EU CAP NETWORK

Rough estimate of the climate change mitigation potential of the CAP Strategic Plans (EU-27) over the 2023-2027 period

Executive summary
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List of acronyms

CO_2e	Carbon dioxide equivalent
CAP	Common Agricultural Policy
CIS	Coupled income support
CRF	Common Reporting Format
CSP	CAP Strategic Plans
EEA	European Environment Agency
ESR	Effort Sharing Regulation (EU) 2018/842
EU-27	EU 27 Member States
GAEC	Good agricultural and environmental conditions
GHG	Greenhouse gas
LULUCF	Land use, land-use change and forestry
Mt	Megatonnes (million tonnes)

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Questions and suggestions regarding the content of the publication can be addressed to the European Evaluation Helpdesk for the CAP at evaluation@eucapnetwork.eu.

1. Background

According to data reported by Member States of the EU under the EU Governance Regulation (EU) 2018/1999, [1] on average over the period 2018-2022, the agricultural sector is estimated to have emitted 377 million tonnes (Mt) of carbon dioxide equivalent (CO_2e), accounting for 12% of the estimated EU's total greenhouse gas (GHG) emissions, with two thirds emitted by the livestock sector (enteric fermentation and manure management) [2]. Land use, land-use change and forestry (LULUCF) sector activities are estimated to have removed on average 243 Mt net CO_2e annually from the atmosphere over the period 2018-2022, equal to 7% of the EU's annual estimated GHG emissions. Cropland, grassland and wetland are net sources of LULUCF emissions at EU level, estimated at 61 Mt CO_2e, accounting for 1.9% of EU annual estimated GHG emissions.

However, the European Environment Agency (EEA) [3] points to important uncertainties in the estimation of GHG emissions at EU level. In addition, the extent to which the granularity of the estimation is considering the implementation of practices and investments at the farm level is not clear. So, there is a need to further analyse and better quantify the contribution of certain agricultural practices to climate mitigation.

To enhance the contribution of the EU farming sector to EU climate objectives, multiple CAP Strategic Plan (CSP) instruments were designed to increase carbon sinks and to reduce emission sources. In addition, in the CSPs, 32% of the total CAP funding is aimed to be devoted to delivering benefits for climate, water, soil, air, biodiversity and animal welfare and to encourage practices beyond the mandatory conditionality.

This study examines the CSPs drawn up as part of the 2023-2027 CAP programming (entered into force on 1 January 2023) and analyses their potential contribution to reducing GHG emissions, enhancing carbon removals and conserving existing carbon stocks. It establishes, for the first time, the link between CSP planned instruments (i.e. good agricultural and environmental conditions (GAECs) and CAP interventions) [4] and their mitigation potential at EU level, representing a starting point for the development of a further refined methodology using Member State data, and the improvement in their GHG emissions and removals inventories. The study does not account for the contribution of other policies and measures implemented in Member States beyond the CSPs and their mitigation potential.

1 Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (Text with EEA relevance.), OJ L 328, pp. 1-77, ELI: http://data.europa.eu/eli/reg/2018/1999/oj.

2 The data from the European Environment Agency can be accessed at: https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emissions-from-agriculture. The website was consulted in January 2025. The values are derived from the 2024 GHG inventory submission to the UNFCCC (referring to GHG emissions in 2022).

3 European Environment Agency, *Annual European Union greenhouse gas inventory 1990-2021 and inventory report 2023 – Submission to the UNFCCC Secretariat*, 2023, https://www.eea.europa.eu/ds_resolveuid/a9f7f010d2d348488e4345e7fdb3709e.

4 The study covers different instruments of Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) 1305/2013 and (EU) 1307/2013, OJ L 435, pp.1–186, ELI: http://data.europa.eu/eli/reg/2021/2115/oj:

- GAECs (Article 13),
- Schemes aimed at promoting climate, environmental, and animal welfare objectives (hereinafter referred to as Eco-schemes), covered under Article 31,
- Coupled Income Support (CIS) targeting protein crops (Article 33(c)),
- Environmental, climate-related, and other management commitments (hereinafter referred to as ENVCLIM), covered under Article 70,
- Investments (hereinafter referred to as INVEST), delineated in Article 73.

