

3. Agricultural Greenhouse Gas Emission Trends in Europe: Potential to Carbon Neutral Agriculture

MACSUR Science-Policy Knowledge Forum

This policy brief provides an overview of agricultural emissions in 10 countries—Austria, Denmark, France, Germany, Hungary, Ireland, Italy, the Netherlands, Norway, and the UK from 1990 to 2020.

Key Messages

- Agricultural emissions decreased between 1990 and 2005 but remain comparatively constant since 2005 despite noticeable climate action policies and measures.
- Non-carbon dioxide (CO₂ emissions from agriculture (methane and nitrous oxide; CH₄ and N₂O) decreased in the last 30 years because of policies and efficiency gains.
- Enteric fermentation, agricultural soils, and manure management are the main sources of agricultural emissions.
- Modest progress in emission reductions (about 2% by 2040) is expected from implemented and planned policy measures, which is far below the EU Green Deal target of reducing emissions by 55% relative to 1990 levels. Results call for urgent additional climate action.

Climate Change Impacts on Agriculture

Climate dependence and its cascading effects on other socio-economic sectors make the agri-food system vulnerable to climate change. The negative impacts of altered climate patterns (temperature, precipitation, heat stress) on crop and livestock yields are evident and disproportionately spread within Europe. Agriculture is not only affected by climate change but also drives it through its greenhouse gas (GHG) emissions. Currently, agriculture contributes to about 10% of the total GHG emission in Europe, with a huge disparity between the countries. The agricultural sector is the second largest contributor after the energy sector in Europe and is therefore relevant to consider to meet the climate neutrality targets. This brief provides a synthesis of emission trend data for all MACSUR partner countries —Austria, Denmark, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, and the UK.

Agricultural Emission Trends (1990-2020)

Agricultural emissions were reported under the predefined sectoral aggregation (sector CRF 3) for all emission gas subcategories methane, nitrous oxide, and carbon dioxide (CH₄, N₂O, and CO₂) for the major sources of enteric fermentation, manure management, rice cultivation, agriculture soils, and other categories of emissions (EEA 2021).

- From the three main GHGs (CH₄, N₂O, and CO₂) the contribution of CH₄ is the highest (>55%), followed by N₂O (40%) in all countries for all 30 reporting years. Since early 2000, CO₂ emissions have increased while N₂O emissions have slightly decreased, and CH₄ emissions decreased in all the countries except Ireland (EEA 2021, NIRs 2020).
- France, Germany, and the UK were responsible for most GHG gases in the last 30 years. All countries except Ireland decreased agricultural emissions.
- The trends indicate that the emissions from agriculture reduced by around 21% from 1990 to 2019. However, between 2005 and 2019, emission reductions leveled off (Figure 1).

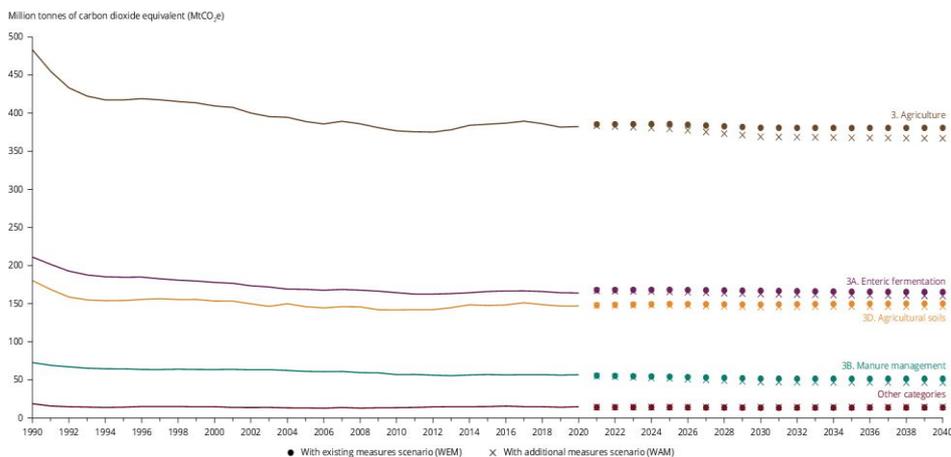


Figure 1: Agricultural emission trends (1990-2020) and projections (2020-2040) in Europe (Source: EEA)

Agricultural Emission Projections with Existing (WEM) and with Additional Measures (WAM):

Even though agricultural emissions show a decreasing trend in most MACSUR countries, the emission reduction projections for 2040 demonstrate that existing and additional measures are not sufficient to significantly reduce emissions (ECA 2021, EC 2020). The projected emissions reductions in Europe are estimated to be 1.5% with existing, and up to 5% with additional policies and measures by 2040 compared to 2019 levels (German et al. 2021, EC 2020). With existing measures, only modest emission reductions are projected in most of the partner countries, while for Austria and Ireland agricultural emissions are projected to increase between 2005 and 2030 (Figure 2). Similarly, with additional measures, agricultural emissions are not be drastically reduced by 2030. The additional measures in Denmark, France, Germany, and Italy are estimated to not result in emission reductions.

