



Insights from national policy measures relevant to the land- agri-food system in Ireland

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Abbreviations

BE	Belgium
CH₄	Methane
CA	Canada
CO₂	Carbon dioxide
CO₂e	Carbon dioxide equivalent
CAP	Common agricultural policy
CSP	CAP Strategic Plan
DE	Germany
DK	Denmark
EAGF	European Agricultural Guarantee Fund
EEA	European Environmental Agency
EPA	Environmental Protection Agency
FI	Finland
FR	France
GHG	Greenhouse gases
IT	Italy
LULUCF	Land Use, Land Use Change and Forestry
Mt	Million ton
N	Nitrogen
ND	Not determined
NH₃	Ammonia
NL	The Netherlands
N₂O	Nitrous oxide
NZ	New Zealand
PL	Poland
SWOT	Strengths, Weaknesses, Opportunities and Threats
UK	The United Kingdom
US	United States
TWh	Terawatt hour

Executive Summary

Ireland has committed to pursue and achieve the transition to a climate resilient, biodiversity-rich, environmentally sustainable, and climate-neutral economy by the year 2050 (Climate Action and Low Carbon Development (Amendment) Act 2021¹). The Irish Government is obliged to reduce the country's greenhouse gas (GHG) emissions by 51 per cent by 2030 relative to 2018 levels. The agriculture sector, which is Ireland's most important indigenous sector of huge importance environmentally, socially and economically, is also the largest contributor to Ireland's GHG emissions, accounting for 37.5 per cent of Ireland's GHG emissions in 2021².

As part of the Food Vision 2030 Strategy³, the Irish Government has set itself the goal to develop a climate neutral Agri-Food system so that by 2050, the climate impact of methane is reduced to zero and remaining agricultural emissions are balanced by removals. In the shorter term, the agriculture sector needs to achieve a 25 per cent reduction of GHG emissions by 2030 relative to 2018 levels, as outlined in Ireland's Climate Action Plan 2023⁴.

To deliver the required reduction in GHG emissions the agricultural sector will have to undergo a significant transformation. The Department of Agriculture, Food, and the Marine (DAFM) has partnered with EIT Climate-KIC – Europe's largest climate innovation partnership – to work with public and private stakeholders in the Irish Land Agri-Food system to help the sector deliver on accelerated pathways for climate action and sustainability. A key deliverable in this partnership is the co-development of a portfolio of innovation ideas that will support systems change.

This report provides insights from policy initiatives that Ireland might draw strategic learnings from. Focusing on their relevance for the Irish Land Agri-Food system this report looks at related policies from the following countries: Belgium, Denmark, France, Germany, The Netherlands, Finland, Italy, and Poland, as well as the United Kingdom (and individually Scotland, Wales, England and Northern Ireland), Canada, New Zealand and the United States.

In most of these countries the agriculture sector accounts for around 10 per cent of the total domestic annual GHG emissions, the exception being New Zealand where emissions are 48 per cent. In the EU Member States, agricultural emissions have decreased on average by 19 per cent, since 1990, mainly due to a decline in emissions from enteric fermentation and from agricultural soils (reduced use of synthetic fertilizers and reduction of livestock). This has stagnated since 2005, with achievements in reducing agricultural GHG emissions being balanced by an increase in agricultural production (EEA

1 <https://www.irishstatutebook.ie/eli/2021/act/32/section/15/enacted/en/html>

2 This does not include emissions from the LULUCF sector.

3 <https://www.gov.ie/pdf/?file=https://assets.gov.ie/179717/910771f6-05ed-43f1-b8ce-52ef7c602710.pdf#page=54>

4 Government of Ireland (2022) Climate Action Plan 2023: Changing Ireland for the Better, <https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/>

2022⁵). Ireland is an outlier in this trend with emissions from agriculture growing by 19 per cent over the last decade (Ireland's Climate Action Plan 2023).

Livestock remains an important activity despite reduction of herds. Herd sizes have declined since 2000 in all countries, especially dairy cattle due to the introduction of milk quotas in the EU in 1984. In general, EU countries have observed a shift from dairy to beef cattle. As for Ireland, emissions related to live-stock production have been growing over the past decade and represent a major challenge. This is similar to other countries with an agricultural identity and economic model strongly based on livestock, for example in the Netherlands, New Zealand, France and Germany.

Land use, land use change and forestry (LULUCF) represent a net sink for most of the countries but this trend has been in constant decline since 1990. In the United States, forest fires, extreme weather events and land use change have caused the extent of carbon sinks to decrease by 12 per cent since 1990. Following fluctuations over the last twenty years, LULUCF has even become a net emitter in the UK and Canada. A trend that is, for example also projected to happen in Germany, if not addressed. Consequentially, all countries analysed in the report have committed to reverse that trend and significantly increase carbon sequestration through voluntary or regulatory measures.

Overall, EU countries have set clear emissions reduction pathways for agriculture towards 2030 (except for Italy and Poland). Non-EU countries analysed in this report, except for New Zealand, have set up Climate Strategies outlining scenarios to reduce the impact from agriculture on climate. However, these plans are not supported by clear medium-term sectoral reduction targets or carbon budgets. Table 1 provides an overview of key measures in national climate action plans and CAP Strategic Plans that seem relevant for Ireland.

Table 1: Overview of key measures in national climate action plans and CAP Strategic plans

Livestock	▪ Support sustainable and better animal welfare practises for livestock farming, rather than decreasing livestock farming (UK, FR, IT) ▪ Support measures to reduce emissions due to manure management and storage (BE, DK, NL, FR, DE) ▪ Develop potential of feed additives for livestock (UK, FI, US, DK, BE, FR) ▪ Develop genetic selection methods (BE, FI, FR) ▪ Introduction of a pricing scheme for agriculture emissions (NZ) ▪ Encouraging diversification options (crop-livestock farming) (FR)
Reduction in crop and soil N₂O	▪ Increase the uptake of agroecological practices (i.e. reduction in the use of mineral fertilisers, encourage crop rotation, increase soil cover, hedge planting, agro-forestry) (BE, NL, FR, IT, DK, CA) ▪ Mandatory nitrogen emissions reduction targets through reduction of use of synthetic fertilisers (DK, NL, NZ, DE) or voluntary targets (CA). ▪ Develop smart and precision farming to minimise inputs and improve nitrogen efficiency (BE, IT, FR, US, FI) ▪ Expand organic farming through support schemes for conversion (DE, FR, DK, FI, UK) ▪ Support to diversification of crops, in particular with legumes (FR, DE) ▪ Introduction of carbon pricing schemes (NZ, CA, US, FR)

5 <https://www.eea.europa.eu/publications/Progress-and-prospects-for-decarbonisation>

Carbon sequestration	▪ Afforestation to increase carbon sinks including tree planting initiatives (all countries) ▪ Investments in research and innovation to develop sequestration potential with new technologies such as pyrolysis (DK) ▪ Encouraging sustainable forest management practices which increase carbon sinks (all countries) ▪ Provide advice on diversifying forestry regimes, including alternative species, in order to develop new types of forest crops that deliver new products or woody biomass (NZ) ▪ Conservation and conversion from temporary to permanent grassland (all EU countries – measure supported by CAP)
Restoration of peatlands	▪ Investment plans and new funding schemes to restore and enhance wetlands and peatlands (CA, UK, DE) ▪ Rewetting of peatlands (NL, DE) ▪ Development of paludiculture activities (FI, DE)
Energy mitigation	▪ Supporting schemes for increasing biogas and biomethane production (all countries) ▪ Increase the share of renewable energy sources and the use of bio-based materials from agricultural and forestry origin (FR, BE) ▪ Improve energy efficiency in agriculture and horticulture (NL, DE)
Wider food system	▪ Increased support to climate research: financial resources have increased significantly in the last years for all countries through different funding programs and investment initiatives (e.g. Canada's Agriculture Clean Technology Program) ▪ Consumer-targeted information will be developed to incentivize behaviour change to food consumption with low environmental impact and reduce food waste (NL, DK, BE, FR) ▪ Investment programs to support fundamental and applied research supporting a path to net zero emissions, knowledge transfer, and developing metrics (to support development and adoption of clean technology) (all countries)

The recent Climate Action Plan 2023, adopted by the Irish Government, lays out pathways and a range of measures related to the Land Agri-Food System that provide a good foundation for action in the coming years, and it resembles many of the above listed measures.

However, just drawing on existing or planned measures alone will not be sufficient to achieve the transformation of the Irish land-agri-food system that would be needed to reach the 2030 targets, let alone the target of climate neutrality by 2050.

According to the EEA, which analysed the progress and prospects for decarbonisation in the agricultural sector in Europe (EEA 2022), reductions in emissions between now and 2040 are projected to be too insignificant to help the EU become climate neutral by 2050. Even taking the policies and measures planned under the 2021-2027 CAP Strategic Plans into account, a reduction in agricultural emissions of only 5% between 2020 and 2040 is projected. Therefore, while any incremental improvement to further decarbonisation of the sector is valuable, the way to significantly reduce emissions of the Irish land-agri-food system must aim at bringing together some of the boldest measures under a coherent and overarching long-term vision aiming to systemically transform the sector. Next to such a coherent and overarching long-term vision for the Land Agri-Food system, other important elements of such a policy-portfolio are suggested to include a regulatory framework for the pricing of greenhouse gas emissions in the land agri-food sector aimed at transforming the sector's economic framework, and policies in support of land use options and productive systems aimed at diversifying agricultural business models.

Ireland's Climate Action Plan 2023 makes a strong case for environmental taxation and carbon pricing in general and lays out pathways to support the transition to alternative land uses through diversification options for agriculture in particular. Regarding pricing greenhouse gas emissions in agriculture, this report presents in more detail two policy initiatives, representing two different approaches to emission pricing, that offer valuable insights that Ireland may wish to draw on (see table 2). In the case of New Zealand there is a proposal for a farm-level, split-gas levy to price agricultural greenhouse gas emissions based on a polluter-pays principle. France, in turn, already has insightful experience with a beneficiary-pays approach, successfully applying its Label Bas Carbone to agriculture and land use. In terms of diversifying land use practices, this report offers policy insights from Germany that provides for a range of progressive policy initiatives related to organic farming (aiming 30 per cent of organic farming by 2030), biogas (having built over 9500 biogas and 200 biomethane plants that allow for the avoidance of 7.1 MtCO₂e of GHG emissions), and a nature-based climate action programme addressing LULUCF (including measures targeting the rewetting of drained peatlands and afforestation).

Even though Ireland has strong foundations in place to reduce emissions from agriculture by 25% by 2030, these measures will not be enough to achieve 2050 targets. Foundations for reaching those targets need to be put in place now. What is not yet emerging clearly from the Irish Climate Action Plan 2023 or the Food Vision 2030, is an overarching long-term vision aiming to systemically transform the sector. Here the report suggests drawing on the insightful experiences that the current policy landscape of the Netherlands is offering as it develops a Roadmap towards a Circular Agriculture by 2040, including a significant reduction of livestock.

Table 2: Recommended policy insights to be considered in the portfolio of interventions intended to accelerate the transformation of the Irish Land Agri-Food system

Vision – the Example of the Netherlands

The Dutch government's [Vision on Circular Agriculture](#) from 2018 sets out their ambition to be a global leader in circular agriculture in 2030. The vision entails a paradigm shift from growth in production volumes and cost price reductions, towards optimisation in resource use and food production in harmony with nature. This vision and its action plan supporting the transition to circular agriculture have been reinforced by a number of environmental crises in the past years that have 'locked' the country in terms of rural and urban planning. Three important lines of action are being followed: 1. Unlocking the Netherlands, e.g., by, supporting some 3000 peak agricultural emitters to become more sustainable, relocate or stop harmful practices to drastically reduce nitrogen emissions from the sector. 2. Developing an agricultural agreement for a future-proof circular agriculture, which remains a strategically important economic sector, while playing its part in the major challenges of nature restoration, water, and climate. 3. Reorienting spatial planning of rural areas under a paradigm with the water and soil system in the lead, providing a base for a broader transition of the rural area.

Pricing Greenhouse Gas Emissions in Agriculture – Examples from New Zealand and France

The government of New Zealand is currently discussing a proposal for a pricing system based on a [farm-level split-gas levy](#) that is effective at reducing emissions, while maintaining a viable and productive agriculture sector. The levy would price emissions from biogenic methane and nitrous oxide (including from fertiliser) separately. Farmers with more than 550 stock units (deer, sheep, cattle) or 50 dairy cattle, or who apply 40 tonnes of synthetic nitrogen fertiliser annually, have to register and pay for their on-farm emissions. Revenue from the system will be used to fund admin costs incentive and sequestration payments, a dedicated fund to support Māori, and other activities to reduce emissions.

The French '[Low Carbon Label](#)' is a voluntary carbon certification framework launched in 2019. This is a key tool put forward by the French government to meet its emission reduction targets. The framework provides opportunities for low-carbon projects to receive funding from investors, companies, or public authorities to compensate their emissions. Only projects demonstrating additional GHG emissions reductions (emissions avoided or sequestered) can be certified. Several methodologies have been developed by stakeholders and experts to determine eligibility criteria for projects to be certified in the areas of agriculture and forestry and new ones are being developed.

Diversification of Land Use Practices – Examples from Germany

Germany has a successful Strategy for the Future of [Organic Agriculture](#), aiming for 30% of the entire agricultural area to be organically farmed by 2030. The Strategy focuses on designing a coherent legislative framework; facilitating access to organic farming; fully utilising and expanding the demand potential; improving productivity of organic agri-systems; providing adequate remuneration for environmental services. Supported by the strategy, the organically farmed area has expanded significantly in Germany to currently 10%. Growth of organic farming up to 20% is projected to be driven by the market alone.

Germany's Renewable Energy Sources Act (EEG) of 2000, which regulated the preferential feed-in of electricity from renewable energy sources into the electricity grid and guaranteed a fixed feed-in tariff, laid the foundation for a steady growth of [biogas plants](#) with currently more than 9,500 biogas production plants with on-site electricity and heat generation, and more than 200 biomethane plants with access to the national gas network. Through the use of approx. 60 million tonnes of farm manure in biogas plants, approx. 4.8 TWh of electricity were generated in 2020, and GHG emissions of 7.1 MtCO₂e avoided.

The German government has recently tabled a proposal for a [Nature-based Climate Action Programme](#) that is described as the central instrument for achieving LULUCF emission targets. Key fields of action include the protection of intact peatlands and rewetting of organic soils, and an increase of size and diversity of forest ecosystems. By 2030, the rewetting of drained peatlands is to reduce annual GHG emissions by 5 MtCO₂e. Forest stands are to be converted towards greater species richness and resilience and 10,000 hectares of new forest to be created annually from 2023 to 2030.

1.Introduction



1.1 Purpose of the report

The recently published Climate Action Plan 2023 is Ireland's plan to meet its national and international commitments to reduce its greenhouse gas emissions and achieve 51 per cent in GHG emissions by 2030, compared to 2018 levels.

Agriculture is the largest sectoral contributor to climate emissions in Ireland with 37.5 per cent of the countries' greenhouse gas emissions in 2021⁶. The sector is already undergoing a transformation supported by clear national strategies such as the Ag Climatise document (2020) which sets a long term vision for the primary agriculture sector to become climate neutral as well as the Food Vision 2030 Strategy presenting a ten year strategy for the Irish agri-food sector under a holistic food systems approach. The Climate Action Plan 2023 points out that efficiency improvements in agriculture will need to be increased by 1.5-fold compared to measures outlined in the previous Climate Action Plan published in 2019. To deliver on this transformation at scale, farmers and the whole land-agri-food value chain will need to be supported and empowered to increase decarbonisation efforts.

The transition towards a more sustainable and resilient agriculture represents a challenge for a number of European and non-European countries. If the Common Agricultural Policy (CAP) continues to strongly influence how national agriculture policies are shaped, more and more countries are adopting ambitious climate mitigation and adaptation strategies complemented by sectoral action plans to address the negative effects of climate change on their agri-food system.

In that context, this report presents a comprehensive assessment of policy measures and initiatives undertaken by twelve countries in the agriculture and land use sectors aiming to meet their climate targets. This document is aimed to act as a briefing to raise awareness on policies of EU and non-EU countries are currently implementing with regards to key challenges of relevance for the Irish context, including the use of chemical fertilisers, reduction of methane emissions from livestock, increasing diversification of farms and developing low carbon energy production.

Based on key national measures identified across our analysis, some recommendations are developed at the end of the report which may be considered as inspiring examples of policy initiatives acting as levers of change for the climate transition of the agri-food sector.

6 Source: Environmental Protection Agency, <https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/agriculture/>

1.2 Methodology and structure of the report

The analysis presented in this report has been defined according to a specific geographical and thematic scope as agreed with Ireland's Department of Agriculture, Food and the Marine.

The report focuses on twelve countries with large agriculture sectors and of relevance for the Irish land-use agri-food system including both EU and non-EU countries: Belgium, Denmark, France, Germany, The Netherlands, Finland, Italy, Poland, the United Kingdom (and individually Scotland, Wales, England and Northern Ireland), Canada, New Zealand, the United States.

With regards to thematic areas to be covered, it was decided to focus on current and future measures relevant to the land-agri-food system in Ireland across climate mitigation, carbon sequestration and renewable energy and to a lesser extent air quality and climate adaptation. Therefore, livestock management, reduction of nitrogen, afforestation, carbon farming, peatlands restoration or renewable energy are the main topics covered across the report due to their significant emissions reduction potential in the agriculture and land use sectors.

Section 2 of this report lays out key insights for each country on i) national climate targets and carbon emissions trends in the agriculture and land use sectors, ii) national policy measures and initiatives aiming at delivering on domestic and international climate targets. A summary of the climate targets and current GHG emissions of the land-agri-food system is provided for each country followed by a more detailed analysis of measures considered in national climate plans and related climate impact when communicated, as well as in Member States' CAP Strategic plans for EU countries.

A common methodology has been used to gather data and insights for each country as the following:

- ➔ Regarding the sub-section on *Climate Targets and Current Emissions Regarding the Land-Agri-Food System*, data relating to agriculture and LULUCF emissions are reported for each country within National Inventory Reports (NIR) under the UNFCCC (2021 reporting year⁷), specifically within chapters 5 and 6 of the reports. Some additional data, including national commitments for 2030 and 2050 have been found in national climate strategies.
- ➔ Regarding the sub-section on *Measures to Meet the Climate Targets Regarding the Land-Agri-Food System*, relevant policy measures are described in a commonly structured table to make it more understandable to the reader. The table uses six main categories or focus areas based on a report published by the European Environment Agency presenting *Progress and prospects for decarbonization in the agricultural sector and beyond* (EEA 2022). An exception was made for non-EU countries for which the structure has been adapted to embed other focus areas of relevance. National climate plans – either laying down action plans towards 2030 and/or 2050 targets – have been our main source of information when collecting insights on each of the areas of focus. Some countries

7 <https://unfccc.int/ghg-inventories-annex-i-parties/2021>

may have also adopted sectoral strategies which have brought further detailed information on measures already being implemented or to be explored to increase the resilience of agriculture and forestry at national level.

- With regards to EU Member States' CAP Strategic plans⁸, our analysis has based on approved versions by the European Commission made publicly available on its official website. We have mainly focused on measures described in the SWOT analysis section *SO4 Contribute to climate change mitigation and adaptation, including by reducing greenhouse gas emission and enhancing carbon sequestration, as well as promote sustainable energy* which assesses both needs and intervention strategies to be implemented for the period 2021-2027.
- Further insights were drawn from the EU member states' long-term strategies⁹ to meet their Paris Agreement commitments and the Energy Union objectives, which present expectations in emissions reductions in the agricultural sector in the order of 30-60 per cent by 2050 relative to 1990 levels.

Drawing on the insights on measures described in section 2, section 3 of the report points out a series of policy recommendations aimed at transforming the land agri-food system in a systemic manner. These measures have been identified as some of the boldest measures analysed across the development of this report, with a significant potential to reduce greenhouse gas emissions in Ireland if considered together in a systemic approach.

This report is meant to be a catalyst, with the aim to provoke discussions about policy insights and reflection by Irish stakeholders on key recommendations developed in the third section.

This report was developed by EIT Climate KIC with Thomas Koetz, Elléa Lhermite, Saskia Visser, Laurène Lebelt, Pernille Modvig, Cecilia Burnfield, Denyse Julien and Stewart Gee as main contributors. A few interviews were also conducted with some countries' Ministries and experts to add valuable input in the description of policy measures highlighted in the third section of the report.

It must be flagged that most of the plans used for this work were only available in their respective official national language, therefore some terms used in this report might not reflect the original meaning. It must also be noted that some of the policy publications referenced in this report might be revised by national authorities and therefore be no longer up to date after the publication of this report.

8 EU Member States' CAP Strategic Plans as approved by the European Commission, https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans-country_en

9 https://ec.europa.eu/info/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-long-term-strategies_en

2. Insights on relevant measures by country



Credit: Shutterstock

This section of the report outlines key insights and national measures relevant to the land-agri-food system in Ireland covered by i) National Climate Action Plans and ii) CAP Strategic Plans of selected Member States including Belgium, Denmark, France, Germany, the Netherlands, Finland, Italy and Poland. The report also highlights emissions reduction targets and measures implemented in non-EU countries including Canada, the United States of America (USA), New Zealand and the United Kingdom (UK).

A summary of the climate targets and current GHG emissions of the land-agri-food system is provided for each country followed by a more detailed analysis of measures considered in national climate plans to deliver on the climate targets and listed in Member States' CAP Strategic plans.

2.1 EU countries

2.1.1 Belgium

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.1.1.a: Belgium's national GHG emissions and reduction targets

GHG emissions (MtCO ₂ e)	GHG emission reduction targets Compared to 2005 levels		
	2020	By 2030	By 2050
Total (without LULUCF)	106.4	52.6	10.2-12
Agriculture	9.4	9.9	6.3-7
N ₂ O (Mt CO ₂ eq.)	35%	ND*	ND
CH ₄ (Mt CO ₂ eq.)	43%	ND	ND
CO ₂ (Mt)	22%	ND	ND

Source: *Belgium's long term strategy (2020)*; *Belgium's eighth national communication and fifth biennial report on climate change (2022)*; climat.be

*Belgium's strategy does not indicate quantitative reduction targets for specific GHG gases in the agriculture sector but overall aims to 'managing nitrates to reduce N₂O emissions and reducing CH₄ emissions from livestock'.

In Belgium, emissions of all gases have decreased by 26.9 % compared to 1990 and 27.8% using 1995 as the base year for the fluorinated gases (excluding LULUCF). The largest contribution to total emissions is CO₂, which accounted for 84.9% in 2020. Emissions of CH₄ account for the next largest share, at 6.7%, and emissions of N₂O make up a further 5.1%. Belgium aims to reduce its agriculture related emissions between 45 and 51% by 2050 compared to 2005 levels.

Land use, land-use change and forestry represent a net sink but has been in constant decline since 1990.

Figure 2.1.1.a: Land use in Belgium in 2021

Source: *Belgium's eighth national communication and fifth biennial report on climate change (2022)*



Table 2.1.1.b: Belgium's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (8.8 % of Total Emissions)		GHG Emissions / Removal of LULUCF	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	4	Forest Land	-2
Manure Management	1.9	Cropland	0.7
Agricultural Soils Liming Urea application & other fertilisers	3.5	Grassland	0.3
		Wetland	0
		Harvested Wood Products	0.1
Other	0	Settlements	0.5
Total (Agriculture)	9.4	Total (LULUCF)	-0.4

Source: *Country's National Inventory Report 2021 submitted to UNFCCC*

Table 2.1.1.c: Number of cattle in Belgium

	2000	2010	2020
Total cattle	2,993,812	2,627,402	2,347,546
Dairy cattle	581,461	464,449	498,849
Non-dairy cattle	2,412,351	2,162,953	1,848,697

Source: *Belgium. 2022 National Inventory Report (NIR)*

Measures and actions

- ➔ Improving agricultural practices (reduction in the use of mineral fertilisers, the storage and spreading of manure, waste recovery, avoiding the ploughing up of permanent grassland, combating soil degradation, etc.) and energy efficiency in horticulture (mainly situated in Flanders).
- ➔ Reforestation and forest conservation are encouraged through specific legislation
- ➔ Increased support to climate research: financial resources have increased significantly since 2017
- ➔ Synergies and cooperation have been strengthened between the federal government and regional authorities to implement measures outlined in the national and regional adaptations plans.

In line with the European regulation (EU) 2018/1999, Belgium has adopted a National Energy and Climate Plan¹⁰ for the period 2021 to 2030 at the end of December 2019. In 2020, Belgium also published its national long-term climate strategy¹¹. This strategy includes greenhouse gas emission reduction targets for the year 2050, as well as the main guidelines and preconditions/focal points to be considered to achieve these targets. It is based on the long-term strategies developed by the Flemish, Walloon, and Brussels governments for their respective regions (which are annexed to the Belgian long-term strategy), as well as on the strategy document of the federal administration.

Belgium is a federal state where decision-making power is shared between a federal authority and three regions (Wallonia, Flanders and the Brussels-Capital Region) and three communities (the Flemish Community, the Wallonia-Brussels Federation and the German-speaking Community). The regions are responsible for areas such as use of energy, promotion of renewable energy sources, public transport, transport infrastructure, urban and rural planning, agriculture, and waste management.

Context – Agriculture

Belgian agriculture is specialized in vegetable and horticultural crops, cereals, potatoes, sugar beet, live-stock and dairy production (see figures in table below). Although agricultural land occupies the largest part of the territory (44 per cent), the number of farms has declined in recent years. The share of agriculture in the Belgian economy now accounts for less than 1 per cent of its GDP. Despite a high population density, forests and other natural areas cover almost a quarter of the territory and have remained relatively stable.

Agriculture accounts for 9 per cent of total GHG emissions in Belgium, mainly CH₄ and N₂O. Some CO₂ emissions are caused by liming. Since 1990, emissions from this sector have decreased by 19 per cent, due to a decline in emissions from enteric fermentation (related to the decrease in livestock, but also to the shift from dairy to breeding cattle, a general trend in Europe related to the Common Agriculture

10 <https://www.plannationalenergieclimat.be/admin/storage/nekp/pnec-version-finale.pdf>

11 <https://climat.be/doc/national-lt-strategy-fr.pdf>

Policy according to Belgian reports) and from agricultural soils (reduced use of synthetic fertilizers and reduction of livestock, which reduces nitrogen excreta in pastures).

Table 2.1.1.d: Main types of production in Belgium between 1990 and 2020

	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
Number of businesses	86962	61705	51540	42854	36913	36910	35910	36158	36111	35996
Usable agricultural area (ha)	1357366	1394083	1385582	1358019	1344329	1354984	1329153	1356078	1358705	1367082
Cropland	760559	864076	842999	834388	908847	916960	835668	850455	857286	864877
Grains (ha) (without maize)	327226	277702	267975	276571	283076	284782	256428	250529	264466	252461
Wheat (ha)	205050	204022	204209	209532	201629	206284	184025	182954	190960	179474
Sugarbeet (ha)	107837	90858	85527	59303	52341	55504	62470	62696	57606	56751
Potatoes (ha)	49255	65845	64952	81760	78640	89163	92854	93331	98188	97337
Maize (ha)	140066	202120	218081	238844	231773	220664	220283	233732	223941	233416
Permanent Grassland (ha)	578626	506946	519096	499687	410884	477570	467837	479635	475464	476119

Source: Belgium. 2022 National Inventory Report (NIR)

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

Agriculture

Although the Walloon and Flemish strategies focus on the specific characteristics of their respective agricultural sectors, it is possible to identify several common elements, which can be grouped under three pillars:

1. Levers within the agricultural system: both strategies aim at adaptation and improvements within the agricultural system leading to a reduction of greenhouse gas emissions: the focus is on **smart farming and precision farming** (to minimize input of raw materials and energy and maximize yield), practices to increase nitrogen efficiency (e.g., better manure management), and the development of new technologies to reduce greenhouse gas emissions. Both strategies also place a strong emphasis on the **application of techniques to reduce enteric emissions from livestock** (e.g., genetic selection and tailored feed rations). Both strategies focus strongly on energy efficiency and **greening the energy mix** to significantly reduce energy emissions from the agricultural sector (this is especially relevant for the Flemish strategy, given the considerable energy consumption in the Flemish greenhouse horticulture sector). In the Walloon agricultural sector, energy emissions are already relatively low due to the limited presence of greenhouse horticulture.
2. LULUCF and biomass: in addition, both the Walloon and Flemish strategies emphasize that the agricultural sector can make an important contribution as a producer of **biomass and biofuels** (not only through the direct production of energy crops, but also by valorising secondary streams such as the fermentation of animal manure to extract biomethane) and through carbon sequestration in agricultural land.

3. Levers within the food system: several levers will be deployed within the broader food system to mobilize the reduction potential. In this context, the focus is on **reducing food waste, maximizing the value of food residues** and other secondary flows, and adapting consumption patterns towards more local and seasonal products and healthier food. The Brussels-Capital strategy has only a limited place for the agricultural sector, particularly because of its very small share in the region's greenhouse gas emissions. In this area, its strategy is mainly focused on the **development of urban agriculture**, which, in addition to mitigating climate change (e.g., less transportation of food), offers many benefits (greening, employment, social cohesion, etc.).

LULUCF

Strategies are planned to maintain or enhance carbon sequestration in soils and biomass. These include the expansion of green spaces (forests, natural areas, parks, etc.), sustainable forest and nature management, and the promotion of agricultural practices that favour carbon sequestration in agricultural land. In this respect, more information is available in the regional strategies in the annexes, see in particular chapter 3.6.1. of the Flemish Region strategy and chapters 2.1.1. and 3.5. of the Walloon Region strategy¹².

Each strategy also addresses potential synergies with climate change adaptation. For example, carbon-rich agricultural soils are more resilient to periods of drought or flooding, the expansion of green spaces is a protective measure against expected heat waves (especially in urban areas) and proper management of our forests can increase their resilience to climate change.

Flanders' CAP Strategic Plan¹³

Flanders continues to focus on a dynamic, resilient and sustainable agricultural and horticultural sector, from which the farmer can earn a living income. In order to receive income support, the farmer must comply with the increased conditionality. For the coupled support, there will be a sustainable alternative in which the beef farmers involved make climate efforts. According to the Flemish Energy and Climate Policy Plan 2021–2030, the agricultural sector must have achieved a 31.3 per cent reduction in greenhouse gas emissions compared to 2005. Flanders must eliminate carbon loss from agricultural soils and the agricultural sector must arm itself against the consequences of climate change. Within the conditionality and incentive policy of eco-schemes and agri-environment-climate commitments, several specific climate actions are included around multiannual grassland, organic carbon in the soil and feed management in cattle.

