NATIONAL GHG INVENTORIES: A TOOL FOR RECORDING AND MONITORING THE PROGRESS MADE IN CLIMATE CHANGE MITIGATION

To mitigate climate change, a drastic reduction in GHG (greenhouse gas) emissions worldwide is necessary. Nations around the world have agreed upon targets in GHG emissions reductions though the Kyoto Protocol and the Paris Agreement. This stipulates that annual reporting of Greenhouse gas emissions is required, together with updates on policies and measures implemented to achieve the climate targets set [1].

“Through its land use, land use change and forestry (LULUCF) activities, the EU currently removes a net total of 249 Mt CO2e from the atmosphere every year, equivalent to 7% of its annual greenhouse gas emissions. The sector will play a crucial role in helping the EU achieve net zero emissions by 2050. Doing so will require reversing the current decreasing trend of the EU's carbon sink. According to national projections from EU Member States, current measures in place will not be sufficient to achieve this, with an average removal of 200 Mt CO2e per year in 2030. However, implementing the national measures currently at planning stage could increase the current EU carbon sink by 3 %. " [2]

The system of reporting to the UNFCCC (United Nations Framework Convention on Climate Change) both urges the countries to take action and provides with a basis for monitoring and reviewing the current mitigation efforts. According to the European Environment Agency, EU-27 greenhouse gas emissions in 2019 declined by 24 % compared to 1990 levels. The EU has a set target for 2030 of a 55 % net reduction in greenhouse gas emissions. According to preliminary data, the EU's net emissions in 2020 were 34 % below 1990 levels. [3]

One of the reasons why these estimates are available is the unified system of national GHG inventories.

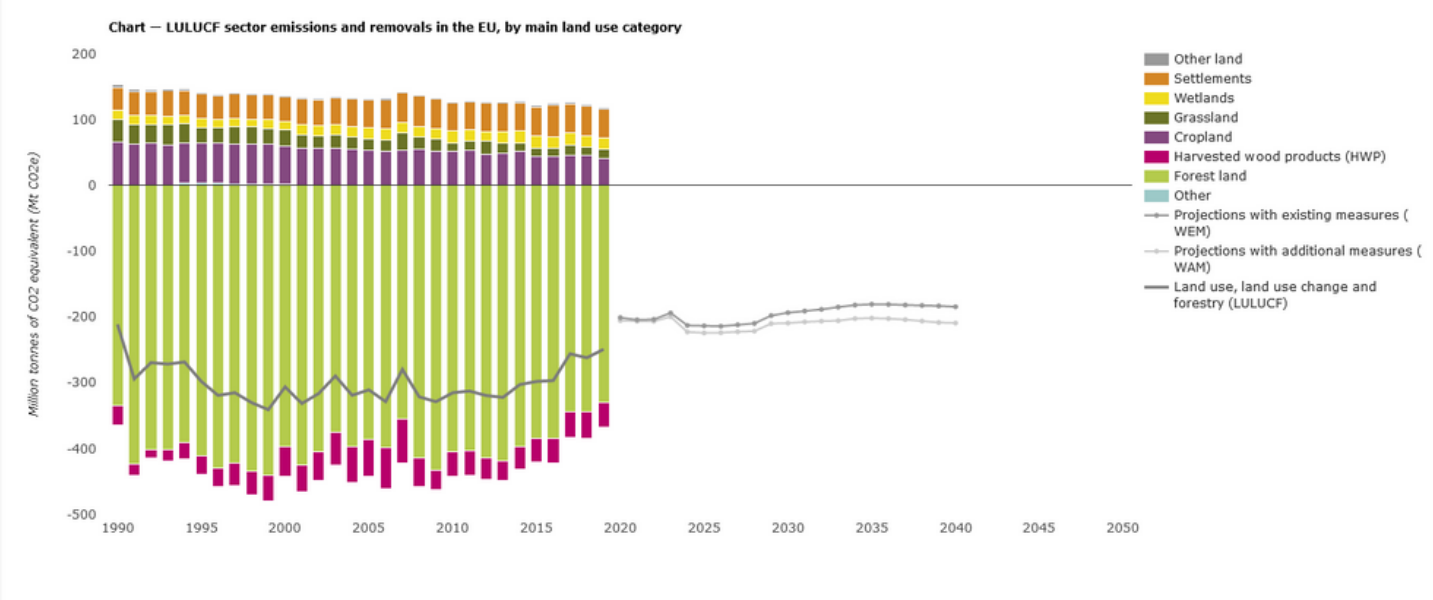

Figure 1. LULUCF sector emissions and removals in the EU, by main land use category.
Detailed view of Figure 1.: https://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emissions-from-land/assessment

About the inventory system

The GHG inventory system was created to record and monitor the greenhouse gas emissions and removals within a country in an unified and comparable manner. The inventories help policymakers set targets and identify areas and sectors where actions should be taken in order to achieve a reduction in GHG emissions and adhere to international agreements.

The inventory lists the amounts of greenhouse gases emitted to or removed from the atmosphere. The gasses reported include carbon dioxide, methane, nitrous oxide, and more. To ensure data comparability, the inventories are created based on an commonly accepted methodology.

The method is based on the 3 tier approach, where each tier represents a level of methodological and data complexity for emission calculations. The tiers 2 and 3 are seen as the more adequate with the condition that appropriate data is available [4]. Tier 1 method generally applies the emission factors (EFs) and equations laid out in the IPCC Guidelines for National Greenhouse Gas Inventories [5].

