# LULUCF inventory developments
## - FORMONPOL -

**JRC LULUCF workshop, 8 June 2021**

*Raúl Abad Viñas*

European Commission. Joint Research Centre

Raul.abad-vinas@ec.europa.eu

Giacomo.grassi.@ec.europa.eu

# Introduction

Administrative arrangement: **Forest Monitoring for Policies**

**FORMONPOL**

**(Task 2.a)**

*OBJECTIVE*

**Support the quality improvement of  MS LULUCF inventories with regards to new requirements under Reg. 2018/841.**

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# Regulation (EU) 2018/841

Article 18 (4) of Regulation (EU) 2018/841, "*For emissions and removals for a **carbon pool** that accounts for at least **25-30 %** of emissions or removals in a source or sink **category which is prioritized** within a Member State's national inventory system because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level of emissions and removals, the trend in emissions and removals, or the uncertainty in emissions and removals in the land-use categories, **at least Tier 2** methodology in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (GHGIs).*"

**TIER 2 (AT LEAST) FOR ESTIMATING SIGNIFICANT POOLS IN THE KEY CATEGORIES**

# Summary

Two **_preliminary analysis_** based on regulation requirements:

1. Key category analysis.

2. Assessing the significant of carbon pools.

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# Key category analysis

**IMPACT ON THE RESULT OF THE KEY CATEGORY ANALYSIS WHEN IT IS PERFORMED USING LAND ACCOUNTING CATEGORIES OF REGULATION 2018/841**

**– ANALYSIS ON FIVE CASE STUDIES –**

- *Identification of KC for CO2 under the level assessment using CRF table 7.*

- *Assign corresponding emissions for ALL the categories in the table to know the % emissions that identified KC represent over the entire inventory.*

- *Aggregation of emissions/removals from land use categories under land accounting categories (based on information from CRF tables 4A-4F)*

- *Redo the KC analysis: using the same % of above but replacing land use categories by land accounting categories we identified new KC*

# From LUC to LAC

| To: / From: | Forest Land FL | Cropland CL | Grassland GL | Wetlands WL | Settlements SL | Other land OL |
|---|---|---|---|---|---|---|
| Forest Land FL | **FL-FL** | FL-CL | FL-GL | FL-WL | FL-SL | FL-OL |
| Cropland CL | CL-FL | CL-CL | CL-GL | CL-WL | CL-SL | CL-OL |
| Grassland GL | GL-FL | GL-CL | **GL-GL** | GL-WL | GL-SL | GL-OL |
| Wetlands WL | WL-FL | WL-CL | WL-GL | **WL-WL** | WL-SL | WL-OL |
| Settlements SL | SL-FL | SL-CL | SL-GL | SL-WL | **SL-SL** | SL-OL |
| Other land OL | OL-FL | OL-CL | OL-GL | OL-WL | OL-SL | **OL-OL** |

| Legend |
|---|
| Deforested Land |
| Afforested Land |
| Managed Forest Land |
| Managed Cropland |
| Managed Grassland |
| Managed Wetland |
| Other categories, excluded |

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# Preliminary results: Example 1

