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

Croatia

28 August 2025

European Environment Agency

Reference: No 3502/B2025/EEA.60384

Contents

List of tables

Introduction and conclusions from the 2025 comprehensive review

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

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 Croatia 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 Croatia pursuant to Articles 26 (4) of the Governance Regulation.

The review consisted of two steps. The initial checks were performed by the EU inventory team (European Environment Agency (EEA)). 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 42 issues with Croatia during the initial check and comprehensive review (see Table 1). The TERT provided recommendations for 14 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. Croatia provided two 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 the revised estimates.

4. The TERT also deemed necessary a technical correction in the meaning of Article 38(2)(d) of Regulation (EU) No 2018/1999 and calculated the technical correction in consultation with Croatia. The technical correction is presented in Table 2 of the present review report and is accompanied by evidence-based justification. In its response to the draft technical correction, Croatia stated that it agrees with the technical correction.

5. The TERT identified recommendations in order to improve the national inventory data of Croatia (see Table 3).

6. The TERT considers that it received a response from Croatia that was sufficient in order to undertake the comprehensive review appropriately.

Table 1: Overview of issues raised with Croatia

	Issues raised during the initial check	Issues raised during the comprehensive review	Recommendations	Revised estimates[1]	Technical corrections[2]
LULUCF	**6**	**36**	**14**	**2**	**1**

[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	HRV-CRT-2025-V0-1-DataEntry-20250314-073454	-5 697.520	-4 883.210	-5 490.102	-5 762.678	-4 866.520	-5 525.740
Difference between revised estimates and original estimates provided by Croatia and accepted by the TERT[2]							
4B1 Cropland remaining cropland (Annual cropland converted to perennial cropland), CO_2, Living biomass (gains only)	HR-4A2-2025-0004	-13.144	-12.900	-12.656	-11.922	-11.678	-11.434
4 Land (Grassland converted to Forest land, Cropland and Settlements; Cropland converted to Grassland and Settlements; Forest land converted to Settlements; Conversions between annual and perennial Cropland), CO_2, Mineral soil	HR-4B2-2025-0002	-7.244	-9.028	-9.838	-11.563	-13.811	-16.406
Difference between technical corrections and original estimates deemed necessary by the TERT[2]							
4 Land (4A1 Forest land remaining forest land and 4(IV) Biomass burning), Multiple GHG (CO_2, CH_4, N_2O), Multiple pools (Biomass losses and biomass burning)	HR-4H-2025-0001	-12.731	-49.474	-	-	-35.029	-
Total net greenhouse gas emissions for the LULUCF sector including revised estimates and technical corrections		-5 730.639	-4 954.612	-5 512.596	-5 786.164	-4 927.038	-5 553.579

[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 Croatia on the conclusions presented by the TERT

