025-0002	-206.298	-206.285	-206.320	-206.358	-206.392	-206.396
4B1 Cropland remaining cropland, CO_2, Living biomass	EE-4B-2025-0004	-14.306	-14.299	-14.292	-1.807	-0.025	1.044
Total net greenhouse gas emissions for the LULUCF sector including revised estimates		1 370.739	1 286.287	3 038.419	608.783	-36.410	1 900.112

[1] The tables presented in this report show numbers rounded to three decimal places, although most numbers are available with greater precision. For all calculations all available decimal places were used. Therefore, the totals shown may slightly differ from calculation results where only three decimals are taken into account.

[2] A positive difference indicates an increase compared to reported emissions or decrease in reported removals. A negative difference indicates a decrease compared to reported emissions or increase in reported removals. For more information on revised estimates and/or technical corrections, see Annex 1.

Statement from Estonia on the conclusions presented by the TERT

Estonia agrees with the aggregated GHG emission inventory estimates presented in Table 2.

Recommendations from the TERT, considering revised estimates and technical corrections deemed necessary by the TERT

Table 3: Recommendations from TERT (RE = Revised estimate; TC = Technical correction)

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
EE-4-2025-0006	No	4 Land use, land-use change and forestry, CO_2, N_2O, 1990-2023	The TERT noted inconsistencies in the calculation of mineral soil carbon stock changes across land-use conversions. For example, the reported emission factor (EF) for Grassland converted to Forest Land is –0.12 t C ha^{-1} yr^{-1} (Table 6.10), while for Forest Land converted to Grassland it is 0.159 t ha^{-1} yr^{-1} (Table 6.21). Furthermore, these values are not consistent with the national soil carbon stock values provided: Forest Land – 108.0 t C ha^{-1}, Grassland – 107.3 t C ha^{-1}, and Cropland – 88.2 t C ha-1. Applying a 20-year transition period, the expected average annual carbon stock change between Forest Land and Grassland would be 0.035 t C ha^{-1} yr^{-1}. The issue persists in all land-use changes. The current approach can theoretically result in a drift toward negative soil carbon stock values if land continuously transitions between two land-use categories. Considering the assumption that both EFs and average C stocks provided by Estonia are based on the same weighted average soil type distribution and applied 20-year conversion period and that the actual annual distribution of converted soil types is not tracked, the applied EFs should be equal to the difference in average C stocks divided by 20, however, such consistency is not ensured. In addition, The TERT noted an incompleteness in the reporting of carbon stock changes (CSCs) in mineral soils in land conversions involving Grassland and Settlements. CSC in mineral soils is reported for Grassland converted to Settlements; however, no mineral soil CSC is reported for the reverse transition, i.e., Settlements converted to Grassland. For consistency and completeness, CSC should be reported in both directions of land-use conversion in accordance with the 2006 IPCC Guidelines (Vol. 4, Ch. 2). In response to a question raised during the review, Estonia explained that mineral soil C stock changes due to land conversion between Forest land, Cropland and Grassland were estimated based on the article (Kõlli et al. 2010) that compares SOC stocks under different land use separately for each soil type. Weighted average EFs were calculated based on the distribution of soil types in the original land use (from Kõlli et al. 2009). The Reference SOC value is not used in calculations. The assumed distribution of soil types is the same as that used for calculating the average SOC stock of the land-use categories. The approach that Estonia applies for land conversions of Settlements and Other land is the same as in the Swedish NIR. Responding to a potential technical correction, Estonia has submitted a revised calculation for lands converted from Wetlands, Settlements, and Other Land categories. Additionally, Estonia provided detailed calculations of CSCFs for land-use changes between Forest Land, Cropland,	RE