2. Methodology

The study establishes the link between CSP instruments and their mitigation potential in the 27 Member States of the EU (corresponding to 28 CSPs) [5]. The methodology applied relies on programming data extracted from the CSPs as approved by the European Commission [6], on rough estimates of expected uptake levels, and on average emission and removal coefficients of farming practices mainly derived from a systematic analysis of available meta-reviews of the scientific literature [7].

Using these sources, the methodology is based on the following key steps:

1. At CSP level, identification of the CAP interventions and GAECs that have the potential to positively contribute to GHG emission reduction and enhance carbon removals or to protect existing carbon sinks.
2. Association of each intervention and GAEC with relevant farming practices.
3. Estimation of the area (in terms of hectares) [8] covered by a farming practice.
4. Estimation of the mitigation or protection potential contribution of each intervention and GAEC, by multiplying the estimated area (or other unit of measurement) of each farming practice by its coefficient value, before aggregating them subsequently at the intervention/GAEC, CSP and EU levels.

The methodology employed is based on a series of assumptions and simplifications necessary at various stages of the analysis. It depends on the availability of the coefficients and enough information in the CSP on the area covered by the various farming practices. Farming practices are assigned coefficient values representing their estimated potential contribution in terms of reducing GHG emissions, enhancing carbon removals, or protecting carbon stocks in soil or biomass, in comparison to a reference conventional farming practice.

The interventions and GAECs considered are those for which relevant effects are expected. CAP interventions with a negative contribution are excluded from the estimates. The selected GAECs and types of interventions are as follows:

- GAEC 1 – Maintenance of permanent grassland
- GAEC 2 – Protection of wetlands and peatlands
- GAEC 5 – Tillage management
- GAEC 6 – Soil Cover
- GAEC 7 – Crop Rotation on arable land
- and GAEC 8 – Non-productive areas and features (note: the simplification introduced to GAEC 8 in Regulation (EU) 2024/1468 is not accounted for in this study)
- Schemes for the climate, the environment and animal welfare (Article 31 of Regulation (EU) 2021/2115), called hereinafter eco-schemes
- Coupled income support (CIS) – For protein crops, including legumes and mixtures of legumes and grasses, provided that legumes remain predominant in the mixture (Article 33 c) of Regulation (EU) 2021/2115)
- Environmental, climate-related, and other management commitments, called hereinafter ENVCLIM interventions (Article 70 of Regulation (EU) 2021/2115),
- Investments, hereinafter referred to as INVEST (Article 73 of Regulation (EU) 2021/2115).

GAECs and CAP interventions are treated differently. For CAP interventions, the estimated potential contribution encompasses all the areas where supported farming practices are expected to be implemented through the different types of intervention covered, whereas, for GAECs, the study aims to estimate only the potential contribution of the additional areas where farming practices will be implemented to comply with the standards in the new programming period, compared to the previous programming period. With this approach, the potential contribution estimated for GAECs might be an underestimate compared to the approach used for CAP interventions. Consequently, results should be interpreted with caution and only as an indicative order of magnitude. Further improvements in the approach and data would bring more accurate results, particularly the use of local coefficients and better estimations of the areas under each farming practice (using data on the actual uptake of the various interventions). Furthermore, the estimated potential contribution encompasses all the areas where farming practices supported through various types of intervention are planned. This can include areas where these practices would be adopted even without financial support or were already supported under the previous CAP programming period. **As a consequence, results cannot fully be considered an assessment of the effect of the CAP**.

5 There are two CSPs in Belgium, one for Flanders and one for Wallonia.

6 **CSPs as approved by the European Commission in December 2022 for 19 CSPs**: Austria, Belgium-Flandres, Belgium-Wallonia, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Poland, Portugal, Romania, Spain and Sweden.

- **CSPs as amended in October 2023 for 6 CSPs**: Croatia, Cyprus, Luxembourg, Malta, Slovenia and Slovakia.
- **CSPs as amended in July 2024 for 3 CSPs: Bulgaria, Estonia and Lithuania**.

