

## 2030 Climate Target: Review of LULUCF Regulation

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### Key conclusions

- **Enhanced targets at EU and Member State level** under the LULUCF Regulation are required for effective enhancement of sinks and reduction of emissions in the LULUCF sector.
- The **LULUCF sector has specific characteristics** such as larger uncertainties of emissions and removals in the inventory, unknown impacts of climate change on the future sequestration potential and the potential risk of reversal of carbon stored in soils and ecosystems. The design of the future contribution of the LULUCF sector to the EU target should take these specific features into account.
- The revision of the LULUCF Regulation should be designed **with a view to setting the right incentives to enhance the long-term carbon sinks** required to achieve EU climate neutrality in 2050 and to **increase the consistency with the long-term requirements**.
- The provisions under the LULUCF Regulation do not avoid potential negative impacts from enhanced bioenergy use or other land-use policies on biodiversity. Therefore, the **regulation needs to be complemented with additional instruments such as legally binding EU nature restoration targets** as proposed in the EU's biodiversity strategy for 2030.
- **Significant potentials for increased carbon storage in peatlands and organic soils are untapped.** Enhancing sequestration in organic soils requires additional instruments and policies beyond the revision of the LULUCF Regulation, e.g. as part of Member States' national strategies under the Common Agricultural Policy.

## 1 Introduction and background

The current European climate target to reduce total emissions by 40% compared to 1990 levels by 2030 consists of three pillars:

- the EU Emissions Trading System (ETS), which covers about 40% of the European greenhouse gas (GHG) emissions and which shall deliver a reduction of 43% compared to 2005,
- the Effort Sharing Regulation (ESR) with a share of about 60% of total GHG emissions with a reduction target of 30% compared to 1990, and
- the Land Use and Land Use Change and Forestry (LULUCF) Regulation (Regulation (EU) No 2018/841), which covers the emissions and removals from the land use, land-use change and forestry sector and sets the target to avoid net emissions from this sector.

In April 2021, the EU adopted an increased target of reducing emissions by 55% by 2030 compared to 1990 levels. This target includes emissions and removals from the LULUCF sector with a maximum accountable contribution of removals set at 225 million tons CO<sub>2</sub>. In July 2021, the European Commission will present legislative proposals underpinning this more ambitious reduction target, including a proposal for a revised LULUCF Regulation.

This background paper provides an overview of current trends of emissions and removals in the LULUCF sector, the existing system to monitor, report and account for emissions and removals and outlines the policy options for a revised LULUCF Regulation based on the inception impact assessment presented by the European Commission (European Commission 2020b).

## 2 Importance of the LULUCF sector for the EU's GHG emissions and removals and related uncertainties

### 2.1 Current and projected trends in GHG emissions and removals

The main physical pools of terrestrial ecosystems to store carbon are above ground biomass in trees and perennial vegetation, below ground biomass, litter and dead wood as well as soil organic carbon (SOC).

**Forests** store carbon in their living biomass with a long lifetime (Böttcher et al. 2021). The EU27+UK forests cover 167 million ha (European Commission 2020) with a carbon stock of 9.8 billion tons of carbon in living biomass, which constitutes 36% of the total forest carbon pool in 2020 (Forest Europe 2020). The forest soil has the highest share in the EU forest carbon pool of 54% (Forest Europe 2020).

Globally, **soils** store more carbon than all the vegetation and the atmosphere combined (Friedlingstein et al. 2019). The total storage of organic carbon for the EU27+UK topsoil (0-30 cm) is estimated to be 73 billion tons of carbon. About 50% is located in peatlands and under forests and 22% in agricultural soils (Camia et al. 2021) (Jones

et al. 2005). Mineral soils store considerably less carbon than organic soils. In Europe organic soils store four to five times more carbon than forests (Swindles et al. 2019). Finland and Sweden report together more than half of the total area of organic soils in the EU (European Environment Agency 2021). Under cultivation, organic soils are usually drained, which causes high CO<sub>2</sub> emissions. Total CO<sub>2</sub> emissions from organic soils in the EU reached 107 million tons CO<sub>2</sub>eq in 2019 which represents about 37% of total EU net removals from LULUCF (Camia et al. 2021; European Environment Agency 2021). After Indonesia, the EU is the second largest emitter of GHG emissions from drained peatlands (van Akker et al. 2016).

**Harvested wood products (HWP)** can also store carbon but cannot sequester it. Harvest of biomass leads to immediate emissions if the biomass is burnt, but to delayed emissions if the biomass is used in products. In 2019, the EU27 net storage through HWP was -40.4 million tons of CO<sub>2</sub> (European Environment Agency 2021). The amount of carbon stored in HWP depends on how much harvested wood is stored in wood products with long lifetimes.

Important **marine carbon pools** in Europe are coastal ecosystems such as salt-marshes and seagrass meadows which are currently not included in the GHG inventories because estimation methodologies have only recently been developed by the IPCC and are not yet mandatory under the UNFCCC. Most EU Member States may not have collected sufficient data to estimate emissions from coastal ecosystems.

Overall, the **LULUCF sector in the EU** showed a total net removal of -264 million tons CO<sub>2</sub>eq for EU 27 for 2019. At EU level there are net emissions from the categories cropland, grassland, wetlands, settlements and other land, and net removals from forest land and HWP, which outweigh net emissions of the other four categories to a large extent.

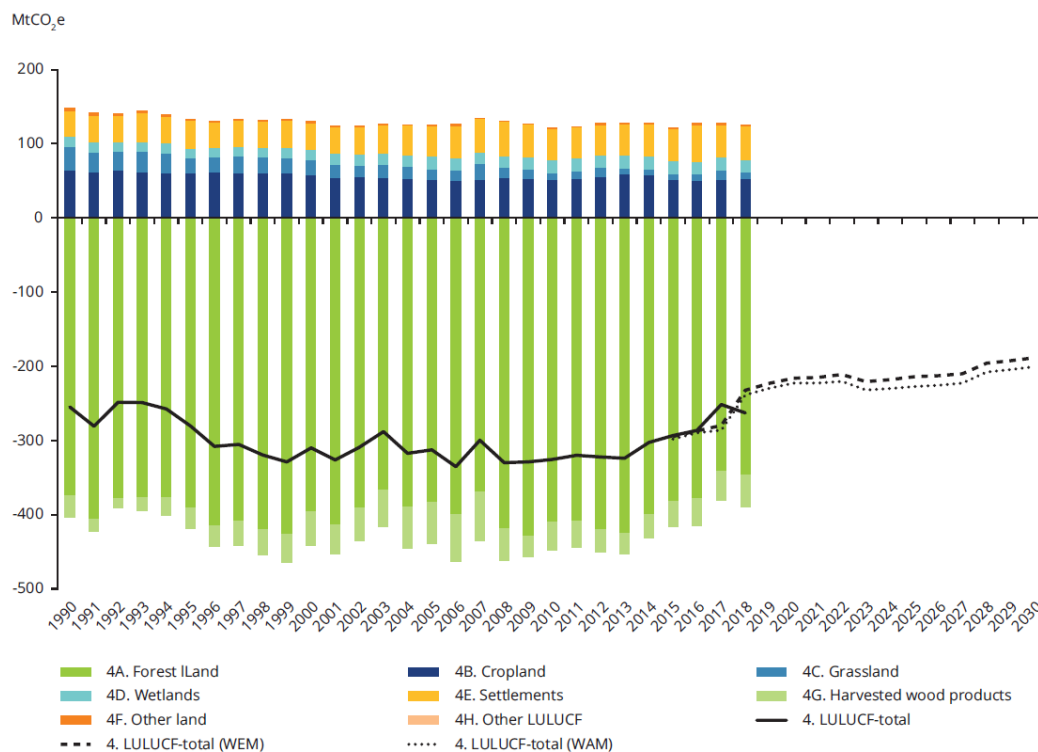
A significant **net decrease of the EU's sink can be observed in the last decade**: it fell from 316 million tons of CO<sub>2</sub>eq in 2013 to 251 million tons of CO<sub>2</sub>eq in 2017. This is due to ageing forests and higher harvesting rates, in addition to climate change-related pressures on forests like natural hazards. Ceccherini et al. (2020) recently reported an increase in the forest harvest rate for Europe, which is an important driver of decreasing carbon stocks in forest biomass.