The Flemish Agricultural Investment Fund¹⁴ (VLIF), is an instrument set up by the region to support Flemish agriculture and horticulture through sustainable investments. The farmer can make invest-

¹² https://unfccc.int/sites/default/files/resource/LTS_BE_EN_summary.pdf

¹³ Approved CAP Strategic Plans are available on the official website of the European Commission: [CAP strategic plans by country \(europa.eu\)](https://ec.europa.eu/eip/agriculture/cap-strategic-plans)

¹⁴ <https://climat.be/doc/national-lt-strategy-fr.pdf>

ments to reduce greenhouse gas emissions, save energy, generate renewable energy, and protect oneself against extreme weather conditions. Investments that have clear added value in terms of climate, and have a long payback period, are subsidized at the highest support rates.

Flanders has formulated seven guidelines on which the Flemish CAP Strategic Plan will prioritise based on the European objectives outlined in the new CAP and the European Green Deal.

- a. National food chain
- b. Sustainable income for sustainable work
- c. Innovation and knowledge sharing
- d. Environmental management within CAP
- e. Agriculture ready for climate
- f. Generation change
- g. Experience the rural area by connected functions

Wallonia's CAP strategic Plan

To develop its Strategic Plan, the Walloon Government has set the following objectives:

- ➔ Support family farming on a human scale;
- ➔ Guarantee farmers' income;
- ➔ Support equitably the different types of agriculture, which must keep their complementarity in relation to market needs (Conventional, Organic, Differentiated Quality, Livestock, Crops, Vegetable growing, ...);
- ➔ Safeguard and promote food autonomy;
- ➔ Reinforce and relocalize the added value of the productions, in particular by the transformation of the production;
- ➔ Encourage the takeover of farms by the new generation;
- ➔ Ensure a transition to a more sustainable agriculture;
- ➔ Contribute to the objectives of the Region for nature, the environment, and climate, and to the orientations given by the Green Deal.

The Walloon strategic plan aims to show greater ambition in terms of the environment, climate and biodiversity, both in terms of cross-compliance and in terms of the 2 pillars.

The eco-schemes have been designed to meet strategic objectives 4 to 6. They will represent 26 per cent of the European Agricultural Guarantee Fund (EAGF) envelope. For climate, priority has been given to the maintenance of permanent grasslands. In the interventions of the second pillar, support for organic farming will be reinforced for all Walloon farmers, but even more so for those located in vulnerable areas. The measures related to these needs and areas of action are described in the table below (Table 2.1.1.e).

Table 2.1.1.e: Description of Measures under Belgium's Climate Action Programme and CAP Strategic Plan 2021-2027

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus area : Livestock	
Flanders Reducing enteric emissions: Continued research and implementation of measures to optimize feed rations and feed efficiency and improve farm management can reduce methane emissions per animal. Further progress is needed in areas such as feed efficiency, feed additives, and cattle longevity. Reducing Emissions from Manure Storage and Management: Support to adoption of practices: manure fermentation, microfermentation, composting, aerobic treatment, acidification of manure and other fertilization methods. Emissions from manure storage and application (fertilizer) can also be avoided through Smart Farming and precision spreading. An input-output balance at the farm level can better map the nutrient cycle of the enterprise and manage losses where they occur.	Flanders ECO-SCHEME The supply of feed with a methane-reducing effect in cattle by adding an additive or feed material. To reduce methane emissions from the digestion processes of cattle, feed management is used, among other things. By adding additives, such as 3-NOP, nitrate, expanded/extruded linseed, rapeseed fat or beer marc (together with rapeseed meal) to the feed for dairy and beef cattle, by up to 26 per cent. The reduction percentage depends on the dosage. Such a practice can intake a 26 per cent reduction of enteric methane emissions (see pp.438 of Flanders' Strategic plan).
	Wallonia "Permanent grassland premium" eco-scheme: The "permanent grassland" eco-regime encourages the maintenance of permanent grasslands on the farm and the reduction of the livestock load. The objective is to reduce GHG emissions, decrease nitrogen and phosphorus discharges, increase the farm's food independence and improve animal welfare. Coupled support to protein crops: Supported crops grow with low nitrogen input and therefore lead to a reduction in GHG emissions. Increasing the autonomy of the production of animal feed and in particular protein crops promotes a rebalancing of the biogeochemical cycles of nitrogen and phosphorus by reducing the import and excessive concentration of nutrients. Coupled support for cattle: provides for a higher limit on the number of eligible animals than in the 2014-2022 period so as not to encourage intensive livestock farming that harms the climate and the environment.

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus area : Reduction in crop and soil N2O	
Flanders: Reduction of soil emissions through increased nitrogen efficiency: Feeding with a low protein ration, clean protein production and residual stream proteins; Precision agriculture: the right dosage, at the right time and in the right place; Better nitrogen uptake through adapted crops (breeding, new techniques, etc.) and crop rotations (e.g. with legumes); Reducing the use of artificial fertilizers by encouraging appropriate crop rotations and the use of artificial fertilizer substitutes; Transition from nutrient removal to nutrient recovery in fertilizer processing and reduction of nitrogen losses. Closing of cycles / valorization of secondary flows: Fermentation is an important valorization of manure by transforming it into green energy (biogas, biomethane) and digestate. A good cooperation between producers and users of secondary streams and an adapted regulation allowing the use of products derived from these secondary streams are of paramount importance in this respect.	Flanders AMKM Sowing perennial eco-crops: Through this multi-year AMKM at plot level, the sowing of crops with a positive effect on the environment, climate or biodiversity is stimulated. A first group comprises several perennial protein crops in the context of a local protein supply. These are mainly perennial legumes, but also grass herb mixtures and alfalfa with delayed mowing date. A second group includes several perennial crops that naturally have a positive effect on the environment, climate or biodiversity, such as short rotation timber and miscanthus. Eco-scheme; ecological management of grassland. through restrictive conditions around fertilisation and the use of plant protection products. This has a positive effect on water, air and soil quality. Because no crop protection products or fertilizers are used, the grassland can also evolve into a botanically more diverse grassland. This type of grassland has a high resilience to climate change. Mechanical weed control; as an alternative to chemical control. Especially crops sown/planted in row lend themselves strongly to mechanical weed control. Useful tools for mechanical weed control include the cradle, the hoeing machine and the finger dough. Not using chemical herbicides has a positive effect on the quality of ground and surface water and on the biodiversity of the plot and the environment.
Wallonia: Supporting Energy, greenhouse gas and NH₃ accounting at farm level (DECIDE tool)	Wallonia: "Environmentally Friendly Crops" eco-scheme: encourages crops that are low in inputs and that improve the farm's feed independence. They are also melliferous. They preserve "water", "air" and "soil" resources and protect biodiversity. "Input Reduction" eco-scheme: allows the maintenance or introduction of production methods that are less dependent on phytopharmaceutical products, which contributes to the reduction of the use of these products. This intervention promotes sustainable development and the preservation of natural resources, particularly water. Cross-compliance: reducing GHG emissions resulting from the loss of permanent grassland, carbon-rich soils and carbon-storing landscape features: GAEC 1 (maintenance of permanent grassland on a PP/SA basis), 2 (protection of wetlands and peatlands), 8 (non-productive areas or elements). Statutory management requirements (SMR) 1 (Directive 2000/60/EC establishing a framework for Community action in the field of water policy), 2 (Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources), 7 (1107/2009 concerning the placing of plant protection products on the market) and 8 (Directive 2009/128 establishing a framework for Community action to achieve the sustainable use of pesticides).
	Coupled support to protein crops: see previous section Natura 2000 agriculture: The limitation of inputs on the areas included in Natura 2000 leads to a significant decrease in the production and consumption of fertilizers and pesticides, of which CO₂ Teq2 are very important, compared to the reference situation. Similarly, limitations on grassland use, including lower livestock stockings, lead to a limitation of methane emissions. Support for organic farming: see previous section Aid for productive investments on farms (ADISA): finance equipment limiting the use or loss of inputs during their application (precision agriculture, mechanical weeding, high-performance spreading equipment, etc.) or limiting soil carbon losses (simplified tillage, overseeding in grassland, etc.).

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus area : Carbon storage/ sequestration	
Flanders: - Development of a comprehensive LULUCF emissions inventory and associated carbon monitoring system. - Soil carbon monitoring network. - Improved data collection and monitoring of wood production. - Preparation of a LULUCF action plan with projections, based on an assessment of the current situation and a calculation of the impact of possible policy strategies on carbon stocks: Practicing carbon-based management of a land use category; Encouraging land use conversion for carbon storage; Slowing down land use conversion resulting in carbon loss - Reducing additional land use, clearing and managing non-concrete land use. - Increase carbon storage in agriculture and horticulture. - Prevention of deforestation and loss of old growth grasslands. - Increased storage through the creation of additional forests and natural areas. - Prevention of natural fires (in forests and more broadly, for example, in moors) by means of appropriate surveillance and monitoring. - Increased storage through integrated water management, landscaping and wetting. - Establishment of a voluntary Flemish carbon market in the framework of the LULUCF policy Estimated impact: - By 2030, 10,000 ha of additional forest will be created in Flanders, of which 4,000 ha by 2024. - By 2024, 20,000 additional hectares of nature will be managed efficiently (integrated water management and adaptation to climate change is also a central principle).	Flanders: AMKM The conversion from temporary to permanent grassland: Grassland that is not ploughed and renewed provides a large carbon storage in the soil, allowing perennial grassland to play an important role in the fight against climate change. Parcels of grassland that have been lying on for five years will be given the status of 'permanent grassland' after the fifth year. This five-year agri-environment-climate measure encourages farmers to maintain their temporary grassland for longer and to convert it to permanent grassland. This measure rewards farmers who focus on carbon storage under grassland, instead of tearing to avoid only the status of 'permanent grassland'. Eco scheme 'Crop rotation with legumes': stimulate to break monocultures. A larger crop rotation ensures, among other things, a higher build-up of organic carbon, a more diverse rotation, a stable (and high) yield under a lower fertilization level, a higher biodiversity and a lower disease and pest pressure. To be eligible for this subsidy, main crops must have been sown in the application year and the four previous years from at least three different crop rotation groups, of which at least one from the legume group.
Wallonia: Afforestation, planting of woody elements and agroforestry: Untapped potential in agricultural areas: re-planting hedges at the edges of plots, planting trees in meadows, developing pre-orchards. Maintain and increase existing agricultural and forest carbon stocks: In the area of forest management, and more specifically planting, local subsidies are granted to private landowners to ensure the renewal of softwood and hardwood stands.	Wallonia: "Long soil cover" eco-scheme: protects the soil, enriches it with organic matter and stores carbon. "Ecological Mesh" eco-scheme: pays for the ecosystem service provided by non-productive areas and elements. It aims to preserve and redeploy biodiversity but also allows carbon storage. "Permanent grassland premium" eco-scheme: see previous section Cross-compliance: GAEC 1 (maintenance of permanent grassland on a PP/SA basis), GAEC 2 (protection of wetlands and peatlands), 3 (prohibition of stubble burning), 6 (no bare soil during the most sensitive periods), 8 (non-productive areas or elements). These GAEC aim to ensure the preservation of carbon-rich soils and stubble after harvest, but they also increase carbon stocks through land cover during the winter and the obligation of a percentage of non-productive areas/elements on the farm. Agri-environment-climate measures (AECMs) that aim to maintain grasslands/green spaces and this promotes carbon sequestration in the soil "Natural grasslands", "natural grasslands of high biological value", "fodder autonomy". Natura 2000 forest allowances: maintenance of forest areas Natura 2000 allowances for agriculture: maintenance of grassland areas Investments in the forestry sector: The objective is to improve the quality of forestry work by reducing its impact on ecosystems and/or ensuring a better diversity and recovery of forest plantations in the context of climate change (diversification and choice of plants, transport and conservation conditions, innovative technical itineraries, etc.). Support for organic farming: see previous section

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus area : Energy mitigation	
Flanders: - VLIF aid scheme for investments in energy efficiency and renewable energy sources - in agriculture. - Supporting farmers in their investments in energy efficiency and renewable energy sources. - Action plan on sustainable management of (residual) biomass flows developed by OVAM Wallonia: Framework for the use of biomass Walloon "Biomass Energy" strategy taking into account the following cardinal issues: sustainability, conflicts of use, integration into the bioeconomy roadmap and respect for consistency between vectors. The Walloon Government wishes to approve a framework governing the use of biomass (all sources combined) for energy purposes. Biomethanization based on co-products from crops for non-energy purposes or based on the treatment of agricultural, household or industrial waste will be favoured.	Wallonia: Aid for physical investments (ADISA) will help develop the energy performance of farms, through the financing of a range of materials and equipment that will facilitate the storage and production of renewable energies other than biomethanation (e.g. installation of heat exchangers and other professional devices providing renewable energy)
Focus area : Wider food system	
Flanders: Cooperation in the food value chain: To ensure a transition in the agri-food chain, close cooperation between all partners in the chain is essential. Integrated approach to research, innovation and knowledge dissemination Food policy: The region is developing a coherent food policy that takes into account ecological, economic, social and health aspects and focuses on making our food supply sustainable. Awareness-raising initiatives emphasizing sustainable diets, based on the food triangle, are also being undertaken. The goal is to ensure that local products are consumed appropriately. Protein transition: - Sustainability of protein sources in animal feed, in accordance with the action plan for alternative proteins in collaboration with the Belgian Feed Association (BFA). - Continuing the sustainability of conventional animal production. - Continue to focus on plant proteins through protein crops. - Support the development of alternative sources of plant and animal protein, including through the strategic platform for insects, algae, etc. - Supporting new markets for the entire chain, from production to waste. Reducing food waste from producer to consumer: Preparations are currently underway within the Ketenplatform Voedselverlies (Food Waste Platform) to develop a successor document to the Food Chain Roadmap. Developing surplus food distribution platforms and food platforms to combat food waste.	
Wallonia: Stimulate changes in consumer purchasing behaviour to support the transition of farms: Support for farmers in their efforts to have their products recognized as Protected Designation of Origin (PDO) (PDO), Protected Geographical Indication (PGI), Traditional Speciality Guaranteed (TSG) or Differentiated Quality (DQ) "Eating tomorrow" strategy approved by the Walloon government in 2018, in order to facilitate and coordinate local and coordinate local and regional food initiatives.	

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus area : Increase Climate Change Resilience of Farms and Forestry	
	Flanders: Eco-scheme 'Cultivation technical erosion control techniques': efforts are made to preserve valuable, fertile soils and to reduce the loss of inputs such as seeds, fertilizers (nutrients) and crop protection products. By reducing the leaching of inputs and sediment to surface waters, this also contributes to better water quality. The supported erosion-fighting cultivation techniques are the construction of thresholds between the ridges in back crops; the application of non-inverting tillage with ground cover and the full-field sowing of maize
Wallonia: ▪ Flood risk management plan ▪ Walloon forest code, sustainable management of forests adapted to climate change ▪ Recommendations to forest managers ▪ Walloon forest health observatory ▪ Agricultural and forestry research ▪ Developing ecological networks and green and blue corridors ▪ Planting, afforestation and agroforestry	Wallonia: Eco-schemes: The five eco-schemes "ecological mesh", "environmentally friendly crops", "Reduction of inputs", "long soil cover" and "permanent grassland premium" will support the resilience of Walloon farms to climate change. Cross-compliance: GAEC 2 requires permanent grassland areas to be maintained in high-level overflow flood hazard zones, so as to ensure the maintenance and functionality of flood expansion areas. GAEC 6 (no bare soil during the most sensitive periods), 7 (crop rotation) contribute to the prevention of mudslides and strengthen the long-term ability to resist erosion and drought by increasing soil water retention. Soil infiltration capabilities are maintained by permanent grasslands under GAEC 1, GAEC 2. Agri-environmental and climatic measures AECM: AECM AnRLM (endangered local breed animals), AECM fodder autonomy, AECM natural grasslands and grasslands of high biological value, AECM Grassy meadows and managed plots Non-productive investments in rural areas and investments for logging and forestry work: financing of soft hydraulic works on agricultural land such as ditches, filter dams, toothed ditches, buffer ponds, retention basins, etc.; restoration of habitats typical of certain areas located in the main ecological structure; Promoting more resilient forestry practices. Natura 200 Forest: support for resilient forestry practices Investments in forestry infrastructure related to climate change (roads, bridges, flood prevention facilities, water regulation services) Develop training and advisory services for farmers and foresters in order to strengthen the resilience of farms and have a positive impact on climate change: sectoral interventions, research and technical assistance to support adaptation to diseases/pests and climate transition in the beekeeping sector and in the fruit and vegetables sector.

2.1.2 Denmark

Key figures

Table 2.1.2.a: Denmark's national GHG emissions and reduction targets

GHG emissions (MtCO ₂ e)		GHG emission reduction targets	
	2021	By 2030	By 2050
Total (without LULUCF)	51.3	-70% compared to 1990 levels	Net 0
Agriculture	10.6	6.1-8.0 million t CO ₂ e in 2030 (incl. LULUCF)	N.D.
N ₂ O (Mt CO ₂ e)	4.87	-0,64	N.D.
CH ₄ (Mt CO ₂ e)	5.84	N.D.	N.D.
CO ₂ (Mt)	0.19	N.D.	N.D.

Source: Denmark's National Inventory Report 2021 submitted to UNFCCC; EEA data; Denmark's Long-term Strategy

Table 2.1.2.b: Denmark's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (25 % of Total Emissions)		GHG Emissions / Removal of LULUCF	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	3.72	Forest Land	- 2.56
Manure Management	2.78	Cropland	2.88
Agricultural Soils	4.3	Grassland	2.1
Liming	0.18	Wetland	0.07
Urea application & other fertilisers	0.04	Harvested Wood Products	- 0.33
Other	-	Settlements	0.22
Total (Agriculture)	11	Total (LULUCF)	2.4

Source: Denmark's National Inventory Report 2021 submitted to UNFCCC

Figure 2.1.2.a: GHG in CO₂ equivalents distributed on main sectors for 2019 (excluding LULUCF and indirect CO₂) and time series for 1990 to 2019

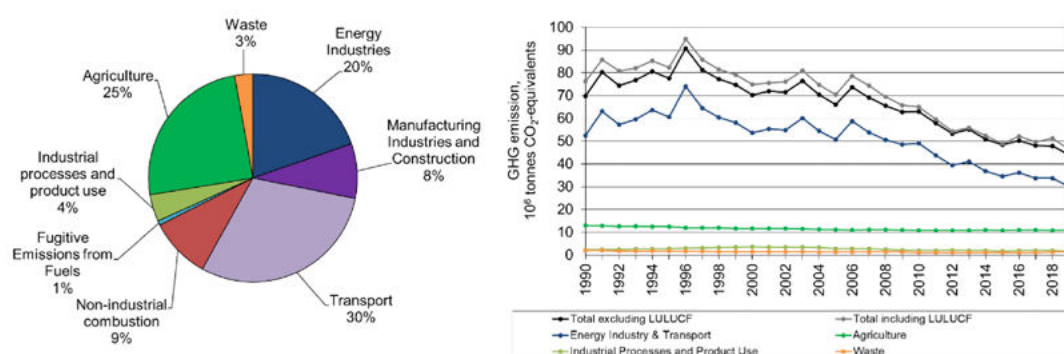


Figure 2.1 Greenhouse gas emissions in CO₂ equivalents distributed on main sectors for 2019 (excluding LULUCF and indirect CO₂) and time series for 1990 to 2019.

Source: Denmark's National Inventory Report 2021 submitted to UNFCCC

Table 2.1.2.c: Number of cattle in Denmark

	2000	2010	2020
Total cattle	2,503,456	2,139,252	2,065,459
Dairy cattle	635,519	568,202	566,986
Non-dairy cattle	1,867,937	1,571,050	1,498,473

Source: Statistics Denmark

Measures and actions

The Danish [Climate Action Programme 2030](#) focuses on the following ten areas of action by which farming, and land use are to become more climate-friendly:

- ➔ Extraction of 88,500 hectares of peatlands
- ➔ Reduction of excess nitrogen and improvement of nitrogen efficiency
- ➔ Increase of the fermentation of manure of animal origin and agricultural residues
- ➔ Doubling organically farmed area
- ➔ Reduction of greenhouse gas emissions in animal husbandry
- ➔ Conservation of permanent grassland
- ➔ Protection of peat soils
- ➔ Private afforestation
- ➔ Increase in sustainable diets

Climate Targets and Current Emissions Regarding the Land Agri-Food System

The Danish climate regulations and strategies are based on EU's climate and energy policy towards 2030 from 2014 setting binding targets for internal reduction of EU greenhouse gas emissions by at least 40 percent by 2030 compared to 1990. With the Energy Agreement¹⁵ from June 2018, Denmark commits to ensure that 55 percent of its energy needs are covered by renewable energy by 2030 and to work towards net-zero greenhouse gas emissions in accordance with the Paris Agreement and for a goal of net-zero emissions in the EU and Denmark by 2050. In 2020, Denmark passed the legally binding Climate Act (Klimaloven)¹⁶ under which Denmark commits to **reduce its carbon emission by 70 percent in 2030 compared to the 1990 levels**. It further **aims to achieve net-zero emissions by 2050**.

The Climate agreement for Energy and Industry¹⁷ enables the Danish government to set targets for tackling global warming with a ten-year perspective. Under the law, the government is bound to produce a Climate Action Plan every year to show its efforts in meeting these targets. The plan must include concrete policies for reducing emissions in various sectors such as energy, housing, transportation agriculture. In addition to the Danish goal of climate neutrality, Denmark has been allocated a reduction target of 39 percent for non-ETS (EU Emissions Trading System) emissions in 2030 compared to 2005. Through its EU membership, Denmark has assumed reduction targets for non-ETS sectors, while the ETS sectors are directly regulated by the EU.

Currently, agriculture generates 10,6 million tons CO₂e annually which corresponding to around 24.8 percent (2019) of Denmark's total greenhouse gas emissions (excluding LULUCF). Ten years ago the sector generated 15.6 per cent of total emissions but the number has increased as other sectors have reduced their emissions. Most of the emissions come from livestock production, where lamb and beef have the largest CO₂ footprints per kg of food produced. With the political agreement on the green transition of Danish agriculture¹⁸ from October 2021, the Danish government agreed on setting **a binding reduction target for land and forestry sector's greenhouse gas emissions of 55-65 per cent compared to 1990 emissions which is equivalent of reducing greenhouse gas emissions from the agriculture and forestry sector by around 6.1-8.0 million t CO₂e in 2030**. The agreement introduces a number of concrete initiatives to ensure GHG reduction by 1.9 million tonnes of CO₂e by 2030.

15 <https://www.skm.dk/aktuelt/publikationer/politiske-udspil-og-aftaler/energiaftale-2018/>

16 <https://danskelove.dk/klimaloven>

17 <https://kefm.dk/Media/4/2/aftaletekst-klimaaf-tale-energi-og-industri.22.06.2020pdf.pdf>

18 <https://www.regeringen.dk/aktuelt/publikationer-og-aftaletekster/aftale-om-groen-omstilling-af-dansk-landbrug/>

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

The CAP strategic plans for Danish Agriculture for 2023 to 2027 ([CAP-planen](#)) is building upon the Rural Development Plan (Landdistriktsprogrammet) from 2022 and will be implemented in close connection with national strategies; and initiatives, including the political agreement on the green transition of Danish agriculture from October 2021. The agreement is estimated to reduce emissions by 1.2 Mt CO₂e in 2025 and 1.9 Mt CO₂e in 2030 as detailed in the following table.

Table 2.1.2.d: Estimations of emissions reduction with the implementation of measures described in the 'Agreement of the green transformation of the Danish agriculture'

	Mt. CO ₂ e		Nitrogen (t. N)
New measures	2025	2030	2027
Reduction requirements for livestock digestion	0.17	0.16	0
More frequent discharge of slurry	0.15	0.17	0
CAP measures	0.38	0.38	1,550
Extraction of 22,000 ha of low-lying soils	0.04	0.33	700
Private forests	0	0.05	50
Extensification	0.1	0.1	400
Nitrogen input management	0.31	0.64	8,000
Temporarily reduced logging in forests	-	0.07	-
Total (reductions)	1.2	1.9	10.800
Measures adopted			
Excavation of low-lying soils (FL ₂ 0-FL ₂ 1)	-	0.3	-
Other measures	-	0.2	-
Total		2.4	
Measures in development			
Brown biorefining	-	2	-
Slurry management	-	1	-
Feed additive		1	
Doubling ecology		0.5	
Extending low-end potential		0.5	
Total		5	

In its recent CAP Strategic Plan, Denmark identified the following three needs for how best to contribute to climate change mitigation and adaptation (SO₄ of the CAP). The three general objectives are split into nine more specific.

Objective 1: To promote a smart, competitive, resilient, and sustainable agricultural sector, thereby ensuring long-term food security.

(a) Support viable farm income and resilience of the agricultural sector across the Union to enhance long-term food security and agricultural diversity as well as ensuring the economic sustainability of agricultural production in the Union;

- a. Enhance market orientation and increase farm competitiveness both in the short and long term, including greater focus on research, technology and digitalisation.
- b. Improve the farmers' position in the value chain.

Objective 2: To support and strengthen environmental protection, including biodiversity and climate action, and contribute to the achievement of the EU's environmental and climate objectives, including the Paris Agreement

- c. Contribute to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and enhancing carbon sequestration, as well as promote sustainable energy.
- d. Foster sustainable development and efficient management of natural resources such as water, soil and air, including by reducing chemical dependency.
- e. Contribute to halting and reversing biodiversity loss, enhance ecosystem services and preserve habitats and landscapes.

Objective 3: To strengthen the socio-economic fabric of rural areas

- f. Attract and sustain young farmers and other new farmers and facilitate sustainable business development in rural areas; promote employment, growth, gender equality, including the participation of women in farming, social inclusion, and local development in rural areas, including circular bioeconomy and sustainable forestry.
- g. Improve the response of Union agriculture to societal demands on food and health, including high quality, safe, and nutritious food produced in a sustainable way, the reduction of food waste, as well as improving animal welfare and combatting antimicrobial resistances.

The measures related to these needs and areas of action are described in the table below (Table 2.1.2.d).

Table 2.1.2.d: Description of Measures under Denmark's Climate Action Programme and CAP Strategic Plan 2021-2027

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus area : Livestock	
Increase of the fermentation of manure of animal origin and agricultural residues - Pyrolysis is an example of a technology that has great climate potential. The method is suitable for recycling biomass that cannot be used for e.g. feed. Animal manure and straw residues can then be converted into bio-fuel, biogas and biochar. Pyrolysis fuel and -gas can replace fossil oil and thereby act as a sustainable fuel for e.g. aircraft, while the biochar can bind carbon in the soil. This minimizes the emission of greenhouse gases into the atmosphere.	
Reduction of greenhouse gas emissions in animal husbandry - The government will allocate DKK 260 million to biorefining grass so that the high protein content can be used for feed and thus replace imports of soy. In addition, grass is also more climate and environmentally friendly per area than the dominant annual crops in Denmark. - The management of manure is crucial in order to reduce the climate footprint of agriculture on a wide range of different technologies and solutions are under development. This applies both to the possibility of added substances to the slurry and manure and to design stables in new ways that reduce agricultural emissions of greenhouse gases significantly. However, more knowledge is needed for all the instruments.	The establishment of green bio refining facilities aims to support deployment of bio-refining plants, where protein can be extracted from resources such as grass. The intervention will thereby contribute to reducing environmental and climate impact of soy protein imports from abroad and local production of green proteins. In this way, bio refining can be an important part of a sustainable green transition of Danish agriculture. The technology will be relevant for farmers, especially organic farmers. This intervention will also create economic value and support development of technology related industries by expanding the possibilities to extract proteins. This intervention provides support for investment in bio-refining technologies that can extract proteins. The technologies can be installed either on or off farms. Support may be granted companies registered under the CVR-system, such as farmers, animal feed companies, bio-gas companies, public agricultural companies and associations thereof.
Focus Area: Reduction in crop and soil N2O	
Reduction of excess nitrogen and improvement of nitrogen efficiency - Nitrogen emissions from agriculture to be reduced by 10,400 tonnes by 2027. The 10,400 tonnes will be secured in two ways. On the one hand, the so-called targeted regulation, which obliges farmers to reduce by 6,500 tonnes of nitrogen by 2027. This requirement will be phased in gradually after 2025. On the other hand, 3,900 tons, which are efforts in the new agrarian reform and voluntary collective efforts such as reestablishment of wetlands. Good ecological status is defined in the EU Water Framework Directive. To achieve this goal, Aarhus University and the Ministry of the Environment have so far estimated that a reduction of 15,000 tonnes is needed of nitrogen to coastal waters in 2027. The nitrogen plan will deliver a CO₂e-reduction of approximately 0.5 million tonnes by 2030. - In 2023/24, the green transition of agriculture will be revisited and remaining efforts will be handled. - Good ecological status is defined in the EU Water Framework Directive.	The eco-scheme for new regulation of areas (also called eco-scheme for new regulation model) This eco-scheme aims to reduce nitrogen leaching from fields to coastlines by planting catching crops or alternatives. The intervention contributes to the national implementation of the EU Water Framework Directive. Support can be granted per hectare for one-year commitments to farmers with holdings of more than 10 hectares of base area under catch crops. The area must be an agricultural area located in one of the coastal watersheds designated by the managing authority and where nitrogen reducing measures are to be applied to meet the needs of river basin management plans.

