

Report on Finland's preliminary technical correction to the forest reference level

Luke, 7th of September 2026

Background and the main findings

This report presents Finland's current preliminary **technical correction (TC)** to the Forest Reference Level (FRL), prepared in accordance with guidance from the European Environment Agency (EEA) and the European Commission. As the correction is still under review, the estimates and methodological descriptions may change before the final submission in 2027.

The report includes the methodological inconsistencies identified to date between the FRL approved in Finland's National Forestry Accounting Plan (NFAP) and the methods currently used in the Finnish greenhouse gas inventory (GHGI) and forest modelling.

Four elements are included in the technical correction of FRL (FRL_TC): (1) changes in the GHGI methods and data, (2) changes in the forest simulation model, (3) climate change effects, and (4) changes in geopolitical circumstances. The report presents two estimates of FRL_TC: one excluding (FRL_TC) and the other including (FRL_TC_geo) the proposed effect of geopolitical changes.

Because of requirements by the revised forest simulation model, consistency between the FRL_TC simulation and GHGI-reported emissions and removals is assessed for the compliance period rather than the reference period. As with the original FRL, **ex-post calibration** appears necessary and is now based on the mean difference between simulated and GHGI-reported net emissions, rather than the mean ratio used for the original FRL. The *ex-post* calibration will be updated when the year 2025 inventory results become available in the 2027 GHGI submission.

The preliminary evaluation suggests that TC has **a substantial effect** on Finland's FRL: while the original FRL is *ca.* -29 387 kt CO₂-eq., the **FRL_TC** is *ca.* -4 901 kt CO₂-eq, both after *ex-post* calibration and with harvested wood products. **FRL_TC_geo** is calculated as a sum of FRL_TC and the proposed geopolitical effect +4 860 kt CO₂-eq and is *ca.* -41 kt CO₂-eq.

The reasoning, data and methods used to calculate FRL_TC

The four elements included in the technical correction of FRL are: (1) changes in the GHG inventory methods and data, (2) changes in the forest simulation model, (3) climate change effects, and (4) changes in geopolitical circumstances. The elements and the reasoning for their calculation are shortly described below and their impact on FRL is broken down by individual carbon pool and GHG emission source in **Tables 1-4**.

(1) Changes in the GHG inventory methods and data

The FRL_TC (and FRL_TC_geo) presented in this document incorporates all changes implemented in the GHG inventory up to and including the 2026 submission. Further changes introduced in the 2027 submission will be incorporated to FRL_TC before the final 2027 submission. **Table 1** presents the effect of each GHGI methodological change on FRL by carbon pool and GHG emission source. The total effect of revising GHG inventory methods on FRL is +2 299 kt CO₂ eq.

Table 1. The methodological changes in the GHG inventory since the original FRL with effects (kt CO₂ eq.) on FRL broken down by carbon pool and GHG emission source.

	Effect on FRL
Improved calculation methods for soil carbon stock changes	
Mineral soil	+383
Organic soil	+6 980
Updated tree biomass models	
Living biomass	-4 504
Mineral soil	-69
Organic soil	+141
A country-specific EF for CH ₄ emissions from organic soil ditches	-47
New area estimates for drained organic soil N ₂ O and CH ₄ emissions	-108
Corrected errors and updated database for HWP sink estimates	-394
N ₂ O emissions added since the FRL calculation	
Emissions from fertilisation	+11
Emissions from mineralization	+78
AR4 GWP factors replaced by AR5 GWP factors	-172
Improved calculation for emissions from wildfires and controlled burning	+1
Total	+2 299

(2) Changes in the forest simulation model (MELA)

After Finland's FRL was set, an error in the way the forest stand data are compiled for the MELA forest growth and management simulation model was found and corrected. The simulation was therefore rerun for FRL_TC. **Table 2** presents the effects of the new simulation on FRL broken down by carbon pool and GHG emission source. The total effect of correcting the forest simulation on FRL is +12 734 kt CO₂ eq.

Table 2. The effect of correction of data compilation in the MELA forest simulation model on FRL (kt CO₂ eq.) by carbon pool and GHG emission source.