Different projections show that **with current practices the capacity of European soils and forests to absorb CO<sub>2</sub> will further decline** to a level of -200 million tons CO<sub>2</sub>eq in 2030, which represents a loss of 63 million tons CO<sub>2</sub>eq. In the Commission's impact assessment for the climate target plan, a net sink of -225 million tons CO<sub>2</sub>eq is projected for 2030 if no further actions are taken. **A more ambitious policy scenario of the impact assessment** (European Commission (2020c)) **enhances the LULUCF sink to approximately -340 million tons CO<sub>2</sub>eq by 2030**. For 2050, by which time the EU aims to be climate-neutral, the entire LULUCF sector is expected to balance about -425 million tons CO<sub>2</sub>eq of residual emissions from other sectors (European Commission 2018). After 2050, net GHG emissions of the EU will need to be negative to stay below the temperature target established by the Paris Agreement.

The potential future sink in the LULUCF sector is not easy to estimate. Böttcher et al. (2021) compile total **results of different studies, ranging from a net sequestration of -244 to -787 million tons CO<sub>2</sub>eq per year in 2050**. A **main factor of uncertainty is the effect of climate change on forests and wetlands**. Between 2018 and 2020,

European forests were affected by severe droughts, wildfires, storms and spreading bark beetle infestations (Lindner and Verkerk 2021). But it remains difficult to predict the future development because it is not known whether the extreme weather patterns of 2018-2020 present a new 'normal' climate or an exceptionally dry period or whether the future climate may even become more extreme.

**Figure**                      **Historical and projected LULUCF emissions and removals**



**Note:** Bars and solid lines represent historical GHG emissions (available for the period 1990-2018). Dashed lines represent projections for the scenario with existing measures (WEM). Dotted lines represent projections for the scenario with additional measures (WAM).

Source: (European Environment Agency 2020b).

## 2.2 Role of Member States in relation to the EU emissions and removals from the LULUCF sector

Under the LULUCF Regulation, Member States have to ensure that accounted GHG emissions from LULUCF are balanced by at least an equivalent accounted removal of CO<sub>2</sub> in the period 2021 to 2030. This is known as the 'no debit' rule.

Information on average LULUCF emissions and removals from 2014 to 2018 in the 2020 EU GHG inventory indicates that there are **six Member States with net emissions** (Denmark, Ireland, Latvia, Malta, the Netherlands and Slovenia, see table below). **Large net sinks can be observed in Sweden** with a share of 80% of total GHG emissions, followed by **Finland** (30% of total emissions) and **Lithuania** (26% of total emissions). Forest land is the most relevant sub-category in absolute terms, resulting in a net sink for all Member States apart from Slovenia and Malta. Another important sink is the net carbon stored in HWP in most Member States. Cropland and settlements are relevant net sources of emissions in most Member States. In the settlement category emissions mainly result from deforestation for transport infrastructure and settlement areas.

## 2.3 Monitoring, reporting and accounting framework for the LULUCF sector

### 2.3.1 Monitoring

Under the Paris Agreement and in the EU, the 2006 IPCC Guidelines have been adopted as mandatory monitoring and estimation methodologies for inventories. The estimates of **emissions and removals in some LULUCF categories have relatively high uncertainties**: 38% for CO<sub>2</sub> emissions from cropland at EU level, 1018% for CO<sub>2</sub> emissions from grassland and 56% for CO<sub>2</sub> emissions from wetlands. **Uncertainties are considerably higher for the changes of carbon stocks in the soil carbon pool than for the above ground biomass.**

There are many ongoing **discussions about the reliability of reported LULUCF data**. Böttcher et al. (2020) identified potential issues of completeness, consistency and accuracy in current reporting and accounting rules and procedures for EU Member States and their implications for incentives to changed land management within the EU looking at cropland, HWP, managed forests and organic soils. Grassi et al. (2021) postulate that **carbon-absorbing effects of forest land are overestimated in GHG inventories**. In addition, there are ongoing discussions about the results from satellite data which suggests a huge increase in the harvested forest area after 2015 (Ceccherini et al. 2020); scientists have questioned whether this result may be influenced by improved sensitivity of satellite data (Palahí et al. 2021).

### 2.3.2 Reporting and verification

Reporting in the EU and under the UNFCCC aims at documenting the level and development of anthropogenic GHG emissions and removals over time. Anthropogenic emissions and removals in the LULUCF sector result from biological processes on land areas directly or indirectly influenced by human activities on managed lands. GHG inventories report six main categories (forest land, cropland, grassland, wetlands, settlements, other land and HWP) and are annually submitted by Member States to the EEA. These inventories are aggregated to an EU inventory. Reported data on emissions and removals are regularly recalculated for past years due to continuous improvements in methodologies and data.

### 2.3.3 Accounting

**Accounting, in contrast to reporting, sets the reported emissions and removals into perspective to a target.** The LULUCF Regulation establishes accounting rules to ensure that the LULUCF sector does not generate net emissions. It defines **six accounting categories** (afforested land, deforested land, managed cropland, managed grassland, managed forest land and managed wetland). HWP are accounted in the categories managed forest land and the afforested land. The Regulation introduces two accounting periods, the first from 2021 to 2025 and the second from 2026 to 2030. Accounting in the different categories follows specific rules:

- For the **afforested and deforested land** categories, the total emissions and removals that occur during the accounting periods are accounted – they are not compared to any reference.
- The categories **cropland, grassland and wetlands** are compared to the average net emissions and removals of 2005 to 2009.