Croatia 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)
HR-4A1-2025-0001	Yes	4A1 Forest land remaining forest land, CO_2, 1990-2023	For 4A1 Forest Land remaining forest land in all years, the TERT noted that the NID p244 states that "According to the harvest practices applied in Croatia, in the period of last five reporting years 14.5% of harvested volume is left on the site in case of deciduous forests and 20.1% in case of coniferous forests. Number of total volumes harvested in these types of forests were corrected with corresponding percentages." During the review, Croatia clarified that "the harvested volume H used in the estimation of biomass losses in forests in Croatia includes: whole stems (dbh>10 cm) with stump, bark, and all branches up to 7 cm in diameter. H consists of the "merchantable wood" part and the "wood residue" part, which is left in the forest. On the other hand, "small woody residue" – such as branches thinner than 7 cm and occasionally felled trees of dbh<10 cm (e.g. from preparatory cuts as part of stand regeneration) – are not officially recorded.". Croatia further explained that although not included in the NID, it uses biomass expansion factors (BEFs) of 1.197 for deciduous and 1.039 for coniferous to expand "merchantable wood" to total aboveground biomass. These BEFs were obtained based on expert judgement. Croatia also explained that "According to national legislation, the following tree biomass parts remain at the harvesting site: wood residues below 7 cm in diameter, stumps, residues that are produced during the production of forest wood assortments, tree tops, and similar.". Finally, Croatia explained that it would undergo further research on appropriate values for consideration in the 2027 submission. The TERT notes that these BEF values are much smaller than those used by other European countries. The value for coniferous is particularly small, and even much below the lower end of the 1.15-4.2 range provided in the 2003 GPG (the 2006 Guidelines do not provide default BEF values).The TERT understands that the Croatian definition of "merchantable wood" is wider than several other countries, because it includes the stump as well as all branches above 7 cm (and not only the stem or "main branch"). For this reason, the TERT understands that a lower than average BEF is likely appropriate. However, the rationale explaining how the values could be so much lower than other European countries and the IPCC range was not provided. The TERT therefore recommends that Croatia provide an expert judgement on its BEF values that is in line with IPCC Guidelines, that is including the name of the experts and the rationale behind the judgement. The TERT also recommends that this rationale include the comparison with neighbouring countries or countries with a similar definition of "merchantable volume" as Croatia. The TERT further recommends that	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			Croatia calculate BEF values for the main tree species - i.e. those that contribute more to the total wood volume of Croatia - and use those for the national GHG inventory as soon as those calculated BEFs are available.	
HR-4A2-2025-0004	Yes	4 Land use, land-use change and forestry, CO_2, 1990-2023	For 4A2 Land converted to forest land in all years, the TERT noted that the NIR states that, regarding the amount of biomass in perennial cropland converted to forest land, "The value of 8.9 tC/ha annually presents a half of the carbon stock determined for perennial Cropland in Croatia under the LULUCF 3 project. Half of the stock has been used because the new land use will require the land immediately after the decision of land use change independent of the age of the stocks and half stocks would be the likely average." (p262). During the review, Croatia clarified several elements: 1) For perennial Cropland converted to other land uses, Croatia assumes that the biomass stock has reached its equilibrium, and therefore uses the total value of 17.8 tC/ha, except for perennial Cropland converted to settlements, perennial Cropland converted to forest land, perennial Cropland converted to wetlands; 2) The lifecycle of perennial Cropland is 40 years, and not 30 years as indicated in the NID. After discussion, the TERT and Croatia agreed that the total value of 17.8 tC/ha should be used for all conversions from perennial Cropland because, according to the report of the Medinet project, Living Biomass in perennial Cropland in Mediterranean countries reaches equilibrium within 10-15 years (https://forest.jrc.ec.europa.eu/media/filer_public/b6/7d/b67d2576-739a-4f3c-82ea-ed89083c1c14/project_life_-medinet_p_canaveira.pdf&ved=2ahUKEwjuu6j839qNAxXyLRAIHWdmNysQFnoECAsQAQ&usg=AOvVaw382hh0Jl8z6U8JEZtTHqCL). Such revision however would result in corrections below the threshold of significance. Furthermore, for the same reason, biomass gains in land converted to perennial cropland are currently under-estimated: current calculations assume that only half the total stock is reached within the 20-year transition period, whereas the Medinet report shows that it would be more accurate to assume that the total stock is reached within this period. Moreover, this more accurate assumption would ensure mass balance (as much C stock is accumulated in the Living Biomass pool when land is converted to perennial Cropland as much C stock is subtracted from the Living Biomass pool when perennial Cropland is converted to another land use). For this reason, biomass gains should be doubled for all conversions to perennial cropland. Croatia provided revised estimates for living biomass in Cropland remaining cropland by 21 June 2025 for the years 2016, 2017, 2018, 2021, 2022 and 2023. The TERT agreed with the revised estimate provided by Croatia. The TERT recommends that Croatia include a complete and consistent time series of revised estimates in its next submission.	RE

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
HR-4B2-2025-0002	Yes	4B2 Land converted to cropland, CO_2, 1990-2023	For 4B2 Land converted to cropland in all years, the TERT noted that in the NID (p274, p258) the combined result of the SOCref and the F_LU CSC factor for soil organic carbon in mineral soils is obtained from the simple average in SOC for each land-use category, using country-specific data from a large soil survey conducted in 2017. National averages per land category may exhibit a difference between SOC in different land-uses (a common example being grassland and forest land) because forests tend to be located on poorer soils (historically, people preferentially chopped down the better soils for agricultural production) and not to the fact that the land-use change results in SOC changes. When this happens, the difference between two land-uses from a soil inventory is unlikely representative of actual transitions, and the resulting estimate for soil carbon changes is not accurate (it is biased). This is why, to obtain these emission factors, it is good practice to compare pairs of plots with similar histories and management as well as topographic position, geographical proximity (2006 IPCC Guidelines, p2.38). In the case of Croatia, the following elements are particularly surprising: 1) A large difference between annual and perennial cropland, whereas the default IPCC values are very similar (2019 IPCC Refinement p5.27); 2) A difference between grassland and forest, whereas the default IPCC values are equal (IPCC 2019 Refinement p5.45 and 6.6); 3) “unsealed Settlements” have a higher value than forests and grassland. This is because SOCref and F_LU have not been determined separately, and by following the IPCC guidelines (for example, through paired plots or statistical analysis, see https://publications.jrc.ec.europa.eu/repository/handle/JRC134645). Croatia provided revised estimates for this category by 21 June 2025 for the years 2016-2018 and 2021-2023. Croatia also included an explanation of the method used to calculate the revised estimates, which included further disaggregated activity data per climatic zone and the use of the F_MG default value of 1 for perennial cropland from the 2006 IPCC Guidelines rather than the default value of 0.72 from the IPCC 2019 Refinement. The TERT agreed with the revised estimate provided by Croatia. The TERT recommends that Croatia include a complete and consistent time series of revised annual estimates in its next submission. The TERT also recommends that Croatia document that its climatic zones are based on the same criteria as the IPCC ones and why the use of the F_MG default value from the 2006 IPCC Guidelines is more accurate than the value from the 2019 IPCC Refinement.	RE
HR-4H-2025-0001		4H Other (LULUCF), CH_4, CO_2, N_2O, 1990-2023	For 4A1 Forest Land remaining forest land in all years, the TERT noted that the NIR (p244) states that “Since felling already includes the volume cut after natural disturbances, carbon losses due to natural disturbances are allocated within the carbon losses due to felling.” During the review, Croatia confirmed that this could not be the case for dead but not combusted biomass that remains after a fire. Carbon losses from living biomass in the areas affected by fire are therefore under-estimated. In addition, for Biomass burning in all years, the TERT noted that the NIR states that “In case of Forest land remaining forest land and Land converted to forest land, a mean value of 19.8 t/ha biomass	TC