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			and Grassland. For these land categories, Estonia presented a matrix that transparently demonstrates the derivation of CSC values at the level of each soil type. The values were calculated as the difference in average carbon stocks measured for different soil types under various land uses and were subsequently aggregated at the land-use category level. Estonia also reported on the verification of these CSC values by referring to the NID, Chapter 6.4.4. The revised estimate included previously absent estimates of mineral soil carbon stock changes for Settlements converted to Grasslands. The TERT does not consider that the method applied causes systematic under- or over- estimates of emissions and removals, and it thus agrees with the recalculated estimates. Nevertheless, the TERT notes that the method applied assumes that the share among soil types of each kind of land use change remains constant across the entire time series based on information collected from a paper (Kolli et al, 2009), and that Other land includes also land with significant SOC stocks. Thus, the TERT recommends that Estonia report a complete time series of recalculated SOC changes in mineral soils, including carbon stock changes for Settlements converted to Grasslands, together with detailed data on SOC stocks of the different soil types under the different land uses, as well as the matrix of calculated CSCs in its next NID. To ensure transparency, the TERT recommends that Estonia report calculations of carbon stock changes in the NID split for the different types of other land, i.e. those without significant carbon stocks (see IPCC definition) and those with significant carbon stocks. Finally, the TERT recommends that Estonia collect information on the soil type of each detected land use change, through a spatially explicit system, and accordingly recalculate estimates of SOC changes, as well as that Estonia continue to verify the accuracy of CSC values in the matrix and report on the results of verification exercises in next submissions.	
EE-4A-2025-0002	No	4A Forest land, CH_4, CO_2, N_2O, 1990-2023	The TERT noted that Estonia does not consistently apply emission factors across gases for organic soils in the Forest Land category. Estonia uses Tier 1 temperate zone emission factors from the 2006 IPCC Guidelines for CO_2 emissions but applies boreal zone emission factors from the 2013 IPCC Wetlands Supplement for N_2O and CH_4 emissions. According to Figure 3A.5.1 of the 2006 IPCC Guidelines, Estonia lies within the temperate zone; therefore, temperate zone emission factors should be applied consistently across all gases. The TERT recommends that Estonia apply the updated 2013 IPCC Wetlands Supplement emission factors for CO_2, N_2O, and CH_4 for the temperate zone to ensure methodological consistency. In response to a question raised during the review, Estonia provided revised estimates. Estonia recalculated N_2O emissions from drained organic forest soils using default emission factors from the 2006 IPCC Guidelines (Ch. 11, Table 11.1, temperate and boreal zone) and calculated CH_4 emissions using EFs for temperate zone from the 2013 IPCC Wetlands supplement, as 2006 IPCC Guidelines do not provide a default value for the CH_4 EF. The TERT agreed with the revised estimate provided by Estonia. The TERT recommends that Estonia include revised estimate using	RE