- For **forest land**, a **Forest Reference Level (FRL)** is the baseline for accounting. The FRL is the counterfactual value of emissions and removals that would occur in managed forest land in the future based on the continuation of ‘sustainable forest management practices’ as applied in the period from 2000 to 2009. Therefore, FRLs provide incentives for improved land management because the continuation of current practices does not result in accountable removals, but only practices that further enhance removals. The FRLs for the first accounting period were determined by Member States based on common criteria and guidance, reviewed by experts, revised in the light of review recommendations and adopted as part of a delegated act (European Commission 2020f). The FRLs for the period 2026 to 2030 will be determined in 2023 with the same procedure. The LULUCF Regulation also applies a limit of 3.5% of total base year emissions to the total accountable net removals from managed forests.

**Table: Accounting rules under the LULUCF Regulation**

LULUCF category	Accounting Rule	Data Source
Afforested land	Total net emissions/ removals in the accounting period (comparison against zero)	Reported emissions and removals in compliance period
Deforested land	Total net emissions/ removals in the accounting period (comparison against zero)	Reported emissions and removals in compliance period
Managed forest land and HWP	Against a Forest Reference Level (FRL)	European Commission (2020f)
Managed cropland	Against historic reference, the average net emissions and removals of 2005-2009	Reported emissions and removals 2005-2009
Managed grassland	Against historic reference, the average net emissions and removals of 2005-2009	Reported emissions and removals 2005-2009
Wetlands	Voluntary until 2025, against historic reference	Reported emissions and removals 2005-2009
Settlements and other	Not included as a category in EU accounting, but land conversion to and from settlements included in categories above while changes of carbon stocks in settlement areas are assumed to be negligible.	

Source: Own representation, for further information see (Böttcher et al. 2019).

Due to the application of accounting rules, accounted emissions and removals differ from the reported emissions and removals. The table below provides an example of balanced accounted emissions while reported emissions and removals in GHG inventories result in a net sink:



**Table: Example results of accounted and reported emissions and removals [in million tons CO<sub>2</sub>e equivalents]**

	Accounting reference (FRL or historic reference)	Average emissions and removals	Result after accounting: <b>+0 Mt CO<sub>2</sub>e<sub>q</sub></b>	Total in GHG inventory: <b>-225Mt CO<sub>2</sub>e<sub>q</sub></b>
Managed forest land and HWP	-316	-316	0	-316
Managed cropland	52	52	0	52
Managed grassland	15	15	0	15
Wetlands	17	17	0	17
Afforested land	None	-40	-40	-40
Deforested land	None	40	40	40
Settlements and other	None	7	Not included	7

Source: Own representation.

The LULUCF Regulation also includes provisions on how Member States may exclude emissions from natural disturbances such as storms, fires, droughts or insect outbreaks from the accounting and how they can account for carbon temporarily stored in HWP.

### 2.3.4 Flexibilities

The LULUCF Regulation includes provisions for Member States to achieve compliance using the following flexibilities:

- In case of non-compliance with the net debit target under the LULUCF regulation, **Member States may use Annual Emission Allocations under the ESR to compensate surplus emissions under the LULUCF Regulation.**
- **Member States** with net removals beyond the commitments under the LULUCF Regulation **can use a limited amount of net removals for compliance with the ESR.** In total, this flexibility is capped at 280 million tons CO<sub>2</sub> in the period 2021-2030. The maximum amounts of net removals that Member States can take into account for compliance with the ESR are fixed in Annex III of the LULUCF Regulation. For further information on the ESR compliance cycles, see (Gores et al. 2019).
- **Member States can sell net removals under the LULUCF Regulation to other Member States** that have net emissions from LULUCF accounting.
- **Member States can bank surplus net removals from the first accounting period (2021-2025) to the subsequent accounting period.**

The flexibilities between the ESR and the LULUCF sector have been criticised for opening a 'fire wall' between biogenic emissions and removals of land use activities and fossil fuel emissions from ESR activities and thereby decreasing incentives for

the reduction of fossil fuel emissions (Fern 2018). However, these flexibilities can also be seen as setting additional incentives for sequestration and mitigation in all sectors and as an important safeguard against non-compliance risks.

## 2.4 The role of bioenergy

Biomass demand is often associated with potential impacts on the land use sink. According to the impact Assessment for the climate target plan (European Commission 2020d), the **production of biomass for industrial and energy use has continuously increased in the EU in the past 30 years**. JRC estimated that about half of the total wood harvested in the EU is directly or indirectly used for energy production (Cazzaniga et al. 2019). **In most scenarios of the impact assessment, the consumption of bioenergy only slightly increases up to 2030 compared to the current level** with highest demand from power generation and residential heating. **Projections for 2050 assume a considerable increase of bioenergy consumption** from around 150 million tons of oil equivalent (Mtoe) in 2030 to 230-250 Mtoe, half of which is assumed to come from solid biomass (European Commission 2020d).

To achieve renewable energy targets, bioenergy is very relevant, especially in the heating and cooling sector. In 2018, biomass has a share of 81% in final energy consumption from renewables in this sector. Toileikyte and Carlsson (2021) analysed the planned development in the heating and cooling sector as reported in National Energy and Climate Plans submitted by Member States in 2020. The use of biomass will slightly increase and will remain the dominant technology in this sector in the EU 27 until 2030. Biofuels will continue to play a role in the transport sector. There is also a high interest in the electricity sector to use biomass to replace coal and to avoid the need to buy increasingly expensive emission allowances under the EU ETS.

At the same time there are serious concerns about the use of biomass for energy production due to the impacts in the LULUCF sector and on biodiversity. **While the emissions from bioenergy are assumed to be zero in the energy sector, the emissions from bioenergy use are counted in the LULUCF sector** in the form of harvested biomass. **Therefore, increased pressure on wood use for bioenergy will not add emissions in the energy sector but in the LULUCF sector**. Imported biomass and biofuels do not add emissions in the LULUCF sector in the EU, but they can be significant drivers of deforestation on a global level (e.g. Gao et al. 2011). **In addition, increased removal of biomass residues for energy use can reduce carbon stocks in soils, dead wood or litter and can have negative impacts on biodiversity. Due to finite land areas, nutrient and water supply, biomass production is limited and there are considerable feedstock limitations for biomass**. Biomass should be used in the most efficient way possible with a preference for replacing fossil-based materials and subsequent burning for energy purposes in a cascade chain (Eickhout 2012). In the construction of forest reference levels under the LULUCF regulation, a constant ratio of wood used for energy and for materials is assumed, which does not take into account the higher priority of material use. Additional ecological safeguards need to be ensured by reinforced sustainability criteria, to be addressed by the revised Renewable Energy Directive (European Commission 2021f). In Camia et al. (2021), several pathways for forest management practices and their impacts on biodiversity and carbon emissions mitigation are compared which could contribute to discussion on sustainable use of woody biomass.