	Effect on FRL
Correction of data compilation in forest simulation model	
Living biomass	+10 461
Mineral soil	+1 875
Organic soil	+399
Harvested wood products	+2
Ditch CH ₄ emissions	+0.5
Total	+12 734

(3) Climate change impact

Because weather variables drive the soil carbon models that are used to calculate soil carbon stock changes in FRL, the original temperature and precipitation estimates must be replaced with observed values as part of the technical correction. **Table 3** shows the resulting changes in the estimates of mineral and organic soil carbon stock changes, amounting to a total effect of +2 290 kt CO₂ eq.

Tree growth simulated with MELA is consistent with the growth observed in NFI11 (2009–2013), while the GHG inventory for the 2021–2025 compliance period uses growth estimates from NFI13 (2019–2023). After accounting for the effects of forest management and age of tree stands, the remaining difference between NFI11 and NFI13 growth can be attributed to climatic, or other environmental, changes and used as a technical correction (**Table 3**). The magnitude of this correction is + 9 092 kt CO₂ eq.

Table 3. The effect of acknowledging climate change impacts on FRL (kt CO₂ eq.) by carbon pool.

	Effect on FRL
Updated weather data in soil carbon stock change modelling	
Mineral soil	+729
Organic soil	+1 561
Adjustment of simulated tree growth	
Living biomass	+9 092
Total	+11 382

(4) Changes in geopolitical circumstances

Wood imports from Russia ceased in 2022, prompting an assessment of whether the resulting effect on domestic harvests warrants a technical correction to the FRL. Two analyses reached different conclusions. The first does not support a correction because average domestic harvests remained virtually unchanged: 74.1 million m³ in 2018–2021 and 74.2 million m³ in 2022–2025. The second supports a correction, estimating that replacing Russian imports would require an additional 6.4 million m³ of domestic harvests per year. Table 4 shows the effect of this increase on the FRL by carbon pool. This estimate implicitly assumes that, without the geopolitical disruption, average domestic harvests in 2022–2025 would have fallen to about 67.8 million m³.

Table 4. The effect on FRL (kt CO₂ eq.), by carbon pool, of assuming geopolitical effects on domestic harvest levels.

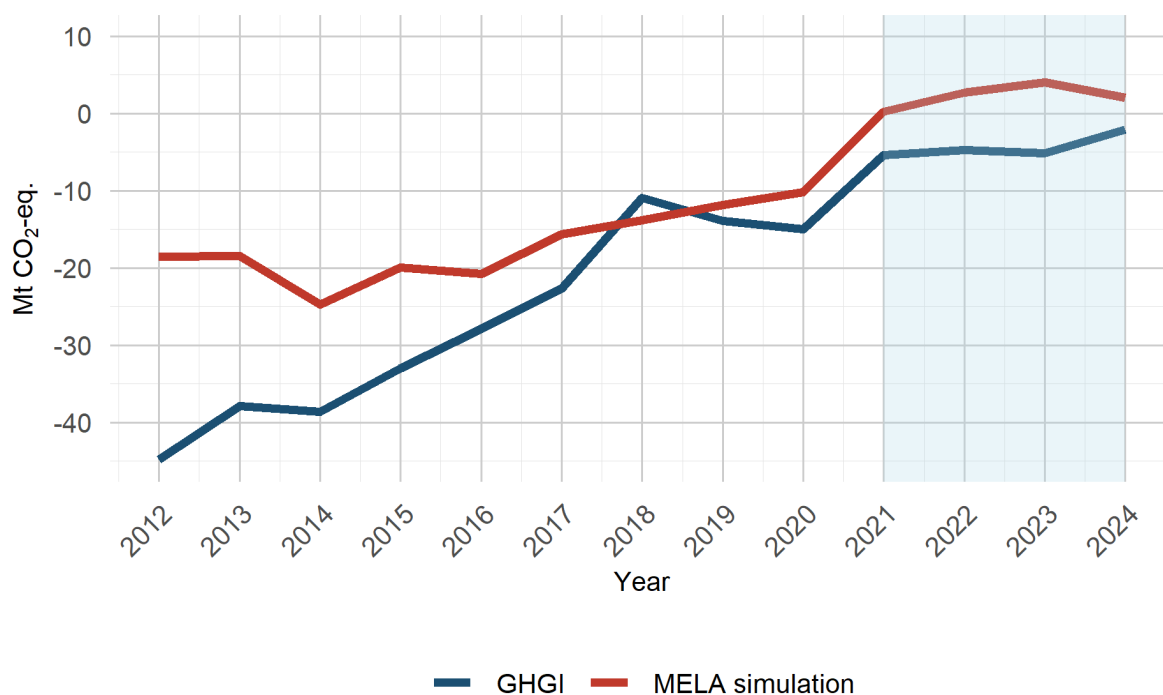
	Effect on FRL
Adjustment of domestic harvests to replace imports from Russia	
Living biomass	+6 804
Mineral soil	-640
Organic soil	-206
HWP	-1 098
Total	+4 860

