

## Discussion paper: Climate Change Mitigation in Agriculture

### Introduction

This paper serves as scene setter for the AgriClimate Workshop hosted by the Danish Ministry of Food and Environment. The goal of the workshop is to facilitate interaction between policy makers from agricultural, environmental and climate change ministries and support co-development of ideas on how to promote the development and scaling-up of mitigation technologies and practices in a manner that is cost-effective, creates opportunities, and takes into account the multiple purposes of the agricultural sector as well as the need for flexibility across member states.

The purpose of this discussion paper is to establish a common ground for the workshop. The paper presents the trends in GHG emissions from the LULUCF sector and the agricultural sector within the EU<sup>i</sup> as well as the overall EU policy frameworks governing these sectors with regards to climate change. It also provides a description of the current political context.

In addition to this paper, three papers provide more in-depth analyses of trends and opportunities in each of the three tracks of the workshop: Livestock, Soil and land management, and Bio-based economy. Each paper also provides a number of questions for inspiration. These questions are intended to help readers prepare for the workshop and generate ideas and questions that can be brought up in discussions.

It should be noted that the workshop and papers use IPCC terminology and hence focus on the agricultural sector and the LULUCF sector related to *agriculture* (in practice cropland and grassland). Although they are related, the workshop does not address forestland or wetlands. It should also be noted that the workshop and papers focus specifically on the EU, not on mitigation at the global level and not on environmental footprints in third countries resulting from global soft commodity supply chains.

Both the agricultural and LULUCF sector are characterized by heterogeneity among the Member States (MS) regarding production systems and intensity, animal type and productivity as well as farming practices<sup>ii</sup>. Accordingly, new ideas on how to strengthen the interplay between EU agricultural policies and EU climate change policies may need to take into account needs for flexibility and subsidiarity. Furthermore, despite its targeted scope, this paper fully recognizes the importance of the multitude of purposes and objectives that the agricultural sector in general and the CAP in particular services, including but not limited to job creation, growth, food security, nature management, rural development and cohesion. These perspectives should be kept in mind when reading the papers.

### Agriculture and Land Use GHG Emissions in the EU

The EU land use sector (Agriculture and LULUCF sector) is a net-emitter of GHGs, mainly nitrous oxide (N<sub>2</sub>O) and methane (NH<sub>4</sub>)<sup>iii</sup>. The sectoral breakdown in figure 1 shows that agriculture accounted for around 11% of the total GHG emissions in the EU, while the LULUCF sector shows negative emissions due to the net-sequestration on forestland. As such, cropland and grassland account for positive GHG emissions, and do not act as net GHG-sinks in the LULUCF sector<sup>iv</sup>.