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Reduction in crop and soil N2O	
Increase of organically farmed agricultural land The government will increase the rates for organic area payments until 2024 as part of an ambition to double the ecology. The government will also support the development of ecology. If it succeeds in double the ecological area, it will give a CO₂e-reduction of 0.5 million tonnes by 2030.	Eco-scheme for organic farming The primary objective of this eco-scheme is to pursue the political objective of doubling the organic area in Denmark. This eco-scheme will contribute to achieving benefits for e.g. climate, environment and biodiversity through conversion to and maintenance of organic agricultural production. In addition, the eco-scheme will support the Danish production of high quality organic food with low climate and environmental impact. The support can be granted organic farmers per hectare for one-year commitments.
Focus Area: Carbon storage/ sequestration	
Biochar -The government will allocate DKK 222 million to research and development of new technologies, such as pyrolysis, which converts agricultural residues into fuel and biochar. Biochar can make sure that CO₂ stored in the soil and not discharged into the atmosphere. In addition, research into additives for feed and handling of manure. These technologies are estimated to have overall technical potential to deliver approximately 4 million tonnes of CO₂e-reduction by 2030.	R.14 PER - Carbon storage in soil and biomass Share of utilised agricultural area (UAA) are subject to supported commitments to reduce emissions or to maintain or improve; carbon storage (including permanent grassland, permanent crops with permanent crops); plant cover, agricultural land in wetlands and peatland)
Conservation of permanent grassland	Conservation of grassland and nature areas (N₂000) The aim is to protect and enhance habitat conditions and biodiversity primarily on designated open nature and agricultural land. This intervention contributes to the national implementation of the EU Habitats and Birds Directives (Natura 2000 Directives). Support is granted activities relating to maintenance of pasture and natural areas, including grazing and mowing. Moreover, support is granted for five-year commitments to farmers and others who own or rent designated areas.
	The eco-scheme for environmental and climate friendly grassland This eco-scheme aims to achieve a higher environmental and climate impact on grassland by extending the rotation period of farmland. The eco-scheme will contribute to soil carbon accumulation, while the grassland will reduce nitrogen leaching compared to other crops. In addition, biodiversity of soil fauna will be increased. Support may be granted per hectare for one-year commitments to farmers whose land is under permanent pasture or permanent grass. The eco-scheme for nutrient extensification of grassland This eco-scheme aims to reduce greenhouse gas and nitrogen emissions from agricultural land through extensive management of carbon-free agricultural soils on a yearly basis. In a longer perspective, the aim of this eco-scheme is to support climate objectives by contributing to a gradual depletion of soil nutrients, in particular phosphorus and methane in preparation for later permanent setting aside of land as water levels rise. The support may be granted per hectare for one-year commitments to farmers with rotational areas within the designation base, based on maps of soils with a minimum organic carbon content of 6 per cent and maps of the extent of river valleys.

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Carbon storage/ sequestration	
Protection of peat soils The government proposes that, including previous agreements, to rewet or extract at least 88,500 hectares of peat land and marginal land by 2030. DKK 3.8 billion will be allocated from the EU's common agricultural policy to include previous agreements overall. 50,500 hectares of agricultural land are re wetted and 38,000 hectares are set aside through one-year demonstrations. In addition to the significant climate effect can set aside areas, among other things, contribute to more nature and to green energy production, for example by installing solar cells. The government will work purposefully to remove barriers, e.g. when handling phosphorus and better mapping of the areas so that the technical potential can potentially be increased. Estimation to deliver a reduction of 0.6 Mt CO₂eq by 2030.	
Afforestation DKK 613 million are allocated for the period 2022-2030 for private afforestation.	17 CU PR - Afforestation Increase of total recipients of afforestation aid and restoration of agroforestry, including divisions by 8253 ha
Conservation and sustainable management of forests and use of wood -The Climate Action Programme 2030 mentions but does not elaborate on an ambition to support private afforestation.	Biodiversity forest (N₂000) primary objective is promotion or conservation of biodiversity in privately owned woodlands (with natural value). The intervention aims to help safeguard Natura 2000 forest habitats and stable habitats for threatened forest-associated species. The intervention encourages forest owners to maintain and increase the proportion of (large) trees decaying naturally, while allowing forest management to continue. The purpose is furthermore to safeguard and increase the amount of dead wood that provides habitats for the species-rich flora and fauna associated with dying and dead wood. The support is granted for conservation of large trees for natural decay and for extensive forestry. The support can be granted to private forest owners and municipalities. Municipalities, are only granted support for Natura 2000 areas.
Focus Area: Biodiversity	
	The eco-scheme for biodiversity and sustainability on farmlands This eco-scheme aims to increase amount of grassland, marginal areas and small habitats on agricultural land. The eco-scheme will have positive biodiversity, environment and climate effects since neither setting aside, marginal areas or small biotopes are used for production. This implies that the area are not allowed to be cultivated, grazed, fertilized or sprayed during the minimum period for setting aside. The ecoscheme supports commitments under the EU Birds and Habitats Directives, the EU Nitrates Directive and the EU Water Framework Directive. In the longer term, the eco-scheme will also supports climate commitments, as the intervention is designed to provide an incentive for farmers to maintain the eco-scheme for several years. The support is granted per hectare of planted area. The eco-scheme builds on the GAEC 8 requirement of at least 4 per cent non-productive elements on rotational land. However, under this eco-scheme, the setting aside of elements on all types of land is supported. If the farmer commits to set aside at least 7 per cent non-productive elements on rotation land, the GAEC 8 requirement is reduced to 3 per cent, whereby 1 per cent will receive support through this eco-scheme. Each non-productive element applied for under this intervention must be at least 100 m².

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Wider food system	
	Increase in sustainable diets including alternative proteins The government will invest in the development of plant-based foods and prioritise DKK 96 million from the EU's common agricultural policy for this purpose. The eco-scheme for diversified plant production This Eco-scheme intends to promote crop diversification and support the plant-based agenda. The eco-scheme will therefore be used to support diverse crop production in 2023-2027, resulting in a greater focus on crops that can be used in human diets and a lesser focus on feed crops. The eco-scheme will build on GAEC 7 requirements on crop rotation for all crops or on crop diversification. Support may be granted per hectare for one-year commitments to farmers using increased diversification targeting crops covering fruit and berries, vegetables, oilseeds and pulses (except winter and spring oilseed rape), root crops, flax and hemp, and potatoes.
Focus Area: Wetlands and aquatic environment	
	Constructed wetlands aims to improve the aquatic environment by reducing input of nitrogen. As a secondary effect, mini wetlands also reduce phosphorus discharges in the aquatic environment. The intervention provides support for the establishment of mini wetlands. Support can be granted applicants with land suitable for a mini wetland. Water and climate projects bring together a number of existing interventions, including phosphorus wetlands, nitrogen rich areas and lowland projects in one collected intervention. In addition, a new measure is introduced for physical watercourse interventions on agricultural land. The overall objective of this intervention is to improve the aquatic environment and reduce nitrogen emissions from agriculture. This is done by providing support for wetland projects to reduce nitrogen and phosphorus inputs. In addition, for the first time it will be possible to apply for support for restoration of river valleys and creation of miniature river valleys on agricultural land. Finally, the water project intervention will contribute to lowlands projects. It will therefore also be possible to apply for support for lowlands projects that help restore natural hydrological conditions around Danish farmlands. Under the four actions of the intervention (phosphorus wetlands, nitrogen wetlands, lowland projects and physical watercourse actions), both feasibility studies and establishment of projects are supported. Support can be given to municipalities and/or the Nature Agency.
Focus Area: Social and organizational Structures	
Support for the new generation of farmers to establish ▪ The Government will allocate DKK 129 million annually to an establishment scheme for young farmers in connection with the CAP. From 2023, newly established farmers of up to 40 years of age will have the possibility to receive a lump sum of up to DKK 745,000 via EU agricultural subsidies. ▪ In addition, the government will further develop Dansk Landbrugskapital (Danish Farming Capital investment fund) to create a new financing solution for agriculture that supports generational change and green transition. ▪ The government will establish a partnership on structural and financial conditions of agriculture, among other things, a new land tenure model will be considered with the aim to make generational change in agriculture more flexible.	R.10 CU PR - Improved organization of the supply chain Increase share of farms participating in producer groups, producer organisations, local markets, short supply chains and quality schemes supported by the CAP Strategic Plan by 0.86 per cent

2.1.3 France

Key figures

Table 2.1.3.a: France's national GHG emissions and reduction targets

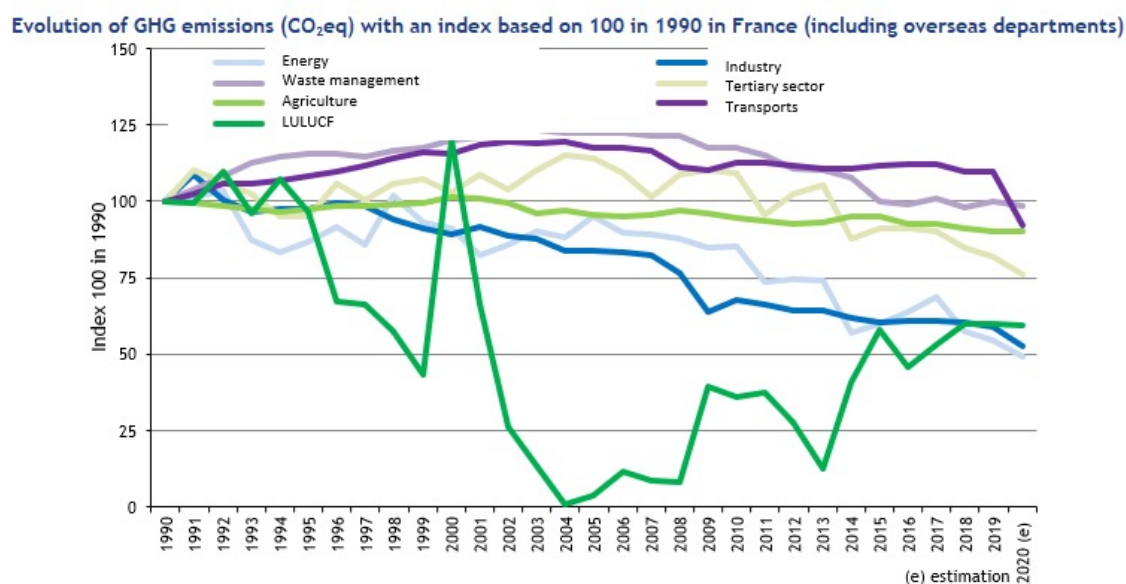
GHG emissions (MtCO ₂ e)	GHG emission reduction targets (compared to 2015 levels)		
	2019	By 2030	By 2050
Total	436	300	80
Agriculture (Mt CO ₂ e)	85	72	ND
N ₂ O (Mt CO ₂ e)	35	31	ND
CH ₄ (Mt CO ₂ e)	38	32	ND
CO ₂ (Mt)	11	ND	ND

Source: France's 'National Low Carbon Strategy'

Table 2.1.3.b: France's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (19.1 per cent of Total Emissions) - 2019		GHG Emissions / Removal of LULUCF - 2019	
Source of emissions	MtCO ₂ eq	Source / Sink	MtCO ₂ eq
Breeding (i.e enteric fermentation)	39.8 Including CH ₄ : 37.3 N ₂ O: 2.4	Forest Land	-51.1
Agricultural soils (i.e. manure spreading, urea and fertilisers, pesticides, liming).	33.4 Including CH ₄ : 0.07 N ₂ O: 31.3 NH ₃ : 0.55	Cropland	16.2
Machinery, engines and boilers in agriculture/forestry	9.9 Total (Agriculture) 83.1	Grassland	-7.5
		Wetland	0.5
		Harvested Wood Products	-0.8
		Settlements	11.7
		Other	0.3
Total (Agriculture)	83.1	Total (LULUCF)	-30.7

Source: CITEPA (2021).

Figure 2.1.3.a: Evolution of GHG emissions (CO₂eq) between 1990 and 2020 in France

Source: CITEPA

Table 2.1.3.c: Evolution of the number of cattle in France between 2000 and 2020

	2000	2010	2020
Total cattle	20,259,000	19,555,000	17,816,000
Dairy cattle	4,193,000	3,716,000	3,406,000
Suckler cows	4,314,000	4,221,000	3,974,000

Source: Agreste

Measures and actions

In consistency with the National Low Carbon Strategy, the French Ministry for Agriculture and Food developed its own Climate Action Plan for the agriculture sector¹⁹ which was published in summer 2021.

The Plan is structured around six main flagship areas:

1. Accelerate the development of agricultural practices that contribute to mitigate GHG emissions
2. Developing carbon sequestration's potential in soils and from forestry (biomass)
3. Support demand and food consumption behaviours which have lower environmental impact
4. Accompany adaptation of agricultural and forestry sectors against climate change impact
5. Promote alternative production practices thanks to innovation, research and development
6. Developing eco-friendly practices within administration

19 <https://agriculture.gouv.fr/plan-daction-climat-du-ministere-de-lagriculture-et-de-lalimentation>

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Emissions related to the agricultural sector accounted for **85 MtCO₂ eq in 2019**, i.e. **19 per cent of France's total greenhouse gas emissions**. Its primary emissions are **methane (CH₄: 38MtCO₂ eq.; 45 per cent of total agri GHG emissions)**, primarily related to livestock farming, and **nitrous oxide (N₂O: 36MtCO₂ eq.; 42 per cent of total agri GHG emissions)** relating to nitrogen fertilisation. The agriculture sector also incorporates about **11 Mt of CO₂ eq. related to energy consumption** by agricultural and forestry machinery²⁰.

GHG emissions have fallen by 8 per cent between 1990 and 2019. The decrease for CH₄ emissions is explained by a reduction in the herd (including -1,9 million dairy cows or 36 per cent reduction between 1990 and 2019) associated with a better milk yield. The increase in manure management in the form of slurry has mitigated the impact of the decline in livestock. The decrease in nitrogen inputs between 1990 and 2019 has contributed to the decrease in N₂O emissions. Introduction of milk quotas in 1984 which have triggered a reduction of dairy cows up to 26 per cent between 1983 and 1990 (from 7.5 million cows to 5.3 million dairy cows) and more than 20 per cent reduction between 1990 and 2000 reaching a number of 4.2 million dairy cows during that year.

France's **land use, land use change and forestry (LULUCF)** has reached a net sink which allows to compensate up to 7 per cent of GHG emissions from other sectors. In 2019, **a balance of -30.7Mt CO₂e was absorbed** mainly due to French forests which occupy nearly 26Mha, of which 9Mha are overseas (8Mha in French Guiana) and 17Mha in Metropolitan France. Carbon sinks have steeply increased during the period 1990-2005 before starting to decrease in recent years, going from circa -45Mt CO₂ eq in the mid-2000s to around -35Mt CO₂ eq in 2015. This evolution can be explained by an increase in tree mortality due to a combination of effects including repeated draughts since 2015, health crises and an increase in harvesting.

The **National Low Carbon Strategy**²¹ (*'Stratégie nationale bas carbone'*) is the overarching roadmap for France to achieve climate neutrality by 2050 and steer a climate change mitigation policy. A first version was developed in 2015 and is being updated every five years. The document lays out sectorial orientations to accelerate a transition towards a low carbon, circular and sustainable economy. The strategy aims for a **18 per cent emissions reduction target in the agriculture sector by 2030** compared to 2015 levels and a **46 per cent reduction by 2050**, excluding agricultural land whose emissions and absorptions are accounted for in the land sector (LULUCF).

The Strategy sets out greenhouse gas emissions caps that must not be exceeded at national level over a five-year period known as 'carbon budgets'. They define a targeted trajectory for greenhouse gas emissions reduction in line with the baseline scenario and with European and international commitments.

20 Source: French General Commission for Sustainable Development < [Les émissions de gaz à effet de serre de l'agriculture Les émissions de gaz à effet de serre et l'empreinte carbone - ressources - notre-environnement.gouv.fr](https://www.ecologie.gouv.fr/sites/default/files/en_SNBC-2_complete.pdf)>

21 English version: https://www.ecologie.gouv.fr/sites/default/files/en_SNBC-2_complete.pdf

Table 2.1.3.d: National carbon budgets for agriculture and forestry

(MtCO ₂ Eq)	GHG emissions (reference year)			Average annual emissions for the period		
	1990	2005	2015	2019-2023	2024-2028	2029-2033
Agriculture and forestry (excluding LULUCF)	94	90	89	82	77	72
Including N ₂ O	40	38	37	35	33	31
Including CH ₄	43	40	40	37	34	32
LULUCF	-26	-48	-41	-39	-38	-42

Source: Ministry for Agriculture and Food, 2021

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

The French National Low Carbon Strategy for the sector is based first and foremost on continuing and **intensifying actions related to the agro-ecological transitional plan** and **precision agriculture** with the aims to bolster systems that directly or indirectly emit fewer greenhouse gases (i.e. organic farming, High Environmental Value farming, optimisation of grassland area management, nitrogen optimisation, innovation, improving protein autonomy on livestock farms, closing off carbon and mineral cycles, legume crops) **and encouraging carbon storage in soils** by increasing the amount of organic matter in soils, respecting the environment and the wellbeing of animals.

France's long-term objective is to increase the importance of the sink associated with wood products and to rely less heavily on the forest sink but in a safer way, as forests are better managed and less vulnerable to climate change. This involves dynamic and sustainable management of private forests in particular via increased demand (specifically of hardwood) and via an incentive-based framework. These policies fall under the National Forestry and Wood Programme²².

In consistency with the National Low Carbon Strategy, the French Ministry for Agriculture and Food developed its own **Climate Action Plan for the agriculture sector** which was published in summer 2021.

The Plan is structured around six main flagship areas:

1. Accelerate the development of agricultural practices that contribute to mitigate GHG emissions
2. Developing carbon sequestration's potential in soils and from forestry (biomass)
3. Support demand and food consumption behaviours which have lower environmental impact
4. Accompany adaptation of agricultural and forestry sectors against climate change impact
5. Promote alternative production practices thanks to innovation, research and development
6. Developing eco-friendly practices within administration

22 <https://agriculture.gouv.fr/le-programme-national-de-la-foret-et-du-bois-2016-2026>

The **CAP French Strategic Plan**²³ seeks to improve the competitiveness of its agri-food sector in a sustainable way, increase resilience of farms and reduce inputs which will contribute to food security. The Strategic Plan is meant to contribute to the objectives of the European Green Deal and carbon neutrality goals. To meet those objectives, France identified the following seven needs to contribute to climate change mitigation and adaptation (SO₄ of the CAP):

- ➔ Create general conditions allowing the transition of farms;
- ➔ Support all levers of the environmental transition including agro-ecology practices, encouraging more autonomous and more resilient systems;
- ➔ GHG emissions reduction from the agricultural sector, both for crop farms and for livestock farms;
- ➔ Energy consumption reduction for agriculture and forestry;
- ➔ Promote carbon storage in biomass, forest and soils;
- ➔ Increase the share of renewable energy sources and the use of bio-based materials from agricultural and forestry origin;
- ➔ Prevention and protection against risks.

Despite some improvements relating to support to organic farming or new promising schemes under Pillar II, a recent assessment (IEEP, 2022) pointed out insufficiencies in the French CAP Strategic Plan to trigger necessary change to allow a radical transformation in the French farming system. Measures including coupled support for livestock or irrigation investments do not necessarily go in the right direction with regards to France's environmental and climate objectives.

23 <https://agriculture.gouv.fr/pac-2023-2027-proposition-de-psn-de-la-france-transmise-la-commission-europeenne>

The measures related to these needs and areas of action are described in the following table.

Table 2.1.3.e: Description of Measures under France's Climate Action Programme and CAP Strategic Plan 2021-2027

Measures in the National Low Carbon Strategy	Measures in CAP Strategic Plan 2021-2027
Focus area: Livestock	
Guideline A₁: reducing direct and indirect N₂O and CH₄ emissions using agro-ecology and precision farming CH₄ Improving livestock effluent management for indoor livestock farming (covering slurry pits, biogas flares, adopting anaerobic digestion) Optimising herd management so as to reduce unproductive periods or improve marketed products (managing health, reducing birth mortality rates, optimising age at first calving, developing fattening systems, etc.) Limiting enteric fermentation through adjustments to animal feed (e.g. use of flaxseed) or genetic selection. The strategy does not call for a decline in livestock numbers which would impact the availability of organic fertilizers of animal origin, particularly essential when developing organic farming.	GHG emissions reduction from livestock farms The consultation process with stakeholders showed that there was a consensus on the objective of maintaining livestock farming, provided that the system will be more resilient in the future (ie. by encouraging the use of grazing and the protein autonomy of farms, to adapt the animal products to demand). The maintenance of breeding is considered essential to ensure, in addition to the maintenance of permanent grasslands, the optimization of the nitrogen cycle by the recovery of livestock effluents as a substitute for nitrogen mineral, so as to limit greenhouse gas emissions and ensure good management of flora diversity in pastoral areas. To reduce enteric emissions, France will support research and innovative solutions as well as the transfer of knowledge. Increasing the resilience and food self-sufficiency of farms will be encouraged, including the development of legumes produced on the farm in synergy with crop farms (particularly via contracts between farms), through support for mixed farming and grazing in permanent grassland, including rangelands. Intervention 70.09 Agri-environment-climate measure for the climate, animal welfare and food self-sufficiency on farms This intervention aims to strengthen the link between the animals and crops in the farm and improving the closure of nutrient cycles. It plans to introduce grass surfaces in rotation, to reduce the consumption of concentrated feed, to improve the fertilization and reduce the use of phytosanitary products. These different actions contribute to the fight against climate change and will aim to improve the well-being of farm animals by limiting the load, i.e. the number of animals reported on the surface of operations, by promoting outdoor access for animals to grassland. The incentive to extensification will also be sought through the development of coupled aid for cattle (intervention 32.04) and the conditions for implementing the compensatory allowance for natural handicaps (ICHN).

Measures in the National Low Carbon Strategy	Measures in CAP Strategic Plan 2021-2027
Focus area: Reduction in crop and soil N₂O	
Guideline A₁: reducing direct and indirect N₂O and CH₄ emissions using agro-ecology and precision farming N₂O Optimising the nitrogen cycle so as to minimize nitrogen surpluses: significant development of single or mixed legumes; for the circular economy, optimising the use of livestock manure and other organic fertilizers in order to reduce the use of mineral fertilizers, and using lower emissions mineral fertilizers; decision support tools for the entirety of the cycle in order to provide inputs suited to crop needs; varieties selected for their low input requirements; improving soil conditions in order to reduce N₂O emissions (e.g. pH); Reducing excess protein intake in animal diets. Improve self-sufficiency in plant proteins (with an effect on the fight against imported deforestation) and promote greater use of legumes, fodder and seeds, in animal feed as well as in human food, in particular in connection with the protein strategy. The climate strategy also considers to promote mixed farming (polyculture-livestock) complementarity at a regional level.	Reduction of fertilizers and phytopharmaceuticals, through precision agriculture to adapt the inputs to the crops or through systemic approaches such as agro-ecology or organic farming. Agroecological practices include: hedge planting, diversification of cultivation, preservation of permanent grassland, encouraging more autonomous and resilient systems, but also extensive livestock farming, encourage organic farming or High Environmental Value (HEV) certification. Intervention 70.08 will support the sustainable change of practices for the production of crops in terms of the management and preservation of agricultural soils. The aim is to encourage farmers to implement agricultural practices that limit erosion, keeping the organic matter and biological activity and avoiding soil compaction. This includes direct seedling, the increase in the share of non-productive surfaces in the rotation and the coverage of soils. Objective to double the cultivated area for organic agriculture by 2027: the plan sets the objective to reach up to 18 per cent of the total cultivated area. - France will increase its budget dedicated to conversion of farms to organic farming of 35 per cent compared to 2020 to meet the plan's objective. Farms are eligible to conversion aids during a period of 5 years. - Support (eco-schemes) to organic farming (interventions from 70.01 to 70.05).
	Developing production of legumes, including fodder legumes (e.g lucerne) and grain legumes - Doubling the areas of legumes in France, i.e. the achievement of 2 million hectares of UAA, can make it possible to reduce consumption of mineral nitrogen by 7 per cent. - Support to production of legumes will be strengthened (interventions 32.06, 32.07, 32.08 Aid coupled with grain legumes and fodder legumes, dehydrated or intended for seed production). The eco-scheme (31.01) will reward practices favorable to the diversification of crops, favoring legumes and grasslands which will allow less use of the original nitrogen fertilization mineral, a source of greenhouse gas emissions, the grassing of the inter-rows of orchards and vineyards which allows to reduce the consumption of pesticides and to cover the soil, and to no-till permanent grasslands to maximize carbon storage in agricultural soils. Reduction of GHG emissions estimated between 0.70 and 0.80 Mt CO₂eq by the reduction in nitrogen fertilizer applications, and up to 0.80 Mt CO₂eq of avoided emissions related to the non-production of induced fertilizers.

Measures in the National Low Carbon Strategy	Measures in CAP Strategic Plan 2021-2027
Focus area: Carbon storage/ sequestration	
Measures include: - Preserving permanent pastures - Widely developing agroforestry, which will generate an additional income source for the sector, as well as an additional source of biomass - increasing the input of crop residues and high quality organic matter into soils - Developing agro-ecological crop practices that are favourable to carbon sequestration, in particular by combining a reduced amount of tillage, permanent cover and longer crop rotations, as well as developing grass buffer strips - Preserving agricultural wetlands	Support to preservation and sustainable management of grasslands, permanent trees, hedgerows, wetlands and pastoral areas, the diversification and lengthening of arable crop rotations, extension of soil cover and the limitation of tillage, the insertion of temporary meadows, the planting of hedges in systems field crops, the development of intra-plot agroforestry. Supporting instruments: - The eco-scheme 31.01 will contribute to improving carbon storage by promoting the maintenance of permanent grass-land without tillage as well as diversification of crops, developing agroecological infrastructures and fallow land, and in particular hedgerows managed in a sustainable way (intervention 73.02). agri-environmental measures dedicated to certain environments such as wetlands, pastoral land and grassland systems with the aim to protect the soil and the climate. increased support for conversion to organic farming, or even the overhaul of coupled aid for cattle, all supplemented by investment aid for farms (modernization, agroforestry, etc.) and consulting. - The soil quality will also be preserved by remunerating land cover between rows in vineyards and orchards. - The eco-scheme will also encourage the maintenance and development of mixed cropping-breeding systems favoring organic fertilization and closing the nitrogen cycles.
Guideline F 1: ensuring the long-term preservation and strengthening of forestry sector carbon sinks and stocks and their resistance to climatic stress - Improving the "carbon pump" and reducing the risk of damage from natural hazards (storms, fires, droughts, phytosanitary attacks etc.), via improved forestry management with a particular focus on adapting forests to deal with climate change. Forestry management must also aim to preserve forest soil carbon stocks. Research and development work in this area is necessary. - Developing afforestation while considering the ecological implications of newly forested land (biodiversity preservation, landscape concerns etc.). - Preserving forested areas by reducing clearing. - Improving the observation and statistical monitoring of forest soil carbon content Guideline F 2: maximising the effects of substitution and carbon storage in wood products by altering supply and demand - Harvesting more wood (increase in marketed wood by 12 Mm³ per year by 2026, and a further increase thereafter, with + 0.8 Mm³ per year from 2036 onwards), in particular through measures to encourage forest management and the mobilisation of wood, while ensuring the preservation of biodiversity (for the record, the baseline scenario sets out a threefold increase in the production of wood products for material use between 2015 and 2050). - Prioritising uses of wood that have a longer life span and high substitution potential (expanded use of wood in construction). Developing the eco-design of wooden buildings. - Bolstering the carbon efficiency of the use of wood resources (improving energy efficiency for wood energy and improving the carbon footprint of wood products). - Developing the reuse, recycling and waste-to-energy use of end-of-life wood products.	Interventions to restore, protect and increase the carbon storage capacity of forests according to the needs of the territories will also be implemented (interventions 73.06-73.08). - The sustainable management of forests and their adaptation to climate change will be incentivized as well as the increase in the harvest of wood and its use in long life products, as part of the development of a carbon-free economy. - The regional authorities will support investments in the forestry sector, with the aim of preserving and restoring forests, particularly in Natura 2000 sites, through prevention of forest risks (in particular against fires), multifunctional forest services, mobilization of wood and development of the forest. - Intervention n. 73.04 will support restoration and preservation of forests (i.e. afforestation) to address natural hazards such as diseases or wildfires and storms.

Measures in the National Low Carbon Strategy	Measures in CAP Strategic Plan 2021-2027
Focus area: Energy mitigation	
Guideline A₂: Reducing CO₂ from the use of fossil fuels and developing the use of renewable energy The Strategy aims to increase energy efficiency for the agricultural sector by deploying renewable sources of energy and increasing electrification, i.e. use of heat pumps and electric tractors.	France has a significant potential for the production of bioenergy from biomass, which already today represent 60 per cent of renewable energy sources and have been supported in several regional biomass strategies. To reduce energy consumption, the Agricultural Investments intervention (73.01) will improve the energy performance of buildings and agricultural equipment (including insulation of greenhouses, livestock buildings, solar water heaters, etc.) and increase the share of alternative and renewable energy sources (solar drying of fodder, use of biogas, electrical equipment or bioNGV). This intervention, rolled out in the territories by the regional authorities will make it possible to support farms towards cost-saving initiatives of energy and innovation.
Guideline A₃: Developing low carbon energy production and the bioeconomy in order to contribute to the overall reduction of CO₂ emissions in France and bolstering the added value of the agricultural sector The baseline scenario sets out that 2/3 of the total biomass mobilised by 2050 for energy production will come directly or indirectly from the agricultural sector. Developing anaerobic digestion for livestock effluents or low worth crop production (intermediate biofuel-producing crops, crop residues, even surplus grass etc.); Developing wind power on farms and solar power on farm buildings; Making use of wood energy from agroforestry; Diversify liquid biofuel production so as to ensure advanced biofuel development; Developing other facets of the bioeconomy, such as the production of bio-based materials or chemicals for their ability to replace materials of non-renewable origin;	
Focus area: Wider food system	
The strategy also focuses on different aspects of the agri-food value chain including: - losses and waste and the methods of agricultural and food consumption, influenced by nutritional recommendations and the possibility of products moving upmarket. - products' carbon footprint: some emissions related to agricultural production may take place outside of the French territory (or take place on the French territory, but are products destined for export). - research and innovation - urban planning and development, particularly the fight against land take, in connection with carbon storage, the circular economy and production; - citizens' education, awareness and assimilation of issues and solutions, as farming systems are highly dependent on their eating habits; - employment, skills, qualifications, and occupational training all constitute major levers for engagement in the transition at individual and regional level, as well as being an important means for removing non-economic obstructions.	

Measures in the National Low Carbon Strategy	Measures in CAP Strategic Plan 2021-2027
Focus area: Protection against weather extremes	
	Increasing resilience and adaptation to climate change Measures related to productive investments on farm (intervention 73.01) will evolve to finance more autonomous systems, resilient to climate change, sustainable practices adapted to the specific conditions of the territories. i.e optimizing the potential of local resources in terms of vegetable proteins (seeds, stems and leaves). protection of orchards, the modernization of greenhouses or the development of irrigation on non-irrigated land subject to increasingly long periods of drought and the optimization from current irrigation to water-efficient systems. intervention 73.06 will support investments and infrastructures allowing to increase risk prevention, develop forests; Intervention 73.07 Aid for irrigation infrastructures. Risk management interventions (76.01 and 76.02) will continue to be mobilized to address climate and health risks. This relates to partially support multi-risk climate insurance schemes and the co-financing of the interventions of the Health and Environmental Mutual Fund.