Consistency between the FRL_TC simulation and GHGI reporting, with implications for *ex-post* calibration

The revised compilation of forest stand data for the MELA simulation is incompatible with old NFI datasets. Therefore, consistency between the FRL_TC simulation and GHGI reporting must be assessed over years later than the reference period. The years 2021–2024 were selected for the assessment to ensure that FRL_TC accurately reflects the compliance period. The final report will extend the assessment to the years 2021–2025.

Figure 1 shows the comparison of forest net GHG balance, including harvested wood products, between the GHG inventory 2026 submission and MELA-based simulation (including all TC elements except the geopolitical effect). The mean difference between the two GHG balances during the years 2021–2024 indicates a need for *ca.* -6.59 Mt CO₂-eq. *ex-post* calibration.

Figure 1. Comparison of forest net GHG balance, including harvested wood products, between the GHGI 2026 submission and MELA-based simulation (including all TC elements except the geopolitical effect).



Emission and removal estimates in the original FRL and FRL_TC

Table 5 presents the estimates for Finland's original forest reference level (FRL) by carbon pool and GHG emission source, together with totals excluding and including harvested wood products (HWP). Finland applied *ex-post* calibration, and Finland's official FRL (see also **Fig. 2**) is the estimate obtained after *ex-post* calibration.

Table 5. Contribution (kt CO₂ eq. per year) of carbon pools and GHG emissions, the *ex-post* calibration and the inclusion of harvested wood products to the original forest reference level (FRL).

	Impact on FRL
Carbon stock change in living biomass	-17 708
Carbon stock change in mineral soils, including dead wood and litter	-4 893
Carbon stock change in organic soils, including dead wood and litter	898
N ₂ O and CH ₄ emissions from drained organic soils	2 806
N ₂ O and CH ₄ emissions from controlled burning	1
N ₂ O emissions from inorganic fertilizers	12
Carbon stock change in harvested wood products (HWP)	-5 846
FRL before <i>ex-post</i> calibration without HWP	-18 884
FRL before <i>ex-post</i> calibration with HWP	-24 729
FRL after <i>ex-post</i> calibration without HWP	-23 490
FRL after <i>ex-post</i> calibration with HWP	-29 387