## 2.5 LULUCF in the EU reduction target for 2030

The inclusion of LULUCF emissions and removals into the -55% EU target for 2030 aims to strengthen the role of natural sinks. **This target is based on emissions or removals as reported in the GHG inventory, without considering accounting rules under the LULUCF Regulation.** To ensure a minimum emission reduction of other sectors, the **contribution of the LULUCF sector to the target is capped at -225 million tons CO<sub>2</sub>eq.** This corresponds to the Commission's assessment of the net carbon sink resulting from the existing commitments under the LULUCF Regulation (European Commission 2020c). If the LULUCF sector contributes to the -55% target within the scope of this cap in 2030, emissions of other sectors need to decrease by -53%. If the LULUCF sector achieved a net sink of -300 million tons CO<sub>2</sub>eq in 2030, the net removals beyond the cap cannot be used to compensate emissions of other sectors, but are additional and would lead to a total EU GHG emission reduction of -57% compared to 1990.

## 3 Policy options presented in the Inception Impact Assessment

In the Inception Impact Assessment (European Commission 2020e), the Commission presented three options for how the LULUCF Regulation could be revised. These are based on the options discussed and quantified in the impact assessment of the Climate Target Plan (European Commission 2020c). The three policy options are discussed below.

### 3.1 Option 1: Strengthen the current LULUCF Regulation and increase its ambition in line with the 2030 Climate Target Plan

There are several ways to enhance the current LULUCF Regulation to increase its ambition.

#### National net sequestration targets instead of no debit rule

The commitments under Article 4 of the regulation – that each Member State shall ensure that emissions do not exceed removals in all land categories – could be **strengthened to a 'net removal' target in the LULUCF sector.** Such a net sequestration target should be aligned with adaptation needs and the EU biodiversity and ecosystem restoration targets (see section 3.4). A net sequestration target at EU level **would need to be converted into specific targets for each Member State, taking into account the different status and potentials to enhance sinks in forest and soils in Member States.** In Böttcher et al. (2021), it is proposed to additionally allow for country targets that go beyond an EU average target. Enhanced individual targets for each Member State would require a difficult and time-consuming political negotiation process. Strengthened targets may also need the maintenance of current flexibilities such as trading of excess net removals between Member States or banking between accounting period to ensure compliance in a sector with high uncertainties.

#### Strengthening accounting rules

Accounting rules for the forest sector could be revised to increase the incentives for Member States to enhance carbon sequestration. The accounting rules are interlinked

with the LULUCF targets. Considerably strengthened targets may not need enhanced accounting provisions whereas strengthened accounting provisions can be a way of ensuring additional efforts for weaker targets.

The current setting of FRLs is based on a projected baseline assuming the continuation of current management practices. The FRLs established for the first accounting period include the possibility of assuming a declining sink in future years or an increase in wood harvesting. If the sink decreases less than the FRL, removals are generated. **Rules for the FRL could be strengthened in such a way that the projected baseline at least assumes a constant sink and does not allow declining net removals or increased harvesting.** Currently there are two Member States (Denmark and Ireland) with positive emissions in their FRLs for the period 2021-2025 who would be particularly affected by such strengthening of FRL rules.

The climate target impact assessment (European Commission 2020e) discusses the more radical change of **replacement of the FRL accounting for forest land with a historic reference period.** This would partly eliminate the difference between reported and accounted emissions and would generate a net sink of around -73 million tons CO<sub>2</sub>eq per year (European Commission 2020c). This quantitative change would not directly reflect increased ambition, but only a change in the accounting approach. A historic reference period for forest land would be simpler, increase transparency and be in line with the way the -55% EU target was set. However, after a lengthy process, FRLs have now been established and agreed for Member States in a burdensome process for the period from 2021 -2025 with the intention of limiting the accounting to effects from improved management. Accounting against historic periods may lead to a situation in which some Member States may achieve considerable net removals without enhanced efforts and some Member States may be confronted with considerably higher efforts. If combined with the option of enhanced net removal targets for Member States, a change to accounting against historic reference periods may be more acceptable for Member States because **national circumstances such as age class structure and sequestration potentials could be taken into account in the target setting instead of the FRLs.**

The LULUCF Regulation **grants Member States some flexibility to temporarily increase their harvest intensity** in accordance with sustainable forest management practices that are consistent with the objective set out in the Paris Agreement, provided that total emissions in the EU do not exceed total removals in the LULUCF sector (Managed forest land flexibility – Article 13). The mechanism allows Member States to reduce their debits by individual amounts set out in an Annex to the LULUCF Regulation. **The deletion of this flexibility would enhance the accounting rules under the LULUCF Regulation and Member States would need to compensate the full net debit in their countries.**

**For afforested land, Member States may use longer transition periods of 30 years instead of 20 years in the LULUCF Regulation** before the land area is accounted as 'managed forest land' if a justification is provided based on IPCC Guidelines. This means that all net removals from the afforested areas are fully accounted for ten additional years before the land area has to be accounted as forest land against the FRL, which leads to significantly lower accounted net removals. **For countries with historically high afforestation rates, this option is an advantage and**

**increases their accounted net removals in the accounting periods without additional efforts.** Older afforestations contribute strongly even when more than 20 years have passed since they were established. **If only the standard IPCC transition period of 20 years were allowed, the incentives for additional new afforestation would increase.**

The LULUCF Regulation also applies a limit of 3.5% of total base year emissions to the total accountable net removals from managed forests. Such limits are particularly relevant if net removals offset emission reductions from other categories or sectors to maintain a certain mitigation ambition from other categories or sectors. Its application has to be considered in the context of the general future accounting approach.

Accounting of managed wetlands is voluntary in the period 2021-2025. Mandatory accounting of wetlands in the first accounting period would strengthen the LULUCF regulation but would be difficult to implement. Not all Member States have fully established monitoring and reporting systems for wetlands and it takes time to develop and implement them.

The exclusion of emission and removals from natural disturbances mediates the effects of storms or fires on the accounted emissions and removals. The provision helps Member States to ensure compliance with LULUCF targets despite strong climate change impacts on the sector. However, the accounted emissions no longer reflect all emissions released into the atmosphere due to their temporary exclusion. A similar function could be achieved if the effects of natural disturbances were considered in the compliance assessment of Member States based on data presented at the end of the accounting period. However, a different EU approach may create inconsistencies with accounting rules under the UNFCCC.

### 3.2 Option 2: Strengthen flexibility with the Effort Sharing Regulation

As opportunities for increased action in the LULUCF sector are not evenly distributed, the increased use of flexibilities with the ESR can contribute to ensuring the compliance of Member States. The flexibilities also moderate costs of emission reductions for Member States, but safeguards are necessary so that ambition levels are maintained under both regulations.