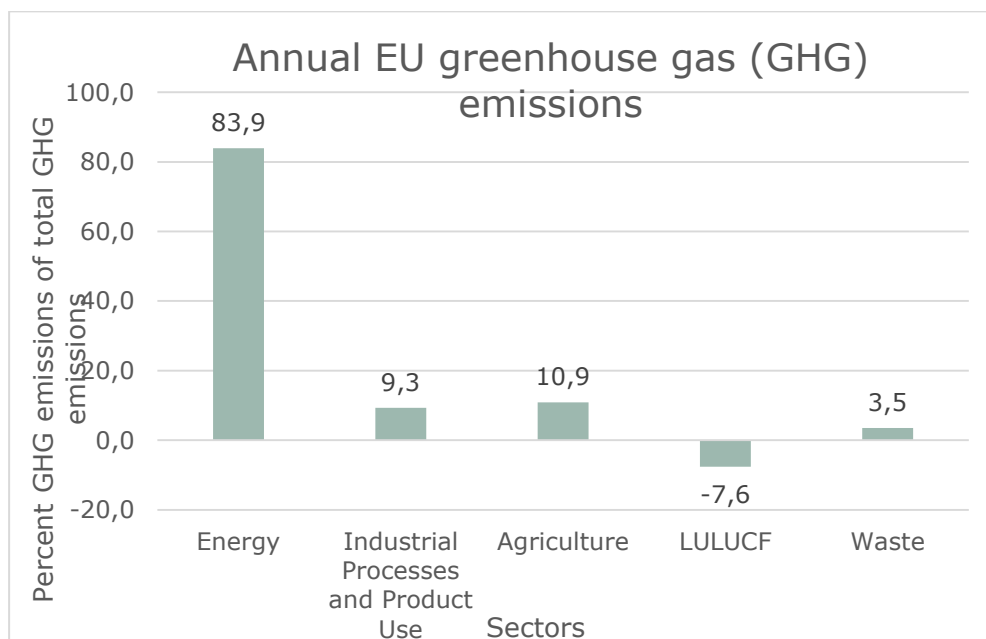


Figure 1 GHG emissions by source sectors in percent of total EU GHG emissions in 2015. Note there are large variations between Member States.

Agriculture will likely come to account for a larger share of the total emissions over the next decades as other sectors, such as the energy sector, continue to reduce their GHG emissions<sup>v</sup>. This implies that the agricultural sector will become an ever-more important part of the transition to a low emission society and compliance with international GHG emission targets. However, other demands on the sector are likely to influence the development of the sector and its GHG emissions such as increased demand for food, food security and dietary changes in and outside the EU. Furthermore, there is an ever-growing competition for land for other uses than agriculture e.g. securing environmental services and biodiversity as well as urbanisation. These concerns all have to be taken into account when developing mitigation actions for agriculture and the LULUCF sector.

### Emissions from agriculture

The historic GHG emissions from agriculture (1990-2015) are dominated by enteric fermentation by ruminant animals, nitrification and denitrification of agricultural soils as well as manure<sup>vi</sup>. Figure 2 shows the EU's annual GHG emissions from these sub-categories as well as for agriculture as a whole (the sum of emissions from the sub-categories). There has been a slight downward trend in emissions for agriculture as a whole as well as in all sub-categories from 1990 until around 2005. This reduction was generally caused by a decrease in livestock numbers, better manure and farming management and reduced nitrogen-based fertilizers application, which may in part have been driven by regulatory instruments<sup>vii</sup>. However, from around 2005 and onwards the GHG emissions have remained nearly constant.