2.1.4 Germany

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.1.4.a: Germany's national GHG emissions and reduction targets

	GHG emissions (MtCO ₂ e)		GHG emission reduction targets (compared to 1990 levels)	
	2020		By 2030	By 2050*
Total	762		-65 per cent	Net 0
Agriculture	62		58 MtCO ₂ eq.	ND
N ₂ O (Mt CO ₂ eq.)	21.6		ND	ND
CH ₄ (Mt CO ₂ eq.)	30.2		ND	ND
CO ₂ (Mt)	4.3		ND	ND

Source: Thünen Institute

*Germany has committed to reach climate neutrality by 2045.

Figure 2.1.4.a: Germany's national GHG emission trends (1990-2045)

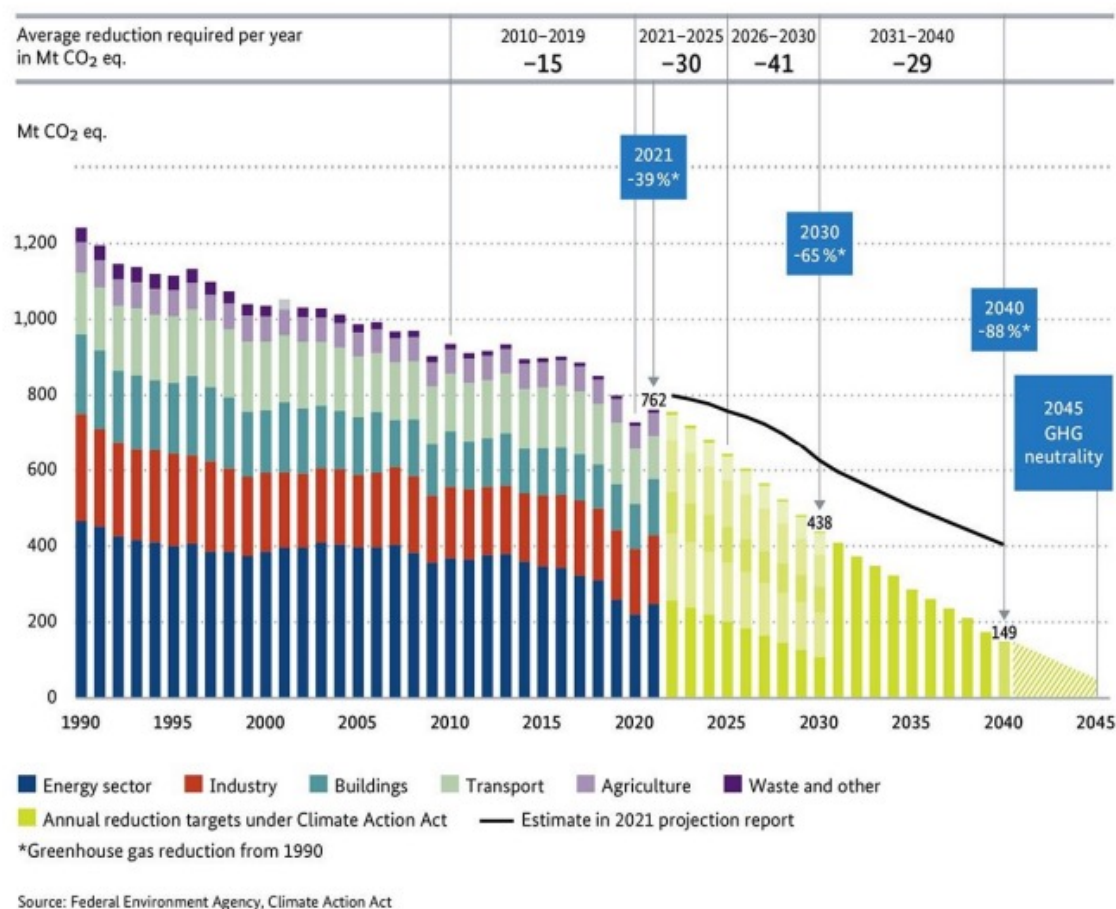


Table 2.1.4.b: Germany's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (8 % of Total Emissions) - 2019		GHG Emissions / Removal of LULUCF - 2019	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	24	Forest Land	- 57
Manure Management	8.5	Cropland	17
Agricultural Soils	25	Grassland	18
Liming	2	Wetland	5
Urea application & other fertilisers	1	Harvested Wood Products	5
Other	1.5	Settlements	- 5
Total (Agriculture)	62	Total (LULUCF)	- 17

Source: Germany's National Inventory Report 2021 submitted to UNFCCC

Table 2.1.4.c: Evolution of the number of cattle in Germany between 2000 and 2020 (in million units)

	2000	2010	2020
Total cattle	14.6	12.8	11.6
Dairy cows	4.6	4.2	4
Beef cows	10	8.6	7.6

Source: Germany's National Inventory Report 2021 submitted to UNFCCC

Measures and actions

- ➔ Expansion of organic farming: the Federal Government has set itself the target of expanding the proportion of agricultural land used for organic farming to 30% by 2030.
- ➔ Restructure agriculture in a climate-friendly manner including more efficient fertilisation using nitrogen, and climate-friendly animal husbandry including reduced livestock holdings.
- ➔ The German Sustainability Strategy of 2021 sets out an agreement to limit the nitrogen surplus to 70 kg/hectare of agricultural land in the five-year average from 2028-2032.
- ➔ Energy efficiency in agriculture is to be improved, e.g. via the federal programme to enhance energy efficiency and reduce carbon emissions in agriculture and horticulture.
- ➔ Forests and peatlands are to be strengthened and expanded as natural carbon sinks.
- ➔ Permanent grassland is to be preserved as a further natural carbon sink.
- ➔ Carbonisation of arable land is also to be promoted via the preservation and increase of humus.
- ➔ Strengthen green infrastructure in settlement areas.

Germany adopted its Climate Action Plan 2050²⁴ in 2016. It is being updated every five years, coinciding with the timetable for revising the NDCs under the Paris Agreement, and is underpinned with programmes of measures (Climate Action Programme 2030²⁵) and, since 2019, in the legally binding Climate Change Act (Klimaschutzgesetz²⁶). As outlined in the Climate Change Act (updated in 2021), **Germany has committed to a reduction of at least 65 percent of greenhouse gases by 2030 and of at least 88 percent by 2040, and to net greenhouse gas neutrality by 2045.**

Currently, agriculture generates around eight percent (2019) of Germany's greenhouse gas emissions, primarily through animal husbandry and the use of fertilisers. While 1990 emissions were recorded at 77 million tonnes of CO₂ equivalents, they have been around 62 million tonnes in 2020. So far, this decline was mainly due to the reduction in animal stocks in eastern Germany following reunification. Since 1995 emissions from the agriculture sector have remained almost unchanged. For the

24 https://www.bmu.de/en/publication?tx_bmuPublications_publications%5Bpublication%5D=396&cHash=21a-83ca91c7188605d8d0ff273fb5e95

25 <https://www.bundesregierung.de/breg-en/issues/climate-action>

26 https://www.gesetze-im-internet.de/englisch_ksg/englisch_ksg.html#p0132

coming decade, the Climate Protection Act prescribes reducing annual emissions in the agricultural sector to 56 million tonnes of CO₂ equivalents by 2030. This corresponds to a reduction of 10 percent from today.

Germany's land use, land-use change, and forestry sector (LULUCF) has so far been a net sink, mainly due to the sink function of forests that cover approximately 11.4 million hectares in Germany equating to one third of Germany's national territory. In 2019, a balance of around 17 MtCO₂e was absorbed. However, due to the shift in the age structure of the forest stands and an increasingly felt impact of climate change on forests, and **the sector is in danger of becoming a source of greenhouse gases in the near future without any additional measures** (see e.g., EEA 2021²⁷). **Maintaining the LULUCF sector as a sink is a declared goal of the Germany's climate actions.**

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

The German Climate Action Programme 2030 focuses on the following ten areas of action by which farming and land use are to become more climate-friendly:

1. Reduction of excess nitrogen and improvement of nitrogen efficiency
2. Increase of the fermentation of manure of animal origin and agricultural residues
3. Expansion of organic farming
4. Reduction of greenhouse gas emissions in animal husbandry
5. Energy efficiency in agriculture
6. Humus conservation and formation in arable land
7. Conservation of permanent grassland
8. Protection of peat soils including reduction of peat use in composts
9. Conservation and sustainable management of forests and use of wood
10. Increase in sustainable diets including avoiding food waste.

In its recent CAP Strategic Plan, Germany identified the following eight needs for how best to contribute to climate change mitigation and adaptation (SO₄ of the CAP):

- ➔ Reduction of GHG emissions in agriculture
- ➔ Securing and enhancing carbon storage and sequestration
- ➔ Adaptation of agriculture and forestry to climate change
- ➔ Flood protection, coastal protection, and improvement of natural water retention
- ➔ Increasing the share of renewable energy sources

27 <https://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emissions-from-land/assessment>

- ➔ Increasing the energy efficiency of farming, buildings, facilities and technologies
- ➔ Sustainable material use of renewable raw materials and agricultural residues
- ➔ Preservation and restoration of stable, site-adapted forests.

The measures related to these needs and areas of action are described in the table below (Table 2.1.4.f).

The “reduction of excess nitrogen including reduction of ammonia emissions and targeted reduction of nitrous oxide emissions and [the] improvement of nitrogen efficiency” are amongst the most important measures to meeting climate targets in the agricultural sector. The second most important measures concern livestock, addressing both the energetic use of manure of animal origin and agricultural residues in biogas plants, as well as the reduction of number of animals being raised does not exceed a maximum of two livestock units per hectare.

Measures described in the CAP Strategic Plan focus predominantly on the storage and sequestration of carbon on farmland. Measures in the forest sector are largely funded outside the CAP. Experience from previous funding periods has shown that the bureaucratic effort and the high risk of charging have made the funding of forest-related measures in the CAP unattractive.

According to the Climate Action Tracker²⁸, the current plans of Germany to reduce carbon emissions in the agricultural sector do not yet include enough new and concrete policy measures to expect a clear improvement compared to current emissions projections, estimating that emissions in the agriculture sector will reach a level of 57 – 63 MtCO₂e in 2030, leaving a gap of 1 – 7 MtCO₂e/year to the sectoral target.

Regarding the forestry sector, the Climate Action Tracker foresees that, even with the measures introduced at this point, the sector would turn into a net emissions source and emit 22 MtCO₂e/year by 2030, clearly missing the target of being an emission sink of 25 MtCO₂e by 2030 set in the updated climate law.

28 <https://climateactiontracker.org/countries/germany/policies-action/>

Table 2.1.4.d: Greenhouse gas emissions from agriculture in the Climate Protection Programme 2030 scenario (CSPR (Jan 2020))

Category	2020	2025	2030
	Mt CO ₂ e		
Fuel combustion	6,4	6,2	5,8
Fermentation in digestion	24,8	24,7	24,6
Manure Management	10,0	8,6	7,5
Agricultural soils	24,4	23,7	22,7
Liming	1,7	1,7	1,7
Urea application	0,7	0,6	0,5
Other carbonaceous fertilisers	0,2	0,2	0,2
Other	1,5	1,4	1,4
Total	69,6	67,1	64,1
Sector target Federal Climate Protection Act	70,0	64,0	58,0
Deviation from sector target*	-0,4	3,1	6,1

*Negative value: sector target is exceeded, positive value: sector target is missed.

Source: Abschätzung der Treibhausgasminderungswirkung des Klimaschutzprogramms 2030 der Bundesregierung, Umwelt-Bundesamt, 2020

Table 2.1.4.e: Reduction contribution of the agriculture-related measures in Climate Protection Programme 2030 + already existing measures

Measures	Total reduction effect compared to 2016 (Mt CO ₂ e)
Reduction of nitrogen surpluses	3,8
Expansion of organic farming*	1,3
Increase in manure fermentation	2,4
Emission reduction Animals	0,3
Increase energy efficiency	0,8
Peatland soil protection	0,3
Total	8,9

* this still relates to the 20 per cent target and not the new 30 per cent target

Source: Abschätzung der Treibhausgasminderungswirkung des Klimaschutzprogramms 2030 der Bundesregierung, Umwelt-Bundesamt, 2020

Table 2.1.4.f: Description of Measures under Germany's Climate Action Programme and CAP Strategic Plan 2021-2027

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Livestock	
Increase of the fermentation of manure of animal origin and agricultural residues - Promotion of manure fermentation in biogas plants including a new funding system for new plants, testing and removal of obstacles to the fermentation of manure, creation of options for connection use by developing new funding and implementation models - Creation of gas-tight digestate storage facilities including support for the conversion of existing systems.	
Reduction of greenhouse gas emissions in animal husbandry - Ensuring that the number of animals being raised does not exceed a maximum of two livestock units per hectare - Realize further savings potential in animal husbandry and animal nutrition [government has developed overall strategy to reduce emissions from livestock farming in 2021 – follow up.]	EL-0101 Management obligations to improve climate protection (Art. 70) Extensive grassland management, including extensive management of (permanent) grassland with specifications for RGV stocking /ha HFF (demarcation from organic regulation); extensive management of (permanent) grassland by avoiding/limiting nitrogen fertilization
Focus Area: Reduction in crop and soil N2O	
Reduction of excess nitrogen and improvement of nitrogen efficiency - Reduction of nitrous oxide emissions by full implementation and consistent enforcement of the legislation on fertiliser, thereby ensuring that the German Sustainable Development Strategy's target of 70 kg N/ha between 2028 and 2032 is achieved - Reduction of ammonia emissions by rapid and comprehensive implementation of all reduction options of the measures of the national air pollution control program to fulfil the NEC guideline - Reduction of nitrogen emissions from agricultural soils, for example, through advice and incentives to reduce nitrous oxide emissions by optimizing the timing of fertilization and management of crop residues (humus build-up), and use of low-emission fertilization technologies	
Expansion of organic farming Increase of organically farmed agricultural land from 9.7 percent at present to 30 percent by 2030. Specific measures to reach this aim include (i) the expansion of support for organic farming, (ii) securing the necessary funding for the conversion in the state budgets and at federal level, (iii) implementation of the future strategy for organic farming to set additional growth impulses along the entire value chain (indirect funding), and (iv) continuation and further development of research funding for organic farming.	

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Carbon storage/ sequestration	
Humus conservation and formation in arable land - Promotion of crop rotation specifications for humus increase and for humus-preserving management in farms that have already practiced sustainable humus cultivation and have achieved a high humus content on their land and at least maintained it - Expansion of funding for planting strips of trees, hedgerows, hedges, bends and avenues/alleys, e.g., with fruit trees, especially on field edges, as well as agroforestry systems, - Voluntary certification within the framework of company audits of humus-enhancing management measures - Development of advisory tools for agricultural practice to precisely determine the soil carbon content	GAEC 3: Ban on burning arable stubble, except for plant health reasons Stubble fields must not be burned. The ban on burning stubble fields protects the organic matter in the soil.
Conservation of permanent grassland The preservation of permanent grassland is predominantly funded under CAP (see GAEC 1). Further included - Continuation and improvement of individual area-related and company-specific funding measures within the framework of the 2nd pillar of the CAP, with which, e.g., a lower N fertilization, less tillage as well as a turf renewal without breaking up are covered, - Continuation of the agri-environmental measures to promote extensive and nature conservation-oriented forms of grassland use and the compensatory allowance for disadvantaged areas within the framework of the 2nd pillar of the CAP make the maintenance of permanent grassland more economically attractive and thus support the maintenance requirements. <i>[Ministry of Food and Agriculture has developed a grassland strategy, with the aim is to describe the importance of grassland, identify conflicts of interest and name concrete fields of action at the federal level to secure and strengthen permanent use of grassland – follow up]</i>	GAEC 1: Maintenance of permanent grassland based on a ratio of permanent grassland in relation to agricultural area Beneficiaries may only convert permanent grassland with permission. Permission is usually only granted if a new permanent grassland area is created to replace the converted area. This should offer an incentive to avoid climate-damaging precautionary changes due to the 5-year rule and to create additional permanent grassland. The approval procedure for the conversion of permanent grassland and the obligation to create replacement areas for permanent grassland that existed before 01.01.2015 ensures that the proportion of permanent grassland in the total agricultural area does not decrease significantly.
Protection of peat soils including reduction of peat use in composts By 2030, annual greenhouse gas emissions from peatlands are to be reduced by five million tonnes of CO ₂ equivalents. Most recently, around 53 million tons of CO ₂ emissions came from drained moorland, which corresponds to 6.7 percent of all German greenhouse gas emissions. For the federal level, the Federal Environment Ministry published the National Peatland Conservation Strategy in 2021 and is making around 50 million euros available over the next ten years for pilot projects to protect peat soil to test and further develop management methods, in particular various forms of paludicultures.	EL-0101 Management obligations to improve climate protection (Art. 70) Conversion of arable land to permanent grassland/grassland, including temporary conversion of arable land into grassland, if necessary, with the definition of target settings (e.g. moors, along water bodies and other sensitive areas); permanent conversion of arable land into permanent grassland, if necessary, with the definition of target settings (e.g. moors, along water bodies and other sensitive areas)
	GAEC 2: Protection of wetland and peatland Wetlands and bogs are to be designated as site settings in accordance with the requirements set out in the national regulation implementing conditionality. Permanent grassland in wetlands and bogs may not be converted or ploughed. Permanent crops in these areas may not be converted to arable land. On agricultural land in the wetlands and moors, no intervention in the soil profile may be carried out with heavy construction machinery. Ground turns deeper than 30 cm (beyond the normal ploughing depth) as well as sand and sand are also prohibited. The cultivation of paludicultures through site-adapted wet use is possible. The management restrictions mentioned are intended to prevent the organic carbon stored in agricultural wetlands and bogs from being released as CO ₂ as a result of far-reaching interventions in the soil.

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Concrete measures for peat soil protection include: (Adjustments to existing legal and subsidy framework conditions with the aim of ensuring the most effective peatland protection possible (including in the CAP) - Creation of new funding instruments, including the necessary funding for programs for the permanent rewetting of moorland - Intensification of research and development measures. To reduce the use of peat the federal peat reduction program foresees, e.g., (i) the creation of a subsidy for default insurance limited to 10 years to cushion the risk of conversion, (ii) the establishment of funding instruments for the cultivation of peat substitutes in addition to the measures mentioned under "Peat soil protection", and (iii) the intensification of research on substitutes.	EL-0101 Management obligations to improve climate protection (Art. 70) - Peat soil protection measures, including rewetting measures (incl. grazing with moss-adapted livestock breeds), and paludicultures (insofar as area funding is granted)
Conservation and sustainable management of forests and use of wood - Increased funding of measures for the development of climate-tolerant mixed forests, including climate-effective contractual nature conservation measures such as measures to improve the carbon storage in the forest or the structural richness of the forest. In consideration of ecological and climate effectiveness concerns, this aims at the reforestation of damaged areas (180,000 hectares, as of September 2019) and an increased adaptation of forests to climate change. - Accompanying measures, e.g., optimized monitoring, optimized wildlife management, increased international cooperation in ensuring sustainable forest management worldwide and strengthening the wood competence center to avoid migratory effects, increased forest construction research. - Increased support for R&D projects, specialist and consumer information, ideas competitions, model/demonstration projects with the aim of climate-friendly and innovative use of wood, especially in the area of building with wood, as well as for the material use of hardwood, the circular economy and cascade use, and the promotion of climate-conscious consumer behaviour.	Eco-scheme: Retention of agroforestry management methods on arable land and permanent grassland (Art. 31) - In the case of agroforestry management on eligible arable land or permanent grassland, the area of woody strips that meet the following requirements is eligible. - The proportion of wooded areas in eligible arable land or permanent grassland is between 2 and 35 percent. - The width of the individual strips of wood is between 3 and 25 meters. - The greatest distance between two strips of wood and between a strip of wood and the edge of the area is 100 meters. EL-0407 Non-productive investments in the forest sector (Art. 73) - Close-to-nature forest management, including conversion of pure stands and stands that are not suitable for the site or are not climate-tolerant into stable deciduous and mixed stands; further development and restoration of near-natural forest communities; creation of a site-appropriate, climate-adapted mixture of tree species and securing of stability and vitality through the care of younger stocks; soil-friendly timber harvest and soil protection liming; and elaboration of forest management plans. - Prevention of forest damage, including establishment and improvement of systems for monitoring the occurrence of forest fires in order to reduce the risk of large forest-destroying fires; forest fire protection measures; preventive measures against calamities in forests as well as preparation and implementation of defense measures in the event of large-scale, forest-destroying insect calamities; compensatory and replacement measures that are related to investment forest protection measures and have been officially determined.

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Energy mitigation	
Energy efficiency in agriculture This measure is to further improve technology used in agriculture and horticulture in terms of its energy requirement, including ▪ Further development of the federal program for energy efficiency in agriculture and horticulture ▪ Promotion of the use of renewable energies	
Focus Area: Wider food system	
Increase in sustainable diets including avoiding food waste ▪ Increase of organic food in German supermarkets to be 30 per cent by 2030 (a strategy for this is in development) ▪ Reduction of food waste in private households and out-of-home catering by 50 percent by 2030 and as much as possible in the other parts of the supply chain (e.g. agricultural production).	
Focus Area: Protection against weather extremes	
	EL-0402 Material infrastructure (flood protection, coastal protection, and regarding inter-company irrigation systems) (Art. 73) ▪ Flood protection, including investments related to the construction and reinforcement of flood defenses; relocation and demolition of dikes, measures to improve water retention in the catchment area and in the valley flood plains; conceptual preparatory work, planning, surveys, purposeful research and individual case studies in connection with intended investment measures ▪ Coastal protection, including conceptual preparatory work and surveys; public investment to increase security on coasts, islands and tidal surface waters against flooding and land loss from storm surge and sea attack; necessary nature conservation and landscape conservation measures as a result of coastal protection measures ▪ Corporate irrigation systems, including investments in connection with inter-company water regulation for purposes of surface water absorption after heavy rain events or spring snowmelt; investments in the provision of additional surface water, both to preserve wetlands, to ensure an adequate supply of extinguishing water in the event of forest fires, and to provide irrigation systems in dry periods; conceptual preparatory work, planning, surveys, purposeful research and individual case studies in connection with intended investment measures
	EL-0101 Management obligations to improve climate protection (Art. 70) - Water retention in the landscape, including water retention in the landscape on permanent grassland without using pesticides and fertilization - Water retention in the landscape on permanent grassland (without extensification); landscape water retention on farmland with no PPPs and fertilization - Cooperative climate protection measures, including cooperative climate protection measures - Implementation of cooperative climate protection measures in a project area including project management

2.1.5 The Netherlands

Key figures

Table 2.1.5.a: The Netherlands' national GHG emissions and reduction targets

GHG emissions (MtCO ₂ e)		GHG emission reduction targets (compared to 1990 levels)	
	2019	By 2030	By 2050
Total (excl. LULUCF)	180.7	-49%	-95%
Agriculture (excl. LULUCF)	17.9	22.2	ND
N ₂ O (Mt CO ₂ eq.)	5.6	ND*	ND
CH ₄ (Mt CO ₂ eq.)	12	ND*	ND
CO ₂ (Mt)	0.1	ND*	ND

Source: *Cbs.nl; Netherlands' Long term strategy on climate mitigation; Netherlands' Climate Act (2019)*

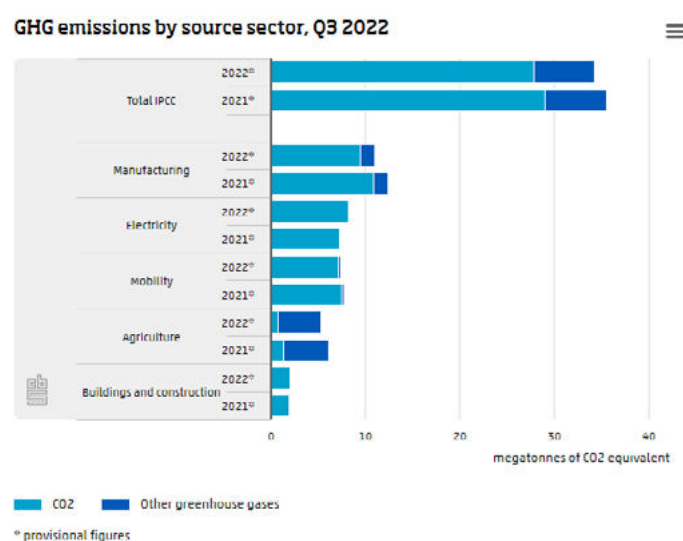
*proposals are being developed by the Dutch government. See section 3.1.1 for more details.

Table 2.1.5.b: The Netherlands' Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (10% of Total Emissions)		GHG Emissions / Removal of LULUCF	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	8.1	Forest Land	-1.8
Manure Management	4.6	Cropland	1.6
Agricultural Soils	4.8	Grassland	2.9
Liming	0.1	Wetland	0
Urea application & other fertilisers	0.1	Harvested Wood Products	0.1
Other	0.2	Settlements & others	1.7
Total (Agriculture)	17.9	Total (LULUCF)	4.5

Source: *The Netherlands' National Inventory Report 2021 submitted to UNFCCC*

Figure 2.1.5.a: GHG emissions by source sector in the Netherlands in Q3 2022 compared to 2021



Source: CBS, Netherlands

Animal farming is an important part of the Dutch agricultural sector. The Netherlands is the world's fifth largest exporter of dairy products and accounts for over 9 percent of annual milk production in Europe. It is also a large meat producer, with significant herds of pigs (8.4 percent of total headcount in Europe), non-dairy bovines (2 percent), and poultry (7.6 percent). There are more than 1,000 poultry farms in the Netherlands, which together produce 10 billion eggs a year (MacLeod et al, 2013).

Table 2.1.5.c Number of cattle in the Netherlands

	2000	2010	2019
Total cattle	4,069,000	3,975,000	3,750,000
Dairy cattle	1,504,000	1,479,000	1,578,000
Non-dairy cattle	2,565,000	2,496,000	2,172,000

Source: The Netherlands' National Inventory Report 2021 submitted to UNFCCC

Measures and actions

- ➔ Optimisation of animal feed and improved manure management;
- ➔ Dissemination of knowledge to promote sustainable soil management;
- ➔ In the greenhouse horticulture sector, efforts will be strengthened to continue on achieving energy savings and generating sustainable energy;
- ➔ Reduction of emissions and carbon storage by means of smart land use;
- ➔ Consumer-targeted information will be developed to incentivize behaviour change to food consumption and food waste.

Climate Targets and Current Emissions Regarding the Land Agri-Food System

In 2019, agriculture contributed 9.7% of the national GHG emissions in comparison with 11.1% in 1990. However, this sector is a major contributor to both national total CH₄ and N₂O emissions. In 2019 agriculture accounts for 69.5% of the total CH₄ emissions and for 71.0% of the total N₂O emissions (NIR, 2021).

To combat climate change, the Dutch government wants to reduce the Netherlands' greenhouse gas emissions by 49 per cent by 2030, compared to 1990 levels, and a 95 per cent reduction by 2050. These goals are laid down in the Climate Act on May 28, 2019. The Climate Plan, the National Energy and Climate Plan (NECP) and the National Climate Agreement²⁹ (2019) contain the policy and measures to achieve these climate goals.

Following the recent increase in EU ambitions, the Netherlands is now considering increasing its reduction percentage from 49 per cent to 55 per cent. In order to realise the reduction targets the Dutch government has adopted a sectoral approach and has specifically chosen to encourage sustainable and strong circular agriculture³⁰ to realise a reduction of 3.5Mt. Dutch agriculture (including horticulture) had in 2019 already reduced its CO₂ emissions by about 17 per cent compared to 1990 and is implementing a number of emission-reducing measures (such as energy generation) that will not be taken into account in the sectoral targets. Additionally, the sector platform for Agriculture and Land Use has stated that it expects to be able to reduce emissions by 6 Mt instead of the 3.5 Mt by 2030 stipulated in the Coalition Agreement. The share of agriculture and greenhouse cultivation in total GHG emissions in the Netherlands is around 12 to 14 per cent. Table 2.1.5.d provides an overview of agri-environmental scope for intended and stricter sustainability boundaries for the Dutch agricultural sector.

Table 2.1.5.d: Agri-environmental scope for intended and stricter sustainability boundaries for the Dutch agricultural sector

Topic	Emissions 2017	Intended policy goals 2050	Stricter policy goals 2050
Climate (CH ₄ and N ₂ O)	19Mton CO ₂ -eq	9Mton CO ₂ -eq	Net zero emissions in NL from agriculture and land use
Climate (Landuse)	6Mton CO ₂ -eq	2Mton CO ₂ -eq	Net zero emissions in NL from agriculture and land use
Ammonia	110 kton NH ₃	85 kton NH ₃	50 kton NH ₃
Nutrients (N, P) leaching and runoff	45kton N 3.7 kton P	N:- 12 per cent P:- 12 per cent	N:- 17 per cent P:- 17 per cent
Nutrient cycles	n/a	Closing feed-manure cycle within Europe	Closing feed-manure cycle within Europe

Source: Lesschen et al. 2020

²⁹ <https://www.klimaataakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands>

³⁰ <https://www.government.nl/ministries/ministry-of-agriculture-nature-and-food-quality/vision-anf>

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

The national policy that focuses on reducing emissions of CO₂ equivalents takes shape along the following four main lines (a) Emission reduction in livestock farming (b) Emission reduction and CO₂ storage through smart land management (c) Making greenhouse cultivation more sustainable (d) Food consumption and food waste.

The Netherlands' LULUCF sector is a source of carbon emissions and has remained stable between 2005 and 2019 with circa 5Mt CO₂eq per year. With the revision of the LULUCF Regulation, the country will have to drastically reverse this trend as the regulation sets a target for the Netherlands of achieving a net 4.5Mt CO₂ equivalents of carbon removals by 2030. To achieve this target, the government has come forward with different measures outlined in the 2019 Climate Agreement, the Sustainability Framework for bio-raw materials, the National Forest Strategy, the National Programme Agricultural Soils and the Peat Meadow Programme.

The new CAP focuses on supporting farmers who actively contribute to the desired transition towards circular agriculture. It is based on the conviction that farmers are part of the solutions for the current problems related to biodiversity, water and climate and that if farmers are rewarded for their efforts and supported in their development and investments, they can provide solutions. The new CAP rewards future-proof farmers and facilitates the transition along 4 pillars: 1) climate smart, resilient agriculture; 2) addressing goals on environment, biodiversity, and climate 3) broad rural development and 4) knowledge, innovation, and networking. This section specifically describes the pillar on addressing the climate goals.