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			consumption was applied.” (p315). During the review, Croatia clarified that this value came from the default mean value of biomass consumption in Chapter 2 from 2006 IPCC Guidelines for Other temperate forest. The use of an IPCC default value is inconsistent with the availability and use of country-specific values for average biomass and deadwood stocks elsewhere in the NGHGI. Furthermore, to estimate biomass losses from burning, Croatia should use IPCC Equation 2.14, including the fraction of biomass lost as CO_2 emissions, and report them in table 4.A, while IPCC Equation 2.27 is to be applied to estimate non-CO_2 emissions. Croatia provided revised estimates for 4.A.1. Forest land remaining forest land, 4.A.2. Land converted to forest land and Biomass burning by 21 June 2025 for the years 2016-2018 and 2021-2023. Croatia also included an explanation of the method used to calculate the revised estimates as: 1) The use of national data to allocate fires to each of the 6 subcategories (Deciduous in Forest Land remaining forest land, Deciduous in Land converted to forest land, …). The TERT welcomes this improvement. 2) The use of national data on merchantable volume burnt per ha for each of the 3 Forest land remaining forest land subcategories. The TERT agrees with the use of national data, however the TERT understands that the values input in row 9 (worksheet “NEW_calc_ALL” of the revised estimates submitted by Croatia) correspond to the merchantable volume of trees that died during the fire, because their aboveground biomass has partially or totally burnt. Those values are incorrect because equation 2.14 requires for variable Bw the use of the entire average above-ground biomass in the disturbed land rather than the fraction disturbed only; the fraction disturbed is indeed calculated in equation 2.14 as Bw*fD, where fD is the fraction of biomass lost because of the disturbance (the fraction includes the portion of biomass C stock emitted as carbonaceous species during the fire plus the biomass C stock transferred to other C pools -i.e. dead organic matter). In addition, the biomass value for Maquis and shrubs is very unlikely small, in particular compared to the value applied for Land converted to forest land. 3) The use of national data on average merchantable volume for each of the 3 Land converted to forest land subcategories. The TERT agrees with the use of national data, but it should be representative of the average biomass in burnt Land converted to forest land. For Maquis and shrubs, this would imply multiplying the annual net accumulation by 10 instead of 20 (i.e. assuming the average age at burning of Land converted to forest land is the average age of the category, in the absence of data that shows that burnt areas have a different age than the average). For deciduous and coniferous subcategories of Land converted to forest land subject to burning, the average biomass is expected to be lower than the average biomass in the corresponding deciduous and coniferous subcategories of Forest land remaining forest land subject to burning. If it turns out not to be the case, Croatia would be expected to explain why. 4) The use of national data on deadwood in Land converted to forest land when estimating non-CO_2 emissions. The TERT welcomes the improvements contained in the revised estimates, although it cannot conclude that the revised estimates are fully consistent with the 2006	