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			temperate EFs in its next submission. Additionally, the TERT encourages Estonia to adopt the 2013 IPCC Wetlands Supplement emission factors for drained organic soil emissions for all gases, until country-specific methods become available.	
EE-4B-2025-0004	No	4B Cropland, CO_2, 1990-2023	The TERT noted that Equation 6.7 to estimate biomass C stock changes in perennial cropland counts for C stock losses/gains associated with area changes only. Such an approach is inconsistent with the IPCC good practice that requires to estimate annual gains, associated with biomass growth, and annual losses, associated with final logging of the trees, across the entire area cultivated with perennial croplands, even when no changes in management, e.g. the type of trees occurs. The TERT asked if Estonia can provide revised estimates of biomass C stock changes from perennial cropland. In response to a question raised during the review, Estonia explained that it has data on the average biomass in orchards from a research project, as well as total annual area data from Statistics Estonia. However, there is no information available on harvested areas or land-use changes to or from perennial croplands. The biomass of perennial woody crops was measured in major market gardens and privately owned orchards in Estonia in 2012. Based on these results, Estonia considers the updated methodology provided in the 2019 Refinement (Chapter 5, Section 5.2.1) to be more suitable than the default values provided in the 2006 IPCC Guidelines. For example, the default value for mean aboveground biomass carbon stock of orchards in Table 5.3 of the 2019 Refinement is close to Estonia's measured value of 7.8 t/ha (assuming a carbon fraction of 0.47). Consequently, Estonia revised its estimate using the Tier 1 methodology from the 2019 Refinement. The TERT agreed with the methodological approach applied to calculate the revised estimate; although the TERT noted that, according to Table 5.5 of the 2019 Refinement, annual growth rate of 0.43 t C/ha should be used, while instead Estonia used a value of 0.28 t C/ha. Accordingly, the TERT informed Estonia of the error and Estonia agreed to correct the value to 0.43 t C/ha in the revised estimates. The TERT recommends that Estonia include a complete time series of the revised estimate in the next submission. Furthermore, given that it is good practice to seek national data on above-ground woody biomass growth rates, the TERT encourages Estonia to address existing knowledge gaps related to woody biomass growth rates, carbon stocks at the time of harvesting and land-use changes between annual and perennial crops, to improve the estimation of carbon stock changes in perennial crop living biomass for Cropland remaining Cropland and conversion to and from Cropland with perennial crops.	RE
EE-4-2025-0007	No	4 Land use, land-use change and	The TERT noted that in the previous UNFCCC review (ARR 2022), the ERT recommended (L.14) that Estonia demonstrate the accuracy of the regression used to estimate BCEFs as a function of stand volume, by providing the equation, parameters, and graphical or numerical evidence (e.g., residual plots, adjusted R^2). In the 2025 submission, Estonia has provided a table of BCEF by stand volume	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
		forestry, CO_2, 1990-2023	class (Annex A.V.4) and mentioned in NID Table 1.5 the use of a regression approach. However, the regression equations and statistics on fitting are not presented, and no graphical or numerical evidence of the regression fit is included. Considering that BCEFs are a key component used within Estonia's Tier 3 method for estimating carbon stock changes in living biomass, the ERT recommended that Estonia report a completed description of the process to derivate the BCEF values, including the regression equations, parameter values, and evidence of the statistical fit (e.g., residuals plots or adjusted R^2) or other empirical evidence that the BCEFs are accurate. In response to a question raised during the review, Estonia explained to the TERT that the development of BCEF coefficients can be found in a report of the Estonian University of Life Sciences (Sims, 2024) (https://keskkonnaportaal.ee/sites/default/files/2024-08/K%C3%A4sundusleping_aruanne.pdf). The report contains information on the development of BCEF coefficients, including the regression estimates and parameters for single tree biomass by species, from NFI data. The TERT recommends that Estonia include information on the regression equations used to develop the BCEF values, as well as information on the statistics on fitting and on the data used, in the NID or in its annex in the next submission, in addition to the literature references.	
EE-4A-2025-0005	No	4A Forest land, CH_4, NO_2, 2012-2023	The TERT noted that for wildfires in Forest lands a constant combustion efficiency value of 0.15 was applied for the years 1990–2011 based on IPCC default values. The TERT further noted that Estonia's NID explains that, starting from 2012, the values of the 2 variables/parameters: "mass of available fuel (MB)" and "combustion efficiency (Cf)" for wildfire emissions are determined through field inventories conducted by the Estonian Environment Agency. However, the actual measured values of MB and Cf used since 2012 are not transparently reported in the NID. Thus, the TERT asked Estonia on MB and Cf values used in each year from 2012 onward and transparently justify their selection. In response, Estonia clarified that it no longer uses the "mass of available fuel (MB)" and "combustion efficiency (Cf)" to calculate emissions from wildfire. Instead, in-situ measurements are conducted at each burned area, where only the burned biomass is assessed. This approach ensures a direct and precise estimation of wildfire-related losses based on actual field observations. The TERT recommends that Estonia report complete information on the methodology applied to estimate the amount of biomass combusted for the year 2012 onward.	No
EE-4A-2025-0004	No	4A Forest land, CO_2, 1990-2023	The TERT noted that in the previous UNFCCC review (ARR 2022, L. 16), the ERT recommended that Estonia provide a transparent description of the counteracting forces that prevail over harvest as drivers of inter-annual carbon stock changes in living biomass for forest land remaining forest land, and that harvest statistics be reported alongside removals over the entire reporting period. In the 2025 submission, Estonia has implemented a Gain-Loss method to estimate carbon stock changes,	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			and harvest statistics are now reported together with removals (Figures 6.12 and 6.13 of the NID), so addressing part of the recommendation, and it is developing a more detailed gain-loss methodology, which is expected to be used no later than in the 2027 submission. During the review, Estonia had communicated to the ERT that factors such as forest age structure, increment, net of natural mortality, and land area changes counteract the effect of harvesting. However, a detailed description of these counteracting drivers is not included explicitly in the NID. The TERT recommends that Estonia include in future NIDs a transparent explanation of each of the components estimated in the Gain and Loss estimate, including the counteracting forces influencing carbon stock changes. In particular, the TERT recommends that Estonia report in its next NID a complete time series of estimates of the gross increment, the natural mortality, and of the harvest losses contributing to the net carbon stock change over the whole time series. This would significantly improve the transparency and understanding of how different components influence the carbon dynamics of forest biomass over time.	