To achieve the goals of the green-blue architecture (including S₀5 and S₀6), an integrated intervention strategy has been developed. Key activities for climate mitigation and adaptation include **raising the water level in peat soils** and **measures to sequester carbon in the soil**, improving the sponge effect of the soil, especially on high sandy soils, and **encouraging less intensive agriculture**. The interventions that contribute to the achievement of the goals are the conditions for the basic payment, the eco-scheme, productive and non-productive investments, and the promotion of knowledge and area-based cooperation.

With regards to raising the water level in the peat meadows, the interventions have not yet been fully worked out. Measures to support this action include facilitating cooperation, compensating farmers for reduced yields and subsidizing necessary investments as a result of this approach. This may be further developed with the use of land-based subsidies, which may not yet be programmed for area-specific disadvantages.

The effort runs along two tracks, with a **national, more generic approach**, through which all farmers in the Netherlands can contribute to the climate objectives. In particular, the GAEC permanent grassland, peat meadow and wetlands and crop rotation are important here.

The second track is the **area-based approach**. Within the Agricultural Nature and Landscape Management, new areas have been designated for climate and water, where activities that promote climate adaptation can be used.

Other measures relevant for the Irish Agri food sector include the following:

- ➔ Stimulating and supporting generational renewal in the Dutch agricultural sector is important, in view of the increasing average age of the farmers. Generational renewal in the Dutch agricultural sector is particularly hampered by the high acquisition price which makes it difficult for young entrepreneurs to take over or start an agricultural business. The Netherlands supports generational change by focusing on setting up support for young farmers. In addition, generational change is stimulated by providing young farmers with a bonus on the basic premium, to provide a supplement for investment support and – via a pilot – to provide support for collaborative projects aimed at generational change.
- ➔ Honey, holding bees is a relatively small more hobby related sector. The following points of attention are relevant to provide the added value of beekeeping, the stimulation of indispensable pollination services. Hence CAP funding is directed towards i) Ensuring bee health ii) Facilitate pollination services and iii) Preserve biodiversity. To be able to realise these objectives, various interventions will be activated, such as the knowledge and information intervention and the cooperation intervention.
- ➔ Energy: in large-scale clustering, attention is asked for nature-inclusive design and management in sustainable energy projects. In this way, disruption or degradation of nature and biodiversity is prevented as much as possible. The generation of renewable energy through solar cells is also favoured in the regional consideration.

Table 2.1.5.e: Description of Measures under the Dutch Climate Action Programme and CAP Strategic Plan 2021-2027

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Livestock	
Develop integrated feed and animal-specific approach to methane and ammonia for the dairy sector to reduce the emissions in conjunction. Develop schemes to stimulate innovations and investments in entirely sustainable and low-emissions animal housing systems that reduce emissions of greenhouse gases, ammonia, offensive odours, and particulates at source. Estimate impact: -1.2-2.7 MtCO₂e by 2030	Animal welfare: The CAP NSP fully integrates animal welfare by ensuring that CAP interventions have not foreseen negative impact on animal welfare and, where possible, contribute to animal welfare. Animal welfare means safeguarding good nutrition, good environment, good health, natural behaviour, positive emotional state, and the intrinsic value and integrity of the animal. Tail docking in piglets and the current lifespan of dairy cows are both signs that improvements are needed in the current method of animal husbandry. These signals do not stand alone and depend on many factors, which makes coming to a solution complex. The NSP supports farmers as much as possible to make the necessary transition possible: it provides scope for investments for animal welfare and animal health improvements in areas such as housing and animal management. This includes investments that can lead to a longer lifespan of dairy cows and reduce the risk of tail biting in pigs, making it possible to gradually stop tail docking of piglets, but also investments for other transitions such as phasing out cage housing of animals mentioned in the "End the Cage Age" initiative.

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Peat meadow areas	
An integrated specific approach to peat meadow areas and areas around Natura 2000 is under development involving - Supporting farmers in relocating or voluntarily closing their business, - Switching to a less intensive form of agriculture (with income compensation) - Technical adjustments, such as drainage techniques; passive and active infiltration, high ditch water levels and high level sensors steered (wet crops; cattail, peat moss, cranberry and miscanthus) soil modifications (peat enrichment with clay) and iv) Many pilot areas where a combination of measures is explored has been established. All measures must be tailored to farmers' prospects, water management options and the type of peat soil. Based on the results of these pilots, a decision can be reached in a few years' time on the most suitable. Estimated impact: -₁ MtCO₂e by 2030	6 provincial peat meadow strategies describe the measures to be implemented in the peat meadow area. These strategies are drawn up under the direction of the provinces in consultation with the land users, social actors and other authorities (water board, municipality). In 2019, demos and pilots started within the four areas that will run till 2023. It examines what the effects of various measures, in order to arrive at an actual mix of measures to achieve the stated objective. Between 2021 and 2030 there will be a definitive approach for approx 90,000 hectares of peat meadows (about one third of the total of peat meadows in The Netherlands). In the package of measures, customization is important on two different tracks. On the one hand, dairy farmers are supported to implement technical adjustments, on the other farmers in peat meadow areas can be supported to relocate or stop their farms. This includes transition to wet crops, raising the summer water level and drainage techniques. Instruments to achieve these measures include mandatory or voluntary plot exchange; tax support and depreciation of land with financial compensation. A system in which farmers are paid for the storage of CO₂ is being developed and will provide a significant contribution to the target to be achieved. The parties jointly monitor progress and effectiveness of the measures. On the basis of this, multi-yearly discussions or interim adjustments to measures or ambitions are necessary.
Focus Area: Soil	
Sustainable Soil Management contributes to a number of social challenges, such as better water quality, greater biodiversity, climate adaptation and the climate challenge. The latter in particular is important for the elaboration of the LULUCF regulation, as the focus is on carbon sequestration. The Ministry of Agriculture, Nature and Food Quality puts circular agriculture at the heart of its vision for 2030. At the basis of this is the National Agricultural Soils Programme (NPL), with the objective of committing public and private parties to the target, the ambition is to have managed all hectares of agricultural land in the Netherlands sustainably by 2030. With this goal investments are made in the development and dissemination of knowledge to promote sustainable soil management for an improved carbon retention in agricultural soils.	All soils sustainably managed will be achieved by applying measures that increase the organic matter content and reduce nitrous oxide formation in these soils. There are several measures planned: - measurement method with soil indicators for the status of Dutch agricultural soils. - Farmers and heirs will be informed about sustainable soil management and carbon sequestration with associated action perspectives, as an intermediate goal for 2022. This is provided, among other things, by (extra trained) qualified broad soil consultants and additionally trained heirs. - From 2020 onwards, the dissemination of knowledge of sustainable soil management and climate adaptation will take place via the Delta Plan for Agricultural Water Management (DAW). For this purpose, use is made of the knowledge base, the knowledge carousel and knowledge in progress, supported by meetings, pilot farms, pilots and accredited advisors actively deployed on the farm. - Furthermore, long-term leasehold relationships between tenant and lessor will be promoted, to sustainably manage agricultural soils. - Non-reversing tillage is also stimulated. - the new CAP promotes sustainable soil management through the eco-scheme and ANLb. - regional initiatives will be strengthened, as carbon sequestration is more challenging in some areas than in others. Additional carbon sequestration on mineral agricultural soils will mainly be achieved with more permanent grassland, resting crops and catch crops. These measures are partly anchored in the conditions GAEC 1 (permanent grassland) and GAEC 7 (rotation with resting crop and catch crop). More application of these measures is encouraged by the eco-scheme; concerns activities that can be used nationally, such as deep-rooted crops (resting crops), catch crops, year-round greenery, non-reversing tillage, precision agriculture. In addition, food forests and agroforestry are also encouraged for carbon sequestration. Estimated impact: -0.5 MtCO₂e/year from 2030 In the area of mineral agricultural soils in NL (1.8Mln ha)

Measures in Climate Action Plan / Programme	Measures in CAP Strategic Plan 2021-2027
Focus Area: Risk	
	Risk management is also used, the broad weather insurance is made possible to draw up a business sustainability plan, where the effects on the climate of the farm are considered.
Focus Area: Nature and forest	
In 2020 a forest strategy has been launched, stipulating the ambitions to: i. increase the areas of forest by 37,000 hectares by 2030. ii. to increase the knowledge about forest and trees, all children will plant a tree during their primary school period. iii. improving the quality of the existing forest by planting different tree species and allowing the forest to grow. This combination should achieve climate and biodiversity goals. Estimated impact: climate gain of at least 0.4 Mton CO₂ with a target of 0.8 Mton CO₂ by 2030.	Since agriculture is the largest land user in the transition zones between nature and agriculture and forest combinations also fit well into a nature-inclusive agriculture, the largest area has been laid for a combination of forest construction and agriculture: approximately 7,000 hectares of forest expansion in 2030. For trees outside the forest, agriculture has a major role to play through landscape elements and agroforestry, a combination of woody crops with crop cultivation or animal production systems. For the former, an implementation programme. Has been set up in consultation with the provinces, and the partners of the Delta Plan for Biodiversity Restoration. For agroforestry, there is an ambition of 25,000 hectares and 1,000 hectares of food forests in the long term (after 2030). This ambition still needs to be concretized before 2030. The aim is to anchor financial incentives for this in the new CAP through investments, ANLb and eco-scheme and outside the CAP (Circular Agriculture Conversion Fund).
Focus Area: Greenhouse cultivation	
Efforts will be made in the greenhouse cultivation sector to further intensify the Greenhouse as a Source of Energy programme. This will include: i. demonstration projects ii. knowledge development to stimulate the electrification of assimilation lighting systems used in cultivation iii. increasing budget for the energy-efficient greenhouse horticulture (EG) scheme, to enable greenhouses to meet the requirements for Green Label Greenhouse (GLK) certification. iv. to better utilise geothermal energy and residual heat. The sector is dependent on the supply of residual heat from industry. Ways in which the industry can supply CO₂ for greenhouse horticulture are being further investigated together with this sector.	In greenhouse horticulture, emissions can be reduced by saving energy, the generation of sustainable energy, the use of residual heat and CO₂ supplied by third parties. In greenhouse horticulture, there is a lot of potential to be a leader in energy-efficient and circular production of high-quality products. The sector can even become CO₂-positive, but currently relies mainly on natural gas. This transformation will be stimulated by creating the conditions under which the greenhouse horticulture can become more sustainable and a leader in energy-efficient, circular products.

2.1.6 Finland

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.1.6.a: Finland's national GHG emissions and reduction targets

GHG emissions (MtCO ₂ e)		GHG emission reduction targets
	2019	By 2035*
Total (excl. LULUCF)	53.1	Net 0
Agriculture	6.6	-29% compared to 2019 levels
N ₂ O (Mt CO ₂ eq.)	3.9	ND
CH ₄ (Mt CO ₂ eq.)	2.5	ND
CO ₂ (Mt)	0.2	ND

Source: *Finland's National Inventory Report 2021 submitted to UNFCCC*

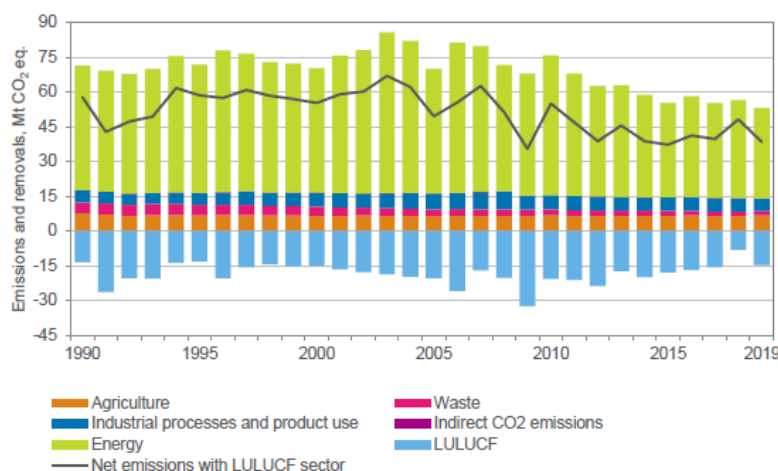
*Finland has committed to reach climate neutrality by 2035.

Table 2.1.6.b: Finland's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (12 % of Total Emissions)		GHG Emissions / Removal of LULUCF	
Source of emissions	MtCO ₂ eq	Source / Sink	
Enteric Fermentation	2.1	Forest Land	-22.9
Manure Management	0.7	Cropland	7.9
Agricultural Soils	3.6	Grassland	0.7
Liming	0.2	Wetland	2.2
Urea application & other fertilisers	0.002	Harvested Wood Products	-3.4
Other	0	Settlements & others	0.7
Total (Agriculture)	6.6	Total (LULUCF)	-14.7

Source: *Finland's National Inventory Report 2021 submitted to UNFCCC, Statistics Finland.*

Figure 2.1.6.a: Greenhouse gas emissions and removals in Finland by reporting sector (Mt CO₂ eq.) and net CO₂ equivalent emissions (emissions plus removals)



Source: Finland's National Inventory Report 2021 submitted to UNFCCC

Measures and actions

- ➔ Restricting the clearing of fields
- ➔ Restricting the transition of previous peat production areas to agricultural use.
- ➔ Afforest waste lands
- ➔ Increased cultivation of wet peatlands
- ➔ Efficiency of fertilisation and the use of nutrients will be improved by precision farming and the associated use of digital systems and services
- ➔ Increasing organic farming
- ➔ Promoting carbon sequestration markets.

The most important greenhouse gas in Finland is carbon dioxide. The share of CO₂ emissions from the total greenhouse gas emissions has varied from 80 per cent to 85 per cent. In absolute terms, CO₂ emissions have decreased by 14.5 Mt (i.e. 25 per cent) since 1990. Around 90 per cent of all CO₂ emissions originated from the energy sector in 2019. The amount of energy-related CO₂ emissions has fluctuated much according to the economic trend, the energy supply structure (including electricity imports and exports) and climate conditions.

Methane emissions (CH₄) have decreased by 42 per cent from the 1990 level until 2019. This is mainly due to the improvements in waste treatment and a contraction in animal husbandry in the agriculture sector. **Emissions of nitrous oxide (N₂O) have also decreased by 24 per cent;** the biggest decline occurred in 2009 when the implementation of a N₂O abatement technology in nitric acid production

reduced emissions significantly. Another reason for the decrease of the emission is the reduced nitrogen fertilisation of agricultural fields.

Emissions from agriculture in Finland have remained relatively stable over the last few years. Agricultural emissions represent approximately 12 per cent of the total emissions of Finland (excluding the land use sector) and roughly 20 per cent of the emissions from the effort sharing sector.

In 2019, agricultural emissions amounted to 6.6 Mt CO₂eq, representing a 1 per cent increase relative to 2018 levels (Statistics Finland 2022). The increase mostly resulted from the larger amounts of agricultural residues due to a good crop year and from growth in the sales of synthetic fertilisers. Livestock numbers continued declining, which decreased emissions from enteric fermentation relative to previous years. In 2020, the emissions remained at the previous year's level. The current measures included in the Medium-term Climate Change Policy Plan are expected to lead to a slight downward trend in agricultural emissions.

Agricultural emissions decreased by 12 per cent (0.9 Mt CO₂ eq.) over the period 1990 to 2019. The emissions increased 2 per cent since 2018, mainly due to higher emissions from crop residues, resulting from a better crop year, and increased sales of synthetic fertilisers. The main driver behind the decreasing trend since 1990 has been the overall change in the economy of agriculture, which has resulted in a decrease in the number of animals and an average increase in farm size. Cattle produce the major part of the emissions from enteric fermentation in Finland, thus the 37 per cent decrease in the number of cattle since 1990 has influenced both emissions from enteric fermentation and nitrous oxide emissions from manure management. Methane emissions from manure management have, on the contrary, increased somewhat, despite the decrease in the number of animals. This is mostly due to an increase in the number of cattle and swine kept in slurry-based manure management systems, which cause considerably more methane emissions compared with solid storage or pasture. Nitrous oxide emissions from manure management are smaller in slurry than in solid storage systems, which have had an impact on the decreasing trend in N₂O emissions.

LULUCF

The LULUCF sector in Finland has been a net sink during the whole UNFCCC reporting period 1990 to 2019 as the removals in the sector exceeded the emissions. **The net removals in the sector were 14.7 Mt CO₂ eq. in 2019 and increased by 79 per cent compared with the previous year.** The most significant reason for the increase in net removals was a 6 per cent decrease in the roundwood removals which yet remained at a high level compared to the historical levels. Compared to 1990, the net removals were 9 per cent higher.

It must be noted that Finland is proportionately the most forested country in Europe, with **75 per cent of its land covered by forests**. This explains that most of the removals in the LULUCF sector have come from tree biomass; that is to say the tree volume increment has exceeded the annual total drain. The increment of the growing stock has increased in Finland since 1990. Annual variations in the total drain (consisting of roundwood removals, logging residues and natural losses) have been considerable. In

addition, the aggregated dead organic matter and soil organic matter pool in mineral soils have been a significant sink during the reporting period. The largest emissions in the LULUCF sector have come from changes in soil organic carbon in organic forest and agricultural soils.

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

The land use sector is not included in the Climate Act that entered into force in 2015. The Climate Act was revised in accordance with the Marin's government program to enshrine Finland's goal to achieve carbon neutrality by 2035. The government's proposal for a new climate act was approved and entered into force on July 1, 2022. The law provides for climate policy plans and was extended to cover the land use sector.

Finland's Climate Plan for the Land Use Sector (2022)

- ➔ The Finnish Government adopted a report on Climate Plan for the Land Use Sector³¹ on 8 July 2022. The plan specifies the means by which climate emissions from the land use sector can be reduced and carbon sinks and reservoirs strengthened.
- ➔ The Climate Plan for the Land Use Sector contributes to Finland's target of achieving carbon neutrality by 2035. The plan also implements the climate targets of the European Union and international commitments.
- ➔ **The targeted annual net effect of the additional measures implemented in the land use sector is at least three million carbon dioxide equivalent tons by 2035.**
- ➔ The Climate Plan for the Land Use Sector covers measures targeted at carbon dioxide emissions from agricultural land, forests, land use changes and climate wetlands. In addition, the Climate Plan will include an implementation plan and a plan on how the measures and their impacts will be monitored.

31 <https://julkaisut.valtioneuvosto.fi/handle/10024/164301>

Most of the key relevant measures are outlined in the following table:

Table 2.1.6.f: Description of Measures under Finland's Climate Action Programme

Measures in Climate Action Plan
Focus Area: Livestock
The number of dairy cows in the WAM scenario will fall from 262,000 to 196,000 by 2050. The total production of milk will fall by 2 per cent. In the baseline scenario, both the number of dairy cows and milk production will fall more. The WAM scenario will bring further reductions to methane emissions from dairy cows by means of rapeseed cake, 3-nitro-oxypropanol (3-NOP) and red seaweed additives in the feed of dairy cows.
Reducing methane emissions from dairy cows through feeding methods. A suitable goal is a 10 per cent reduction of methane emissions from dairy cows by means of feeding that are currently being researched and developed, including new additives, which should be economically viable, profitable and suitable for the feeding processes of the farm. Of the feed additives that reduce methane emissions from digestion, 3-NOP (3-nitroxypropanol) is the most intensively researched and has been applied for a feed additive for dairy cows. The Government parties outlined in their September 2021 budget negotiations that the proportion of climate-friendly feed will be increased by means of a blending obligation or tax incentives, for example. The parties also decided to allocate EUR 0.7 million in the 2022 budget for the development of feeds and the required studies.
Impact on the emissions from the effort sharing sector: 0.2 Mt CO₂-eq in 2030.
Age range of cattle. As the lifespan of cows is lengthened, replacement heifers will be needed less, which means that a higher proportion of calves will be reared for slaughter. As it takes longer to rear replacement heifers than beef cattle, the methane reductions will fall as the number of replacement heifers falls. The Agricultural Development Fund is funding a related programme on breeding dairy cows to be more resource-efficient and environmentally sustainable. No policy measures exist at present to control the age range of cattle.
Sexed semen Sexed semen can affect the gender of calves. The goal is to reduce the number of male dairy calves and increase the share of faster-growing dairy-beef crossbreed calves among the dairy cattle. Sexed semen is a relatively new technology, so it needs more research on its use and effects. Nevertheless, the method is gaining popularity rapidly.
Focus Area: Reduction in crop and soil N2O
In the baseline scenario, the arable area subject to agricultural subsidies remains almost unchanged, whereas the implementation of the WAM scenario will reduce the area by 64,000 hectares by 2030. Grain cultivation area will fall by approximately 10 per cent but without a corresponding drop in total production, since the cultivation will concentrate on fields that produce the best yields. Field-specific crop rotation and the shift to new plant varieties will result in an increase of 2.5 per cent in crop yields by 2035.
Nitrogen utilisation efficiency will grow, and by 2040, precision farming will have reduced the need for nitrogen fertilisation by 10 per cent from the 2019 figure. At the same time, crop yields will increase by 5 percent by 2050, partly thanks to new plant varieties that are able to utilise nitrogen better than their predecessors. The improved crop yields are a major factor in the nationwide 1.5 per cent increase in agricultural income in the WAM scenario compared to the baseline scenario in 2050.
Precision farming. The purpose of precision farming is to improve the utilisation rate of fertiliser nitrogen and thereby the consumption of nitrogen fertilisers. The efficiency of fertilisation and the use of nutrients can be improved by precision farming and the associated digital systems and services. The WAM scenarios in the HIIIS programme assumed that nitrogen fertilisation would reduce by 5 per cent by 2030 and by 10 per cent by 2040. The proportion is calculated from all fertiliser nitrogen and the reduction from nitrogen in artificial fertilisers. The reformed CAP will promote precision farming with a range of means, such as a farm-specific environmental compensation under the measure 'promoting a circular economy'. The reform also proposes support for investments that promote biodiversity and sustainable production methods; such investments might also include devices and equipment for precision farming.
Impact on the emissions from the effort sharing sector: 0.05 Mt CO₂-eq in 2030 + 0.02 Mt CO₂-eq in 2035.

Measures in Climate Action Plan

Restricting the clearing of fields.

Finland has tried to mitigate clearing of fields by excluding fields cleared after 2004 from compensatory allowances, and therefore no compensatory allowances have been paid for such fields. The payment of national subsidies is tied to the eligibility for compensatory allowances, which means that new cleared fields will not receive any national surface area subsidies either.

Impact on the emissions from the effort sharing sector: 0.02 Mt CO₂e in 2030 + 0.02 Mt CO₂e in 2035. Impact on the emissions from the land use sector: 0.5 Mt CO₂e in 2030 + 0.2 Mt CO₂e in 2035.

Focus Area: Carbon storage/ sequestration

The increase in fallow area will stop at around 300,000 hectares in the WAM scenario. Incentives for increasing fallow area include subsidies for green fertiliser grasses and renovation plants. The purpose of these subsidies is to improve the fertility of fields and increase carbon sequestration, but they will also improve the crop yields a little. The area of biogas grass cultivation will increase.

Afforestation.

Afforest wastelands, such as fields left outside agricultural use and former peat production areas pursuant to the Afforestation Subsidy Act (1114/2020) that entered into force in 2021. The subsidy system is intended for private landowners and will remain in force until the end of 2023. Work is underway to assess the conditions for continuing the afforestation subsidy post-2023 and potentially expanding the subsidy system to also cover fields in cultivation, such as small fields in agricultural use that produce poor yields and have a thick layer of peat, or other areas with high emissions.

Impact on the emissions from the effort sharing sector: 0.02 Mt CO₂e in 2030 + 0.02 Mt CO₂e in 2035. Impact on the emissions from the land use sector: 0.01 Mt CO₂e in 2030 + 0.1 Mt CO₂e in 2035.

Promoting carbon sequestration markets.

As decided in the budget session in autumn 2021, Finland will promote carbon sequestration markets and incentives for climate actions in agriculture. To strengthen carbon sequestration, Finland will promote the national and international efforts to create ecologically, economically and socially sustainable rules for carbon sequestration markets.

Finland is currently preparing an information service on carbon markets that will serve the providers of compensation and parties interested in procuring compensation units. The website of the service will contain research-based information on climate measures and their climate impact. The Ministry of Agriculture and Forestry is about to launch a pilot project on carbon markets and an assessment on the impact of carbon compensations on the economy as a whole.

Focus Area: Energy mitigation

Biogas

The support scheme for biogas investments and new manure processing techniques set out in the Government Programme was launched in December 2020. Another subsidy scheme for the production of biogas based on nutrient cycles is also being prepared. The Government's coronavirus stimulus package increased the rates of agricultural investment subsidies and rural business financing for biogas investments to 50 per cent for the period 2021–2022.

Finland will strengthen the implementation of the biogas programme and present additional measures that bring the production of biogas up to 4 TWh.

Focus Area: Wider food system

Dietary habits

The Government Programme contains a promotion programme for increasing the consumption of domestic fish, which was approved in July 2021. The programme aims towards increasing the fishing and consumption of less used species of fish for human nutrition, such as fish from the carp family.

Public procurement.

The Government Programme points out that public procurement and public food and catering services play a key role in improving the sustainability of the food system. The objective set for public procurement and public food and catering services is to increase the share of fish and vegetable-rich food, which is also included in official nutrition and meal recommendations. As for meat, eggs and milk, the municipalities are instructed to favour Finnish local and organic produce, which promotes the consumption of sustainably produced products of animal origin and supports the goal of a sustainable food system.

Measures in Climate Action Plan

Focus Area: Peatlands

Restricting the transition of previous peat production areas to agricultural use.

The intention is that starting from 2023, if a farmer wants a full farmers' support package, areas released from peat production may only be used for agriculture if they are used for cultivating grasses. Other measures for restricting land use change are currently being investigated as part of the creation of the Climate Plan for the Land Use Sector.

Impact on the emissions from the effort sharing sector: 0.02 Mt CO₂e in 2030 + 0.01 Mt CO₂e in 2035. Impact on the emissions from the land use sector: 0.1 Mt CO₂e in 2030 + 0.1 Mt CO₂e in 2035.

Cultivation of wet peatlands (paludiculture).

Water level on peatlands will be increased and the cultivated plants are grass, reed canary grass or some other plant suitable for wetland cultivation. CAP contains provisions on investment and management subsidy for the increase and regulation of the water level (environmental compensations – management of runoff waters). The subsidy is also available for a more affordable means of increasing and regulating the water level: check weirs. A separate management agreement is needed for the monitoring of the water level. Farmers should be compensated for managing the regulator devices, regulating the water level and the risks caused by the increase in water level.

One of the challenges in increasing paludiculture in Finland is that there is currently no market for the cultivated products, i.e. no buyers or sales channels for the product/biomass coming from paludiculture. A working value chain must be in place before any larger-scale production can start in Finland.

Impact on the emissions from the effort sharing sector: 0.1 Mt CO₂e in 2030 + 0.1 Mt CO₂e in 2035. Impact on the emissions from the land use sector: 0.7 Mt CO₂e in 2030 + 0.4 Mt CO₂e in 2035.

2.1.7 Italy

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.1.7.a: Italy's national GHG emissions and reduction targets

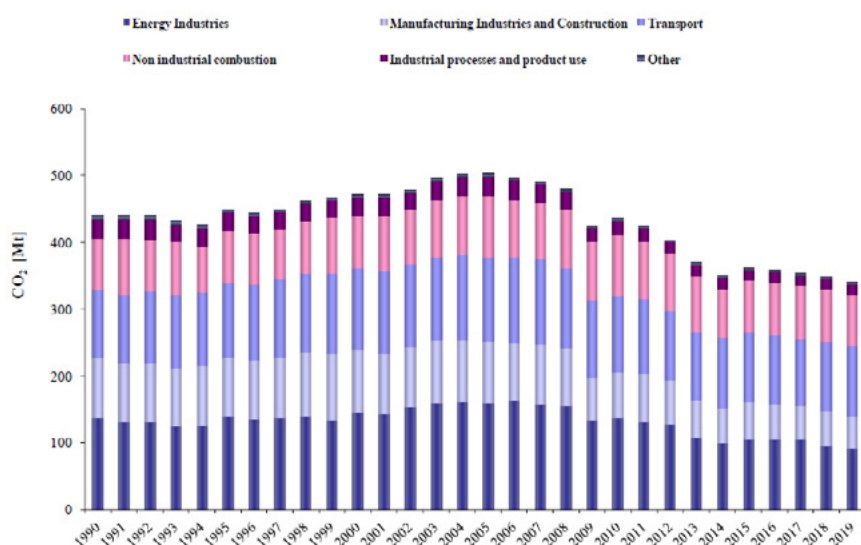
GHG emissions (MtCO ₂ e)		GHG emission reduction targets <i>Based on 2005 levels</i>	
	2019	2030	2050
Total (excl. LULUCF)	418	-43 per cent (for ETS sectors) and -30% for non-ETS sectors	Net 0
Agriculture	29.5	ND	ND
N ₂ O (Mt CO ₂ eq.)	10.1	ND	ND
CH ₄ (Mt CO ₂ eq.)	18.9	ND	ND
CO ₂ (Mt)	0.4	ND	ND

Source: Italy's National Inventory Report to the UNFCCC (2021); Italy's Long term Strategy (2018)

Table 2.1.7.b: Italy's Greenhouse Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (7% of Total Emissions)		GHG Emissions / Removal of LULUCF	
Source of emissions	MtCO ₂ eq	Source / Sink	MtCO ₂ eq
Enteric Fermentation	13.2	Forest Land	-37.3
Manure Management	4.1	Cropland	-0.1
Agricultural Soils	8	Grassland	-8.3
Liming	0.02	Wetlands	0.04
Urea application & other fertilisers	0.4	Harvested Wood Products	-1.8
Other	3.7	Settlements	5.2
Total (Agriculture)	29.5	Total (LULUCF)	-41.6

Source: Italy's National Inventory Report to the UNFCCC (2021)

Figure 2.1.7.a: National CO₂ emissions by sector in Italy between 1990 and 2019

Source: Italy's National Inventory Report to the UNFCCC (2021)

Measures and actions

- ➔ Diffusion of agro-forestry-ecological practices that favour more extensive cultivation systems
- ➔ Structural modernization in the livestock sector
- ➔ Encouraging increased use of renewable energy and its production on farms, especially biomethane.
- ➔ More investments will be directed to increase carbon storage capacities
- ➔ Increase the resilience and adaptation of the agricultural sector to the effects of climate change, with interventions such as promoting the diversification of the agro ecosystem, support the adoption of practices that improve water use efficiency, support the conservation and restoration of threatened ecosystems and habitats

In 2019, 7.1 per cent of the Italian GHG emissions, excluding emissions and removals from LULUCF, (6.9 per cent in 1990) originated from the agriculture sector, which is the third source of emissions, after the energy and IPPU sector which accounts for 80.5 per cent and 8.1 per cent, respectively. For the agriculture sector, the trend of GHGs from 1990 to 2019 shows a decrease of 17.3 per cent due to the reduction of the activity data, such as the number of animals, the cultivated surface/crop production, the amount of synthetic nitrogen fertilisers applied, and the changes in manure management systems. In 2019, CH₄, N₂O and CO₂ emissions account for 64.3 per cent, 34.3 per cent and 1.5 per cent, respectively. In the period 1990-2019, CH₄, N₂O and CO₂ emissions have decreased by 14.7 per cent, 21.8 per cent and 15.7 per cent, respectively. Moreover, in recent years, the share of renewable energies has increased in the Italian economy, with a strong expansion of number of farms contributing to the production of energy from biogas, biomass and photovoltaics.