7 iMAP (Integrated Modelling platform for Agro-economic and resource Policy analysis):

- Guerrero, I., Bielza Diaz-Caneja, M., Angileri, V., Assouline, M., Bosco, S., Catarino, R., Chen, M., Koeble, R., Lindner, S., Makowski, D., Montero Castaño, A., Perez-Soba Aguilar, M., Schievano, A., Tamburini, G., Terres, J. and Rega, C., Quantifying the Impact of Farming Practices on Environment and Climate, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/20814, https://publications.jrc.ec.europa.eu/repository/handle/JRC137826.
- Schievano, A., Perez-Soba Aguilar, M., Bosco, S., Montero Castaño, A., Catarino, R., Chen, M., Tamburini, G., Landoni, B., Mantegazza, O., Guerrero, I., Bielza Diaz-Caneja, M., Assouline, M., Koeble, R., Dentener, F., Van Der Velde, M., Rega, C., Furlan, A., Paracchini, M.L., Weiss, F., Angileri, V., Terres, J. and Makowski, D., iMAP FP dataset – An evidence library of the effects of Farming Practices on the environment and the climate, European Commission, Joint Research Centre (JRC) [Dataset] (created 8 November 2023, last updated on 25 June 2024). doi: 10.2905/4e3c371a-be72-4ea0-aa0b-45f8cdda2064.

8 Other units of measurement can also be used, such as livestock units or megawatts.

3. Main results

Estimated potential contributions of the CSP instruments on GHG emissions and removals are differentiated from those on carbon protection, and results for both categories are kept separate.

3.1. Estimated mitigation potential contribution

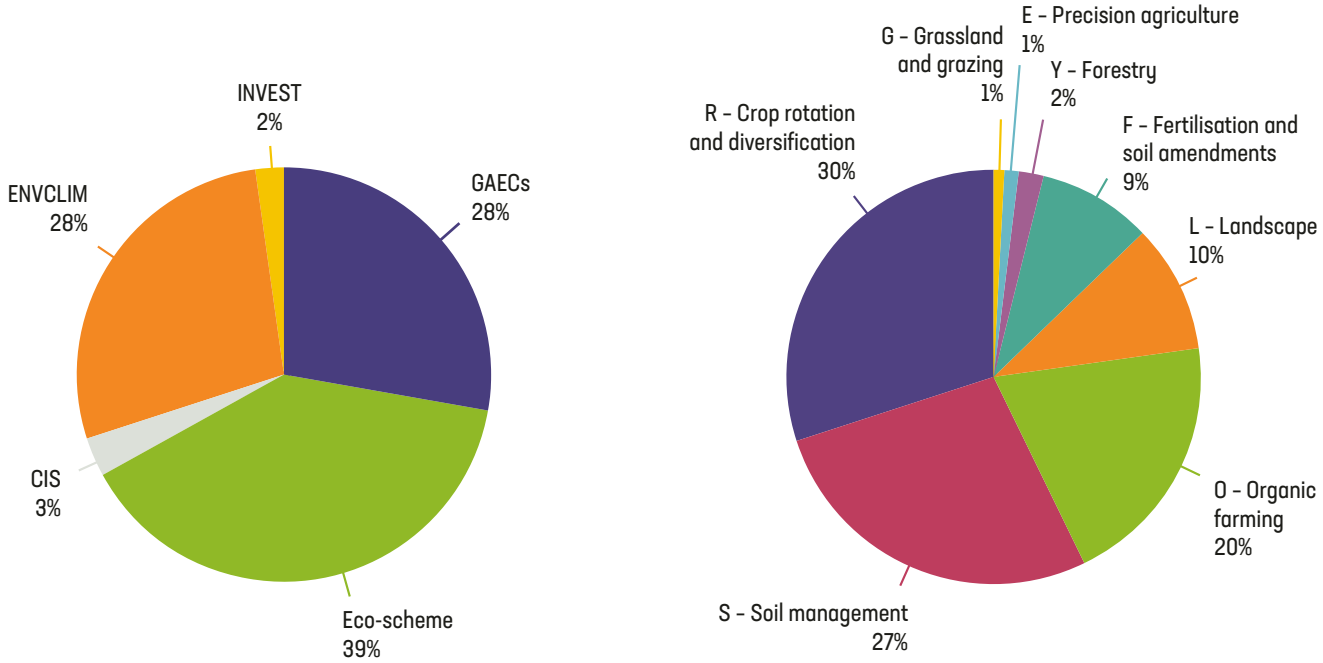
The analysis indicates a potential positive contribution of the 28 CSPs to GHG emission reductions and enhanced removals of 35 Mt CO_2e per year on average over the 2023-2027 period.