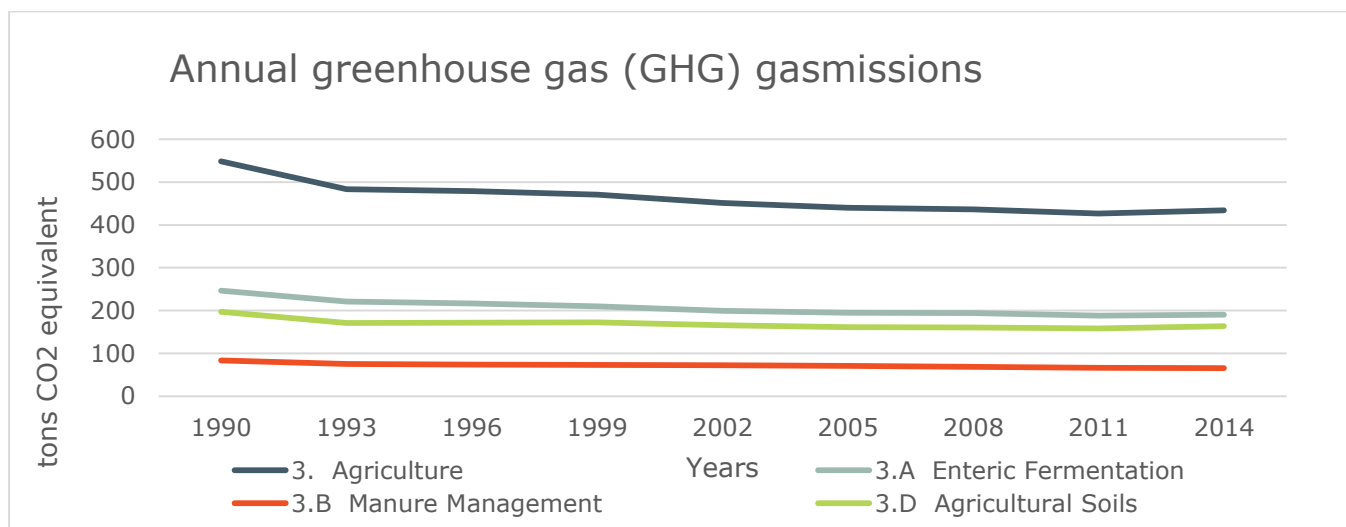


Figure 2 Annual GHG emissions for the EU in kiloton CO<sub>2</sub>-equivalents from 1990-2015.

Enteric fermentation, agricultural soils and manure management constituted 44%, 37% and 15% respectively of the total agricultural GHG emissions in 2015. Agricultural soils cover direct N<sub>2</sub>O emissions including N fertilizers and indirect N<sub>2</sub>O emissions from managed soils<sup>viii</sup>. In 2014, cattle were responsible for 84% of the emissions from enteric fermentation<sup>ix</sup>.

### Emissions from Land Use, Land Use Change and Forestry

LULUCF is reported as a separate sector in the UNFCCC<sup>x</sup>. The land use categories related to agriculture are 'cropland' and 'grassland'. These cover CO<sub>2</sub> as well as non-CO<sub>2</sub> emissions from above-ground biomass, dead organic matter, soil carbon and biomass/crop residue burning as well as rice cultivation<sup>xi</sup>. Figure 3 shows the annual GHG emissions for the EU from cropland and grassland. The level of emissions mitigation potential is linked to the land management applied, the soil type and climate, and hence there can be large differences between closely situated sites, and across the EU.

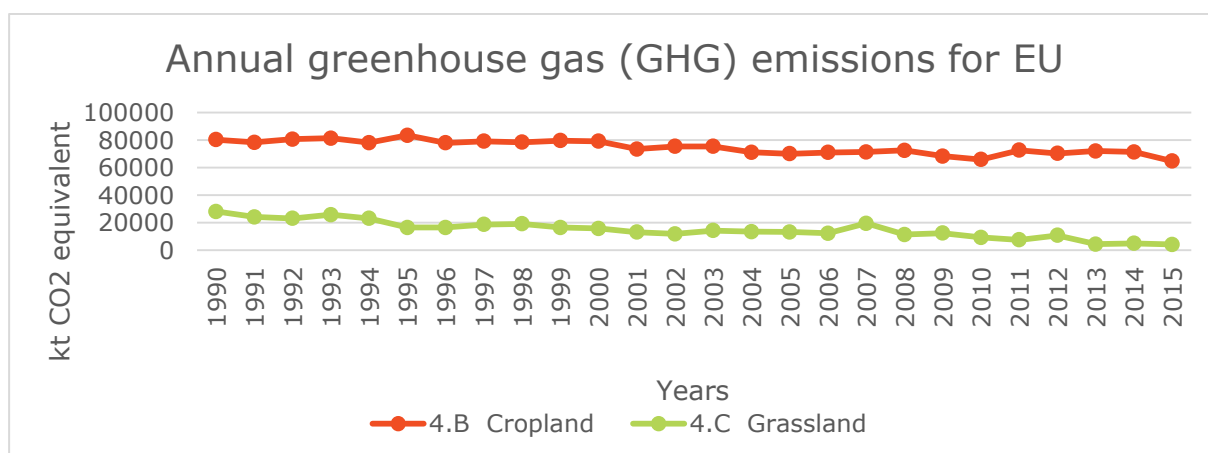


Figure 3 Annual GHG emissions for the EU from cropland and grassland in kiloton CO<sub>2</sub> -equivalents. Based on data from UNFCCC.