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			IPCC Guidelines, as explained for bullets 2 and 3 above. Thus, the TERT retains its calculation of the technical correction, as necessary. The TERT recommends that Croatia include a complete and consistent time series of revised annual estimate of biomass stock losses and non-CO_2 emissions from burning in forest land in its next submission.	
HR-4A-2025-0005		4A Forest land, CO_2, 1990-2023	For 4A Forest land in all years, the TERT notes that the description of the gain and loss method applied to estimate carbon stock changes in living biomass of forest land miss clarity on whether the natural mortality is included (either through the calculation of a net increment or as a loss). During the review, Croatia clarified that for validation, an analysis is conducted during the development of a new forest management plan, -i.e. a comparison is made between the net difference in growing stock obtained from the new measurement and the growing stock from 10 years before as well as the volume of harvested trees; which is understood to correct the estimated gain across time by the actual C stock, including losses due to natural mortality. The TERT recommends that Croatia clarify in the NID the calculation of the increment as well as how it includes natural mortality within the net C stock change in living biomass reported for forest land.	No
HR-4A1-2025-0003	Yes	4A1 Forest land remaining forest land, CO_2, 1990-2023	For 4A1 Forest land remaining forest land in all years, the TERT noted that the NIR states that for carbon stock changes (CSC) in dead organic matter (DOM) and in soil of Forest land remaining Forest land the IPCC Tier 1 approach is applied which assumes no net changes of C stocks in these pools across the time series." During the review, Croatia indicated that a project named "Determining the deadwood pool carbon stocks based on new surveys at 2006 deadwood sampling sites" had been finalized in March 2025 and that this project had collected data on dead wood (standing and lying) with the purpose of securing compliance with the LULUCF regulation. Croatia further indicated that the results of this project would be analysed in 2025 with the purpose of being integrated in the 2026 GHGI submission. Considering that Forest land remaining Forest land is a key category the TERT recommends that Croatia collect information to assess whether the DOM and soil C pools significantly contributes to the C stock changes of category Forest land remaining Forest land, and where this is the case report Tier 2 estimates in accordance to Annex V Part 3 of the Governance Regulation.	No
HR-4A2-2025-0003	Yes	4A2 Land converted to forest land, CO_2, 1990-2023	For 4A2 Land converted to forest land in all year, the TERT noted that the NIR explains that afforested land by plantation is detected through a legal requirement to register it (p257), and that afforested land by "human induced promotion of seed sources" in existing forest management units managed by "Croatian forests Ltd" is detected by comparing older topographic maps with recent ortho-photos (p250). Moreover, the NIR explains that "At the time of LULUCF 1 project implementation 50% of private owned forests were covered by the forest management programs." This therefore leaves out 50% of privately-owned forests. During the review, Croatia explained that only those areas for which	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			the competent Ministry gave permission to be included in the Croatian forest management area, were reported in the Land converted to forest land. Areas that are abandoned and overgrown with forest, and for which the competent Ministry has not issued a permit to be registered as forest, are not treated as Land converted to forest land in the LULUCF report, but in most cases are listed in the Grassland category. Croatia further indicated it intended to create a dedicated category for these areas by its 2027 submission as part of its LIFE CROLIS project. The TERT concludes that Land converted to forest land areas that either go unnoticed or are not legally qualified as Land converted to forest land despite reaching the definition of forest are likely small. Nevertheless, the TERT recommends that Croatia include within the category Land converted to forest land all land converted to a vegetation that exceeds the forest thresholds regardless to the dynamic that determined such conversion. Further, the TERT recommends that Croatia verify its future land identification approach for Land converted to forest land with independent source of information such as LUCAS or Corine Land Cover. Even if the latter has likely a too coarse spatial resolution to be fully reliable, one would expect a general correlation in trends between the data sources.	
HR-4A2-2025-0002	Yes	4A2 Land converted to forest land, CO_2, 1990-2018	For 4A2 Land converted to forest land between 1990 and 2018, the TERT noted that in the NIR p. 241, Table 6.4.1 shows that removals can very suddenly fall (e.g. in the Grassland converted to forest land subcategory from -31 kt CO_2 in 2004 to 0 in 2005) or rise (e.g. in the Land converted to forest land subcategory from -136 kt CO_2e in 2015 to -216 kt CO_2e in 2016). Although some events can exceptionally generate spikes in the Land converted to forest land category, this category usually exhibits smooth trends due to the inertia of C storage in afforested land and to the 20-year residence time of land in this category. During the review, Croatia explained that these spikes were due to sudden influx of land in the category. The TERT finds that this explanation is implausible, as the influx of land show the opposite trend: the annual conversions to Forest Land in 2005 are much larger than in 2004, which should increase removals instead of decreasing them. The opposite happens between 2015 (where the inflow is large) and 2016 (where the inflow is much lower). The TERT assumes that this could be caused by the losses of biomass from the land use which is being converted which in turns would be surprising as the natural afforestation is unlikely to trigger biomass losses. The TERT therefore recommends that Croatia investigate the cause of these sudden spikes and report on those in its next submission.	No
HR-4A2-2025-0001	Yes	4A2 Land converted to forest land,	For 4A2 Land converted to forest land between 2004 and 2015, the TERT noted that in the CRTs table 4.A, the area gradually increases from 4.9 kha in 2004 to 56.7 kha in 2015, that is more than a 10-fold increase in 10 years, whereas before and after, the values are more or less stable. During the review, Croatia explained that this dramatic increase in afforestation was due to the improvement in	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
		CO_2, 2004-2015	identification and traceability of land that was subject of natural spreading of forests, in particular the possibility for landowners to register their afforested land as forest land which was implemented in 2004 through the 2004-2015 general forest management plan. The TERT considers that there is therefore likely a time series inconsistency over the period of the 2004-2015 general forest management plan as landowners likely caught up by registering forest land that had been converted several years before. The TERT recommends that Croatia use methods in the 2006 IPCC Guidelines on time series consistency (vol1, ch5), possibly using Corine Land Cover data as a surrogate or any other method that would allow to allocate some of the conversions declared in excess during the 2004-2015 period over a longer time period.	