This positive contribution is only a potential contribution and comes at this stage with a range of uncertainties due to the numerous assumptions made. In particular, the extent to which the annual positive contribution can be cumulated until 2027 strongly depends on the additionality of actual uptake of practices by farmers year on year.

In terms of farming practices, crop rotation or diversification, expansion of cover crops and conversion to organic farming contribute 74% of the estimated mitigation potential.

In terms of instruments, eco-schemes account for 39% of the estimated mitigation potential, ENVCLIM interventions 28% and GAEC compliance 28% (notably GAEC 6 (soil cover) and GAEC 7 (crop rotation on arable land)). CIS and INVEST interventions are expected to contribute to the mitigation potential only in a few CSPs.

Figure 1. Estimated mitigation potential per GAEC, type of intervention and categories of farming practices (according to the JRC farming practices classification) (%)



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2025) based on CSPs, Mapping and analysis of CAP Strategic Plans, iMAP and other sources

3.1.1. Contextualisation of the estimated potential

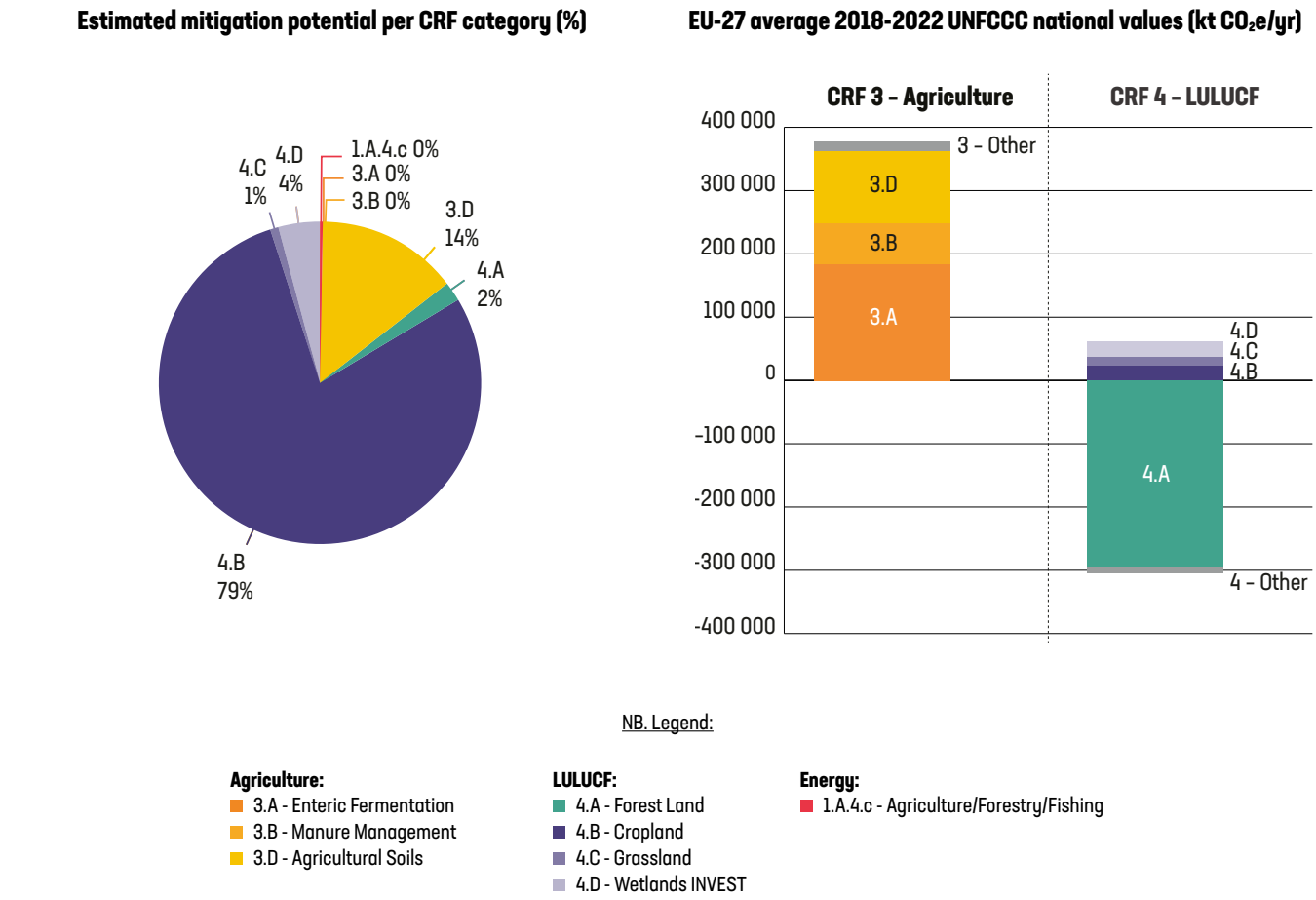
To contextualise the contribution of the CSPs, estimates are aggregated according to the categories of the United Nations Framework Convention on Climate Change (UNFCCC) Common Reporting Format (CRF) developed for national inventories of GHG emissions and removals. Although the correspondence is not always straightforward because the methodology employed to estimate the CSPs potential mitigation contribution deviates from the Intergovernmental Panel on Climate Change (IPCC) inventory methodologies used by Member States under the EU Governance Regulation (EU) 2018/1999, this step makes it possible to put CSP estimated potential contribution into context with regard to current emissions and removals in the EU.