National GHG inventory	*A comprehensive listing, by source, of annual GHG emissions and removals resulting directly from human activities. [6]*
Emission factor	*A coefficient that quantifies the emissions or removals of a gas per unit activity. [7]*
Tier	*A level of methodological complexity. [8]*

The 3 tiers

For example, for estimating the CO2 emissions and removals from drained inland organic soils, the category of on-site CO2 emissions/removals of the of the organic soil from mineralisation and sequestration processes should be assessed.

If this task would be done with the Tier 1 methodology, the data of emission factors from the IPPCC guidelines would be used and the CO2 emissions or removals would be calculated by multiplying the emission factors with the area of the subsequent land of interest. Even with the most generalised method, the emission factors set in the guidelines are differentiated by the land use category

forest land, drained, grassland, deep-drained etc), nutrient status (nutrient-poor, nutrient-rich, etc), and climate/vegetation zone (boreal, temperate etc).

If the Tier 2 approach would be employed, country-specific information would be incorporated into the equations applied in Tier 1. This information could include more specific EFs, specification of climate sub-domains, more detailed classification of management systems with a differentiation of land-use intensity classes, more detailed classification of nutrient status, and other details that are specific to the country of interest.

Tier 3 approach in this case would likely include information obtained from more advanced modelling and measuring of the environmental conditions in the area. Dynamic, mechanistic models would typically be used to simulate underlying processes while capturing the influence of land use and management, particularly the effect of seasonally variable levels of drainage on decomposition [9].

OrgBalt's role in improving the GHG inventories of the region

According to the Zigmas Medingis, the Counsellor of the Division of Crop Production and Agri-Environment at the Ministry of Agriculture of the Republic of Lithuania "Reliable and properly functioning Greenhouse gas inventory system is the main tool to tackle the progress of greenhouse gas reductions and assess the effectiveness of the greenhouse gas emission measures. We observe the lack of consistent data on the realistic greenhouse gas emissions on organic soils internationally."

The LIFE OrgBalt project actions aim to strengthen the capacity of national GHG inventory teams and develop bilateral and regional channels of the GHG accounting and mitigation tools related to information exchange. The work done in the demonstration sites of OrgBalt contributes to the improvement of the GHG inventory, accounting of GHG emissions and CO2 removals in nutrient-rich organic soils, and evaluation of the impact of the CCM (climate change mitigation) measures in nutrient-rich organic soils. To ensure that the results are considered even after the project, decision support and inventory tools for management of nutrient rich organic soils in cropland, grassland and forest land will be developed.

Einārs Mednis, Senior officer of Sustainable Agriculture Development Division of the Department of Agriculture of the Ministry of Agriculture is emphasizing the usage of data: "The development of sound, analytical policies require convincing data, scientific evidence, a reliable and good monitoring system. The big challenge we face today is that it is not always possible to reflect all GHG mitigation measures in national GHG inventory report. Therefore, when thinking about the collection of monitoring data, it is necessary to think about, how the data can be used in the GHG inventory and also for GHG emissions projection, scenario modelling".

Currently in the Baltic States the national inventory calculations for various categories of drained and rewetted organic soils mostly use the Tier 1 method or are not reported at all, as some are not mandatory. In some cases, Tier 2 methods are used, based on data from past research projects. In Finland, however, most GHG estimations are based on Tier 2 or 3 methodology. [10]

Ieva Līcīte LIFE OrgBalt project coordinator elaborates "Improvement of GHG inventory calculation methods (regionally specific GHG emission factors and moving to higher Tiers) and activity data sets is crucial for more precise GHG inventory calculations and GHG emission projections. Activity data (e.g. land use and management practices and conditions) in one of the most important elements of the GHG calculation and projections from organic soils, especially if climate changes are considered in modelling. Research within the LIFE OrgBalt project is elaborating set of organic soils related activity data for Baltic States for different climate change and management scenarios including climate change scenarios for modelling of GHG emissions, equations, scripts and specific activity data sets (land use, soil properties,

moisture regime, climate conditions) for adaptation of SUSI peatland simulator for projections of GHG emissions from organic soils in Baltic States level. Another advanced methods for activity data improvements developed within the LIFE OrgBalt project are based on peat properties and water regime analysis thus improving land use and characteristics data. One of the challenging and most important task of the project is to develop regional and climate sensitive emission factors and incorporate them into GHG modelling tools. From previous research (LIFE REstore project and others) it is known that there can be significant differences between IPCC guidelines default emission factors and national or regional estimates. Local GHG emission measurements are currently scarce in Baltic States, LIFE OrgBalt is contributing here. Thus regionally measured and calculated GHG emission factors (for CO2, CH4, N2O) is one of the biggest contributions to GHG inventory improvement in project countries. Emission factors calculated within the project are to be published in peer-reviewed journals and will be available for application in project partner countries."

As a result, the improved data availability can lead to a higher tier approach in calculating the GHG emissions for the national inventories, and therefore provide policymakers with more precise information on the status quo of GHG emissions of a country and mitigation measures that have proven effective.

LIFE ORGBALT TEAM

[1] https://ec.europa.eu/clima/eu-action/climate-strategies-targets/progress-made-cutting-emissions/emissions-monitoring-reporting_en

[2] European Environment Agency https://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emissions-from-land/assessment

[3] https://www.eea.europa.eu/themes/climate/eu-greenhouse-gas-inventory/is-europe-reducing-its-greenhouse

[4] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

[5] IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

[6] UNFCCC Resource Guide for Preparing the National Communications of non-Annex 1 Parties

[7] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

[8] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

[9] Interim draft report on improved methodologies for GHG inventory reporting and related national reports, C1/3, 2021- C1/3, LIFE18 CCM/LV/001158

[10] Interim draft report on improved methodologies for GHG inventory reporting and related national reports, C1/3, 2021- C1/3, LIFE18 CCM/LV/001158

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