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

CAP Strategic Plan (CSP)

Italy's agricultural policy is mainly based on European legislation and on the Common Agricultural Policy framework. Italy's CAP Strategic Plan was approved by the European Commission on 2 December 2022.

Key highlights of the plan:

- ➔ More than 80 per cent of the agricultural area will comply with good agricultural and environmental conditions (GAECs), such as establishing buffer strips along water courses, the maintenance of permanent grassland or providing minimum soil cover during sensitive periods.
- ➔ Over EUR 10bn of the CSP is earmarked for climate and environmental related interventions.
- ➔ Italy aims to increase organic farming up to 25 per cent of its total agricultural land by 2027. To that end, the country will allocate EUR 2 billion to develop organic farming.
- ➔ EUR 2.4 billion are earmarked for improving animal welfare conditions and to address the phenomenon of antimicrobial resistance, in line with the objectives of the EU Farm to Fork strategy.
- ➔ Incentives to increase the dissemination of practices supporting sustainable forest management.

The Italian CSP includes a series of interventions and actions aimed at reducing climate-changing gas emissions in atmosphere and increase the carbon sequestration capabilities of agriculture and forestry, as well as reduce methane and ammonia emissions related to the management of livestock farms, the use of nitrogenous fertilizers and the distribution of manure. To achieve these objectives, the CSP intends to support:

1. the **diffusion of agro-forestry-ecological practices** that favour more extensive cultivation systems and a wider contribution of organic matrices to the soil also with a view to recycling waste materials and by-products (with reference to the reuse of by-products).
2. **structural modernization in the livestock sector**, promoting the diffusion of innovations in the sector, i.e., manure management and animal feed practices;
3. actions aimed at **preventing natural disasters and extreme events and forest fires**;
4. the **deployment and increased use of renewable energies**, products and by-products of agricultural origin, livestock and forestry and energy efficiency, encouraging its production within the companies, favouring the achievement of neutral or positive territorial environmental balances and the development of energy communities;
5. **land and landscape protection actions to contain instability and degradation phenomena**, included those derived from extreme events;
6. investments in agricultural, agri-food and forestry companies as well as infrastructure investments aimed at reducing emissions and **increasing carbon storage capacity**.

Other pieces of legislation can be referred when it comes to increasing the resilience of the land use and agricultural sector, including:

National code indicative of good agricultural practices for controlling ammonia emissions:

The code, which will become part of the national programme for controlling atmospheric pollution, takes account of the following factors for reducing ammonia emissions:

- ➔ nitrogen management, taking into account the whole nitrogen cycle;
- ➔ livestock feeding strategies;
- ➔ low-emission manure storage and spreading techniques;
- ➔ low-emission animal housing systems;
- ➔ possibilities for limiting ammonia emissions from the use of mineral fertilisers.

The code provides mandatory measures for mitigating and reducing ammonia by means of different use of fertilisers and techniques for spreading manure and storage. The optional mitigation measures are to be financed using European funding attributable to rural development policies.

Programme Agreement for coordinated and joint adoption of measures to improve air quality in the Po basin:

The Po Basin Agreement 2017 identifies joint measures and actions to combat emissions, including greenhouse emissions and fine particles. Regarding measures in the agricultural and animal husbandry sectors, the Italian Regions must, as part of the air quality plans, apply practices aimed at the reduction of emissions produced by agricultural activity, including coverage of structures for storing sewage, using the correct methods for spreading of manure and the burial of soil surfaces used to apply fertilisers, where these practices are technically feasible and economically sustainable. For biogas of agricultural origin, consideration must be given to the system for managing animal-husbandry waste liquids, and the end-use of digestate. This is especially important in areas which are vulnerable to nitrates and are affected by air-quality problems caused by the build-up of secondary pollutants deriving from the recombination of ammonia released mainly into the atmosphere by agriculture.

Italian regions and local authorities have also adopted their own climate mitigation and adaptations plans with detailed action plans to deliver on climate neutrality goal by 2050.

2.1.8 Poland

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.1.8.a: Poland's national GHG emissions and reduction targets

	GHG emissions (MtCO ₂ e)	GHG emission reduction targets	
	2019	2030 Based on 2005 levels	2050*
Total (excl. LULUCF)	390.7	-7% (for non-ETS sectors)	ND
Agriculture	32.7	ND	ND
N ₂ O (Mt CO ₂ eq.)	17.7	ND	ND
CH ₄ (Mt CO ₂ eq.)	13.9	ND	ND
CO ₂ (Mt)	1.1	ND	ND

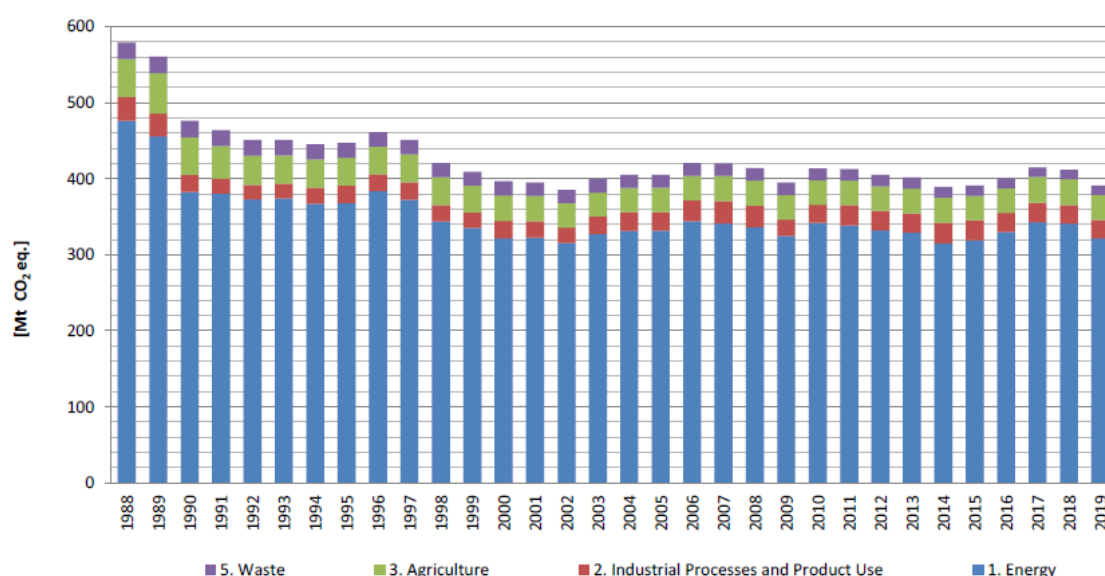
Source: *Poland's National Inventory Report to the UNFCCC (2021); Poland's NECP.*

*Poland has not adopted yet a long-term strategy.

Table 2.1.8.b: Poland's Greenhouse Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (8% of Total Emissions)		GHG Emissions / Removal of LULUCF	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	14	Forest Land	-15.2
Manure Management	4	Cropland	-0.9
Agricultural Soils	13	Grassland	-0.1
Liming	1.3	Wetlands	1.4
Urea application & other fertilisers	0.4	Harvested Wood Products	-4.7
Other	0	Settlements	2.4
Total (Agriculture)	32.7	Total (LULUCF)	-17.1

Source: *Poland's National Inventory Report to the UNFCCC (2021);*

Figure 2.1.8.a: National CO₂ emissions by sector in Poland between 1988 and 2019

Source: Poland's National Inventory Report to the UNFCCC (2021);

Measures and actions

- ➔ Reducing water pollution with nitrates from agricultural sources
- ➔ Poland to deliver by 2026 a water management reform which will consist in simplifying the regulations in the field of water management in agriculture and increase resilience of its agriculture.

Total GHG emissions in the agriculture amounted to 32.74 Mt CO₂eq in 2019. Emissions have decreased since 1988 by about 34.8 per cent. Strong decrease in emissions in Poland occurred after 1989 when an economic transformation began shifting from centrally planned economy to a market-oriented economy. Up to 1989, agricultural production was generally subsidised at State level. Since 1990 the country's subsidies for agricultural products as well as for agricultural means of production (like mineral fertilisers or machines) were cut off which contributed to trigger a strong structural change among the farming sector. The big state agricultural farms became economically ineffective in the new market conditions and went rapidly out of business. On the contrary, many small family farms became cost-ineffective and private collective farms were growing with large livestock herds. Still today, we can note a majority of small farms in the Polish landscape with more than half of total farms being very small farms (up to 5ha of agricultural land). The percentage of the largest farms, with an area of 50 ha and more, was only 2.4 per cent [GUS R₄ 2020].

Livestock population significantly decreased after 1989, with the cattle population almost cut by half – from over 10 million heads in 1988 to about 6 million in 2019. Since 2002, the population of dairy cattle stabilized when milk production was regulated. Sheep population also dropped by 94 per cent (from over 4 million in 1988 up to 0.27 million in 2019). Sheep breeding became unprofitable without subsidies to support the wool economy and with a small domestic demand for sheep meat.

Poland's agriculture mainly produces cereals, poultry, pigs and milk. Poland remained the largest producer of rye in the EU in 2018 and the second largest for oats (Eurostat, 2019).

LULUCF

Estimated sink for 2019, associated with the afforestation activity, increased by about 11.4 per cent as compared to 2013. At the same time, emissions associated with deforestation increased significantly in 2016 due to, in this particular year, higher area of forest land exclusions for non-forestry and non-agricultural purposes. Since 2017, deforestation area returned to the level consistent to previous years. Moreover, the size of net absorption for forest management activity for the year 2019 is lower by about 58.6 per cent in relation to 2013. This situation is related to the noticeable change in total increase of wood resources triggered by extreme events this year. Indicated growth decreased by 59.3 per cent as compared to the previous year. Although significant change in dynamics of forest resources growth has been noticed, changes in the species and age structure of forests slightly allowed compensating such exceptional situation.

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

Based on Poland's emissions reduction commitments, recent projections indicate that emissions from the agricultural sector are expected to increase in the long term, around by 4 per cent by 2040 (Prandecki, Wrzaszcz, Zielinski, 2021). Polish climate policy in the agricultural sector faces enormous challenges in reversing existing trends, also due to a lack of dedicated decarbonisation policies for the agricultural sector in the last two decades³² (Wise Europa, 2022).

32 'Assessment of the national Long-Term Strategies of the Visegrad Group Countries', Wise Europa, 2022.

Table 2.1.8.c: Description of Measures under Poland's Climate Action Programme

Measures in Climate Action Plan
Focus area: Livestock
No specific measures found in Poland's climate strategic policy plans.
Focus area: Reduction in crop and soil N2O
Issues relating to the storage and use of fertilisers containing nitrogen, including livestock manure, are regulated in the Act of 20 July 2017 – Water Law and the Cabinet Regulation of 5 June 2018 regarding the adoption of the 'Programme of measures aimed at reducing water pollution caused by nitrates from agricultural sources and preventing further pollution', known as the Nitrate Programme, issued on the basis of Article 106 of the Water Law. The Water Law stipulates in particular that a livestock manure dose used in a year for agricultural purposes may not contain more than 170 kg of nitrogen in a pure component per hectare of agricultural land. Additionally, in Chapter 1.5 of the aforementioned Cabinet Regulation, the obligation has been set out for a plan for nitrogen fertilisation to be developed by entities: - having a farm with an area of more than 100 ha of agricultural land, or - growing intensive crops on arable land in an area in excess of 50 ha, or - maintaining stocking density in excess of 60 livestock units (LU) on an annual average basis. All entities will thus be obliged to apply fertilisers in a rational fashion. The Nitrate Programme will require entities engaged in agricultural production to undertake investment activities that are necessary and at the same time long-term. Pursuant to the aforementioned Nitrate Programme, entities engaged in agricultural production and in the activities referred to in Article 102(1) of the Water Law are obliged to put the area or capacity of sites designated for storing natural fertilisers (livestock manure) in line with the requirements set out in the Programme, by: 1) 31 December 2021 – in the case of entities breeding animals in numbers exceeding 210 LU, including entities raising or breeding poultry in numbers exceeding 40 000 places or raising or breeding pigs in excess of 2 000 places for pigs with weight exceeding 30 kg or 750 places for breeding sows; 2) 31 December 2024 – in the case of entities engaged in raising or breeding livestock in numbers not exceeding 210 LU. To adapt to the new requirements farmers must ensure appropriate funds in their farm budgets. Additionally, funds must also be ensured in the state budget to support investment activities. The Water Law (amending Article 400a(1)(2a) of the Act of 27 April 2001 – Environmental Protection Law) has obliged environmental protection and water management funds to finance projects involving the implementation of a programme of measures aimed at reducing water pollution with nitrates from agricultural sources. In the justification of the act it is noted that projects involving the implementation of the Nitrate Programme will be funded with the use of repayable instruments, in compliance with State aid regulations. Additionally, some of the measures relating to the implementation of the Nitrate Programme may be funded from the Rural Development Programme 2014–2020, the 'Support for investments in agricultural holdings' sub-measure, as part of such operations as 'Investments aimed at protecting water against pollution caused by nitrates from agricultural sources'.
Focus area: Carbon storage/ sequestration
Launching mitigation measures by testing the possibilities of increasing capabilities for carbon retention in forest ecosystem elements with the use of methods consisting in expanding applied technologies and the scope of breeding and management works for all ownership type forests. For this purpose, measures forming part of the Forest Carbon Farm pilot project carried out by the 'State Forests' National Forest Holding will be undertaken. The Forest Carbon Farm project envisages an attempt to achieve an increased carbon dioxide removal by forest areas through additional forest management activities to be carried out within its impact area. As part of the works already conducted in the initial period the scale and location of activities have been established and first forestry works have been started. Based on inventory data concerning the committed forest area of the FCF project, the expected effect, i.e. the volume of additional carbon dioxide accumulation, has been modelled. The pilot part of the Project will cover 10 years (2017–2026) and the effect and durability modelling period is expected to take 30 years. An effect of the Forest Carbon Farm project, which is important for enhancing the quality of the carbon balance inventory in forest ecosystems, is the improvement of the system for acquiring forest-related data for emission reporting and removal purposes, as envisaged in the project, by launching measures aimed at building a carbon removal model for forests in Central Europe conditions. The acquired data will also make it possible to consider additional measures to be implemented in the forest sector on a broader scale.

Measures in Climate Action Plan**Focus area: Energy mitigation****Bionergy**

Biomass stocks from energy crops are estimated to range from 120,000 to 130,000 tonnes of dry matter, and orchard wood stocks are estimated to amount to ca. 88,700 tonnes annually. Along with the development of the agricultural biogas production sector, the importance of the use of agricultural by-products and agri-food industry residual products has been increasing. Their use in 2017 reached approximately 3.8 million tonnes. The energy potential of the agri-food processing industry as regards the production of agricultural biogas is estimated to exceed 7.8 billion m³ annually.

The Polish National Recovery and Resilience plan (2021) mentions policy reform to be conducted in the next five years to improve conditions for investments in rural areas in terms of water management and efficiency use of its resources. Access to water is a critical issue for the Polish agriculture while negative effects of draught have increased over the last years. To address the issue, Poland intends to achieve a water management reform which will consist in simplifying the regulations in the field of water management in agriculture. Proposed amendments to the provisions of the Water Law, Construction Law and Geological and Mining Law will facilitate the simplification and shortening of the process of preparation and implementation of retention investments and stopping its outflow in agricultural areas, including those related to reconstruction and renovation melioration devices to fulfill the retention and drainage function, thus protecting agricultural land against floods and droughts. This will allow for the efficient implementation of investments, which will result in a significant increase in retention opportunities in rural areas. Expected effects are the following:

- increasing the resilience of agriculture to drought and preventing flooding in agricultural areas;
- improving the rationality of water management through the appropriate regulation of water conditions in the agricultural areas and limiting water outflow;
- increasing water retention.

Focus area: Wider food system

No specific measures found in Poland's climate strategic policy plans

Focus area: Peatlands

No specific measures found in Poland's climate strategic policy plans.

2.2 Non-EU countries

2.2.1 United Kingdom

Key figures

Table 2.2.1.a: United Kingdom's national GHG emissions and reduction targets

	GHG emissions (MtCO ₂ e) Year 2020		Overall GHG emission reduction targets (compared to 1990 levels)	
	From Agriculture	Total (excl. LULUCF)	By 2030	By 2050*
UK	44.8	406	-68%	Net 0
CH ₄	24.8			
N ₂ O	14.5			
CO ₂	5.5			
Scotland		40	-75%	Net 0
Wales		33.6	-63%	Net 0
Northern Ireland		22	-48%	Net 0

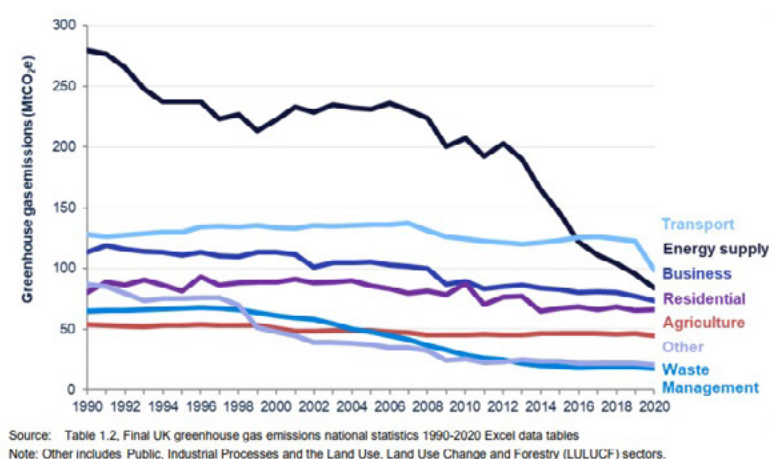
Source: gov.uk

*by 2045 for Scotland

Table 2.2.1.b: UK's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (11 % of Total Emissions) - 2019		GHG Emissions of LULUCF (1% of Total Emissions)– 2019	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	21.2	Forest Land	-17.1
Manure Management	6.7	Cropland	15.0
Agricultural Soils (direct and indirect)	12.4	Grassland	0.6
Liming	1.3	Wetland	3.4
Urea application	0.3	Harvested Wood Products	-2.3
Other (Stationary and mobile combustion)	4.5	Settlements	4.2
Total (Agriculture)	46.4	Total (LULUCF)	4.0

Source: 2020 UK Greenhouse Gas Emissions: Final Figures – Data Tables (Excel); National Inventory Report

Figure 2.2.1.a: Territorial UK greenhouse gas emissions by NC sector, 1990-2020 (MtCO₂e)

Source: Department for Business, Energy and Industrial Strategy

Table 2.2.1.d: Number of heads in the main livestock categories in the UK (in million heads)

	2005	2010	2020
Total Cattle	10.6	10.1	9.4
Dairy cattle	3	2.7	2.7
Non-dairy cattle	7.6	7.4	6.7

Source: Department for Environment, Food and Rural Affairs

Measures and actions

- ➔ From 2022, the UK Government will also provide grants for new slurry stores, equipment, and other interventions. The primary goal will be delivering reductions in nitrate and ammonia pollutants from slurry, a key cause of pollution on farms, but the grants will also reduce methane emissions and protect and restore habitats.
- ➔ Agroforestry to be encouraged
- ➔ Develop potential of feed additives for livestock
- ➔ The UK government will boost the existing £640 million Nature for Climate Fund with a further £124 million of new money, ensuring total spend of more than £750 million by 2025 on peat restoration, woodland creation and management. This will enable more opportunities for farmers and landowners to support net zero through land use change.
- ➔ Restore at least 35,000 hectares of peatlands in England by 2025, through the Nature for Climate Fund. Restore approximately 280,000 hectares of peat in England by 2050, including via funding from the new environmental land management schemes.
- ➔ Mobilise private investment into tree planting, including through the Woodland Carbon Code, with the support of government's Woodland Carbon Guarantee, and into peat restoration through implementing a package of reforms to the Peatland Code.
- ➔ The UK has set a target to increasing planting rates to 30,000 hectares per year

Climate Targets and Current Emissions Regarding the Land Agri-Food System

In 2008 the United Kingdom passed the Climate Change Act³³ establishing a legally binding framework for the Government to address and combat climate change. This act requires an independent Climate Change Committee; a Climate Change Risk Assessment which, every five years, analyses risks and opportunities; and for all four UK administrations to produce a National Adaptation Programme every five years in response to the aforementioned Risk Assessment. These plans are to set out the objectives, proposals and policies of each nation.

The current iterations of the National Adaptation Programmes are *Net Zero Strategy: Build Back Greener* – England³⁴; *Update to the Climate Change Plan 2018 - 2032: Securing a Green Recovery on a Path to Net Zero* – Scotland³⁵; *Net Zero Wales Carbon Budget 2 (2021 to 2025)* – Wales³⁶; and the *Northern Ireland Climate Change Adaptation Programme 2019-2024* – Northern Ireland³⁷.

The Climate Change Act commits all four of the UK nations to reduce their greenhouse gas emissions by at least 100 per cent of the 1990 levels (achieve net zero) by 2050. In 2019 the pledge was updated to also be 68 per cent below 1990 levels by 2030.

In Scotland, an additional Climate Change (Emissions Reduction Targets) (Scotland) Act 2019, has more ambitious targets to reduce Scotland's emissions of all greenhouse gases to 75 per cent by 2030, 90 per cent by 2040 and achieve net zero by 2045. Wales has also gone further, in 2021 the Welsh Senedd committed to a suite of emissions targets – 37 per cent by 2025, 63 per cent by 2030, 89 per cent by 2040 and at least net zero by 2050.

On average, UK emissions have dropped 47 per cent from their 1990 levels to 426.5 MtCO₂ in 2021 (GHG covered by the Kyoto Protocol).

Agriculture is the fifth highest sectoral emitter of greenhouse gases in the UK. It is responsible for approximately 11 per cent of all UK emissions. A breakdown of emissions shows that 54 per cent is methane from animal husbandry, 32 per cent is Nitrous Oxide from synthetic fertilisers and in part live-stock too, and 12 per cent is Carbon Dioxide from farm machinery. In Northern Ireland, agriculture is a growing emitter and the highest emitter by sector at 29 per cent. Northern Ireland aside, The Office of National Statistics³⁸ shows a slight downward trend in UK agricultural emissions with an overall drop of 13 per cent from 1990 levels. Although not impressive relative to the overall drop or the target of 68

33 <https://www.legislation.gov.uk/ukpga/2008/27/contents>

34 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

35 <https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents/>

36 <https://www.gov.wales/sites/default/files/publications/2021-10/net-zero-wales-summary-document.pdf>

37 <https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Northern%20Ireland%20Climate%20Change%20Adaptation%20Programme%202019-2024%20Final-Laid.PDF>

38 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957887/2019_Final_greenhouse_gas_emissions_statistical_release.pdf

per cent by 2030, this mild success is attributed to the fall in numbers of livestock and decreased use of fertilisers. The legacies of the 1980's Milk Lakes and Butter Mountains, the 2001 outbreak of Foot and Mouth Disease and changes in diet are to name but a couple of external factors linked to the downward trend of at least the former. We must also conversely note that fertiliser use has been creeping back up from 2013 and interestingly the independently commissioned National Food Plan notes that GHG emissions from agriculture have not decreased in the last decade. Each administration has different targets and priorities reflecting the varied challenges and opportunities of the dominant agricultural practices of each nation. For example, in Build Back Greener, England targets that by 2030 75 per cent of farmers will be engaged in low carbon practices, this number rising to 85 per cent by 2035. According to Climate Action Tracker³⁹, the UK's climate action is so far insufficient to meet the Paris Agreement needs and a key policy gap is agricultural decarbonisation.

The UK's land use, land-use change, and forestry sector (LULUCF) is unlike some other countries in this report, a net emitter. This is in part because of the UK's low forest coverage (only 13 per cent – 3.2 million Hectares) and the UK's degraded peatlands. The emissions have, however decreased by over 70 per cent from 1990 levels partially due to an increase in non-farmed wild spaces and an increase in forest cover (please see Table). Unfortunately, Government published results⁴⁰ do show numbers of woodland birds and butterflies are nonetheless declining rapidly in the UK. The Government's strategy to decrease LULUCF emissions relies on agricultural productivity improvements and afforestation coupled with carbon markets to drive needed private investment. In England, the government has also committed to restore 280,000 Ha of peatlands in England by 2050 but this only represents ~30 per cent of England's peat.

39 <https://climateactiontracker.org/countries/uk/>

40 <https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2021/chapter-11-environment>

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

The measures, policies and programmes being carried out to decarbonise the UK Land Agri-Food System are listed and discussed in depth in the Table below. The three lists before the table highlight key action areas, needs recognised (some by independent reports commissioned by the government) and (in our opinion) the most inspired policies, reports and ideas which we would like to draw your attention to.

1. **The key focal of areas of action** by which farming and land use in the UK are to become more climate-friendly in the UK can be summarised as following:
 - ➔ An array of incentive schemes – Public money for public goods and innovation
 - ➔ Sustainable and better animal welfare practises for livestock farming, rather than decreasing livestock farming
 - ➔ Incentivising sustainable farming practices for livestock and arable farming
 - ➔ Afforestation
 - ➔ Peatland restoration
 - ➔ Making space for nature on farmland, or repurposing farmland to wilder spaces.
2. **The key needs identified** – for farmers and for the climate – in the UK be summarised as following:
 - ➔ Soil degradation across the UK
 - ➔ Biodiversity loss and loss of wild spaces
 - ➔ Existence of dysfunctional feedback loops: Junk Food Cycle and the Invisibility of Nature
 - ➔ Various systems traps including addiction to inputs; marketability of junk food; yield economies; trade-deals and competition; and subsidy distortion
 - ➔ Trade-off between long-term viability, profitability (especially with loss of CAP) for farmers and intensification of farming
 - ➔ A decade without decreased Green House Gas emission by the sector
 - ➔ Farming is in part responsible for the beauty, tourist attractiveness and rural culture of the United Kingdom
 - ➔ Limited carbon sequestration by our farms and landscapes
 - ➔ Lack of agriculture's (and downstream public services) resilience to extreme weather
 - ➔ Need for technological improvements in farming to overcome reliance on fossil fuels
 - ➔ Need to cultivate trust of the farmers and landowners.
 - ➔ The vast amount of food waste and broken circular economy in the UK
 - ➔ Water quality issues and eutrophication
3. **The most inspired policies and proposals** (in our opinion) by which farming and land use in the UK are to become more climate-friendly in the UK are as following:
 - ➔ In general, some interesting incentive mechanisms and schemes are emerging in the UK out of necessity, in response to basic farm payment (from CAP) being phased out. Farming for most in the UK is neither viable nor possible without subsidies at the moment and so the governments of each nation are providing alternative sources of public money for farmers in

return for 'public goods.' The most developed of these are the **Environmental Land Management schemes (ELMs)** in England which has three different tiers, but we advocate looking at all. One promoting sustainable farming – directly tackling arable and livestock farming techniques, the second encouraging neighbouring farms to work together for wide environmental benefit and the third is for landscape recovery. Another notable incentive mechanism is the **Farming Innovation Programme**, a series of competitively won funds for a variety of research and innovation topics run at farm level, the funds of which are available to farmers. We like the competitive nature of this programme and also the encouragement of farmers to work in consortia.

- Although not discussed in the below table, we would like to draw attention to the Welsh paper which partners the Welsh *Net Zero Wales Carbon Budget 2 (2021 to 2025) - Working Together to Reach Net Zero*⁴¹. The paper wisely notes from the off that it takes more than the Welsh government to reach net zero - it takes everyone, and in this vein Senedd has taken steps to engage the wider population through the linked Pledge Campaign launched in 2019 which has been taken up by schools, councils, communities and alike. There are some excellent examples of farmer led cooperatives and land/forestry groups undertaking exemplar trials into net zero and environmentally friendly farming because of this initiative and these are highlighted in this paper. We feel this is a paper and policy worth exploring.
- The paper commissioned by Westminster, the *National Food Strategy*⁴² brings human and environmental health together under the microscope. There are innumerable links between farming healthily for our diets and farming healthily for the environment and the climate. This paper, and the commissioning behind it we feel is vitally important in the creation of thoughtful and systemic policies to tackle farm emissions and the need for carbon neutrality and environmental consideration in farming. We strongly advise reading. We would also like to flag pages Chapter two pages 30-36 on systems dynamics and systems traps as a clear and useful fundamental tool for the employment of systems thinking.
- The Woodland Carbon Code is a relatively new UK-wide standard for verifying carbon capture through woodlands and peatlands. It links farms and their woodland creation/peatland restoration projects to the private sector/ individuals wanting to carbon offset by providing a standard and verifiable measure of carbon sequestration for carbon offsetting. This code is also being used to mobilise private investment into woodland creation. The Forest Expansion Scheme in Northern Ireland, alike the rest of the UK encourages the creation of new forests, however this scheme stipulates that new forested areas need to be in blocks of at least 5 hectares or larger and contain a wide variety of tree species. The carbon capture, biodiversity and resilience benefits as well as the bolstering other public benefits such as flood alleviation by this programme are worth noting.
- The Welsh have introduced an exciting new circular economy measure, *Beyond Recycling Strategy*⁴³, which will support farms and the surrounding food system to be more resource efficient, requiring changes in farmer/business approach and behaviour. Actions are varied and will be achieved by working across the whole supply chain with businesses and connecting them to farmers; improving advice on resource efficiency to farmers; and (most notably)

41 <https://www.gov.wales/sites/default/files/publications/2022-04/working-together-to-reach-net-zero-all-wales-plan-april-22-update.pdf>

42 <https://www.nationalfoodstrategy.org/>

43 <https://www.gov.wales/beyond-recycling>

introducing *Extended Producer Responsibility for Packaging* - so that producers bear the full end of life costs of their packaging.