| KC showed in CRF table 7 | | | | KC anlysis using LACs of Regulation (EU) 2018/841 | | |
|---|---|---|---|---|---|---|
| N | Category | Kt (CO2) | | N | Category | Kt (CO2) |
| 1 | 2.B.1 Ammonia Production | 356,75 | | 1 | 2.A.4 Other Process Uses of Carbonates | 499,11 |
| 2 | **4.E.2 Land Converted to Settlements** | 374,64 | | 2 | 2.A.2 Lime Production | 544,16 |
| 3 | 2.A.4 Other Process Uses of Carbonates | 499,11 | | 3 | **Managed Grassland** | 574,83 |
| 4 | 2.A.2 Lime Production | 544,16 | | 4 | 1.A.3.e Other Transportation | 587,49 |
| 5 | 1.A.3.e Other Transportation | 587,49 | | 5 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Other Fossil Fue | 925,18 |
| 6 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Other Fossil Fue | 925,18 | | 6 | 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | 1036,23 |
| 7 | 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | 1036,23 | | 7 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | 1268,43 |
| 8 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | 1268,43 | | 8 | 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | 1367,29 |
| 9 | 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | 1367,29 | | 9 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | 1582,64 |
| 10 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | 1582,64 | | 10 | **Afforested Land** | 1728,79 |
| 11 | **4.A.2 Land Converted to Forest Land** | 1728,79 | | 11 | 2.A.1 Cement Production | 1826,66 |
| 12 | 2.A.1 Cement Production | 1826,66 | | 12 | 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | 2545,32 |
| 13 | **4.G Harvested Wood Products** | 2000,71 | | 13 | 1.A.4 Other Sectors - Gaseous Fuels | 3981,69 |
| 14 | 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | 2545,32 | | 14 | 1.A.4 Other Sectors - Liquid Fuels | 4327,86 |
| 15 | **4.A.1 Forest Land Remaining Forest Land** | 2577,10 | | 15 | **Managed Forest Land** | 4577,81 |
| 16 | 1.A.4 Other Sectors - Gaseous Fuels | 3981,69 | | 16 | 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | 5024,25 |
| 17 | 1.A.4 Other Sectors - Liquid Fuels | 4327,86 | | 17 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | 7011,72 |
| 18 | 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | 5024,25 | | 18 | 2.C.1 Iron and Steel Production | 9495,37 |
| 19 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | 7011,72 | | 19 | 1.A.3.b Road Transportation | 23406,96 |
| 20 | 2.C.1 Iron and Steel Production | 9495,37 | | | | |
| 21 | 1.A.3.b Road Transportation | 23406,96 | | | | |

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# Preliminary results: Example 2

| | KC showed in CRF table 7 | | | | KC anlysis using LACs of Regulation (EU) 2018/841 | |
|---|---|---|---|---|---|---|
| N | Category | Kt (CO2) | | N | Category | Kt (CO2) |
| 1 | **4.G Harvested Wood Products** | 3239,37 | | 1 | 2.B.1 Ammonia Production | 4157,00 |
| 2 | **4.E.2 Land Converted to Settlements** | 3652,35 | | 2 | **Afforested Land** | 4761,94 |
| 3 | 2.B.1 Ammonia Production | 4157,00 | | 3 | 2.A.2 Lime Production | 4831,50 |
| 4 | **4.A.2 Land Converted to Forest Land** | 4761,94 | | 4 | 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | 6600,33 |
| 5 | 2.A.2 Lime Production | 4831,50 | | 5 | 2.A.1 Cement Production | 13227,90 |
| 6 | **4.C.2 Land Converted to Grassland** | 5542,30 | | 6 | **Managed Cropland** | 15928,57 |
| 7 | 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | 6600,33 | | 7 | 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | 16825,56 |
| 8 | **4.B.1 Cropland Remaining Cropland** | 6716,42 | | 8 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | 16825,56 |
| 9 | **4.B.2 Land Converted to Cropland** | 9022,11 | | 9 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | 16825,56 |
| 10 | 2.A.1 Cement Production | 13227,90 | | 10 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | 16825,56 |
| 11 | 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | 16825,56 | | 11 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Other Fossil Fue | 16825,56 |
| 12 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | 16825,56 | | 12 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | 16825,56 |
| 13 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | 16825,56 | | 13 | **Managed Grassland** | 17751,43 |
| 14 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | 16825,56 | | 14 | 2.C.1 Iron and Steel Production | 20145,87 |
| 15 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Other Fossil Fue | 16825,56 | | 15 | 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | 48776,00 |
| 16 | 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | 16825,56 | | 16 | 1.A.4 Other Sectors - Liquid Fuels | 50266,40 |
| 17 | 2.C.1 Iron and Steel Production | 20145,87 | | 17 | 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | 56759,37 |
| 18 | **4.C.1 Grassland Remaining Grassland** | 20876,85 | | 18 | **Managed Forest Land** | 65753,38 |
| 19 | 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | 48776,00 | | 19 | 1.A.4 Other Sectors - Gaseous Fuels | 68277,24 |
| 20 | 1.A.4 Other Sectors - Liquid Fuels | 50266,40 | | 20 | 1.A.3.b Road Transportation | 155812,70 |
| 21 | 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | 56759,37 | | | | |
| 22 | **4.A.1 Forest Land Remaining Forest Land** | 62514,01 | | | | |
| 23 | 1.A.4 Other Sectors - Gaseous Fuels | 68277,24 | | | | |
| 24 | 1.A.3.b Road Transportation | 155812,70 | | | | |

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# Preliminary findings:

1. KC analysis based on LACs may slightly differs from the KC analysis currently done under the UNFCCC.

2. Although representing a small additional burden to GHGI compliers it can be easily automatized.

3. They should not be seen as mutually exclusive; but as complementary.

4. The information from both analysis could serve to incentive deeper assessment of the main sources/sinks and therefore better use of resources.