EE-4A-2025-0003	Yes	4A Forest land, CO_2, 1990-2023	The TERT noted that category 4A1. Forest Land Remaining Forest Land is a key category, with organic soil representing a significant source while Tier 1 EFs are applied. In accordance with Article 18(4) of Regulation (EU) 2018/841, at least a Tier 2 method should be applied for such pools. In Table 10.4 of the NID, it is indicated that an improved emission calculation method may be developed as an outcome of the project "Demonstration of climate change mitigation potential of nutrient-rich organic soils in the Baltic States and Finland." The TERT noted that several studies conducted in Estonia (listed below) provide estimates of soil carbon losses or CO_2 emissions from drained organic soils. Namely: Salm, J.-O., Maddison, M., Tammik, S., Soosaar, K., Truu, J., and Mander, Ü.: Emissions of CO_2, CH_4 and N_2O from undisturbed, drained and mined peatlands in Estonia. Hydrobiologia, 692: 41–55, https://doi.org/10.1007/s10750-011-0934-7, 2012. Uri, V., Kukumägi, M., Aosaar, J., Varik, M., Becker, H., Morozov, G., and Karoles, K.: Ecosystems 280 carbon budgets of differently aged downy birch stands growing on well-drained peatlands. Forest Ecol. Manag., 399, 82–93, https://doi.org/10.1016/j.foreco.2017.05.023, 2017. Minkkinen, K., Laine, J., Shurpali, N. J., Mäkiranta, P., Alm, J., and Penttilä, T.: Heterotrophic soil respiration in forestry-drained peatlands. Boreal Environ. Res., 12, 115–126, www.borenv.net/BER/pdfs/ber12/ber12-115.pdf, 2007b. In response to a question raised during the review, Estonia explained that it has launched a research project for developing country-specific GHG emission factors for drained organic forest soils (nutrient-poor sites) in 2021. During the project LIFE OrgBalt, emission factors have been developed for nutrient-rich organic soils in the temperate cool & moist (TCM) climate region. Both projects have been concluded, but the results will be implemented in the inventory after the publication of the emission factors in peer-reviewed journals. In 2025, Estonia also initiated a project for developing Tier	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			3 methodologies to estimate GHG emissions/ removals in mineral and organic forest soils. Given that Forest Land Remaining Forest Land is a key category and organic soils represent a significant source, the TERT recommends that Estonia continue improvements as planned and implement a higher-tier method (Tier 2 or Tier 3) as soon as it is scientifically validated and available.	
EE-4A1-2025-0002	Yes	4A1 Forest land remaining forest land, CH_4, N_2O, 1990-2023	The TERT noted that for 4A1 Forest Land Remaining Forest Land, Estonia reports N_2O and CH_4 emissions from organic soils in Table 4(II) using a Tier 1 method with default emission factors from the 2013 IPCC Wetlands Supplement (the issue on choice of boreal EFs was raised by observation EE-4A-2025-0002). However, this is a key category, and organic soils represent a significant source. In line with the 2006 IPCC Guidelines and the LULUCF Regulation, higher-tier methods (Tier 2 or 3) are required for such significant pools of key categories. The TERT notes that in the NID, page 276 Estonia refers to recently concluded research projects expected to support methodological improvements in the estimation of emissions from organic soils. In response to a question raised during the review, Estonia explained it has launched a research project for developing country-specific GHG emission factors for drained organic forest soils (nutrient-poor sites) in 2021. During the project LIFE OrgBalt, emission factors have been developed for nutrient-rich organic soils in the temperate cool & moist (TCM) climate region. Both projects have been concluded, but the results will be implemented in the inventory after the publication of the emission factors in peer-reviewed journals. In addition, a research project to specify the activity data and emissions from drainage diches in all land use categories has been recently concluded. Results will be evaluated and implemented in the GHG inventory. Currently the methodological changes concerning organic soils are planned to be implemented in the 2026 submission. The TERT recommends that Estonia introduce the methodological improvements concerning organic soils and move to higher tiers for this significant pool of a key category (Forest land remaining forest land, organic soils).	No
EE-4A1-2025-0001	Yes	4A1 Forest land remaining forest land, CO_2, 1990-2023	Estonia reports on page 261 of the NID that, although the extraction of stumps and roots is not practiced, the C stocks in the stumps and roots of harvested trees is not transferred to the DOM pools, as per Tier 1 approach, and thus counted in the NGHGI as emitted in the year in which the trees are harvested, although harvesting residues of belowground biomass likely represent a substantial transfer of living biomass to the dead organic matter pool making it a significant pool under the key category of Forest Land Remaining Forest Land. Moreover, given the high harvesting rates observed in the period 2010–2014, counting as an instantaneous emission in the year of harvest the entire C stock of the stumps and roots of harvested trees artificially concentrates carbon losses into earlier years, potentially affecting the accuracy of the time series for the period 2016–2023. The TERT recommends that Estonia count as a C stock gain in the DOM pool the C stocks in the stumps and large roots of	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			harvested trees and then apply a decay function to estimate annual losses from DOM pool, using a Tier 2 or Tier 3 method in line with the 2006 IPCC Guidelines (Vol. 4, Ch. 4, Section 4.2.2.2). In response to a question raised during the review, Estonia explained that it is currently developing a decay function for stumps and roots. Analysis is based on NFI permanent plots. The results are planned to be implemented no later than in the 2027 inventory submission. The TERT recommends that Estonia implement a higher-tier method for estimating carbon stock changes in dead organic matter in the inventory as soon as the noted methodological work is concluded.	