#### **Flexibility to use net removals under the ESR**

Currently, the use of net removals from LULUCF sector for compliance under the ESR is capped at a maximum of 262 million tons CO<sub>2</sub> over the period 2021-2030. This represents 1.3% of total Annual Emission Allocations in the period 2021-2030 under the ESR. **Depending on the review of the ESR, the total amount of Annual Emission Allocations may change and the amount would need to be recalculated** based on this percentage. The maximum amounts of net removals under the LULUCF Regulation which can be used under the ESR have been determined for each Member State. Member States can only use them in the case that Effort Sharing emissions exceed the Annual Emission Allocations for a certain year but only to the level of the annual total of net emissions and removals of the country. Due to these restrictions, it can be assumed that the full amount will not be used.

The permitted flexibility for using net removals under the ESR could be increased or decreased. **The current "no-debit" target under the LULUCF Regulation is likely**

**to leave some Member States with considerable excess net removals after accounting, reducing incentives to actively change management practices in the land-use sector** (Böttcher et al. 2021). These countries could have windfall benefits under the ESR, which reduces incentives for emission reductions under the ESR. However, **additional flexibilities for using surplus net removals for compliance under the ESR may increase the incentive to improve management in the LULUCF sector in some Member States.**

### **Flexibility to use Annual Emission Allocations for compliance with the LULUCF Regulation**

In the case of non-compliance with the net debit target under the LULUCF Regulation, **Member States may use Annual Emission Allocations under the ESR to compensate surplus emissions under the LULUCF Regulation.** Due to high uncertainties related to the future emissions and removals in the LULUCF sector, it is **recommended that this flexibility is retained** to support compliance under the LULUCF Regulation.

### **Changes to flexibilities**

The impact assessment of the climate target discusses a sub-option in which Member States would have to cancel or discount a certain amount of net removals before surplus net removals can be transferred to the ESR or other Member States (European Commission 2020c). This proposed sub-option could be an instrument for accounting for the higher uncertainties in the LULUCF sector.

### **3.3 Option 3: Combine agriculture and LULUCF sectors into a single climate policy pillar with a separate target**

The agriculture sector includes mainly CH<sub>4</sub> and N<sub>2</sub>O emissions from livestock, fertilisation, manure management, rice cultivation, burning activities and CO<sub>2</sub> emissions from liming and urea application. CO<sub>2</sub> emissions and removals from carbon stock changes in agricultural soils are reported as part of the LULUCF sector (cropland and grassland). Thus, emissions from cropland areas and grassland areas are reported in two different sectors. It has been suggested that an **integration of both sectors into an AFOLU** (Agriculture, Forestry, Land Use, Land-Use Change) sector would promote more consistent use of data **and bring emissions and removals from the same land area into one sector.**

The emissions from agriculture mostly result from natural microbiological processes in soils and from ruminant animals and cannot be reduced to zero as in other sectors as long as the EU intends to continue food production. **In a net zero emission scenario for 2050, residual emissions from agriculture production have to be offset by CO<sub>2</sub> sequestered in the LULUCF sector or by other CO<sub>2</sub> capture and storage options.** From the perspective of the 2050 climate neutrality target, it seems useful to combine the sector with the potentially largest residual emissions in 2050 with the sector that includes the potential to compensate these emissions.

### **New AFOLU targets necessary**

New targets for a AFOLU pillar would need to be defined for 2030 at EU and Member State level to contribute to the overall 55 % reduction target. The minimum target at

EU level for 2050 would be net zero emissions from a combined AFOLU sector. However, this may not be a very ambitious target as can be shown based on the Commission's impact assessment: The ambitious LULUCF+ scenario with additional actions could enhance the LULUCF sink to approximately -340 million tons CO<sub>2</sub>eq by 2030 (European Commission 2020c). The agriculture emissions in 2018 were 394 million tons CO<sub>2</sub>eq. To achieve a net balance by 2030, agriculture emissions would need to be reduced by 13% to 340 million tons CO<sub>2</sub>eq. In the LULUCF+ scenario, the net sink would grow to -425 million tons CO<sub>2</sub>eq in 2050, which is about the same level as 2019 emissions from agriculture. Thus, if the combined target were zero net emissions, the LULUCF sector would carry the full burden and the agriculture sector would not need to reduce emissions in this scenario. These considerations show that **due to the high uncertainties of the future net removals from LULUCF and of emissions from agriculture, it may be difficult to set a combined AFOLU target which provides sufficient and balanced incentives for action for both sectors.**

The **differentiation of targets on the Member State level** needs a national target setting approach which has to take into account national circumstances and sequestration / mitigation potentials. The political negotiation process may be even more complex than for increased LULUCF targets. Establishing a single AFOLU sector will enhance the dependency of the agriculture sector on LULUCF and vice versa, which may create a **more complex situation to ensure compliance in Member States.** Such national targets should provide clear incentives to drive action directly on the level of farmers and foresters. **For compliance with an ambitious AFOLU target, it is essential that additional mitigation policies in the agriculture and LULUCF sectors are implemented which is not a direct function of the LULUCF Regulation.**

### **Accounting periods to be defined**

Technically, the GHG emissions of the agriculture sector are currently accounted on an annual basis against the 2005 base year under the ESR while the LULUCF Regulation uses the accounting periods 2021-2025 and 2026-2030 against different reference levels (as explained above). **An integration of both sectors would require as a minimum a uniform accounting period** – either on an annual basis or in 5-year periods as under the LULUCF regulation.

**If the accounting period were changed to a 5-year accounting period for agriculture emissions, this would lower ambition** because compliance would no longer be assessed on an annual basis and it may be that cases of non-compliance are detected too late to remedy the situation. In its submission to the UNFCCC to update its NDC, the EU has indicated that it accounts GHG emissions from the agriculture sector on an annual basis. Thus, five-year accounting periods for agriculture would be inconsistent with the EU's NDC.

The opposite option of **adopting annual accounting for the LULUCF sector would strengthen the compliance system.** This would create the need to establish annual AFOLU targets for the EU and Member States that are similar to the annual caps in the ETS. **This may be technically challenging for Member States.** Currently, they report emissions and removals from the LULUCF sector on an annual basis; however, the monitoring systems in most countries are not based on annual, but on periodic measurements. Member States would either need to move to strengthened annual



data collection systems or it would need to be accepted that the net emissions/removals used for annual EU compliance are different to the final data. It would also be possible to install a recalculation mechanism for EU compliance in cases in which final emissions/removals from the LULUCF sector show large deviations from the annually accounted data. Generally, this option of annual accounting for the LULUCF sector would strengthen EU climate legislation and decrease the differences in accounting compared to other sectors.

### High uncertainties

An AFOLU sector would combine two sectors in which emissions and removals generally have higher uncertainties than other sectors and where the projected trends are also facing high uncertainties due to the impacts of climate change on forests and agriculture areas. Climate change impacts may turn existing carbon stocks into emissions at any point in time and on a large scale. **A separate LULUCF target may handle these uncertainties in a better way than a combined AFOLU target.**

### Comparison of emissions at Member State level

Agriculture emissions have remained approximately constant since 2005 at EU level; limited reductions were achieved between 1990 and 2005. Since 2013, the start of the Effort Sharing Decision period, emissions have increased. For an overview of current agriculture and LULUCF emissions and removals on Member State level, see the Annex.