The differences in GHG emissions and removal trends between cropland and grassland are mostly due to tillage frequency, soil disturbances, and soil conditions. For cropland, the emissions are largely caused by land converted to this use and tillage/farming practices that reduce soil carbon content. For grassland, they are largely caused by draining of humid organic soils used for grazing and cultivation. The GHG emissions from grassland on mineral soils are less prominent. On the other hand, conversion of cropland or settlements to grassland acts as a sink. In relation, grassland could potentially be a sink for GHG if left undisturbed or under extensive management, which would still allow for some harvest and use<sup>xii</sup>. It should be noted, that the numbers reported by MS in many cases are based on simple estimates and the use of default factors, much dependant on the correct identification of the actual land management practices and changes to these over the years. It is therefore likely that in the years to come continuous improvements of data and methods will allow for more detailed understanding of the drivers of GHG emissions from agricultural land management. Current data and reporting must be interpreted with care, as they in many cases are associated with high level of uncertainty.

There are multiple ways forward and opportunities for promoting GHG mitigation in these sectors. While not to be investigated in detail in this paper, a non-exhaustive list could include: Technical improvements in production (e.g. precision farming); improved land use planning and optimized utilization of land (including changing crops); improved data on and monitoring of the GHG fluxes and GHG reduction potentials, changes in behaviour, consumption and values by consumers and downstream producers, possibly driven by innovative regulatory approaches.

## Policy context and opportunities towards 2030

Currently, climate change forms part of the three main objectives of the current Common Agricultural Policy (CAP 2013-2020). The objectives, covering both pillars, are:

- › viable food production,
- › sustainable management of natural resources and climate action, and
- › balanced territorial development.

As confirmed by the October 2014 Council Conclusions, the multiple objectives of the agriculture and land use sector shall also guide future EU policy, and specifically ensure coherence between food security and climate change objectives. Climate change is also highlighted by the Commission as one of the important areas in focus for a reform of the CAP going beyond 2020. This is related to the EU's commitment to the Paris Agreement. Current dedicated climate action as part of CAP implementation in MS vary and dedicated Rural Development Program (RDP) budget allocations for climate actions appears to be important to reach mitigation of GHG emissions in agriculture<sup>xiii</sup>. However, as mentioned in the introduction it should be borne in mind that the CAP is not a climate policy instrument and is expected to deliver many different, but related, benefits including growth and job creation<sup>xiv</sup>.

While the CAP may be one of the main policy instruments to address GHG emissions from the agricultural sector, the emission reduction targets are set in a different policy. Currently, the EU's Effort Sharing Decision (ESD) and LULUCF decision as shown in Figure 4 below, govern how GHG emissions and removals are accounted and how they are taken into consideration in view of the EU2020 Emission Reduction Targets. The ESD is designed to ensure geographical and temporal flexibility for the MS to meet their targets<sup>xv</sup>. The ESD sets national binding GHG emission reduction

targets, while the LULUCF Decision transpose the accounting and reporting requirements set by the Kyoto Protocol into EU law. The Decision also sets out a roadmap for the inclusion of CO<sub>2</sub> emissions from LULUCF into EU climate targets. A similar policy architecture will expectedly come out of the negotiations on the Effort Sharing Regulation and the LULUCF regulation, but with a foreseen partial inclusion of the LULUCF emissions and removals into the non-ETS sector in the accounting for the EU2030 target.