HR-4B1-2025-0001	No	4B1 Cropland remaining cropland, CO_2, 1990-2023	For 4B Cropland for all years, the TERT noted that the NIR does not include the collection of activity data on key carbon farming practices listed by the JRC (e.g. cover crops, agroforestry, hedges, temporary grassland, extent of organic soils) to refine its expert judgment that management practices in cropland have not changed across the time series. No management data is collected across time either on forest or grassland management. During the review, Croatia explained that forest management is a very traditional field in Croatia and that therefore it does not expect practices to change. Regarding cropland and grassland however, Croatia noted that the Common Agricultural Policy was likely to drive changes, and that Croatia was considering new pieces of legislation to collect data on these changes. The TERT recommends that Croatia collect activity data on management practices across the time, prioritizing cropland over grassland given in cropland management changes are most likely and most impactful.	No
HR-4B2-2025-0005	Yes	4B2 Land converted to cropland, CO_2, 1990-2023	For 4B2a Forest land converted to cropland for all years, the TERT noted that the NIR states that “Through the conducted survey within the scope of LULUCF 1 project it was determined that conversion from Forest land to perennial Cropland happens in Croatia starting from 2004 while conversion to annual Cropland did not occur in the period 1990-2023.” (p275). The TERT noted that the absence of forest conversion to annual Cropland and Grassland over 33 years is a very rare feature. During the review, Croatia explained that deforestation has to follow a strict legal procedure which ensures that it is reliably recorded. Croatia suggested that rural exodus likely explains why forests where only converted to settlements or perennial croplands which received high subsidies at some point. Croatia also explained that the coarse resolution of Corine Land Cover for cover changes (5 ha) made it an irrelevant point of comparison. The TERT notes however than LUCAS points in Croatia reveal 9 transitions from Forest Land to annual Cropland between 2015 (the earliest vintage in Croatia) and 2022, that is only slightly less than the 14 transitions of Forest land to settlements. Further, transitions of Forest land to grassland are plentiful (63) but a more refined analysis would be	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			needed for these as shrubland are often similar to forests. The TERT also notes that it seems possible that some conversions go unreported, especially for maquis and shrubs that are more or less abandoned. For these reasons, the TERT recommends that Croatia assesses the consistency of all available land-use change data, including Corine Land Cover and LUCAS, to ensure that its monitoring system for deforestation is accurate and report the results of such assessment in its next submission.	
HR-4E-2025-0002		4E Settlements, CO_2, 1990-2023	For 4E2 Land converted to settlements for all years, the TERT noted that the NIR states that "According to the Corine Land Cover database, the average share of unsealed areas in the settlements category was 4.5%." (p295). However, the coarse resolution of Corine Land Cover (25 ha) makes it poorly suited to assess the share of unsealed areas, which requires to distinguish between a house and the grass and trees in its garden. Croatia itself noted that it was not able to properly identify roads with Corine Land Cover (NID p234). Using high resolution imagery, Luxemburg, for example, obtains around 50% for unsealed areas in its settlement category, although the country-specific definition and shape of settlements can certainly create some difference with other countries. During the review, Croatia summarised the method as follows: 141 (Green urban areas) is counted as 100% unsealed, 142 (Sport and leisure facilities) is counted as 0% unsealed, 111 (Continuous urban fabric, >80 built) is counted as 10% unsealed and 112 (Discontinuous urban fabric, <80% built) is counted as 20% unsealed. Croatia also indicated that its CROLIS project would probably allow to improve upon this method by the end of 2026. The TERT notes that counting Corine Land Cover class 112 areas as 80% unsealed is probably conservative as the title of the class itself shows that this figure is a maximum. Together with the poor sensitivity of Corine Land Cover to small or linear land-uses, this may explain the large difference in the share of unsealed area between Croatia and other Member States with higher resolution data (e.g. Luxemburg, Austria). The TERT recommends that Croatia provide evidence that its settlement areas have a lower sealed percentage than other Member States or validate its method against the percentages obtained by Member States with similar land cover in Settlements that have used high resolution images to determine the share of unsealed areas in land classified as settlements, and report on this in its next submission.	No
HR-4E2-2025-0002	Yes	4E2 Land converted to settlements, CO_2, 1990-2023	For Land representation for all years, the TERT understood from the NID, that Corine Land Cover data is the backbone of land-use change detection and the land-use matrix, with the exception of changes to and from forest. Given that the resolution of Corine Land Cover data is 25 ha (5 ha for Land-Use Change layers), small land-use changes are likely to be undetected. During the review, Croatia confirmed this understanding and indicated that the CROLIS project, due to end of 2026, is expected to provide data at higher spatial resolution. Croatia further explained that there were not enough LUCAS points to produce sub-national estimates for land-use changes. The TERT agrees with Croatia	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2025 (RE/TC/no)
			but notes that LUCAS could still be used to provide an accurate national total, that could then be distributed spatially using Corine Land Cover data. The TERT therefore recommends that, should the CROLIS project not bear fruit in time for the 2027 submission, Croatia verify the accuracy of its estimated land-use changes through other products to complement Corine Land Cover and report on this in its 2027 submission.	
HR-4FEE-4A-2025-0003-2025-0001		4F Other Land, CO_2, 1990-2023	For 4F Other Land in all years, the TERT noted that the NIR states that “As informed in Chapter 6.3.6, the area of Other land category has been always reported by Croatia as a difference between the total area of Croatia and the sum of all other categories of land, which is in line with the 2006 IPCC Guidelines.” (p302). During the review, Croatia indicated that it was aware that this approach is not in line with geographically explicit approach 3 to land representation. Croatia also indicated that it would be able to implement a fully geographically explicit approach upon the completion of LIFE CROLIS project in Croatia (finalization scheduled for the end of 2026). The TERT recommends that a geographically explicit approach to land representation be implemented for all land categories, including “Other land”, when the results of the CROLIS project become available at the end of 2026, and no later than the 2027 submission.	No