## 3.4 Synergies and linkages to other legislative elements, EU strategies and key policies

The LULUCF Regulation alone is not sufficient to ensure that countries enhance the contribution of the land sector to keeping the global temperature increase below 1.5°C. Additional instruments are necessary. Countries are more likely to increase their ambition level in the land-use sector if the targets are supported through incentives from a mix of policy instruments.

The **Common Agriculture Policy (CAP)** should be implemented by Member States in such a way that the CAP strategic plans incentivise the restoration and expansion of carbon sinks and implement measures to reduce CH<sub>4</sub> and N<sub>2</sub>O emissions from agriculture. The **Farm to Fork Strategy** is directly linked to agriculture; it aims to accelerate the transition to food systems with neutral or positive environmental impacts and provides key opportunities to contribute to emission reductions in the agriculture sector (European Commission 2020a).

The **Biodiversity Strategy** (European Commission 2020b) includes the intention to put forward a proposal for legally binding EU nature restoration targets in 2021 (European Commission 2021c). According to the latest report of the European Environment Agency (2020a), especially coastal habitats but also peatlands (more than 50%) and grasslands (49%) are in a bad condition. Forests also show mainly poor to bad (total 80%) conservation conditions in 2018. These aspects highlight the need for incentives for increasing carbon sinks to consider biodiversity aspects in parallel.



The EU **Forest Strategy** is very relevant for the future development of the LULUCF sector. It will build on the biodiversity strategy, cover the whole forest cycle, and promote services provided by forests (European Commission 2021d). It will focus on EU forest protection, restoration and sustainable management and on world forests where not already covered.

The European Commission recently adopted a new **EU Strategy on Adaptation** (European Commission 2021e). There are many potential synergies between effective net sink and biodiversity protection strategies that can also be beneficial for climate adaptation. For example, the increase of forests has positive regional climatic effects, especially in urban areas, where the cooling effect of woody vegetation cover can be used to buffer heat waves. Water run-off and erosion in croplands can be reduced by agroforestry.

The upcoming revision of the EU's **Renewable Energy Directive** is highly relevant for the LULUCF sector with regard to the incentives for biomass and biofuel use. The level of (sectoral) renewable targets will be relevant to biofuel demand (see section 2.4) and expected enhanced sustainability criteria for biomass use will be essential for a biomass policy that also ensures the protection of carbon stocks in forests.

The revision of the EU's **Directive on Energy Performance of Buildings** could increase the wood demand in the construction sector, e.g. via the enhancement of the use of wood for buildings. In addition, the directive sets rules for decreasing the heating demand of buildings which directly reduces the need for energy, reduces the denominator for the renewable share for heating and cooling and reduces the pressure on biomass use for heating purposes.

## 4 Other options to enhance the contribution of the LULUCF sector to the EU climate targets

Apart from the revision of the LULUCF Regulation, many other initiatives are discussed to increase carbon sequestration in the LULUCF sector and reduce emissions. Some selected options discussed in the EU are reflected in this section; it is not possible to present a complete overview, however, as part of this background paper.

In 2021, the European Commission will propose **legally-binding EU nature restoration targets**. These targets are part of its Biodiversity Strategy for 2030 and a public consultation took place at the end of 2020. Strong synergies exist between the restoration of carbon-rich ecosystems and maintaining as well as strengthening the sinks required to compensate residual emissions from other sectors in 2050 and beyond. Restoration supports **long-term sequestration of carbon in biomass and soil** and helps to reduce emissions from those pools in the short term. Nature restoration can mean, for example, increasing the area of forest land, restoring carbon stocks in standing forests, maintaining and increasing soil organic carbon in mineral soils and restoring wetlands (Böttcher et al. 2021). One of the most effective measures is to reduce GHG emissions from organic soils in arable land and wetlands (Pérez Domínguez et al. 2020). Avoiding peat extraction could reduce about 9 million tons of CO<sub>2</sub> emissions annually (European Commission 2020c), but in 2019 13,000 ha of organic soils were still converted to peat extraction (European Environment Agency

2021). Nature restoration also contributes to biodiversity and adaptation to climate change. Clear definitions and criteria at EU level are required to promote the restoration and sustainable use of ecosystems in the EU.

As set out in the Farm to Fork strategy, the Commission is piloting **carbon farming initiatives** (European Commission 2021b). Carbon farming practices focus on management techniques that, for example, help to enhance soil organic carbon in arable land, protect organic soils or increase the carbon stock in forests. The key idea behind carbon farming is to provide results-based payments to incentivise action from farmers and foresters. Like nature restoration, this would also have benefits in terms of ecosystem and biodiversity conservation. Some of the recognised challenges associated with carbon farming are that it requires robust and precise monitoring, reporting and verification, and that permanence and additionality of stored carbon need to be ensured (European Commission 2021a). Also, foresters and farmers will need to cover short-term costs, but the carbon benefit will only be achieved in the long term, given the inertia of natural systems.

Another idea is to introduce **carbon removal certification mechanisms**, whereby carbon sequestration would generate carbon units. These units could then be sold by farmers and foresters to stakeholders aiming to offset their GHG emissions. This approach is only recommended if robust procedures to ensure that removals are additional and permanent can be put in place. Offsetting fossil fuel emissions with non-additional removals from the land use sector or with removals that are easily reversed, poses a serious risk to environmental integrity, if it leads to less mitigation in other sectors, than would have occurred without offsetting (Broekhoff et al. 2019). The current estimation of emissions and removals from LULUCF in GHG inventories is not linked with a geographic identification of land areas in which carbon stock changes occur. This makes it impossible to detect double counting if carbon removal certificates were fungible with ETS, ESR or the LULUCF Regulation.

## 5 Conclusions

- The EU's Green Deal policies are likely to enhance demand for biomass, either in form of renewable bioenergy or for bio-based products replacing fossil products. At the same time, the EU sink in the LULUCF sector needs to be maintained and enhanced, while climate change is posing additional risks for forests and ecosystems. The agriculture sector is not yet on a pathway to reduce emissions in line with the GHG neutrality target. Biodiversity must be safeguarded as well. Many policies in the LULUCF sector have long lead times before they show mitigation effects and Member States' mitigation and sequestration potentials are very diverse. The long-term efforts to increase carbon stocks in forests and soils can be quickly reversed by natural hazards or a change in Member States' policies. **All these challenges must be tackled in a careful design of the EU's LULUCF policies for 2030 and beyond.**
- Effective enhancement of sinks and the reduction of emissions in the LULUCF sector require **enhanced targets at EU and Member State level under the LULUCF Regulation. Such enhanced targets are necessary in both options of a separate LULUCF pillar or a combined AFOLU target.** It is, however, more

complex to set targets for a combined LULUCF and agriculture sector that provides the right incentives for both sectors.