5. And, ultimately  to move faster towards higher tiers methods for main sources/sinks

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# Assessing the significant of carbon pools

**- PRELIMINARY ASSESSMENT OF THE SIGNIFICANCE OF CARBON POOLS -**

*"Tier 2 methods (at least) for estimating carbon pools that are significant within a KC"*

***BUT,***

*Assumption of equilibrium is widely used for pools when MS lack country-specific data and IPCC lacks default factors.*

*(i.e. for these pools we do not have a numerical value)*

***QUESTION**:*

*How do we know which carbon pools need to be reported with higher tiers if we do not have quantitative estimates?*

***POSSIBLE INTERIM SOLUTION:***

*Use as a proxy of the significant of a not-reported pool in a certain LU category the average value of the significant from those MS that quantitatively reported the pool.*

# Preliminary analysis and caveats

- The information is based on individual GHGI **submission 2020**.

- Assignation of method is based on MS´s NIRs and annex-III of EU GHGI.  Only differentiation among **T1 vs. 2/3** is done.

- The analysis is carry out only for **three main "remaining"** categories of FL, CL and GL.

- The approach could be **further refined** by stratifying the average value used as a proxy by global ecological zones, management practices, climate zones etc.

- Effects of **natural disturbances**, and **market-prices** impact the significance of the pools. In this case, the average value from MS should does not serve as a proxy for the significant of the pools under different circumstances.

- The significance of pools within a category **is interlinked** - when a pool is not reported the significance of those that are quantitatively estimated increase-.

- Area of **organic soils** is often relatively small as compared with mineral soils, and the significant  could appears not as high as that of mineral soils but should be noted that their emissions per unit of area are substantially larger.

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# Preliminary results – Forest land remaining forest land

| MS | Living biomass | | Dead wood | | Litter | | SOC mineral | | SOC organic | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Significance (%) | IPCC Method | Significance (%) | IPCC Method | Significance (%) | IPCC Method | Significance (%) | IPCC Method | Significance (%) | IPCC Method |
| AT | 65% | T2,3 | 8% | T2,3 | IE | T2,3 | 28% | T2,3 | | |
| BE | 100% | T2,3 | T1 | | T1 | | T1 | | | |
| BG | 100% | T2,3 | 0% | T2,3 | T1 | | T1 | | | |
| HR | 100% | T2,3 | T1 | | T1 | | T1 | | | |
| CY | 100% | T2,3 | T1 | | T1 | | T1 | | | |
| CZ | 97% | T2,3 | 3% | T2,3 | T1 | | T1 | | | |
| DK | 60% | T2,3 | 3% | T2,3 | 25% | T2,3 | T1 | | 12% | T2,3 |
| EE | 60% | T2,3 | 4% | T2,3 | T1 | | 27% | T2,3 | 9% | T2,3 |
| FI | 66% | T2,3 | IE | T2,3 | IE | T2,3 | 17% | T2,3 | 17% | T2,3 |
| FR | 92% | T2,3 | 8% | T2,3 | T1 | | T1 | | | |
| DE | 65% | T2,3 | 5% | T2,3 | 1% | T2,3 | 25% | T2,3 | 4% | T2,3 |
| GR | 100% | T2,3 | T1 | | T1 | | T1 | | | |
| HU | 86% | T2,3 | 11% | T2,3 | T1 | | T1 | | 3% | T1 |
| IE | 70% | T2,3 | IE | T2,3 | 7% | T2,3 | 1% | T2,3 | 22% | T2,3 |
| IT | 96% | T2,3 | 1% | T2,3 | 2% | T2,3 | T1 | | | |
| LV | 66% | T2,3 | 26% | T2,3 | T1 | | T1 | | 8% | T2,3 |
| LT | 87% | T2,3 | 13% | T2,3 | T1 | | T1 | | IE | T1 |
| LU | 90% | T2,3 | 10% | T2,3 | T1 | | T1 | | | |
| MT | ---- | | T1 | | T1 | | T1 | | | |
| NL | 91% | T2,3 | 5% | T2,3 | T1 | | T1 | | 4% | T2,3 |
| PO | 89% | T2,3 | T1 | | T1 | | 9% | T1 | 3% | T1 |
| PT | 98% | T2,3 | IE | T2,3 | 1% | T2,3 | 2% | T2,3 | | |
| RO | 99% | T2,3 | T1 | | T1 | | T1 | | 1% | T1 |
| SK | 100% | T2,3 | T1 | | T1 | | T1 | | | |
| SI | 90% | T2,3 | 10% | T2,3 | T1 | | T1 | | | |
| ES | 100% | T2,3 | T1 | | T1 | | T1 | | | |
| SE | 49% | T2,3 | 1% | T2,3 | 20% | T2,3 | 6% | T2,3 | 24% | T2,3 |
| IS | 99% | T2,3 | T1 | | T1 | | T1 | | 1% | T1 |
| Average | 86% | | 7% | | 9% | | 14% | | 9% | |