- ➔ Strongly recommend reading *Delivering our future, Valuing our Soils: A Sustainable Agricultural Land Management Strategy for Northern Ireland*⁴⁴ which includes a very thorough – and inspired – analysis and list of recommendations for agriculture in Northern Ireland.
- ➔ Peer to Peer learning within and including farming circles is being encouraged in all nations and we see this as a hugely valuable way to promote behavioural change and trust in farmers. We have particular admiration for the Scottish and Welsh programmes.

The measures related to these needs and areas of action are described in the table below (Table 2.2.1.e).

Table 2.2.1.e: Description of Measures under the United Kingdom's Climate Action Programme

Measures in Climate Action Plan / Programme
Focus area: Livestock ▪ UK general: Please note that the Climate Action Tracker criticises the UK government for its current policies which ignore measures to reduce consumer demand for high-carbon activities such as consumption of red meat. Rather than decreasing numbers of livestock, policy is steered towards increasing the sustainability of livestock farming practices. Sustainable practises ▪ Scotland: This Scottish government understands that (i) with its temperate climate, reliable rainfall, and permanent grassland, it has a climate ideally suited to livestock farming and (ii) that alongside best practice by its farmers, Scotland is well suited to producing high quality meat - therefore instead of transitioning away from livestock farming (although encouraging mixed farming and agroforestry), adopting new methods and technologies is important for Scotland as is the route that will be taken. ▪ Wales: Proposal 27 – Organic conversion - despite being a proposal, this is now running. Wales is providing 3 years of financial support to farmers who are converting their operations to organic farming. This is not exclusive to livestock farming but reflects the dominance of livestock farming in Wales. As is well known, farmers lose revenue during their period of conversion to organic, as livestock stocking densities are reduced, and costlier organic feed and seed needs to be used. By providing farmers with a payment during the conversion process, Welsh farms will be able to meet part of the growing demand for organic products sold in the UK and hence shorten supply chains. The reduced stocking density of animals on farms will mean lower carbon emissions from farms themselves, while not using farm chemicals such as fertiliser will further reduce a farm's carbon footprint, because of the emissions caused during the production of such chemicals. ▪ Wales: The Red Meat Development Programme aims to equip the red meat sector for the future; promoting efficiency, profitability and sustainability throughout the supply chain, and ensuring a high-quality traceable product that future consumers will want. It notably protects red meat suppliers in Wales – aiming for transformation over decimation. This programme consists of three strategically important projects: Stoc+, the Hill Ram Scheme and Welsh Lamb Meat Quality which focus on animal health, genetics and meat-eating quality. ▪ Wales: Proposal 28 – Precision farming – The uptake of new technology and precision farming techniques will be crucial in climate change mitigation. From soil and grassland management, animal health, genetics and feed conversion, applying innovative practices on the ground will support the industry as it adapts to the challenges ahead. ▪ Wales: Policy 65 – Wales Animal Health and Welfare Framework (WAHWF) - The WAHWF sets out a plan for continuing and lasting improvements in standards of animal health and welfare for kept animals, whilst also helping to protect public health and contributing to tackling the climate emergency. Healthy animals help protect the productivity and production levels of farmers, reduce capital losses, minimise negative trade impacts as well as reducing pollution and greenhouse gas emissions. Greenhouse gas emission benefits that accrue from improved health vary between diseases. This links to the Policy 66 – Red Meat Development Programme and Policy 67 – Dairy Improvement Programme. ▪ ▪

44 <https://www.daera-ni.gov.uk/sites/default/files/publications/daera/16.17.079%20Sustainable%20Land%20Management%20Strategy%20final%20amended.PDF>

Focus area: Reduction in crop and soil N₂O

- **Northern Ireland:** DAERA has developed and maintained the NI Plant Health Risk Register which is a local prioritised list in which plant diseases and pests are prioritised based on local NI factors. It is a tool for government, industry and other stakeholders to prioritise action against pests and pathogens which threaten our crops, trees, gardens and countryside. Climate change can bring an increased threat from a wide range of plant diseases and pests. This register provides an important step in protecting the agriculture, horticulture, forestry, landscapes and the wider environment wildlife from pests, pathogens and invasive species by identifying these threats.
- **Wales: Policy 61** – The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 will be fully implemented by August 2024 and apply across the whole of Wales. Whilst developed primarily to prevent the pollution of watercourses, the Regulations are also a key part of reducing atmospheric emissions from agriculture. Increasing nutrient efficiency will reduce losses of pollutants to the environment, the regulations are expected to reduce annual nitrous oxide emissions from agriculture by approximately 2.7 per cent by the end of 2024.

Focus area: Low Carbon/Nature Friendly Farming (Not arable/ livestock Specific)

- **Northern Ireland (and the Republic of Ireland):** The *All-Ireland Pollinator Plan* provides an important framework to bring together pollinator initiatives from NI and the Republic of Ireland. It is the start of a process by which positive steps can be taken to protect pollinators and the services they provide into the future. The plan aims to halt pollinator losses by creating a pollinator friendly landscape which will enable pollinators to survive and thrive. The plan will help to address the risks to native pollinator species and their habitats by helping them adapt to changing climatic conditions.
- **Northern Ireland:** The Expert Working Group published their strategy document *Delivering our future, Valuing our Soils: A Sustainable Agricultural Land Management Strategy for Northern Ireland* – a document well worth reading – a series of DAERA initial actions to be tested through a series of pilot initiatives to ensure that the Expert Working Group recommendations were suitable for wider implementation.

Advice and Peer to Peer learning:

- **Scotland:** Increasing provision of advice, corresponding to a promising increase in uptake and support through two initiatives the *Farm Advisory Service* and *Farming for a Better Climate*
- **Scotland:** Is undertaking a range of research and knowledge transfer projects to inform low carbon farming and to help develop understanding of low carbon technologies and the opportunities they present for Scotland.
- **Scotland:** encouraging peer to peer support through their Climate Change Champions award and *Monitor Farms*
- **Wales:** Recognising that farmers learn best from each other and by using strategic farms encouraging 'farmer to farmer' learning through regular on-farm meetings, Wales has various schemes such as *Farming Connect*, *The Red Meat Development Programme*, *Dairy Improvement Programme* and *European Innovation Partnership Wales* which open up support, links to advisers, researchers, and businesses, illustrative farms and peer to peer learning channels.
- **Wales:** Policy 69 – Agriculture Bill – new bill to create a new system of farm support that will maximise the protective power of nature through farming. It is proposed that this new system will reward farmers who take action to meet the challenges of responding to the climate and nature emergencies, supporting them to produce food in a sustainable way.
- **Wales:** Proposal 23 – Sustainable Farming Scheme (SFS) – This is very similar to the ELMs scheme in England and aims to ensure active farmers who are working to benefit the environment are supported and is expected to commence in 2024. The proposed SFS will provide support to farmers – both financial and advisory – which will be targeted at outcomes not currently rewarded by the market. It is proposed the fundamental change to the current Basic Payment Scheme will be the level of payment being linked to the outcomes delivered by a farmer through undertaking a range of management actions on farm such as: increased livestock performance by improving animal health; managing and reducing inputs such as artificial fertiliser; improving soil health and soil carbon content; increased energy efficiency and use of renewables, reducing reliance on fossil fuels; increased tree cover through agroforestry; and, restored and well managed natural habitats such as peatland.

Incentive Mechanisms:

- **UK General:** the UK is phasing out the Basic Payment Scheme, a historic subsidy associated with the EU Common Agricultural Policy. It is being replaced by various new schemes which include investment in farm productivity, landscape recovery, carbon neutral farming and animal health and welfare.
- **England:** The line-up of English grants is well visualised through this *DEFRA Blog post* and the following doc gives a nice intro: *New farming policies and payments in England*.
- **England:** is currently trialing and will be introducing *three environmental land management schemes* (ELMs): the Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery. The Sustainable Farming Incentive will be open to all farmers and will incentivise low carbon practices, for example, soil and nutrient management and is made up of a series of standards. Local Nature Recovery will fund actions that support local nature recovery and deliver local environmental priorities working with multiple farmers. The Landscape Recovery scheme will fund long-term land use change projects such as large-scale tree planting, and peatland restoration projects (see LULUCF Landscape Recovery of this table for more info on these latter two).

- **England:** The [Farming Innovation Programme](#) is a series of competitively won funds which started in 2021. This programme is for a variety of research and innovation programmes, is run at farm level and is available for farmers. Theme 1 (closed) was Climate Smart Farming, Theme 2 (closed) was Sustainable Farm-based Proteins and Theme 3 (currently open) is on automation and robotics.
- **Northern Ireland:** The [Environmental Farming Scheme](#) is a voluntary scheme that financially supports farmers and land managers to carry out environmentally beneficial farming practices on agricultural land. This includes actions that aim to contribute to climate change adaptation by supporting farmers and land managers to restore, preserve and enhance biodiversity; improve water management and water quality; reduce soil erosion and improve soil management.
- **Scotland:** In 2020 Scotland launched its 2020 Agricultural Transformation Programme to support farming's contribution to meeting Scotland's climate change ambition – it appears to be an incentive mechanism; however, it has remained vague in descriptions.
- **Wales: Policy 62 – Glastir grant scheme** – a currently running five year whole-farm sustainable land management scheme, offering payment for the delivery of specific environmental goods and services which tackle emissions from agriculture, reduce the impacts of climate change within agriculture and reverse biodiversity loss, whilst improving water, air and soil quality.
- **Wales:** The [Glastir Small Grants Scheme](#) provides support for farmers to undertake investments on farms to enhance their environmental performance, including the restoration and creation of hedgerows and small-scale tree planting.
- **Wales: Policy 63 – Farm Business Grant (FBG)** – A total of £40m was made available under the FBG through the EU Rural Development Programme to help farmers invest in new equipment and machinery. Grants of up to £12,000 were available to buy equipment to support farm efficiencies such as animal handling, energy efficiency, storage and management of nutrients – all of which contribute to lowering on farm emissions.
- **Wales: Policy 64 – Sustainable Production Grant** – A total of £22m was made available through the last three rounds of the SPG, with the last funding window having closed in March 2021. The scheme offered a maximum 40 per cent grant contribution (from £12,000 to £50,000) towards capital investments in equipment and machinery which have been pre-identified to specifically support farmers to address and safeguard nutrient management and improve water, soil and air quality by reducing the impacts of agriculture pollution.

Focus area: Energy mitigation

- **General UK:** - In the December 2020 advice, the Climate Change Committee explain improving fuel efficiency on farm will require transitioning from fossil fuel machinery to the use of electric mobile and stationery machinery. The Climate Change Committee recommend encouraging the take up of low carbon technology such as robotics and improving/ updating on farm technology to reduce the use of fossil fuels for heating, cooling and lighting farm buildings.
- **England:** Biomass is to be an important component of the pathway to net zero. It is likely that the UK will be producing more domestic perennial energy crops (such as miscanthus and short rotation coppice) and short rotation forestry than today, but the exact role is yet to be determined. [The Biomass Strategy](#) should address this. The sustainability, and wider environmental impact of growing and using biomass, including on air quality, will be key factors in establishing its role.
- **England:** The aforementioned [Farming Innovation Programme](#) competition is currently open for funding is on automation and robotics.
- **Wales:** Proposal 25 – Fuel efficiency - Wales will support agricultural businesses to exploit opportunities for use of low carbon farm technology and on farm renewable energy generation. Fossil fuel use on-farm will decrease as renewable energy, electrification of transport and heat and hydrogen and bio methane, from anaerobic digester, technology develops. Furthermore, Zero emission technological advances in the transport sector will progress the technology available for use in agricultural machinery. A wider shift towards zero emission technologies in vehicles will bring down the cost of technology making it more accessible for use on-farm. It is anticipated, electric agricultural vehicles will primarily recharge on-farm from on-farm renewable energy generation in the future, whilst the roll out of electric vehicle charging infrastructure will support the use of these vehicles off farm. This links to Proposal 26 – supporting innovation in renewable energy/technology

Focus area: Wider food system

- **England:** To support the UK's commitment to explore options for the near elimination of biodegradable municipal waste to landfill from 2028, England are bringing forward £295 million of capital funding which will allow local authorities in England to prepare to implement free separate food waste collections for all households from 2025. Waste management emissions currently consist of waste disposed to landfill sites, waste incineration without energy recovery and the treatment of wastewater. In 2019, waste management accounted for 25 MtCO₂e (5 per cent) of UK emissions, a significant decrease of 71 per cent since 1990, largely driven by a reduction in biodegradable waste to landfill.

- **England: The Resources and Waste Strategy (RWS)**, (2018) sets out how the UK will transition to a more circular economy and included key reforms to enable the UK to manage our waste more efficiently, reduce the amount of waste the UK creates as a society, and ensure the UK uses resources more efficiently.
- **England:** The Government commissioned a (second) independent **National Food Strategy** (2021)- which takes a close look at how the UK (including imported) food system really works, the damage it is doing to human health and the ecosystem, and the interventions the UK could make to prevent these harms. It considers the characteristics of complex systems and the mechanisms that cause system failures and sets out a strategy for the future. This report, and the commissioning by the government ties together human health and environmental health – whilst nodding to the Malthusian defying ‘miracle’ which is our global food system in being able to provide (albeit it unevenly) the calories to feed 7.8 billion people – it calls for the UK to look critically at two destructive cycles ruling our food system – the junk food cycle and the invisibility of nature – for both human and environmental health. The government is expected to return with policies that respond to the health and environmental crisis. A big watch this space and encouragement to read.
- **Northern Ireland:** The strategic action plan - ‘**Going for Growth*** in support of the NI Agri-Food industry’;- is worth a read because it specifically recommends the development of a strategic land management policy which emphasizes that agricultural productivity must be considered in parallel with the need for our Agri-Food Industry to maintain and enhance environmental performance.
- **Wales: Proposal 24** – Working with farmers and the waste sector to improve resource efficiency and increase circularity on farms. There are a number of actions within the **Beyond Recycling Strategy**, which will support farms to be more resource efficient and which require changes in farmer approach and behaviour. Actions include eradicating food waste by working with businesses and connecting them to farmers and vice versa, across the whole supply chain from farm to fork; improving advice on resource efficiency to farmers; and introducing Extended Producer Responsibility for Packaging - so that producers bear the full end of life costs of their packaging. This will include mandatory universal labelling to ensure it is easy for people to understand what can and cannot be recycled. This will incentivise better design and the use of more sustainable materials. Wales will work with farms and others who produce packaging to be aware of and be ready for these changes; and lastly take action on single use items, especially plastic. In terms of farms, this could include reducing the amount of single use plastics used and ensuring what plastic is used is recycled effectively such as bale wraps.

Focus area: Woodland Creation/ Carbon sequestration

- **Northern Ireland:** The Forest Expansion Scheme encourages the creation of new forests blocks of at least 5 hectares and larger. The main benefit delivered under the scheme is to increase carbon capture (sequestration) and reduce the amount of carbon dioxide in the atmosphere. However secondary climate change adaptation benefits from the scheme also include improved biodiversity. The scheme encourages creation of new resilient woodland of at least 5 hectares and larger by promoting projects with a wide variety of tree species and larger woodland areas. This enhances the ability of individual species to endure climate change. Forests are known to help reduce flooding as they absorb more water than other 73 vegetation types. They also contribute to flood alleviation risk by enhancing soil’s ability to store rainwater and by holding back and delaying the passage of rainwater to streams and rivers.
- **The Forests for our Future Programme** aims to plant 18 million trees by 2030 to create 9,000 ha of new woodland.
- **Scotland:** encouraging the integration of trees on farms and crofts.
- **Scotland:** will continue to expand forest cover in Scotland, building on the success of creating 22,000 hectares of new woodlands in the last two years. Scotland will increase new woodland creation from the current target level of 12,000 hectares annually in 2020/21 up to 18,000 hectares in 2024/25.
- **Scotland:** Scottish Forestry and Forestry and Land Scotland will work with investors, carbon buyers, landowners and market intermediaries to increase private investment in new woodlands in order to increase the woodland carbon market by at least 50 per cent by 2025.
- **Scotland:** A new policy to support the forestry sector to develop a plant and seed supply strategy to help meet the increased planting targets. A programme of technical innovation to develop and adapt modern horticultural practices will help improve seed preparation and handling, techniques to reduce environmental impacts, and increase nursery production. Funding to support increased production of young trees is available through the Harvesting and Processing grant which is now open to forest nurseries across GB with support from Defra.

Focus area: Woodland Maintenance

- **UK General:** The **Woodland Carbon Code**, a UK-wide standard for verifying carbon capture through woodlands (and peatlands) has been introduced and works with farmers in woodland creation, creating links between farms and the private sector/ individuals through providing a standard measure for carbon offsetting.

- **England:** Aims to treble woodland creation rates by the end of this Parliament (2024), reflecting England's contribution to meeting the UK's overall target of increasing planting rates from 13,410 hectares to 30,000 hectares per year by the end of this Parliament and maintain new planting at least at this level from 2025 onwards (please see the [The England Tree Action Plan](#) (2021) for more information). The government will explore a long-term statutory tree target in England within the public consultation on Environment Bill targets. Forestry and woodlands currently act as carbon sinks and, in 2019, captured (only) about 4 per cent of the UK's emissions. Since 2010, 123,000 hectares of new woodland have been planted across the UK, committed to increasing tree planting rates across the UK.
- **England:** Mobilise private investment into tree planting (£500 million already supported in the Nature for Recovery Fund for reforestation), including through the Woodland Carbon Code, with the support of government's Woodland Carbon Guarantee.
- **Northern Ireland:** Maintain an emergency Forest Service fire plan and monitor and report the extent of fire damage to forest and open ground (hectares) on Forest Service managed property. DAERA Forest Service is one of the largest landowners in NI, and it manages a natural capital asset of approximately 75,000 hectares of productive forest and open ground valued at some £300 million. Just over 25 per cent of land it manages is covered by European and National conservation designations including Special Areas of Conservation, Special Protected Areas and Areas of Special Scientific Interest. As custodians of the forest estate, Forest Service has a responsibility to protect this asset as well as those people who work in and visit the forest. Forest fires have been an issue for forestry since the major re-forestation programme started in the middle of the twentieth century. However, there is evidence in the NI Evidence Report that climate change may lead to a trend of progressive increases in wildfire incidents and impacts. To mitigate this risk, Forest Service maintains an Emergency Fire Plan to deal with fire incidents including risks posed to public safety and property. This is achieved through co-operation with the NI Fire and Rescue Service. Forest Service monitors wild-fire damage to its forests and open ground and reports the area and value of forest damaged by wildfire in its annual reports.

Focus area: Peatlands

- **England:** Restore at least 35,000 hectares of peatlands in England by 2025, through the Nature for Climate Fund. Restore approximately 280,000 hectares of peatland in England by 2050, including via funding from the new environmental land management schemes. Although peatlands are the UK's largest terrestrial carbon store, in a degraded condition they represent a net source of emissions. In 2019, peatlands emitted 4 per cent of UK net GHG emissions, having become degraded due to drainage for agricultural use, overgrazing and burning. The UK have already rewetted around 100,000 hectares of peatland across the UK and set out further plans for peatland restoration and responsible management in the England Peat Action Plan (May 2021).
- **England:** Boost the Nature for Climate Fund some of which is being directed at Peatland restoration.
- **England:** Mobilise private investment into peat restoration through implementing a package of reforms to the Peatland Code.
- **Scotland:** As of March 2020, over 25,000 hectares of peatland have been put on the road to restoration, and earlier this year Scotland announced a £250 million ten-year funding package to support the restoration of 250,000 hectares of degraded peat by 2030. To deliver on the 2032 emissions reduction envelope annual peatland restoration needs to be far higher than the current 20,000-hectare annual target and Scotland will work closely with delivery partners, land-owners, managers, farmers and crofters to continue to encourage more restoration of peatland, both traditional bog but also land that offers the highest emission savings per hectare.
- **Wales:** In November 2020, the Welsh Government published its National Peatland Action Programme to target peatland bodies most in need of restoration, with the aim of delivering 600-800 ha of restoration per year. It will also safeguard those in good and recovering condition. Activity will be delivered by Natural Resources Wales and partners across a range of land uses on both private and public land.

Focus area: Timber usage

- **England:** The UK will work with key stakeholders to develop a policy roadmap to increase the use of timber in construction in England and will create a cross-government and industry working group tasked with identifying key actions to safely increase timber use and reduce embodied carbon.

Focus area: LULUCF Landscape recovery

- **England:** Through the Environment Bill the UK will legislate for Local Nature Recovery Strategies – a new system of spatial strategies that will map proposals for improving or creating habitat for nature and wider environmental benefits, helping to deliver net zero objectives.
- **England:** spotlights on the second of the ELMs incentive scheme – The Local Nature Recovery scheme will pay for actions that support local nature recovery and meet local environmental priorities. Importantly, the scheme will encourage collaboration between farmers, helping them work together to improve their local environment.

- **England:** spotlight on the third of the ELMs incentive scheme – Landscape Recovery – The Landscape Recovery scheme will support landscape and ecosystem recovery through long-term projects, such as: restoring wilder landscapes in places where it's appropriate; large-scale tree planting; peatland and salt marsh restoration. The scheme will begin piloting around 10 projects in 2022, and will launch in 2024.
- **Northern Ireland:** Complete 23 catchment studies as part of the ScaMP NI project*: The ScaMP NI project (discussed previously in Chapter 7 Outcome Objective NC1) applies sustainable catchment-based solutions that focus on protecting and enhancing the natural environment by reducing contaminants washed into our drinking water sources. This is achieved through sustainable catchment management activities. These activities include: managing livestock to prevent over-grazing; restoring areas of eroded/ exposed peat; improving farm management practices to reduce pesticide and fertiliser run-off; and education and public awareness campaigns. The activities have a secondary climate change adaptation benefit as they also contribute to the management of risks and opportunities arising from changes in agricultural and land suitability, and the risks to soil from increased soil aridity or wetness.
- **Scotland:** In recognition of the importance of the marine environment for naturally storing carbon, Scotland has committed over £570,000 to its Blue Carbon Research Programme. Scotland is currently developing Scotland's Blue Economy Action Plan – please watch this space.
- **Scotland:** will explore options for land-use change to optimise uses beyond traditional farming and food production to multi-faceted land use including forestry, peatland restoration and management and for biomass production, including provision of advice for farmers and crofters who wish to step back from agricultural businesses by providing an opportunity to consider alternative land- uses or alternative agricultural uses.
- **Scotland:** Scotland's land and the natural capital it supports will play a fundamental role not only in its response to the climate crisis, but also in its green recovery from COVID-19. Land use change at the required scale will provide green economic and employment opportunities, offer public health benefits, help to address rural depopulation, and provide social benefits to communities across Scotland. This will in turn help secure a just transition to the Scottish economic and environmentally sustainable future.
- **Wales: Proposal 29 – Land sharing –** The Climate Change Committee recommends converting some of Wales' agricultural land into woodland, shifting some agricultural land to biofuel production and the restoration and sustainable management of our peatland. Wales has set out our proposal to establish Sustainable Land Management as the framework for future agriculture support by way of the Agriculture Bill. It is proposed that Sustainable Land Management will reflect the use of land for production, whilst ensuring our natural resources are preserved and enhanced for future generations. The intention is that SLM will incorporate the whole farming system. Farms will be incentivised to make best use of their land to deliver economic, social and environmental outcomes through a land sharing approach (which can be achieved, for example, through more diverse cropping, reducing the use of agrichemicals, planting more trees in and around fields and introducing more diverse species in a grass sward), as opposed to a land sparing approach (which can be categorised as intensifying farming practice to obtain the same yield from a smaller area of farmland so that less productive areas can be released specifically for conversion away from food production).

2.2.2 Canada

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.2.2.a: Canada's national GHG emissions and reduction targets

	GHG emissions (MtCO ₂ e)	GHG emission reduction targets (compared to 2005 levels)	
	2019	By 2030	By 2050
Total (excl. LULUCF)	730	-40-45%	Net 0
Agriculture	59	ND	ND
N₂O (Mt CO₂eq.)	28.8	ND	ND
CH₄ (Mt CO₂eq.)	28.4	ND	ND
CO₂ (Mt)	1.8	ND	ND

Source: National Inventory Report to UNFCCC (2021), Canada's NDC.

Table 2.2.2.b: Canada's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

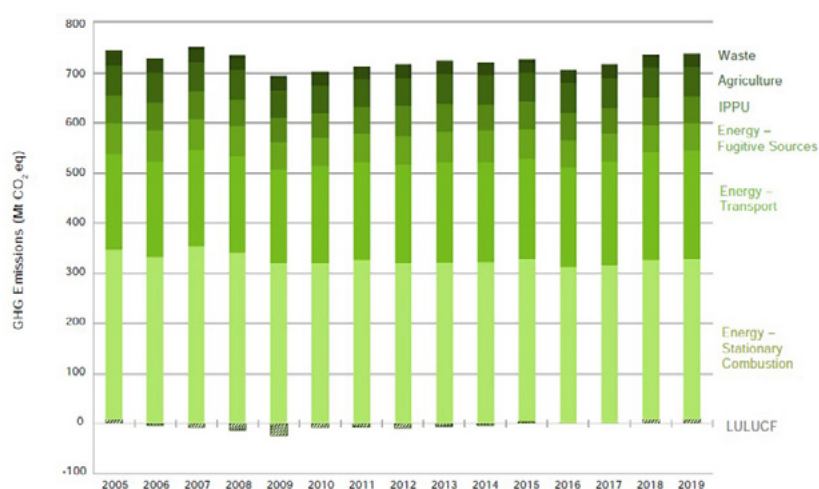
GHG Emissions of Agriculture (8 % of Total Emissions) - 2019		GHG Emissions / Removal of LULUCF - 2019	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	24	Forest Land	-133
Manure Management	7.9	Cropland	-4.2
Agricultural Soils	24	Grassland	<0.05
Liming	2.6	Wetland	2.6
Urea application & other fertilisers		Harvested Wood Products	143
Other	0.05	Settlements	2.2
Total (Agriculture)	59	Total (LULUCF)	9.9

Source: Country's National Inventory Report 2021 submitted to UNFCCC

Figure 2.2.2.a: Trends in Canadian GHG emissions by Intergovernmental Panel on Climate Change Sector (2005-2019)

Source: National Inventory Report to UNFCCC (2021),

Table 2.2.2.c: Number of cattle (in million heads)



	2000	2010	2020
Total Cattle	14.9	13.7	12.6
Dairy cows	1.1	0.97	0.97
Beef cows	4.7	4.1	3.8

Source: Statistics Canada

Measures and actions

- ➔ National fertilizer emission reduction voluntary target of 30% below 2020 levels
- ➔ Invest more than \$3 billion over 10 years to plant two billion trees
- ➔ Invest \$631 million to restore and enhance wetlands, peatlands, grasslands and agricultural lands, as well as to improve land management practices, and conserve carbon-rich ecosystems.
- ➔ Provide climate action programs for farmers, including the \$185 million Agricultural Climate Solutions Program and the \$165 million Agricultural Clean Technology Program with an additional \$200 million to launch immediate, on-farm climate action, targeting projects that accelerate emission reductions by improving nitrogen management, increasing adoption of cover cropping, and normalizing rotational grazing.
- ➔ Increase funding for Indigenous Protected and Conserved Areas and Indigenous Guardians programs.

In March 2022, the Government of Canada introduced Canada's 2030 Emissions Reduction Plan⁴⁵, which provides a roadmap for the Canadian economy to **achieve 40-45 per cent emissions reductions below 2005 levels by 2030**. This builds on the actions outlined in Canada's previous climate plans.

Economy-wide strategies to reduce emissions, like carbon pricing, clean fuels, and reducing methane emissions (from oil and gas), aim to enable Canada to reduce emissions in the most flexible and cost-effective way. It is planned that they will provide policy certainty to businesses and Canadians, allowing everyone to make more informed decisions as Canada's economy decarbonizes.

According to Canada's National Inventory Report 2021, **Canada is also committed to reaching net-zero emissions** by 2050, and the Canadian Net-Zero Emissions Accountability Act⁴⁶ will establish a legally binding process of interim targets, plans and reports toward this objective.

After fluctuations in recent years, in 2019 (the most recent dataset in this report) Canada's greenhouse gas (GHG) emissions were up 0.2 per cent from 2018 emissions, but there was a net decrease of 1.1 per cent from 2005 emissions. Emission trends since 2005 have remained consistent with previous editions of the inventory; emission increases in the Oil and Gas and Transport sectors being offset by decreases in other sectors, notably Electricity and Heavy Industry.

Agriculture accounts for 8.1 per cent, or 59Mt CO₂e of emissions (2019). This is a 1.4 per cent reduction since 2005. The agriculture sector covers non-energy GHG emissions related to the production of crops and livestock. Agriculture accounted for 29 per cent of national methane emissions and 78 per cent of national N₂O emissions.

45 <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030.html>

46 <https://laws-lois.justice.gc.ca/eng/acts/c-19.3/fulltext.html>

Canada is the eighth-largest exporter of agricultural products and seafood in the world. It is a major producer of wheat and one of the world's biggest exporters of pulse crops like peas and beans. Canada is also a major producer of potash, a fertilizer, and canola oil and seed, used to make animal feed and vegetable alternatives to sunflower oil.

The main drivers of the emission trend in the agriculture sector are the fluctuations in livestock populations and the application of inorganic nitrogen fertilizers to agricultural soils in the Prairie provinces. Since 2005, fertilizer use has increased by 71 per cent. Major livestock populations peaked in 2005, then decreased sharply until 2011. In 2019, emissions from livestock digestion (enteric fermentation) accounted for 41 per cent of total agricultural emissions, and the application of inorganic nitrogen fertilizers accounted for 23 per cent of total agricultural emissions.

Net emissions/removals from the LULUCF sector have fluctuated over recent years, switching from a net source of 8.2 Mt in 2005 to a net sink of 24 Mt in 2009 and subsequently back to a net source of 9.9 Mt in 2019. Fluctuations are driven mainly by variations in emissions from Harvested Wood Products (HWP) and removals from Forest Land that are closely tied to harvest rates.

Approximately 30 per cent of HWP emissions result from long-lived wood products reaching the end of their economic life decades after the wood was harvested. Emission and removal patterns in both HWP and Forest Land have therefore been influenced by recent forest management trends and by the long-term impact of forest management practices in past decades.

After peaking in the years 2006 to 2011, current net removals from Cropland are 4.2 Mt, 6.2 Mt lower than in 2005, mainly as a result of increased conversion of perennial to annual crops on the Prairies and the declining effect of the adoption of conservation tillage on cropland that mainly occurred in the 1980s and 90s.