- **The revision of accounting rules for the forest sector can contribute to increasing the incentives for Member States to enhance carbon sequestration.** A number of specific changes have been identified in the discussion of option 1. The accounting rules are interlinked with the LULUCF targets. Considerably strengthened targets may not need strongly enhanced accounting provisions, whereas strengthened accounting provisions can be a way to ensure additional efforts for weaker targets. The same trade-offs apply to flexibilities under the LULUCF Regulation. Strongly enhanced targets need more flexibilities towards the sectors outside the LULUCF Regulation or the transfer of net removals between Member States to ensure compliance if individual Member States are not able to meet such strengthened targets.
- The LULUCF sector has specific characteristics such as **larger uncertainties of emissions and removals in the inventory, unknown impacts of climate change on the future sequestration potential, the potential risk of reversal of carbon stored in soils and ecosystems and the lack of geographically referenced carbon stock changes in GHG inventories.** The **design of the future contribution of the LULUCF sector to the EU target and its linkage to the ETS and ESR must take these specific features into account.** This is particularly relevant for any use of net removals under the ETS or for carbon removal certification mechanisms to foster carbon removal activities from farmers and foresters.
- The revision of the LULUCF Regulation should be designed with a view of **setting the right incentives to enhance the long-term carbon sinks required to achieve EU climate neutrality in 2050.** There are general design inconsistencies, e.g. between the accounting of forest land against FRLs in the LULUCF Regulation and the inclusion of LULUCF emissions and removals in the EU's -55% target for 2030 based on a comparison with a historic period. Transparency and simplicity of the design of the EU's climate architecture would improve if such inconsistencies were removed.
- **The provisions under the LULUCF Regulation do not avoid potential negative impacts from enhanced bioenergy use or other land-use policies on biodiversity and the regulation needs to be complemented with additional instruments such as legally-binding EU nature restoration targets** as proposed in the EU's Biodiversity Strategy for 2030 and **enhanced criteria for sustainable biomass use under the revised Renewable Energy Directive.**
- **Significant potentials for increased carbon storage in peatlands and organic soils are untapped.** These opportunities are only relevant in some Member States. Enhancing sequestration in organic soils requires additional instruments and policies beyond the revision of the LULUCF Regulation, e.g. as part of Member States' national strategies under the Common Agricultural Policy.

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## Annex

### List of Abbreviations

AFOLU	Agriculture, Forestry, Land Use, Land-Use Change
CO <sub>2</sub> eq	Carbon dioxide equivalents
CAP	Common Agricultural Policy
CRF	Common Reporting Format
EEA	European Environment Agency
ESR	Effort Sharing Regulation
ETS	Emission Trading System
EU	European Union
FRL	Forest Reference Level
GHG	Greenhouse gas
Ha	Hectares
HWP	Harvested Wood Products
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land-Use Change and Forestry
Mt	Million tons
NDC	National Determined Contribution
OE	Oil equivalent
SOC	Soil Organic Carbon
UNFCCC	United Nations Framework Convention on Climate Change

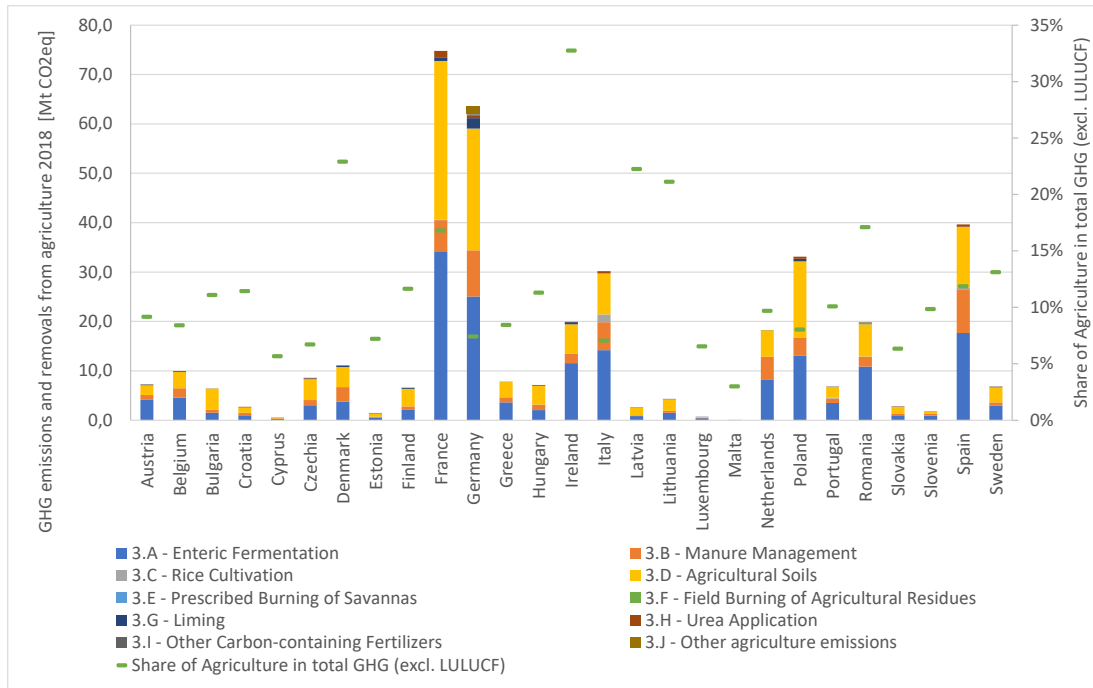
### Member States GHG emissions and removals from agriculture and LULUCF