EE-4A2-2025-0002	Yes	4A2 Land converted to forest land, CH_4, 1990-2023	Estonia reports biomass gains for 4A2 Land converted to Grassland but does not report biomass losses for Grassland converted to Forest Land. Under typical land-use transformation practices, the establishment of forest cover is likely to result in the replacement or suppression of existing grassland vegetation and Estonia reports an annual living biomass carbon stock change of 0.11 t C ha^{-1} yr^{-1} for Grassland Remaining Grassland and Land converted to grassland (NID Table 6.20), which means that biomass C stocks are present on Grassland. In response to a question raised during the review, Estonia explained that grassland conversion to forest land takes place slowly during natural succession on areas that are no longer under agricultural use, and that thus there are no abrupt changes in the vegetation biomass stock (i.e. biomass losses) at the time of conversion. Instead, the existing vegetation continues to grow alongside the newly established trees. Since tree growth is slow, it is assumed that the grass persists throughout the entire 20-year transition period. Consequently, no biomass loss is reported during the conversion. The TERT partly agreed with the explanation provided by Estonia, indeed, although a constant rate of 0.11 t C ha^{-1} yr^{-1} is reported for the annual net gain in woody biomass on Grassland remaining Grassland and Land converted to Grassland, which thus justifies the presence of substantial woody biomass stocks, that constant rate may not accurately capture the long-term dynamics of biomass stocks in Grassland given it is derived by interpolating woody biomass stock data between two NFI cycles and the resulting figure is extrapolated across the entire time series. Further, the TERT notes that this may, in turn, affect assumptions related to carbon stock changes in living biomass due to afforestation of Grasslands. The TERT recommends that Estonia apply splicing techniques to extrapolate living biomass carbon stock changes in Grasslands, with the aim of producing dynamic and more accurate estimates and to assess the impact of these estimates on living biomass CSCs in Grassland Converted to Forest land, including potential biomass losses resulting from afforestation by forest planting following biomass removal.	No
EE-4B-2025-0003	No	4B Cropland, CO_2, N_2O, 1990-2023	The TERT noted that Estonia applies updated F_{LU}, F_{MG}, and F_I factors from the IPCC 2019 Refinement to estimate soil carbon stock change in mineral soils in cropland. On page 273 of the NID, it is reported that a national study (Putku and Penu, 2018) found no statistically significant differences in SOC stocks	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			between conventional and no-till practices in Estonian soils (0–25 cm layer). The TERT thus noted that the use of IPCC default values of F_{MG} may not be justified under the reported national circumstances of Estonia. In response to a question raised during the review, Estonia explained that the study by Putku and Penu (2018) included too few sites for developing country-specific F_{MG} values. In addition, most fields representing conventional practices were actually tilled only 1-3 times across a 5-year period, and the effect was therefore more similar to the reduced tillage management. Thus, Estonia concluded that those results still supports the decision taken to apply F_{MG} values from the 2019 Refinement, given those are lower compared to those provided in the 2006 IPCC Guidelines (as well as other published studies from the same region, e.g. Sheehy et al. 2015. Soil and Tillage Research 150, 107-113). In 2025, Estonia initiated a project that aims to implement RothC model for estimating SOC changes in Cropland mineral soils. The project will end in 2027. The TERT considers that the justification provided—namely that the study included too few sites and that the management practices did not clearly differentiate conventional from reduced tillage— to be sufficient for continuing the use of default F_{MG} factors from the 2019 Refinement. Considering that mineral soils in Cropland Remaining Cropland represent a significant carbon pool, the TERT recommends Estonia to continue its methodological development efforts, including the planned implementation of the RothC model for cropland mineral soils, to improve the accuracy of future estimates of soil carbon stock changes in this category.	
EE-4C2-2025-0003	No	4C2 Land converted to grassland, CO_2, 1990-2023	The TERT noted that Estonia reports CO_2 emissions from organic soils in the category Land converted to Grassland using a Tier 1 method and emission factors from the 2006 IPCC Guidelines. However, this is a key category, and organic soils represent a significant carbon pool given that emissions account for more than 25% of total emissions in this category, consequently the application of a higher-tier method (Tier 2 or 3) is required, in line with IPCC good practice and with the Governance Regulation. The TERT notes that Estonia reported on page 276 of the NID a recently concluded research project, from which methodological improvements may be derived. In response to a question raised during the review, Estonia informed on the plan to implement a country-specific emission factor (Tier 2 method) that was developed during the LIFE OrgBalt project after it has been published in a peer-reviewed article. To ensure that the reporting of land converted to grassland, organic soils is compliant with the requirements in the Governance and LULUCF regulation, the TERT recommends Estonia to apply a higher tier method as soon as the needed information is published.	No
EE-4G-2025-0002	Yes	4G Harvested wood	The TERT noted that on page 299 of the NID Estonia reported that the Production approach is applied. However, it is also reported that the HWP pool includes “all wood products in use in Estonia,” which raises a potential inconsistency. As outlined in the 2006 IPCC Guidelines (Vol. 4, Chapter 12, p.12.29),	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
		products, CO_2, 1990-2023	the Production is limited to wood products from domestically harvested wood only, and may include products made from domestic harvest that are exported and stored in uses in other countries. The TERT asked Estonia to clarify whether the current HWP methodology corresponds to the Production approach as required by the LULUCF Regulation and thus excludes the imported HWP in use as well as the HWP domestically produced with imported wood (if any). Estonia clarified that only domestically produced HWP with domestic wood is included in the HWP pool and that it will correct and clarify the description in the NID in the next submission. The TERT recommends that Estonia improve the clarity of the methodological description for harvested wood products in the NID in its next submission.	