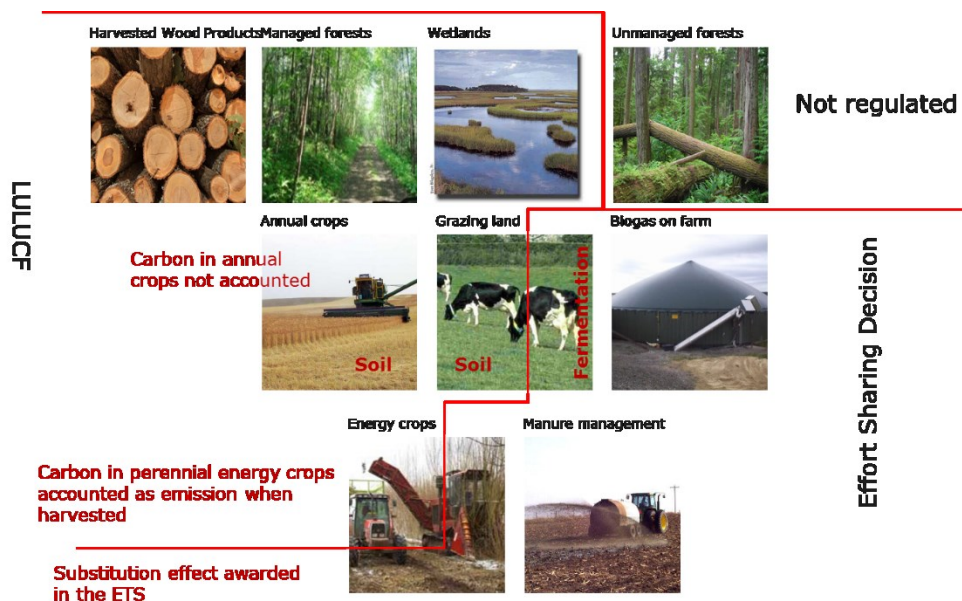


Figure 4 Regulatory set-up in EU in terms of IPCC categories.

The overview of relevant policies that are relevant to climate policy action and have direct or indirect effects are broader than the CAP and the Climate and Energy Package. They also include the Nitrate Directive, the Water Framework Directive (WFD) and the EU National Emission Ceilings (NEC) Directive. Consistency between the different policies and pieces of legislation could support future mitigation action. In particular, unhelpful inconsistencies or gaps between different pieces of legislation with different objectives and intervention logics should be avoided. This may entail simplification of some legislation. If rules become too complicated for the farmer, there is the risk that little will be done in practice.

In summary, any action, measure or idea targeted at driving GHG reductions in the agricultural sector, should consider existing policies and regulation and ideally build on and synergize with those in order to avoid suboptimal regulation. The policy cycle of the European Union is currently in “preparation” mode, looking ahead to post-2020 and preparing for the next Multiannual Financial Framework and its key policy initiatives. This means that renewed or revised versions of many of the key policy packages relevant for climate, agriculture, land use and bio-economy are being prepared and negotiated, and that windows of opportunity exists. The Post-2020 CAP is at the Impact Assessment preparation stage and the Energy Package – including a new Bioenergy Policy as part of a new Renewable Energy Directive and legislation on LULUCF – is being negotiated.