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

1	EMRT ID:	HR-4A2-2025-0004
	EMRT URL:	https://emrt-esd.eionet.europa.eu/2025/HR-4A2-2025-0004
	Country:	Croatia
	Land use category:	4B1 Cropland remaining cropland (Annual cropland converted to perennial cropland)
	Gases:	CO_2
	Pool:	Living biomass (gains only)
	Completed by LULUCF Expert:	Valentin Bellassen
	Reviewed by Thematic Counterpart Expert:	
	Reviewed by Lead Reviewer:	Sandro Federici
	Reviewed by Quality Controller:	Justin Goodwin
	The underlying problem:	For Land converted to Forest Land in all year, the TERT noted that the NIR states that, regarding the amount of biomass in perennial cropland (pCL) converted to forest land, "The value of 8.9 tC/ha annually presents a half of the CS carbon stock defined in pCL in Croatia under the LULUCF 3 project. Half of the stock has been used because the new land use will require the land immediately after the decision of land use change independent of the age of the stocks and half stocks would be the likely average." (p262). During the review, Croatia clarified several elements: 1) For pCL converted to other land uses, Croatia assumes that the biomass stock has reached its equilibrium, and therefore uses the total value of 17.8 tC/ha, except for pCL-SL, pCL-FL, pCL-WL; 2) The lifecycle of pCL is 40 years, and not 30 years as indicated in the NID. After discussion, the TERT and Croatia agreed that the total value of 17.8 tC/ha should be used for all conversions from pCL, because, according to the report of the Medinet project, LB in pCL in Mediterranean countries reaches equilibrium within 10-15 years (https://forest.jrc.ec.europa.eu/media/filer_public/b6/7d/b67d2576-739a-4f3c-82ea-ed89083c1c14/project_life_-medinet_p_canaveira.pdf&ved=2ahUKEwjuu6j839qNAxXyLRAIHWdmNysQFnoECAsQAQ&usg=AOvVaw382hh0Jl8z6U8JEZtTHqCL). The implications are however below the threshold of significance. However, for the same reason, biomass gains in land converted to perennial cropland are currently under-estimated: current calculations assume that only half the total stock is reached within the 20 years transition period, whereas the Medinet report shows that it would be more accurate that the total stock is reached within this period. Moreover, this more accurate assumption would ensure mass balance (as much enters the LB pool when land is converted to pCL as leaves the LB pool when pCL is converted to another land use). For this reason, biomass gains should be doubled for all conversions to perennial cropland. The TERT proposed a technical correction restricted to conversions from annual cropland to perennial cropland, the only category for which the correction is above the threshold of significance. Croatia responded with a revised estimate for conversions from annual cropland to perennial cropland that was applied to all years for consistency.
	Summarise the methodology used:	Biomass gains are doubled for conversions from annual cropland to perennial cropland. Croatia thus provided revised estimate by applying the correct methodology with more disaggregated data