KC according the CRF table 7.
(i)  Non-compliance based on MS data.
(ii)  Non-compliance based on proxy data.
Assumed in balance under the Tier 1 methods.

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# Preliminary results – Cropland remaining cropland

| MS | Living biomass | | Dead organic matter | | SOC mineral | | SOC organic | |
|---|---|---|---|---|---|---|---|---|
| | Significance (%) | IPCC Method | Significance (%) | IPCC Method | Significance (%) | IPCC Method | Significance (%) | IPCC Method |
| AT | 22% | T2,3 | T1 | | 78% | T2,3 | | |
| BE | 2% | T2,3 | T1 | | 64% | T2,3 | 34% | T1 |
| BG | 8% | T1 | T1 | | 92% | T2,3 | | |
| HR | 49% | T1 | T1 | | 8% | T2,3 | 42% | T1 |
| CY | 100% | T1 | T1 | | ---- | | | |
| CZ | 8% | T1 | T1 | | 92% | T2,3 | | |
| DK | 1% | T2,3 | T1 | | 12% | T2,3 | 87% | T2,3 |
| EE | 1% | T2,3 | T1 | | 37% | T2,3 | 62% | T2,3 |
| FI | 0% | T2,3 | IE | T2,3 | 12% | T2,3 | 88% | T2,3 |
| FR | 18% | T2,3 | T1 | | 82% | T2,3 | IE | T2,3 |
| DE | 1% | T2,3 | T1 | | 1% | T2,3 | 98% | T2,3 |
| GR | 74% | T2,3 | T1 | | ---- | | 26% | T1 |
| HU | 13% | T2,3 | T1 | | 87% | T2,3 | | |
| IE | 41% | T1 | T1 | | 59% | T1 | | |
| IT | 21% | T2,3 | T1 | | 62% | T2,3 | 17% | T1 |
| LV | 1% | T2,3 | 0% | T2,3 | ---- | | 99% | T1 |
| LT | 39% | T1 | T1 | | 61% | T2,3 | IE | T1 |
| LU | 92% | T1 | T1 | | 8% | T2,3 | | |
| MT | 76% | T2,3 | T1 | | 24% | T1 | | |
| NL | ---- | | T1 | | ---- | | 100% | T2,3 |
| PO | 70% | T1 | T1 | | 7% | T1 | 23% | T1 |
| PT | 90% | T2,3 | T1 | | 10% | T2,3 | | |
| RO | 21% | T2,3 | 4% | T2,3 | 72% | T1 | 4% | T1 |
| SK | 96% | T2,3 | T1 | | 4% | T2,3 | | |
| SI | 78% | T1 | T1 | | 1% | T1 | 21% | T1 |
| ES | 35% | T2,3 | T1 | | 65% | T2,3 | | |
| SE | 5% | T2,3 | 0% | T2,3 | 18% | T2,3 | 77% | T1 |
| IS | ---- | | T1 | | 3% | T2,3 | 97% | T1 |
| Average | 37% | | 1% | | 40% | | 58% | |

KC according the CRF table 7.
(i) Non-compliance based on MS data.
(ii) Non-compliance based on proxy data.
Assumed in balance under the Tier 1 methods.