The 35 Mt CO_2e yearly estimated potential contribution of the 28 CSPs are distributed between **5 Mt non-CO_2 emission reduction and 30 Mt carbon removals per year**.

These estimates account respectively for **1.4% of the non-CO_2 emissions reported under CRF Sector 3 (agriculture) for the EU-27 (average 2018-2022) and 10% of the net carbon removals reported under CRF Sector 4 – LULUCF** [9].

9 See footnote 2.

Figure 2. Estimated mitigation potential per CRF category (left) and EU-27 average 2018-2022 UNFCCC national values (right)



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2025) based on CSPs, Mapping and analysis of CAP Strategic Plans, iMAP, EAA and other sources

The majority (79%) of the estimated mitigation potential is associated with CRF category 4.B (LULUCF-cropland), while croplands represent a minor source of net emissions within the overall LULUCF sink (9%). This estimated potential contribution to increase the removal capacity of croplands (28 Mt CO_2e/year) exceeds the net emissions reported to the UNFCCC in this category (22 Mt on average over the period 2018-2022) [10]. This suggests that cropland soils could shift from being a net source of emissions to a net carbon sink.

The second-largest estimated potential contribution is a reduction of non-CO_2 emissions from agricultural soils (CRF categories 3.D (agricultural soils)), accounting for 14% of the estimated mitigation potential. This estimated potential contribution (5.0 Mt CO_2e/year) corresponds to 4% of the emissions reported to the UNFCCC in this category, which accounts for 30% of the total GHG emission from agriculture (CRF 3).

The estimated potential contribution through carbon sequestration in wetlands and peatlands, associated with CRF category 4.D (wetlands) (1.5 Mt CO_2e/year), accounts for 4% of the estimated mitigation potential. These 1.5 Mt represent 6% of the UNFCCC inventories in this category (average 2018-2022) [11], which accounts for 10% of the net removals from the LULUCF sector.

The estimated potential contribution associated with the CRF categories 3.A (enteric fermentation) and 3.B (manure management) are expected to be low, whereas these categories account for 49% and 17%, respectively, of the total GHG emissions from agriculture (CRF 3). However, this study does not assess other policies and measures programmed by Member States to reduce emissions from livestock, which represent a significant share of non-CO_2 emissions in some Member States.

10 See footnote 2.
11 See footnote 2.

3.1.2. Towards meeting the EU climate neutrality objectives

The EU's climate framework includes two key regulations:

- **the Effort Sharing Regulation (EU) 2018/842** [12] **(ESR),** covering non-CO_2 emissions from agriculture (methane and nitrous oxide); and
- **the LULUCF Regulation (EU) 2018/841** [13], mainly addressing CO_2 emissions and carbon removals from land use, land-use change and forestry.