Revised estimates provided by Estonia and accepted by the TERT[1]

EMRT ID:	EE-4-2025-0006
EMRT URL:	https://emrt-esd.eionet.europa.eu/2025/EE-4-2025-0006
Country:	Estonia
Sector:	4 Land (All land conversions)
Gases:	Multiple GHGs (CO2, N2O)
Pool:	Mineral soil
Completed by LULUCF Expert:	Aldis Butlers
Reviewed by Thematic Counterpart Expert:	
Reviewed by Lead Reviewer:	Sandro Federici
Reviewed by Quality Controller:	Justin Goodwin

1

The underlying problem:	Inconsistencies in the calculation of mineral soil carbon stock changes across land-use conversions. For example, the reported emission factor (EF) for Grassland converted to Forest Land is –0.12 t C ha-1 yr-1 (Table 6.10), while for Forest Land converted to Grassland it is 0.159 t ha-1 yr-1 (Table 6.21). Furthermore, these values are not consistent with the national soil carbon stock values provided: Forest Land – 108.0 t C ha-1, Grassland – 107.3 t C ha-1, and Cropland – 88.2 t C ha-1. Applying a 20-year transition period, the expected average annual carbon stock change between Forest Land and Grassland would be 0.035 t C ha-1 yr-1. The issue persists in all land-use changes
Summarise the methodology used:	Estonia provided a revised estimates for lands converted from Wetlands, Settlements, and Other Land. For land conversions between Forest Land, Cropland, and Grassland retaining the original approach (see point 1). 1. Estonia has applied CSCFs calculated as the difference between the initial and final land-use SOC stocks, divided by 20 years. For land conversions between Forest Land, Cropland, and Grassland, CSCFs were calculated separately for each soil type, and a weighted average was applied at the category level. 2. The Tier 1 assumption for Settlements (20% carbon loss) has been applied. 3. For Wetlands Estonia applied mean SOC stock values for hydromorphic mineral soils measured in grasslands, as reported by Kõlli et al. (2009), Estonian Journal of Earth Sciences, Vol. 58, pp. 95–108. 4. Estonia assumed SOC stocks in Other Land equal to those in Settlements.

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	Original estimate (kt CO2e)				Notes
Year	CO2	CH4	N2O	Total GHG	
2016	22.688		18.321	41.010	
2017	49.981		19.540	69.521	
2018	77.751		20.873	98.624	
2021	147.645		24.366	172.011	
2022	163.555		25.067	188.622	
2023	173.015		25.224	198.239	

	Revised Estimate received from country (kt CO2e)				Notes
Year	CO2	CH4	N2O	Total GHG	
2016	-23.972		18.376	-5.596	
2017	5.980		19.595	25.574	
2018	36.710		20.929	57.639	
2021	116.052		24.426	140.478	
2022	135.296		25.129	160.424	
2023	147.622		25.286	172.908	

	Difference between RE and OE (kt CO2e)			
Year	CO2	CH4	N2O	Total GHG
2016	-46.660		0.055	-46.605
2017	-44.001		0.055	-43.946
2018	-41.041		0.056	-40.984
2021	-31.593		0.060	-31.533
2022	-28.259		0.062	-28.198
2023	-25.392		0.062	-25.331

EMRT ID:	EE-4A-2025-0002
EMRT URL:	https://emrt-esd.eionet.europa.eu/2025/EE-4A-2025-0002
Country:	Estonia
Land use category:	4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils
Gases:	Multiple GHGs (CH_4, N_2O)
Pool:	Organic soil
Completed by LULUCF Expert:	Aldis Butlers
Reviewed by Thematic Counterpart Expert:	
Reviewed by Lead Reviewer:	Sandro Federici
Reviewed by Quality Controller:	Justin Goodwin

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The underlying problem:	The TERT noted that Estonia does not consistently apply emission factors across gases for organic soils in the Forest Land category. Estonia uses Tier 1 temperate zone emission factors from the 2006 IPCC Guidelines for CO_2 emissions, but applies boreal zone emission factors from the 2013 IPCC Wetlands Supplement for N_2O and CH_4 emissions. According to Figure 3A.5.1 of the 2006 IPCC Guidelines, Estonia lies within the temperate zone; therefore, temperate zone emission factors should be applied consistently across all gases. The TERT recommends that Estonia apply the updated 2013 IPCC Wetlands Supplement emission factors for CO_2, N_2O, and CH_4 for the temperate zone to ensure methodological consistency.
Summarise the methodology used:	Use of 2006 IPCC Default EF for N_2O and 2013 IPCC Wetlands Supplement default EF for CH_4 (no default EF factor provided by 2006 IPCC Guidelines)

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	Original estimate (kt CO_2e)				Notes
Year	CO_2	CH_4	N_2O	Total GHG	
2016		77.272	242.183	319.454	
2017		77.302	242.154	319.456	
2018		77.329	242.189	319.518	
2021		77.432	242.199	319.630	
2022		77.477	242.226	319.703	
2023		77.506	242.218	319.725	