Table: Average emissions and removals from LULUCF in 2014-2018

2014-2018 average	Land Use, Land-Use Change and Forestry	4.A - Forest Land	4.B - Cropland	4.C - Grassland	4.D - Wetlands	4.E - Settlements	4.F - Other Land	4.G - Harvested Wood Products	4.H - Other LULUCF	Share of LULUCF in total GHG (excl. LULUCF)
	Mt CO <sub>2</sub> eq									
<b>EU27</b>	-279,3	-369,5	53,1	9,0	17,4	44,7	1,8	-37,1	0,4	<b>-7%</b>
Austria	-4,7	-4,3	0,1	0,4	0,1	0,5	0,2	-1,5	0,0	-6%
Belgium	-1,1	-1,3	0,8	-0,8	0,0	0,4	0,0	-0,3	0,0	-1%
Bulgaria	-8,7	-7,4	0,8	-1,9	0,3	0,7	0,0	-1,3	0,0	-14%
Croatia	-5,2	-5,5	0,4	-0,1	0,0	0,8	0,0	-0,8	0,0	-21%
Cyprus	-0,3	-0,1	-0,2	-0,1	0,0	0,0	0,0	0,0	0,0	-4%
Czechia	-2,7	-2,0	0,2	-0,3	0,0	0,2	0,0	-0,8	0,0	-2%
Denmark	4,8	-0,5	3,8	1,4	0,1	0,2	0,0	-0,1	0,0	10%
Estonia	-2,0	-2,7	0,4	0,0	0,9	0,3	0,0	-1,0	0,0	-10%
Finland	-16,9	-25,0	7,8	0,7	2,2	1,0	0,0	-3,6	0,0	-30%
France	-28,0	-51,3	19,5	-8,0	0,5	11,7	0,0	-1,2	0,3	-6%
Germany	-27,4	-67,4	15,9	16,6	4,3	5,2	0,0	-2,3	0,1	-3%
Greece	-2,7	-2,1	0,3	-1,2	0,0	0,1	0,1	0,1	0,0	-3%
Hungary	-5,0	-4,9	-0,3	-0,1	0,2	0,2	0,0	-0,1	0,0	-8%
Ireland	4,3	-4,2	-0,1	6,9	2,3	0,2	0,1	-0,8	0,0	7%
Italy	-36,5	-34,1	0,1	-7,9	0,1	5,2	0,0	0,0	0,0	-8%
Latvia	0,9	-2,7	2,4	1,6	1,5	0,2	0,0	-2,0	0,0	8%
Lithuania	-5,2	-5,9	1,2	-1,0	0,9	0,7	0,1	-1,1	0,0	-26%
Luxembourg	-0,4	-0,5	0,0	0,0	0,0	0,1	0,0	0,0	0,0	-4%
Malta	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0%
Netherlands	5,0	-1,8	1,7	3,4	0,0	1,5	0,2	0,1	0,0	3%
Poland	-34,1	-35,3	-0,7	0,0	1,8	4,4	0,0	-4,4	0,0	-9%
Portugal	-3,9	-6,7	0,6	0,1	0,4	2,6	-0,8	-0,1	0,0	-6%
Romania	-22,7	-22,4	-1,7	0,4	1,5	3,8	1,9	-6,1	0,0	-20%
Slovakia	-6,3	-4,4	-1,1	-0,2	0,0	0,1	0,1	-0,9	0,0	-15%
Slovenia	0,0	0,5	-0,2	-0,4	0,0	0,2	0,0	-0,1	0,0	0%
Spain	-38,0	-34,6	-2,6	-0,2	0,0	1,3	0,0	-1,9	0,0	-11%
Sweden	-42,6	-43,1	3,8	-0,1	0,2	3,2	0,0	-6,6	0,0	-80%

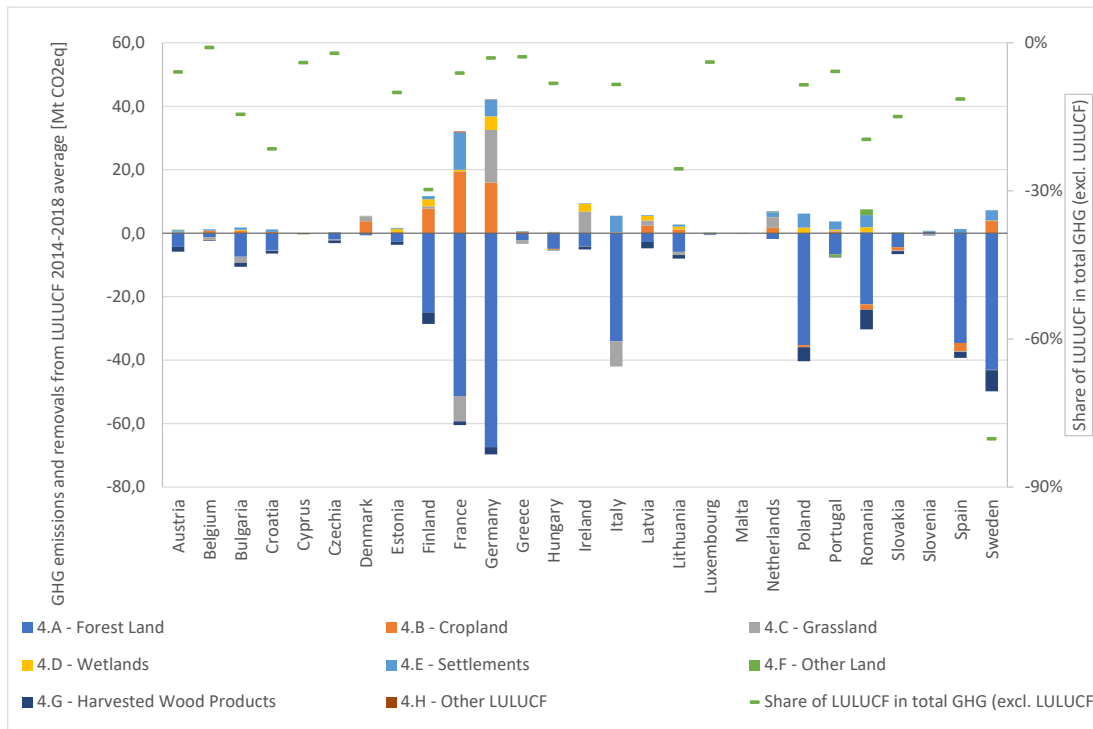
Source: European Environment Agency 2020c; own representation.

Figure: Agriculture emissions by EU Member States in 2018



Source: European Environment Agency 2020c; own representation.

Figure: LULUCF emissions by Member States 2014-2018



Source: European Environment Agency 2020c; own representation.

Table: Overview of contributions of LULUCF and agriculture sectors to GHG emissions in 2018

	Share of LULUCF in total GHG (excl. LULUCF) 2014-2018	Share of Agriculture in total GHG (excl. LULUCF) 2018	Difference
<b>EU 27</b>	<b>-7%</b>	<b>10%</b>	<b>3%</b>
Austria	-6%	9%	3%
Belgium	-1%	8%	7%
Bulgaria	-14%	11%	-3%
Croatia	-21%	11%	-10%
Cyprus	-4%	6%	2%
Czechia	-2%	7%	5%
Denmark	10%	23%	33%
Estonia	-10%	7%	-3%
Finland	-30%	12%	-18%
France	-6%	17%	11%
Germany	-3%	7%	4%
Greece	-3%	8%	6%
Hungary	-8%	11%	3%
Ireland	7%	33%	40%
Italy	-8%	7%	-1%
Latvia	8%	22%	31%
Lithuania	-26%	21%	-4%
Luxembourg	-4%	7%	3%
Malta	0%	3%	3%
Netherlands	3%	10%	12%
Poland	-9%	8%	0%
Portugal	-6%	10%	4%
Romania	-20%	17%	-2%
Slovakia	-15%	6%	-9%
Slovenia	0%	10%	10%
Spain	-11%	12%	0%
Sweden	-80%	13%	-67%

Source: European Environment Agency 2020c; own representation.