The Effort Sharing Regulation (EU) 2018/842, which encompasses the agriculture sector, excluding land use, mandates an overall GHG reduction target of 40% by 2030, distributed among Member States. There are no specific EU or national targets set for agricultural emissions in the regulation, but the impact assessment of the Fit for 55 package [14] includes some modelled trends per sector. The estimated potential contribution of the 28 CSPs to the mitigation of non-CO_2 emissions from agriculture is **5 Mt per year, which represents 32% of the distance between the current emissions levels reported to the UNFCCC (2018-2022 average values)** [15]**, and the emission level for the agricultural sector in 2030 as defined in the mix scenario of the Fit for 55 impact assessment**.

The LULUCF Regulation (EU) 2018/841 sets an EU-wide net removal target of 310 Mt CO_2e by 2030 [16]. Based on the sector's average sink between 2016 and 2018, in order to achieve the EU target, an increase in carbon sink capacity of 42 Mt CO_2e is required. The analysis suggests that the CSPs could contribute to enhancing carbon sequestration by approximately 30 Mt CO_2e on average every year. **This yearly 30 Mt accounts for 10% of the LULUCF 2030 target and 71% of the required increase in sink capacity to achieve the LULUCF 2030 target**.

The mitigation effects of the CSPs are estimated on a yearly basis. This entails that the CSPs' potential contribution to emission reduction and increased removals objectives could be delivered every year from 2023 to 2027, making the contribution quite significant. However, whether this potential will be fully realised and the magnitude of the contribution to the 2030 LULUCF target and ESR emission level defined in the impact assessment mentioned above, will depend on farmers' uptake of relevant measures, whether supported practices have additional effects each year and whether these practices were already financed under the previous CAP programming period (deadweight effect), which is not possible to assess at this stage. Actions outside the CSPs will also help reach the emission and removal levels targeted for 2030.

3.2. Carbon protection estimated potential contribution

The CSPs' GAECs and interventions also seek to protect the carbon stored in soils (grasslands, peatlands, arable lands) and woody features (forests, hedgerows) by maintaining these areas and encouraging sustainable management.

The analysis of the 28 CSPs indicates a potential positive contribution to protecting existing carbon sinks of 32 Mt CO_2e yearly across the EU.

Support for the maintenance of organic farming accounts for more than half (54%) of the estimated protection potential, followed by forestry maintenance (or management) (23%) and grassland protection (17%).

Maintenance of organic farming is supported through ENVCLIM and eco-scheme interventions, whereas the INVEST interventions contribute to supporting sustainable forest management in certain Member States.

In the case of GAECs, due to the difficulty to quantify their contribution against a baseline, such as for GAEC 1 (maintenance of permanent grassland), an obligation in place for many years and the lack of information on the areas potentially concerned for GAEC 2 (protection of wetlands and peatlands), the applied conservative approach shows a small net additional potential contribution (these measures are mainly to maintain carbon in soils).

12 Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (Text with EEA relevance), OJ L 156, p. 26–42, ELI: http://data.europa.eu/eli/reg/2018/842/oj.

13 Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from Land Use, Land Use change and Forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (Text with EEA relevance), OJ L 156, pp. 1-25, ELI: http://data.europa.eu/eli/reg/2018/841/oj.

14 European Commission, *Commission Staff Working Document – Impact assessment report – Part 3 Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Securing our future – Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society*, 2024, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52024SC0063; see Table 3 p. 8 ('Excludes fossil fuel combustion in the sector, but includes "category 3" CO_2 emissions, assumed constant at 10 Mt CO_2').

15 See footnote 2.

16 Expressed as additional net removals compared to the yearly average for the years 2016, 2017 and 2018. See also Annex II of LULUCF Regulation (EU) 2018/841.

4. Recommendations for improvements

The estimation process delivers rough estimates of the maximum potential contribution (not the additional expected effect) of the interventions and GAECs in reducing GHG emissions, increasing carbon removals and protecting existing carbon sinks. These estimates come with levels of uncertainty contingent on the chosen approach, the information available in the CSPs, the applied mitigation coefficients and the assumptions made to estimate the area on which the farming practice is applied.

The report includes several recommendations for improvement, such as using local coefficients, estimating areas per farming practices based on the actual uptake of the interventions and determining whether the farming practices are newly introduced or were already in place before 2023 to better assess the additional potential effect of the 2023-27 CAP.

These recommendations are addressed primarily to national authorities willing to enhance the quantification of their CSP for policy assessments and complement it with other national policies and measures for climate change. On the other hand, national inventory compilers can also use data and estimation to improve reporting to the UNFCCC.

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