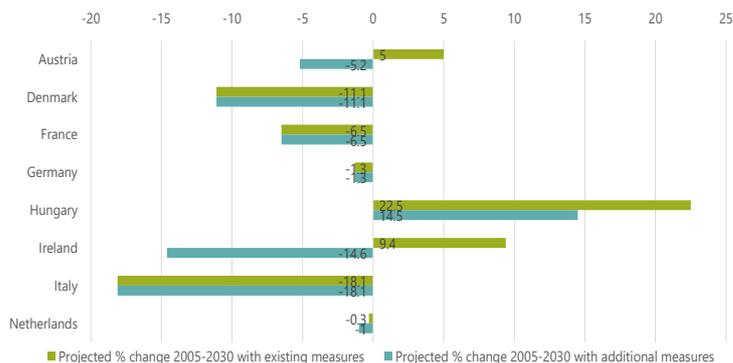


Figure 2: Projected percentage changes in agricultural emissions (2005-2030)

Carbon Neutral Agriculture Targets and Progress

The EU Climate and energy framework set a reduction target of 40% by 2030, which was later revised under the EU Green Deal to at least 55% below 1990 levels. Except for Austria (2040) and Germany (2045), all other MACSUR countries are committed to achieving a net zero by 2050. Agriculture poses huge potential in achieving those emission targets through reducing the non-CO₂ GHGs, for example, CH₄ from ruminants, N₂O from the soil organic pools, and Nitrogen fertilisers, and contributes to the removal of CO₂ from the atmosphere by soil organic carbon sequestration. It is therefore imperative that agriculture contributes substantially to GHG emissions reductions, and this needs to happen without reductions in agricultural productivity and with improvements in soil health, biodiversity, and animal welfare.

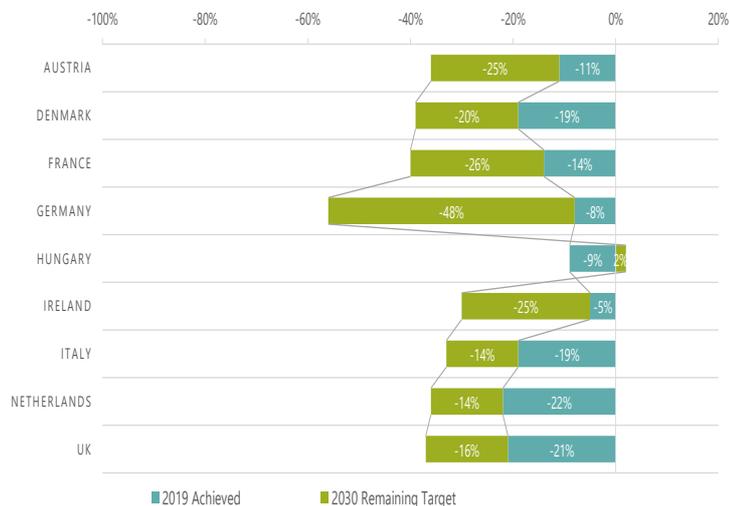


Figure 3: Status of carbon neutral agriculture targets

The emissions projections stress the need for policymakers to take action and readjust agricultural mitigation measures. For this, understanding emission patterns is key. National policymakers have to investigate emission trends in their respective countries and identify the dominant GHGs and national key emission sources. Based on this, suitable mitigation measures have to be put in place (EC 2020). The measures supported by the common agricultural policy, however, have not proved to be effective so far, while effective measures, including the use of foraged legumes, improved manure treatment, and fertiliser application, are not broadly considered (ECA 2021).

Further Reading

- EC (2020): Commission staff working document: Impact assessment 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 'Stepping up Europe's 2030 climate ambition: investing in a climate-neutral future for the benefit of our people', SWD(2020) 176 final, Brussels, 17.9.2020.
- ECA (2021): Common agricultural policy and climate: Half of EU climate spending but farm emissions are not decreasing, Special Report, 16, European Court of Auditors
- German, R., Raoult, J., Schmid, C., Mandl, N., Peglidou, P. (2021): Agricultural climate mitigation policies and measures. Good practice, challenges, and future perspectives.

The MACSUR SciPol knowledge forum is a pilot exercise initiated by the *Joint Programming Initiative for Agriculture, Food Security and Climate Change (FACCE-JPI)* to bring science and policy actors together for the strategic design of climate change adaptation and mitigation solutions in the agri-food sector in Europe. This policy brief contributes to this mission by providing evidence-based information to policy for achieving carbon neutrality by 2050, adapting to climate change and understanding synergies and trade-offs in achieving these targets.

Writing and research: Keerthi Bandru¹, Katharina Helming¹

Editing and Design: Abigail Muscat^{3,4}

¹Leibniz Center for Agricultural Landscape Research, Müncheberg, Germany ³Wageningen University and Research, ⁴FACCE-JPI secretariat