		Original estimate (kt CO_2e)				**Notes**
2	Year	CO_2	CH_4	N_2O	Total GHG	
	2016	-13.144			-13.144	
	2017	-12.900			-12.900	
	2018	-12.656			-12.656	
	2021	-11.922			-11.922	
	2022	-11.678			-11.678	
	2023	-11.434			-11.434	
		Revised Estimate received from country (kt CO_2e)				**Notes**
	Year	CO_2	CH_4	N_2O	Total GHG	
	2016	-26.289			-26.289	
	2017	-25.800			-25.800	
	2018	-25.311			-25.311	
	2021	-23.845			-23.845	
	2022	-23.356			-23.356	
	2023	-22.867			-22.867	
		Difference between RE and OE (kt CO_2e)				
	Year	CO_2	CH_4	N_2O	Total GHG	

2016	-13.144			-13.144	
2017	-12.900			-12.900	
2018	-12.656			-12.656	
2021	-11.922			-11.922	
2022	-11.678			-11.678	
2023	-11.434			-11.434	

1	EMRT ID:	HR-4B2-2025-0002
	EMRT URL:	https://emrt-esd.eionet.europa.eu/2025/HR-4B2-2025-0002
	Country:	Croatia
	Land use category:	4 Land (Grassland converted to Forest land, Cropland and Settlements; Cropland converted to Grassland and Settlements; Forest land converted to Settlements; Conversions between annual and perennial Cropland)
	Gases:	CO_2
	Pool:	Mineral soil
	Completed by LULUCF Expert:	Valentin Bellassen
	Reviewed by Thematic Counterpart Expert:	
	Reviewed by Lead Reviewer:	Sandro Federici
	Reviewed by Quality Controller:	Justin Goodwin
	The underlying problem:	The TERT noted that in the NID (p274, p258) the combined result of the SOCREF and the F_LU CSC factor for soil organic carbon in mineral soils is obtained from the simple average in SOC for each land-use category, using country-specific data from a large soil survey conducted in 2017. National averages per land category may exhibit a difference between SOC in different land-uses (a common example being grassland and forest land) due to the fact that forests tend to be located on poorer soils (historically, people preferentially chopped down the better soils) and not to the fact that the land-use change results in SOC changes. When this happens, the difference between two land-uses from a soil inventory is unlikely representative of actual transitions and the resulting estimate for soil carbon changes is not accurate (it is biased). This is why, to obtain these emission factors, it is good practice to compare plots with similar histories and management as well as topographic position, geographical proximity (2006 IPCC Guidelines, p2.38). In the case of Croatia, the following elements are particularly surprising: 1) A large difference between annual and perennial cropland, whereas the default IPCC values are very similar (2019 IPCC Refinement p5.27); 2) A difference between grassland and forest, whereas the default IPCC values are equal (2019 IPCC Refinement p5.45 and 6.6); 3) “unsealed Settlements” have a higher value than forests and grassland. This is because SOC_REF and F_LU have not been determined separately and by following the IPCC guidelines “similarity” in the case of F_LU (for example through paired plots or statistical analysis, see https://publications.jrc.ec.europa.eu/repository/handle/JRC134645).
	Summarise the methodology used:	The TERT applied IPCC Equation 2.25 to estimate soil carbon stocks, using the country-specific values for FL and GL, as provided in the NID, to determine a country-specific SOC_REF. Default IPCC values are then used for F_LU parameters. A proportion among the original SOC_REF*F_LU and the corrected SOC_REF*F_LU is calculated and applied to SOC changes in mineral soils reported in CRTs 4.A, 4.B, 4.C, 4.E to correct those. The TERT noted that this calculation can obviously be improved, in particular with better disaggregated activity data and differentiation per region as is already done for temporary grassland in the NGHGI. Accordingly, Croatia has resubmitted revised estimates calculated by correctly applying IPCC Equation 2.25 in sheet "CROATIA_Calculations". Croatia applied the default FLU factors for aCL as provided in the 2006 IPCC Guidelines (Table 5.5, p. 5.17) using values specific to climate regimes: 0.80 for Temperate/Boreal-Dry and 0.69 for Temperate/Boreal -Moist conditions. To better reflect national conditions, Croatia calculated an area-weighted correction factor based on the proportion of agricultural areas falling within Dry and Moist regions. For pCL default FLU factor of 1 is used (2006 IPCC Guidelines, Table 5.5, p. 5.17, for Dry and Moist/Wet regime). SOC_ref values for FL and GL were not averaged equally, but adjusted using a weighted factor based on the relative area share of FL and GL.