	Revised Estimate received from country (kt CO_2e)				Notes
Year	CO_2	CH_4	N_2O	Total GHG	
2016		64.790	48.366	113.156	
2017		64.807	48.363	113.171	
2018		64.826	48.372	113.198	
2021		64.891	48.381	113.272	
2022		64.921	48.389	113.310	
2023		64.939	48.390	113.329	

	Difference between RE and OE (kt CO_2e)			
Year	CO_2	CH_4	N_2O	Total GHG
2016		-12.481	-193.816	-206.298
2017		-12.495	-193.790	-206.285
2018		-12.503	-193.817	-206.320
2021		-12.541	-193.817	-206.358
2022		-12.556	-193.837	-206.392
2023		-12.567	-193.828	-206.396

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EMRT ID:	EE-4B-2025-0004
EMRT URL:	https://emrt-esd.eionet.europa.eu/2025/EE-4B-2025-0004
Country:	Estonia
Land use category:	4B1 Cropland remaining cropland
Gases:	CO_2
Pool:	Living biomass
Completed by LULUCF Expert:	Aldis Butlers
Reviewed by Thematic Counterpart Expert:	
Reviewed by Lead Reviewer:	Sandro Federici
Reviewed by Quality Controller:	Justin Goodwin
The underlying problem:	Annual gains, associated with biomass growth, and annual losses, associated with final logging of the trees were not recorded.
Summarise the methodology used:	Country provided a revised estimate using default value for mean aboveground biomass carbon stock of orchards is 8.5 t C/ha (± 25%) in Table 5.3 of 2019 Refinement. The TERT noted that according to Table 5.5, annual growth rate of 0.43 t C/ha should be used, however value 0.28 was used in the revised estimate provided by the country. The TERT corrected this issue and agrees with the approach of the revised estimate.

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	Original estimate (kt CO_2e)				Notes
Year	CO_2	CH_4	N_2O	Total GHG	
2016	14.255			14.255	
2017	14.255			14.255	
2018	14.255			14.255	
2021	1.782			1.782	
2022	0				
2023	-1.069			-1.069	

	Revised Estimate received from country (kt CO_2e)				Notes
Year	CO_2	CH_4	N_2O	Total GHG	
2016	-0.051			-0.051	
2017	-0.044			-0.044	
2018	-0.037			-0.037	
2021	-0.025			-0.025	
2022	-0.025			-0.025	
2023	-0.025			-0.025	

	Difference between RE and OE (kt CO_2e)			
Year	CO_2	CH_4	N_2O	Total GHG
2016	-14.306			-14.306
2017	-14.299			-14.299
2018	-14.292			-14.292
2021	-1.807			-1.807
2022	-0.025			-0.025
2023	1.044			1.044

[1] Carbon stock changes (in kt C) from the CRT tables have been converted into kt CO_2 by multiplying by -44/12.

Annex I: Legal background and procedures of the 2025 comprehensive review

The LULUCF Regulation (EU) 2018/841 sets net emission removal targets for 2030 and net emission budgets in the period 2026 to 2029. In Article 4(5) of the LULUCF Regulation, the Commission is required to adopt decision setting out the annual limit values for net greenhouse gas removals for each year in the period from 2026 to 2029, for which it shall carry out a comprehensive review.

The Governance Regulation (EU) 2018/1999 lays down annual reporting obligations, compliance checks and a review process to ensure that the compliance with annual GHG emission limits is assessed in a credible, consistent, transparent and timely manner.

The requirements for the review of the national inventory data submitted by countries are set out in Article 38 of Regulation (EU) 2018/1999. The details concerning the review process, such as the timing and steps of conducting of the annual and comprehensive reviews are set out in Chapter V and Annex XXII of the Commission Implementing Regulation (EU) No 2020/1208.

The 2025 reviews were thus held as a comprehensive review in line with Article 38(1a) of Regulation (EU) 2018/1999in concert with the reviews required by the LULUCF Regulation.

Objectives

The objectives of the comprehensive review of countries' GHG emission inventories in 2025 are:

a) to support the European Commission by ensuring it has accurate, reliable and verified information on annual GHG emissions for
    - determining the budget for the period 2026-2029 according to Article 4(4) of Regulation (EU) 2018/841.

b) to assist countries in improving the quality of their GHG inventories.

Procedures

The scope of the 2025 comprehensive review is presented in Table A-1. The checks carried out during the 2025 comprehensive review are presented in Annex II.

The initial checks were carried out by the EEA with support from the ETC/CM. All findings from the initial checks that were partly resolved or not resolved within the initial check phase were followed up in the comprehensive review.