Values may not add up due to rounding

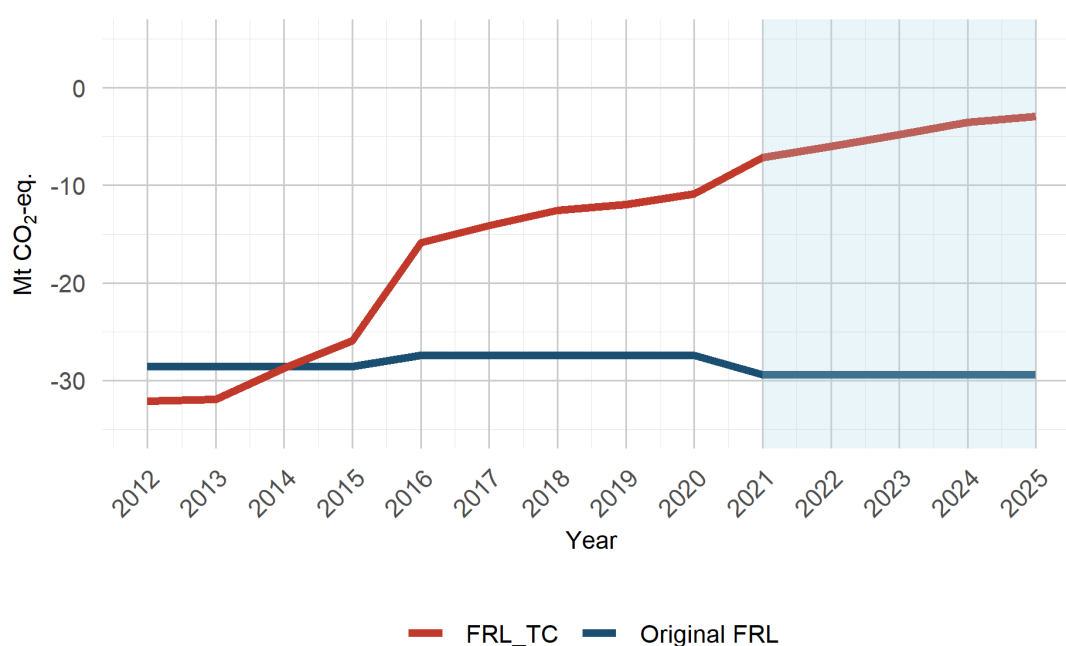
Table 6 presents the technically corrected FRL (FRL_TC), excluding the proposed geopolitical effect, based on the methods and data used in Finland's 2026 GHG inventory submission (see also **Fig. 2**). For each carbon pool, GHG emission source, and the total FRL, the technical correction (TC) is the difference between FRL_TC and the corresponding original FRL estimate. Adding the proposed geopolitical effect of +4 860 kt CO₂-eq. (Table 4) to FRL_TC after *ex-post* calibration with HWP gives the **FRL_TC_geo** of -41 kt CO₂-eq.

Table 6. Contribution (kt CO₂ eq.) of carbon pools, GHG emissions, *ex-post* calibration and harvested wood products to the technically corrected forest reference level, both excluding (FRL_TC) and including (FRL_TC_geo) the proposed geopolitical effect (FRL_TC_geo = FRL_TC after *ex-post* calibration with HWP + the geopolitical effect as in Table 4). For each component, the technical correction (TC) is calculated as the difference between the FRL_TC value and the corresponding original FRL value reported in Table 5.

	FRL_TC	TC
Carbon stock change in living biomass	-2 659	15 048
Carbon stock change in mineral soils, including dead wood and litter	-1 974	2 919
Carbon stock change in organic soils, including dead wood and litter	9 980	9 083
N ₂ O and CH ₄ emissions from drained organic soils	2 505	-302
N ₂ O emissions from N mineralization	54	54
N ₂ O and CH ₄ emissions from controlled burning	2	1
N ₂ O emissions from inorganic fertilizers	21	8
Carbon stock change in harvested wood products (HWP)	-6 241	-395
FRL_TC before <i>ex-post</i> calibration without HWP	7 928	26 812
FRL_TC before <i>ex-post</i> calibration with HWP	1 687	26 417
FRL_TC after <i>ex-post</i> calibration without HWP	-605	22 885
FRL_TC after <i>ex-post</i> calibration with HWP	-4 901	24 485
FRL_TC_geo	-41	

Values may not add up due to rounding

Figure 2. The original FRL and FRL_TC (with no geopolitical effect), both after *ex-post* calibration (in FRL_TC applied for 2021–2025 only) and with harvested wood products (HWP).



Elements that will be added to or refined in the final FRL_TC submission

The suitability of some elements for inclusion in the technical correction is still examined. These elements include the part of differences in natural tree mortality and biomass conversion and expansion factors (BCEFs) between the NFI11-data (used in the MELA simulation) and the 2021–2025 compliance period that cannot be attributed to changes in forest structure or management.

The final FRL_TC will also incorporate methodological changes introduced in the 2025 inventory (2027 submission), and in addition, the forest area used in the MELA simulation will be aligned with the mean forest area reported in the GHG inventory for the 2021–2025 compliance period.