2

	Original estimate (kt CO_2e)				Notes
Year	CO_2	CH_4	N_2O	Total GHG	
2016	604.564			604.564	
2017	598.620			598.620	
2018	599.030			599.030	
2021	562.220			562.220	
2022	525.348			525.348	
2023	486.207			486.207	

	Revised Estimate received from country (kt CO_2e)				Notes/methodology
Year	CO_2	CH_4	N_2O	Total GHG	
2016	597.320			597.320	
2017	589.592			589.592	
2018	589.192			589.192	
2021	550.657			550.657	

2022	511.537			511.537	
2023	469.801			469.801	

	Difference between RE and OE (kt CO_2e)			
Year	CO_2	CH_4	N_2O	Total GHG
2016	-7.244			-7.244
2017	-9.028			-9.028
2018	-9.838			-9.838
2021	-11.563			-11.563
2022	-13.811			-13.811
2023	-16.406			-16.406

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

Technical corrections deemed necessary by the TERT[1]

1	EMRT ID:	HR-4H-2025-0001
	EMRT URL:	https://emrt-esd.eionet.europa.eu/2025/HR-4H-2025-0001
	Country:	Croatia
	Land use category:	4 Land (4A1 Forest land remaining forest land and 4(IV) Biomass burning)
	Gases:	Multiple GHGs (CO_2, CH_4, N_2O)
	Pool:	Multiple pools (Biomass losses and biomass burning)
	Completed by LULUCF Expert:	Valentin Bellassen
	Reviewed by Thematic Counterpart Expert:	
	Reviewed by Lead Reviewer:	Sandro Federici
	Reviewed by Quality Controller:	Justin Goodwin
	The underlying problem:	For Forest Land remaining Forest Land in all years, the TERT noted that the NIR (p244) states that "Since felling already includes the volume cut after natural disturbances, carbon losses due to natural disturbances are allocated within the carbon losses due to felling." During the review, Croatia confirmed that this could not be the case for dead but not combusted biomass that remains after a fire. Carbon losses from living biomass in the areas affected by fire are therefore under-estimated. In addition, for Biomass burning in all years, the TERT noted the NIR states that "In case of Forest land remaining Forest land and Land converted to Forest land, a mean value of 19.8 t/ha biomass consumption was applied." (p315). During the review, Croatia clarified that this value came from the default mean value of biomass consumption in Chapter 2 from 2006 IPCC Guidelines for Other temperature forest. The use of an IPCC default value was inconsistent with the availability and use of country-specific values for average biomass and deadwood stocks elsewhere in the NGHGI. To estimate biomass losses from fire, Croatia should therefore use IPCC Equation 2.14 applied to estimate biomass C stock changes in Forest land, and report them in table 4A. The IPCC Equation 2.27 applied to estimate non-CO_2 emissions should in turn use country-specific values for the mass of fuel (M_B).
	Summarise the methodology used:	The TERT applies the IPCC default methodology as follows. IPCC Equation 2.14 is applied to estimate biomass losses from fire, and report them in table 4A. Values from neighbouring Italy are used to allocate the fire-affected area to the three forest types present in Croatia (deciduous, coniferous and shrubs), and total fires are shared between FLrFL and LcFL on the basis of the percentage contribution to total GHG emissions from fire in forest land reported in CRT 4(IV). The IPCC Equation 2.27 is then applied to estimate non-CO_2 emissions, using country-specific values for the mass of fuel (M_B) by adding up average aboveground biomass, deadwood, and litter stocks per forest type from the NID. The combustion factors per forest type and the CH_4 and N_2O EFs are the IPCC default values. The TERT noted that the technical correction for Forest land remaining Forest land is below the threshold of significance in 2018, 2021 and 2022. To ensure a consistent time series, the TERT encourages Croatia to also include 2018, 2021 and 2022 in their revised estimate. The TERT noted that the potential technical correction for Land converted to Forest land is below the threshold of significance in all years. To ensure a consistent approach, the TERT encourages Croatia to include Land converted to Forest land in their revised estimate.

		Original estimate (kt CO_2e)				Notes
2	Year	CO_2	CH_4	N_2O	Total GHG	
	2016	9 176.058	7.371	3.859	9 187.289	For CO_2, data refers to biomass losses in FL in 4.A + CO_2 emissions from FL in 4(IV) CH_4 and N_2O estimates refers to FL in CRT 4(IV)
	2017	10 154.823	65.856	34.479	10 255.158	
	2018					
	2021					
	2022	9 861.146	29.411	15.398	9 905.955	
	2023					

		Technical Correction calculated by TERT (kt CO_2e)				Notes
	Year	CO_2	CH_4	N_2O	Total GHG	
	2016	9 161.990	8.249	4.319	9 174.558	- Estimates for CO_2 refer to biomass loss in FLrFL in CRT 4.A - Estimates for N_2O and CH_4 refer to FLrFL in CRT 4(IV)
	2017	10 084.054	79.833	41.797	10 205.684	
	2018					
	2021					
	2022	9 818.488	34.418	18.020	9 870.926	
	2023					

		Difference between TC and OE (kt CO_2e)

Year	CO_2	CH_4	N_2O	Total GHG
2016	-14.068	0.878	0.460	-12.731
2017	-70.769	13.977	7.318	-49.474
2018				
2021				
2022	-42.658	5.007	2.621	-35.029
2023				

[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/24/002 of 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.