The EEA LULUCF experts consisted of the following experts:

- Sector experts: Raul Abad-Viñas and Peter Iversen (EEA)
- Quality coordinator: Lucia Perugini (EEA)

The comprehensive review 2025 was performed by a Technical Expert Review Team (TERT) under service contract **No 3502/B2025/EEA.60384** implementing Framework service contract No EEA/CET/24/002of the European Environment Agency. The lead reviewers and sector review experts did not review emission inventories of countries where these individuals have themselves contributed to the compilation of that inventory or presently are or have been any part of the decision-making process related to the compilation of that inventory.

The TERT consisted of the following experts:

- Iordanis Tzamtzis, Lora Stoeva, Rosie Brook, Carmen Schmid, Boštjan Mali, Andis Lazdiņš, Sven van Baren, Bradley Matthews, Valentin Bellassen, Aldis Butlers, Mattias Lundblad, Juan José Rincón Cristóbal, Etienne Mathias, Erwin Moldaschl and Mélanie Juillard;
- Lead reviewers: Peter Weiss, Kevin Black, Sandro Federici and Marina Vitullo.

The comprehensive review was coordinated by Bernd Gugele and Justin Goodwin.

The EEA review secretariat consisting of Claire Qoul, Lærke Callisen, Peter Iversen and Roxy Cottey prepared and coordinated the comprehensive review as foreseen in Article 30 of Commission Implementing regulation (EU) No 2020/1208 and Article 42 of the Governance Regulation (EU) 2018/1999.

The comprehensive review was performed on the basis 15 April submissions of GHG emission data and the national inventory document (NID) under the Governance Regulation.

Where relevant, the TERT calculated technical corrections for over- or under-estimates identified in a mandatory category in the countries' GHG inventories that exceed the threshold of significance. Technical corrections have been calculated only for the years 2016-2018 and 2021-2023. If the technical correction exceeds the threshold of significance for at least one year of the inventory under review (2021-2023) but not for all the years, the technical correction was calculated only for those years where the technical correction exceeds the threshold of significance.

Table A-1: Scope of the comprehensive review 2025

Element	Scope	Further information
Countries	EU geographical coverage of the Member States, Norway and Iceland	
Years	2016, 2017, 2018, 2021, 2022 and 2023	According to GovReg Article 38(1a): According to LULUCF Article 4(4)
Gases	CO_2, CH_4 and N_2O	
Sectors	LULUCF	

Annex II: Checks carried out during the 2025 initial checks and review

The checks carried out during the 2025 initial checks are pursuant to Article 37(4) of Regulation (EU) 2018/1999 and Article 6 of Commission Delegated Regulation (EU) 2020/1044 and the comprehensive review following Article 38(1a) of Regulation (EU) 2018/1999 and Article 30 of the Commission Implementing Regulation (EU) No 2020/1208.

Initial checks may include:

1. Assessment whether all emission source categories and gases required under Regulation (EU) No 2018/841 are reported;
2. Assessment whether emissions data time series are consistent;
3. Assessment whether implied emission factors across Member States/countries are comparable taking the IPCC default emission factors for different national circumstances into account;
4. Assessment of the use of 'Not Estimated' notation keys where IPCC Tier 1 methodologies exist and where the use of the notation key is not justified in accordance with point 32 of the Annex to Decision 18/CMA.1;
5. Analysis of recalculations performed for the inventory submission, including whether the recalculations are based on methodological changes;
6. Assessment whether issues from earlier Union initial checks and reviews as well as recommendations from UNFCCC reviews have been implemented by the Member State;
7. Assessment of the accuracy of Member States' emissions by sources and removals by sinks estimates in relation to Union key categories;
8. Assessment of the transparency and completeness of the methodological descriptions reported by Member States for the Union key categories;
9. Assessment of monitoring and reporting of emissions by sources and removals by sinks in the land use, land use change and forestry (LULUCF) sector pursuant to Part 3 of Annex V to Regulation (EU) 2018/1999, including the assignment of key categories, Tier methodology applied, and a comparison of reported land use and land use change activity data with information derived from the Union and Member State programmes and surveys.

Comprehensive review checks:

1. Detailed examination of the inventory estimates including methodologies used by the Member State in the preparation of inventories;
2. Detailed analysis of the Member State's implementation of recommendations related to improving inventory estimates as listed in its most recent UNFCCC annual review report made available to that Member State before the submission under review where recommendations have not been implemented;
3. Detailed analysis of the justification provided by the Member State for not implementing them;
4. Detailed assessment of the time series consistency of the greenhouse gas emissions estimates;
5. Detailed assessment whether the recalculations made by a Member State in the given inventory submission as compared to the previous one are transparently reported and made in accordance with the greenhouse gas inventory guidelines;
6. Follow-up on the results of the initial checks and on any additional information submitted by the Member State under review in response to questions from the technical experts review team and other relevant checks; -
7. Other relevant checks complementing the initial checks;
8. Check that all gases and pools are reported under LULUCF.