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- <sup>i</sup> The data presented in this paper is collected from the UNFCCC Greenhouse Gas Inventory Data. The UNFCCC provides common guidelines and methodology for the parties to submit GHG inventories. In the UNFCCC system, emissions from agriculture and land management are to be reported under two different sectors – *Agriculture* as well as *Land use, Land Use Change and Forestry (LULUCF)*. The LULUCF Sector includes both agricultural land, forestland and wetlands. UNFCCC (2017a) Greenhouse Gas Inventory Data - Detailed data by Party, available at [http://di.unfccc.int/detailed\\_data\\_by\\_party](http://di.unfccc.int/detailed_data_by_party)
- UNFCCC (2017b) GHG data from UNFCCC, available at [http://unfccc.int/ghg\\_data/new\\_reporting\\_requirements/items/9560.php](http://unfccc.int/ghg_data/new_reporting_requirements/items/9560.php)
- <sup>ii</sup> Lesschen, J. P., Van den Berg, M., Westhoek, H. J., Witzke, H. P., & Oenema, O. (2011). Greenhouse gas emission profiles of European livestock sectors. *Animal Feed Science and Technology*, 166, 16-28. Available at: <http://www.sciencedirect.com/science/article/pii/S0377840111001775>
- Eurostat (2017a) Agriculture - greenhouse gas emission statistics, available at [http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture\\_-\\_greenhouse\\_gas\\_emission\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture_-_greenhouse_gas_emission_statistics)
- <sup>iii</sup> UNFCCC (2017a) Greenhouse Gas Inventory Data - Detailed data by Party, available at [http://di.unfccc.int/detailed\\_data\\_by\\_party](http://di.unfccc.int/detailed_data_by_party)
- Eurostat (2017a) Agriculture - greenhouse gas emission statistics, available at [http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture\\_-\\_greenhouse\\_gas\\_emission\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture_-_greenhouse_gas_emission_statistics)
- <sup>iv</sup> Eurostat (2017b) Climate change - driving forces, Directorate E: Sectoral and regional statistics, European Commission
- <sup>v</sup> IEEP (2017) Research for AGRI Committee - The Consequences of Climate Change for EU Agriculture. Follow-up to the COP21 - UN Paris Climate Change Conference, Directorate-General for Internal Policies, Policy Department B: Structural and Cohesion Policies, Agriculture and Rural Development, European Union 2017
- <sup>vi</sup> Eurostat (2017a) Agriculture - greenhouse gas emission statistics, available at [http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture\\_-\\_greenhouse\\_gas\\_emission\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture_-_greenhouse_gas_emission_statistics)
- <sup>vii</sup> Eurostat (2017a) Agriculture - greenhouse gas emission statistics, available at [http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture\\_-\\_greenhouse\\_gas\\_emission\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture_-_greenhouse_gas_emission_statistics)
- <sup>viii</sup> UNFCCC (2017a) Greenhouse Gas Inventory Data - Detailed data by Party, available at [http://di.unfccc.int/detailed\\_data\\_by\\_party](http://di.unfccc.int/detailed_data_by_party)
- <sup>ix</sup> Eurostat (2017b) Climate change - driving forces, Directorate E: Sectoral and regional statistics, European Commission
- <sup>x</sup> UNFCCC (2017a) Greenhouse Gas Inventory Data - Detailed data by Party, available at [http://di.unfccc.int/detailed\\_data\\_by\\_party](http://di.unfccc.int/detailed_data_by_party)
- <sup>xi</sup> IPCC (2006) Introduction in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, By the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.
- <sup>xii</sup> Eurostat (2017c) Climate change - driving forces. Available at [http://ec.europa.eu/eurostat/statistics-explained/index.php/Climate\\_change\\_-\\_driving\\_forces](http://ec.europa.eu/eurostat/statistics-explained/index.php/Climate_change_-_driving_forces)
- <sup>xiii</sup> COWI (2016). Mainstreaming of climate action into ESI Funds. Final Report. European Commission DG Climate Action. Available at: [https://ec.europa.eu/clima/sites/clima/files/budget/docs/report\\_mainstreaming\\_of\\_climate\\_action\\_en.pdf](https://ec.europa.eu/clima/sites/clima/files/budget/docs/report_mainstreaming_of_climate_action_en.pdf)
- <sup>xiv</sup> EC (European Commission) (2017b) [https://ec.europa.eu/agriculture/future-cap\\_en](https://ec.europa.eu/agriculture/future-cap_en)
- <sup>xv</sup> EC (European Commission) (2017b) [https://ec.europa.eu/agriculture/future-cap\\_en](https://ec.europa.eu/agriculture/future-cap_en)
- The European Parliament & the Council of the European Union (2013a) Decision No 529/2013/EU of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities, L 165/80
- The European Parliament & the Council of the European Union (2013b) DECISION No 406/2009/EC of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, L 140/136