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# Preliminary results – Grassland remaining grassland

| MS | Living biomass | | Dead organic matter | | SOC mineral | | SOC organic | |
|---|---|---|---|---|---|---|---|---|
| | Significance (%) | IPCC Method | Significance (%) | IPCC Method | Significance (%) | IPCC Method | Significance (%) | IPCC Method |
| AT | ---- | | | T1 | 3% | T2,3 | 97% | T1 |
| BE | ---- | | | T1 | 99% | T2,3 | 1% | T1 |
| BG | 3% | T1 | | T1 | 97% | T2,3 | | |
| HR | ---- | | | T1 | ---- | | 100% | T1 |
| CY | 100% | T1 | | T1 | ---- | | | |
| CZ | ---- | | | T1 | 100% | T2,3 | | |
| DK | 2% | T2,3 | | T1 | IE | T2,3 | 98% | T2,3 |
| EE | 3% | T2,3 | | T1 | ---- | | 97% | T2,3 |
| FI | 21% | T2,3 | | T1 | ---- | | 79% | T2,3 |
| FR | 85% | T2,3 | | T1 | 15% | T2,3 | IE | T1 |
| DE | 2% | T2,3 | | T1 | 1% | T2,3 | 97% | T2,3 |
| GR | 100% | T2,3 | | T1 | ---- | | | |
| HU | ---- | | | T1 | 100% | T2,3 | | |
| IE | ---- | | | T1 | 12% | T1 | 88% | T1 |
| IT | 46% | T2,3 | 6% | T2,3 | 47% | T2/3 | 1% | T1 |
| LV | 5% | T2,3 | 1% | T2,3 | ---- | | 95% | T1 |
| LT | ---- | | | T1 | ---- | | IE | T1 |
| LU | ---- | | | T1 | ---- | | | |
| MT | ---- | | | T1 | 100% | T1 | | |
| NL | 1% | T2,3 | | T1 | 0% | T2,3 | 99% | T2,3 |
| PO | ---- | | | T1 | 40% | T1 | 60% | T1 |
| PT | ---- | | | T1 | 100% | T2,3 | | |
| RO | 100% | T1 | | T1 | ---- | | 0% | T1 |
| SK | ---- | | | T1 | ---- | | | |
| SI | 66% | T2,3 | 31% | T2,3 | 3% | T1 | | |
| ES | ---- | | | T1 | ---- | | | |
| SE | 33% | T2,3 | 33% | T2,3 | 7% | T2,3 | 26% | T1 |
| IS | 0% | T2,3 | 0% | T2,3 | 0% | T1 | 100% | T1 |
| Average | 38% | | 14% | | 45% | | 69% | |

KC according the CRF table 7.
(i)   Non-compliance based on MS data.
(ii)   Non-compliance based on proxy data.
Assumed in balance under the Tier 1 methods.

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# Preliminary findings:

- For **Forest Land**, dead wood and litter appear as carbon pools not "formally" significant. The assumption of equilibrium for DW is not allowed under the Reg. 2018/841. Noting that recently more NFIs are collecting information on these pools, further efforts are expected to quantify their carbon stock changes.

- Lack of estimates for **Mineral soils** is often justified by the implementation of constant management practices over time, or when current management is less intensive than before. According to IPCC default approach this would result in equilibrium or (unknown) carbon removals. Overall, there is need for further information and verification approaches to support these arguments.

- **Grassland** areas are often considered as lacking woody vegetation, and not subject to management practices that could enhance carbon fluxes. Therefore, and in accordance with IPCC approaches most of the pools are not quantitatively estimated. Although, for MS that report carbon stock change in LB, SOCmin and SOCorg, the pools seem to be significant.

- It seems that a number of MS will have to **move to higher tier methods** to comply with Reg. 2018/841. Mainly those using T1 for living biomass and soil organic carbon in Croplands, but also "potential" not compliance cases appear for the reporting of these pools under Grassland.

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# Thank you

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