The conversion of forests to other land uses is still a prevalent practice in Canada and is mainly due to resource extraction and cropland expansion. Emissions due to forest conversion in the years 2005 to 2019 have fluctuated around 16 Mt.

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

The Government of Canada's focus areas for meeting 2030 emissions reduction target and reach net zero by 2050 in the agriculture sector are outlined in the table below. In addition to those measures they have also committed to:

- ➔ Committed to set a national fertilizer emission reduction target of 30 per cent below 2020 levels by 2030. Targets will only be voluntary as the plan has received a significant pushback from farmers.
- ➔ Budget 2022 proposes \$150 million for a resilient agricultural landscapes program to support carbon sequestration, adaptation and address other environmental co-benefits.
- ➔ Invest \$100 million in transformative science for a sustainable sector in an uncertain climate and net-zero economy for 2050. This funding will support fundamental and applied research supporting a path to net zero emissions, knowledge transfer, and developing metrics.

Canada is currently developing its first Sustainable Agriculture Strategy. A consultation process was launched in December 2022 and is due to run until the end of March 2023. The Strategy is meant to be a comprehensive tool to provide an integrated and coordinated approach for addressing environmental issues in the agricultural sector.

Canada's Provinces have also developed their own Provincial and Territorial Climate Action plans which are summarised in Canada's National Determined Contribution (2021)⁴⁷.

LULUCF

Canada has announced several billion dollars to support nature-based solutions. Its flagship initiative is to plant two billion trees over the next ten years. Talk of the two billion commitment dates back to the 2019 election, but the programme itself was only launched for the 2021 growing season. By 2031, up to \$3.2 billion will be invested in tree planting efforts to support provinces, territories, third-party organizations (for and not-for profit) and Indigenous organizations to plant two billion trees across Canada. Overall, these activities are estimated to reduce emissions by 4 – 7 MtCO₂e annually by 2030.

Carbon Trading

It is also worth noting that mandatory carbon pricing has been in effect across the country since 2019. The legislation enacting the carbon pricing scheme, the Greenhouse Gas Pollution Pricing Act, was found to be constitutional by the country's top court in March 2021 after three provinces challenged it (Supreme Court of Canada, 2021). Under the scheme, **all Canadian provinces and territories must have a cap and trade system or carbon tax in place**. Those jurisdictions that do not have such systems or taxes will fall under the federal backstop. The federal system has two components: a regulatory charge on fossil fuels and an output-based pricing system (OBPS), which applies to major emitting industrial facilities.

The initial carbon price of CAD 20/tCO₂e was set in 2019 and increased by CAD 10 each year to CAD 50/tCO₂e in 2022. In its revised climate plan, the government has proposed further increasing the carbon price by CAD 15 per year to 2030 or CAD 170. Canada is developing a federal GHG Offset system that would cover activities not covered by carbon pricing. Initially, the system will focus on voluntary projects in agriculture, waste and forestry. Credits generated under the system can be used to reduce the compliance costs of industrial facilities. Draft regulations were published in March 2021.

47 https://unfccc.int/sites/default/files/NDC/2022-06/Canada%27s%20Enhanced%20NDC%20Submission1_FINAL%20EN.pdf

The measures related to these needs and areas of action are described in the table below (Table 2.2.2.d).

Table 2.2.2.d: Description of Measures under Canada's Climate Action Programme

Measures in Climate Action Plan / Programme
Focus area: Reduction in crop and soil N₂O First announced in Budget 2021, the \$200-million On-Farm Climate Action Fund is an initiative to help farmers tackle climate change. The Fund is part of the Government of Canada's Agricultural Climate Solutions initiative, which falls under the \$4 billion Natural Climate Solutions Fund, a program managed by Natural Resources Canada, Environment and Climate Change Canada, and Agriculture and Agri-Food Canada. A further \$470 million has been allocated to this fund in 2022. This funding will allow the program to top-up funding for some current successful applicants, broaden support to additional key climate mitigation practices, extend the program past its current end date of 2023/24, and support adoption of practices that contribute to the fertilizer emissions target and Global Methane Pledge. The objective of the Fund is to support farmers in adopting beneficial management practices (BMPs) that store carbon and reduce greenhouse gases, specifically in the areas of: - Nitrogen management - Cover cropping - Rotational grazing practices These practices also provide other environmental benefits such as improved biodiversity and soil health. Other activities to support the adoption of beneficial management practices, such as outreach, education and training are supported. In February 2022, 12 projects were announced under the Fund, totalling up to \$182.7 million. Through individual application intakes, these 12 recipient organizations will redistribute funding to help farmers adopt and implement immediate on-farm BMPs that store carbon and reduce greenhouse gases in the areas of nitrogen management, cover cropping, and rotational grazing practices. A full list of successful projects can be found at https://agriculture.canada.ca/en/agricultural-programs-and-services/agricultural-climate-solutions-farm-climate-action-fund-0
Focus area: Carbon storage/ sequestration 2 Billion Trees Initiative
Focus area: Energy mitigation A \$165.7 million Agriculture Clean Technology (ACT) Program to support development and adoption of clean technology. This was increased to \$330 million in 2022. The Program aims to create an enabling environment for the development and adoption of clean technology that will help drive the changes required to achieve a low-carbon economy and promote sustainable growth in Canada's agriculture and agri-food sector. The ACT Program offers support under 2 streams: ▪ The Adoption Stream will support the purchase and installation of commercially available clean technologies and processes with a priority given to those that show evidence of reducing greenhouse gas (GHG) emissions, and other environmental co-benefits. Eligible activities under the Adoption Stream are of the following nature and type: - Green energy and energy efficiency - Precision agriculture - Bioeconomy solutions ▪ The Research and Innovation Stream will support pre-market innovation, including research, development, demonstration and commercialization activities, to develop transformative clean technologies and enable the expansion of current technologies, in the 3 priority areas above. Eligible activities are of the following nature and type: - Applied research and development of clean technologies - Piloting and evaluating clean technologies - Demonstration and knowledge and technology transfer activities - Commercializing and scaling up clean technologies - Other activities that support the Research and Innovation Stream as determined by the program

Focus area: Wider food system

A \$3 billion, five-year (2018–2023), **Canadian Agricultural Partnership**, cost-shared with provinces and territories (\$2 billion) and the federal government (\$1 billion), that supports on-farm environmental stewardship programs. The federal component of these includes:

- **AgriScience Program:** A five-year, up to \$338 million initiative to support leading edge discovery and applied science, and innovation driven by industry research priorities. Designed to accelerate the pace of innovation, the program supports pre-commercialization activities and invests in cutting-edge research to benefit the agricultural and agri-food sector. The AgriScience program offers funding through two components:
 - **AgriScience Program – Clusters:** Funding provided will support industry-led and commodity specific science and research projects that address priority themes and horizontal issues, and coordinate research activities across Canada. **Clusters are required to address environment and climate change issues unique to their sector and are encouraged to support research dissemination, extension and decision support tools for producers.**
 - **AgriScience Program – Projects:** Funding provided will support specific shorter-term science projects to help industry overcome challenges and address fiscal barriers experienced by small and emerging sectors. Project activities must address key industry and government priorities.
- **AgriInnovate Program:** A five-year, up to \$128 million initiative to accelerate the commercialization, adoption, and/or demonstration of innovative products, technologies, processes or services that increase agri-sector competitiveness and sustainability. The program will provide repayable contributions on projects that focus on one or more of the following priorities:
 - Adoption of new or world leading clean technology (including precision agriculture)
 - Increase productivity through advanced manufacturing, automation or robotics
 - Strengthen Canada's value-added agri-sectors
 - Secure or expand new export markets

Focus area: Peatlands

Canada is investing \$631 million to restore and enhance wetlands, peatlands, grasslands and agricultural lands, as well as to improve land management practices, and conserve carbon-rich ecosystems.

2.2.3 New Zealand

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.2.3.a: New Zealand's national GHG emissions and reduction targets

	GHG emissions (MtCO ₂ e)	GHG emission reduction targets (compared to 2005 levels)	
	2019	By 2030	By 2050
Total (excl. LULUCF)	82.3	-50%	Net 0
Agriculture	39.6	ND	ND
N ₂ O (Mt CO ₂ eq.)	7.7	ND	Net 0
CH ₄ (Mt Co ₂ eq.)	28.9	-10% compared to 2017	-24 to -47% compared to 2017
CO ₂ (Mt)	2	ND	Net 0

Source: *National Inventory Report to UNFCCC (2021)*, *New Zealand's First emissions reduction plan*.

Table 2.2.3.b: New Zealand's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (48 % of Total Emissions)		GHG Emissions / Removal of LULUCF (-33% of Total Emissions)	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	29	Forest Land	-22.1
Manure Management	1.7	Cropland	0.4
Agricultural Soils	7.8	Grassland	4.3
Liming	0.5	Wetland	0.01
Urea application & other fertilisers	0.6	Harvested Wood Products	-10.1
Other	0	Settlements	0.1
Total (Agriculture)	39.6	Total (LULUCF)	-27.4

Source: New Zealand's National Inventory Report 2021 submitted to UNFCCC

Figure 2.2.3.a: Agriculture sector emissions reductions in New Zealand

Source: NZ First emissions reduction plan

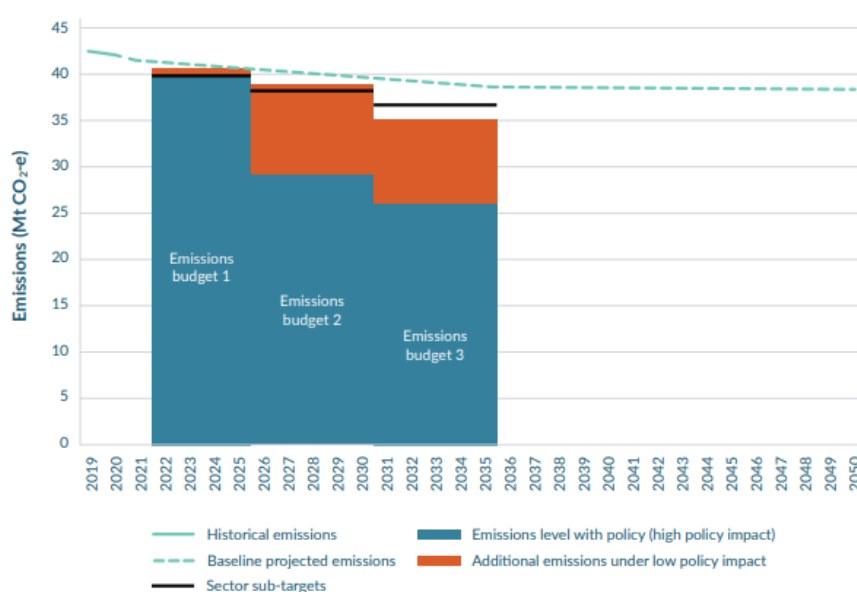


Figure 2.2.3.b: Sub-targets for this agriculture sector

ALL GASES, NET (AR5), EXPRESSED IN MT CO ₂ -E	EMISSIONS BUDGET 1 (2022–25)	EMISSIONS BUDGET 2 (2026–30) PROVISIONAL	EMISSIONS BUDGET 3 (2031–35) PROVISIONAL
Agriculture – baseline projections	163.1	199.0	194.8
Agriculture – emissions budgets sub-target	159.4	191.0	183.0
Additional emissions reductions required	3.7	8.0	11.8

Source: NZ First emissions reduction plan

Table 2.2.3.c: Number of livestock (in million heads)

	1999	2010	2019
Total Cattle	8.9	9.9	10.6
Dairy cows	4.3	5.9	6.3
Beef cows	4.6	3.9	3.9
Total sheep	45.7	32.6	26.8

Source: Stats NZ Agricultural Production Survey

Measures and actions

New Zealand's first emissions reduction plan (2022)⁴⁸ intends to introduce the following key actions during the period 2022–2025 with an estimated impact of 0.3 to 2.7 Mt CO₂eq emissions reduction resulting from the initiatives from this plan.

- ➔ The government will introduce an emissions pricing mechanism for agricultural emissions by 2025;
- ➔ Accelerating mitigation technologies: the government will establish a new Centre for Climate; Action on Agricultural Emissions to drive a step change in mitigation technology innovation and uptake on farms;
- ➔ Support producers to make changes, i.e. introduction of advisory services;
- ➔ Develop food and fibre science and mātauranga Māori accelerators.

48 <https://environment.govt.nz/assets/publications/Aotearoa-New-Zealands-first-emissions-reduction-plan.pdf>

New Zealand has a net zero emissions by 2050 goal enshrined in law, its Climate Change Response or 'Zero Carbon' Act⁴⁹ from 2019. The Climate Change Response Act provides an enduring framework by which New Zealand can develop and implement clear and stable climate change policies. It sets domestic greenhouse gas emissions reduction target for **New Zealand to reduce net emissions of all greenhouse gases (except biogenic methane) to zero by 2050 and reduce emissions of biogenic methane to 24–47 per cent below 2017 levels by 2050**, including to 10 per cent below 2017 levels by 2030. By 2030 New Zealand is to reduce net greenhouse gas emissions to 50 per cent below gross 2005 levels. Excluding LULUCF this is equivalent to 21 per cent below 1990 levels by 2030. This responsibility target is economy-wide covering all sectors.

In 2019, **emissions from the agriculture sector contributed 39,6 MtCO₂e, representing 48 percent of New Zealand's gross GHG emissions** that year. Enteric fermentation was the main source of agriculture emissions, contributing 73 percent of the sector's emissions. Agricultural soils (20 percent) were the second largest source followed by manure management (4.4 per cent). In 2019, New Zealand's Agriculture sector emissions were 17 percent above the 1990 level. The greatest contributions to the increase since 1990 are a 47 percent increase in N₂O emissions from agricultural soils and a 6 percent increase in CH₄ emissions from enteric fermentation. The increase in N₂O emissions from agricultural soils has largely been driven by the increased application of synthetic nitrogen fertiliser since 1990. The increase in emissions from enteric fermentation is driven by increases in dairy cattle numbers, which have been partially offset by a decrease in beef cattle and sheep.

In 2019, **total net removals from the LULUCF sector were 27,4 Mt CO₂e or 33 percent of New Zealand's gross GHG emissions**. This is largely due to increasing yields in plantation forests from improved genetics and management practices, the rapid expansion of afforestation in the 1990s and an increase in the production of harvested wood products, which have compensated for the emissions from the increase in forest harvesting.

Measures to Meet the Climate Targets Regarding the Land Agri-Food System

In May 2022, New Zealand published its first emissions reduction plan '*Towards a productive, sustainable and inclusive economy*'. It contains strategies, policies and actions for achieving our first emissions budget, as required by the Climate Change Response Act.

For the agriculture and forestry sectors the plan foresees the following key actions:

- ➔ Pricing agricultural emissions, including the introduction of an agricultural emissions pricing mechanism by 2025 and support to early adopters of low emissions practices
- ➔ Accelerating mitigation technologies, including by the establishment of a new Centre for Climate Action on Agricultural Emissions to drive a step change in mitigation technology innovation and uptake on farms

49 <https://environment.govt.nz/acts-and-regulations/acts/climate-change-response-amendment-act-2019/>

- ➔ Supporting producers to make changes, including the introduction of climate focused extension and advisory services
- ➔ Transitioning to lower-emissions land uses and systems, including the development of food and fibre science and mātauranga Māori accelerators
- ➔ Support afforestation by considering amendments to the New Zealand Emissions Trading Scheme (NZ ETS) and resource management settings to achieve the right type and scale of forests, in the right place; supporting landowners and others to undertake afforestation, particularly for erodible land; providing advisory services to land users, councils, Māori and other stakeholders to support choices for sustainable afforestation.
- ➔ Encourage native forests as long-term carbon sinks through reducing costs and improving incentives.
- ➔ Maintain existing forests by exploring options to reduce deforestation and encourage forest management practices that increase carbon stocks in pre- 1990 forests.
- ➔ Grow the forestry and wood processing industry to deliver more value from low-carbon products, while delivering jobs for communities. **The measures related to these needs and areas of action are described in the table below (Table 2.2.3.d).**

According to the Climate Action Tracker⁵⁰, New Zealand is increasingly relying on the mitigation potential of the land use and forestry sector to meet its target rather than focusing efforts on reducing emissions from high emitting sectors. Although the agriculture sector represents around half of the country's emissions (excl. LULUCF), the Climate Action Tracker finds that New Zealand lacks any strong policy to reduce emissions in the sector. Methane from agriculture and waste (over 40 per cent of New Zealand's emissions) is exempt from the net zero emissions goal and has a separate target (at least 24-47 per cent reduction below 2017 levels by 2050), not yet covered by significant policies.

Regarding the forestry sector, the Climate Action Tracker provides information on scenarios modelled by the New Zealand Institute for Economic Research, which would require the LULUCF sector to increase the carbon sink to -50 MtCO₂e by 2050 in the zero net emissions scenario, meaning that New Zealand's harvested forestry area would need to increase by 140 per cent from 2018 levels (New Zealand Institute of Economic Research, 2018).

50 <https://climateactiontracker.org/countries/new-zealand/policies-action/>

Table 2.2.3.d: Description of Measures under New Zealand's Climate Action Programme

Measures in Climate Action Plan / Programme
Focus Area: Reduction in crop and soil N₂O Actions to reduce synthetic nitrogen fertiliser include: ▪ adopting best practice to ensure fertiliser is applied in the right amount, in the right location at the right time to limit the amount of nitrogen lost to both water and the atmosphere. The synthetic nitrogen fertiliser cap limits the application of synthetic fertiliser to land as part of pastoral activities to less than 190 kilograms of nitrogen per hectare per year; ▪ increasing the proportion of nitrogen fertilisers applied that have been modified to reduce emissions, for example, urease inhibitors, nitrification inhibitors and slow-release nitrogen fertiliser products.
Focus Area: Price agricultural emissions Action 13.1.1: An emissions pricing mechanism is developed, and agricultural emissions are priced by 1 January 2025 ▪ Ministers will take decisions on pricing agricultural emissions by the end of 2022, to enable implementation by 2025. The Government will then support the essential work to develop and implement an agricultural emissions pricing scheme by 2025. ▪ Expected emissions reductions will depend on the details of the recommended pricing mechanism, such as what mitigations are recognised and rewarded, and how revenue is recycled to support further reductions. Action 13.1.2: All producers will have emissions reports by the end of 2022 and a farm mitigation plan in place by 2025 ▪ Ensure all producers have a greenhouse gas report by the end of 2022. ▪ Develop outreach programme focused on farm planning. ▪ Ensure all producers have a green house gas emissions mitigation plan in place by 2025. He Waka Eke Noa has also produced Greenhouse Gases: Farm Planning Guidance to support farmers to incorporate emissions into their farm plan. Action 13.1.3: Further incentivising on-farm mitigation ▪ contribution towards the cost of adopting technologies to mitigate biological emissions ▪ acceleration of on-farm trials of overseas technologies to adapt them for the Aotearoa pastoral farming context.
Focus Area: Accelerate new mitigations Action 13.2.1: Strengthen the role of research and development to get mitigations to producers sooner ▪ Streamline the path to market of new innovations to accelerate deployment and uptake. ▪ Expand greenhouse gas methane measurement capacity to speed development of new technologies. ▪ Deliver technology and practice demonstration programmes to ensure mitigation options are visible to farmers. ▪ Support entrepreneurs to encourage technological breakthroughs and demonstrate our international contribution to reducing global agricultural emissions. Action 13.2.2: Establish a new Centre for Climate Action on Agricultural Emissions to drive a step change in research, development and commercialisation of emissions reduction technologies The Centre will include a new public-private joint venture with a focus on product development and commercialisation to drive our research and development (R&D) activity, and will deliver on three key outcomes: ▪ faster development, commercialisation, extension and uptake of emissions mitigation technologies ▪ a strong system to support delivering mitigations over the long term ▪ strong leadership and alignment of biological emissions efforts.

Action 13.2.4: Support clear and effective regulatory pathways for agricultural mitigation tools

- The Government will work to have a robust regulatory system to manage the risks of new mitigation tools to the trade of primary produce, along with managing risks to animal welfare, agricultural security, public health and food safety.
- This includes work underway to enable the regulatory oversight of greenhouse gas inhibitors under the Agriculture Compounds and Veterinary Medicines Act 1997 so that risks associated with their use are appropriately managed. The first stage of this work is expected to be completed in July 2022.

Action 13.2.5: Lead and contribute to global agricultural climate change mitigation

- Advocate for robust evidence-based approaches and recognition of mitigation efforts which can create a more fair and even international playing field for agricultural exports.
- Actively engage in key intergovernmental organisations and associated initiatives – including through the United Nations Framework Convention on Climate Change's Koronivia Joint Work on Agriculture and the Agriculture Innovation Mission for Climate – for increased commitments, research and on-the-ground actions to reduce agricultural emissions.
- Support the Global Research Alliance on Agricultural Greenhouse Gases (GRA)
- Deliver capability programmes, including working with other countries through the GRA to improve greenhouse gas accounting methodologies and develop the skills and infrastructure needed to accelerate mitigation solutions.

Focus Area: Support producers to make changes**Action 13.3.1: Develop further climate-focused extension and advisory services****The Government will introduce:**

- multichannel information campaigns to upskill producers, ie, building and enhancing support networks and rural communities to become more climate resilient in the face of changing local conditions, in parallel with practical on-farm changes that will start to reduce emissions
- extension programmes, including workshops, action groups and on-farm activities
- using the Action Network approach (small, focused and facilitated groups) to provide producers with tools, resources, a network of experts and the advice and experiences of other farmers to develop their confidence to turn knowledge into on-farm action
- growing the pipeline of trusted industry advisers who have a strong understanding of emissions reduction practices and practical experience in working farm settings. This could include a focus on professional learning to upskill existing farm advisers on leading edge research on low-emissions farm practices.

Specialised climate-focused services will complement wider efforts by industry and the Government to support whole-of-system farming change, including by strengthening the Ministry for Primary Industries' [Primary Industry Advisory Services](#) and implementing its [Integrated Farm Planning](#) programme. Another example is the [Ag Matters](#) website which provides science-backed information for farmers, growers and rural professionals on agricultural greenhouse gas emissions, and which is managed by the New Zealand Agricultural Greenhouse Gas Research Centre with support from the Ministry for Primary Industries.

Action 13.3.3: Improve rural digital connectivity to improve farm efficiency and access to information and online tools to reduce emissions**Improved rural acc**

ess to information and online tools can support uptake of new emissions mitigations technologies, e.g. by unlocking access to information on climate change and steps farmers can take, supporting more farmers to adopt precision farming tools, lowering carbon emissions from vehicles by reduce the number of avoidable trips, or enabling sensors, real-time monitoring, and verification of carbon management techniques

Focus Area: Transition to lower-emissions land use and systems**Action 13.4.1: Build the evidence base for regenerative agriculture**

A Technical Advisory Group for regenerative agriculture was established by the Ministry for Primary Industries in September 2020. Its purpose is to help establish an evidence base for regenerative farming and horticultural practices. The Sustainable Food and Fibre Futures fund is investing in projects to test and validate regenerative agriculture practices.

Action 13.4.2: Reduce the emissions of our largest farmer – Pāmu

The Government will work with Aotearoa New Zealand's largest farmer, the state-owned enterprise Landcorp Farming Limited (trading as Pāmu), to investigate options to further reduce its gross emissions beyond current plans. This work will consider opportunities for Pāmu to demonstrate sector leadership by accelerating on-farm emissions reductions while continuing to fulfil its principle objective of operating as a successful business over the long-term.

Pāmu manages 110 farms over 364,000 hectares, which in financial year 2021 contributed 0.75 Mt CO₂-e gross annual emissions and sequestered around 0.33 Mt CO₂-e per annum, with revenue primarily coming from dairy and livestock farming.

Action 13.4.3: Develop food and fibre science and mātauranga Māori accelerators

Develop science and mātauranga Māori-based research and development plans to accelerate R&D to grow and transform the food and fibre sector, while promoting lower-emissions land use and food production.

Focus Area: Support the right mix, level and location of afforestation

Action 14.1.1: Ensure regulatory settings deliver the right type and scale of forests, in the right place

To ensure regulatory settings deliver the right type and scale of forests, in the right place, the Government is considering changes to:

- the NZ ETS, to support a better mix of forest type, retain important productive land uses, to avoid displacing gross emissions reductions and to better manage the potential long-term environmental effects of exotic forests, including: restricting exotic forests from the permanent post-1989 forest category, adjusting the application of accounting rules to land which is remote and/or, marginal to harvest, to support production on this land.
- the National Environmental Standards for Plantation Forestry (NES-PF), to ensure environmental management of all exotic afforestation, including consulting on whether greater local control over location and forest types/species of forests is required.

Action 14.1.2: Support landowners and others to undertake afforestation

The Government is continuing to assist landowners and others to undertake afforestation and conservation projects through:

- the One Billion Trees Fund (1BT)
- Crown Forestry joint ventures
- the Hill Country Erosion Programme
- the Erosion Control Funding Programme (ECFP).

Action 14.1.3: Enhance forestry planning and advisory services

There is an opportunity to provide better planning and advisory services to support afforestation and ensure that the right forests are in the right place, for the right purpose. To achieve this, the Government will:

- better support and inform current and potential forest growers and the full forestry system by providing advisory services across the full cycle of establishing, managing and harvesting forests
- work with regional councils, tangata whenua, and other landowners to support climate change work programmes including native afforestation, land reversion and establishment of new production forests in the right location
- help understand at a regional level where forests will be grown and where harvested wood will be needed so that the forest estate, regional infrastructure and processing capacity align to support the growth of production forestry and domestic manufacturing
- provide advice on diversifying forestry regimes, including alternative species, in order to develop new types of forest crops that deliver new products or woody biomass for emerging markets (eg, bio-energy)
- build and share knowledge within the nursery sector to enable the increase in native afforestation.

Focus Area: Encourage native forests as long-term carbon sinks

Action 14.2.1: Update NZ ETS yield tables to include indigenous species

To encourage native forests as long-term carbon sinks, the Government is:

- investing in a review of the NZ ETS yield tables (carbon look up tables) to ensure their accuracy. The review will look at ways to: develop more accurate indigenous yield tables, extend the tables beyond the current 50 years, recognise carbon storage resulting from particular indigenous forest, management practices, promoting positive outcomes.
- exploring technologies that: enable accurate measurement of carbon in specific forests and provide improved understanding of how current management of forest links to the long-term carbon stock.

Action 14.2.2: Reduce the cost of native afforestation

The Government is making an initial investment to work with the nursery sector to address the issue of cost and survivability of native tree seedlings and the need to expand production. This includes work to:

- explore and test science-based practices and technologies to support the sustainable expansion of the sector. This includes demonstrating best practice/ technology, and providing training for the native plant nursery sector
- harness technology to increase scale and lower the cost of native seedlings. This will focus on developing and demonstrating best practice in seed collection, propagation and forest management
- investigate options for additional support for early adopters in the nursery sector to gear up for higher native afforestation levels.

Action 14.2.3: Encourage greater levels of native afforestation over the long term

To encourage greater levels of native afforestation over the long term, over the next two years the Government will:

- investigate options to lower costs, address supply chain barriers and improve the successful establishment of native forests
- engage stakeholders on a longer-term strategy and action plan
- undertake research to protect/enhance stored carbon in existing native forests
- support Māori-led approaches to native forest establishment
- establish a cross-agency group to improve demand signals to nurseries, to ensure seedling supply.

Focus Area: Maintain existing forests**Action 14.3.1: Explore measures to reduce deforestation of pre-1990 native forests**

The Government will:

- continue to monitor the deforestation of pre-1990 native forests
- explore how to address the Commission's recommendation to improve and enforce measures to reduce deforestation balanced with the scale of the issue, the need for additional measures, and the need to avoid unintended consequences.

Action 14.3.2: Maintain and increase carbon stocks in pre-1990 forests

To maintain and increase carbon stocks in pre-1990 forests, the Government will:

- research and investigate which forest management activities will increase carbon storage in pre-1990 forests
- consider opportunities to incentivise and encourage those management activities, including mechanisms to enable the recognition of additional carbon storage for pre-1990 forests.

Focus Area: Grow the forestry and wood processing industry to deliver more value from low-carbon products**Action 14.4.1: Develop forestry and wood processing industry transformation plan (ITP)**

- set out a cohesive set of actions to transform the forestry sector, grow the domestic wood processing industry and get more value from our logs
- consider options to attract investment in the production of low-emissions wood products and biofuels, including how forests can provide a more consistent supply of wood fibre
- provide a transformation roadmap to lift value from the forestry and wood processing sector while delivering for communities and our climate change goals
- identify specific actions to: increase wood processing and accelerate the bioeconomy, lift productivity and resilience across the forestry and wood processing supply chain, scale up internationally competitive wood-processing clusters, support increased use of wood in construction and improve export outcomes

Action 14.4.2: Invest in expanding supply of woody biomass

To secure sufficient supply of woody biomass to fuel the bioeconomy, the Government will investigate options to:

- work with landowners to increase planting of commercial forest crops to replace coal process heat and/or as input to biofuels and biomaterials
- undertake research to support cost effective recovery of harvest residues to supply biomass
- undertake operational research to support species selection and forest management of short rotation crops.

2.2.4 The United States of America

Climate Targets and Current Emissions Regarding the Land Agri-Food System

Key figures

Table 2.2.4.a: USA's national GHG emissions and reduction targets

GHG emissions (MtCO ₂ e)	GHG emission reduction targets		
	2019	By 2030	By 2050
Total (excl. LULUCF)	6,558.3	3,907–4,179 MtCO ₂ e 35–39% below 1990 levels 40–44% below 2010 levels	558–1,540 MtCO ₂ e 91–100% below 1990 levels 92–100% below 2010 levels
Agriculture	628.6	ND	ND
N ₂ O (Mt CO ₂ e.)	364.4	ND	ND
CH ₄ (Mt Co ₂ e.)	256.4	ND*	ND
CO ₂ (Mt)	7.8	ND	ND

Source: USA NDC, Climate Action Tracker.

*Specific targets might vary from one State to another. For example, the Senate Bill 1383 in California has established methane emissions targets, including a reduction in statewide methane emissions of 40 percent below 2013 levels by 2030 and an equivalent methane emissions reduction target for the dairy and livestock sector (2030 target).

Table 2.2.4.b: USA's Green House Gas Emissions in 2019 (from National Inventory Report 2021)

GHG Emissions of Agriculture (9.6 % of Total Emissions) - 2019		GHG Emissions / Removal of LULUCF - 2019	
Source of emissions	MtCO ₂ e	Source / Sink	MtCO ₂ e
Enteric Fermentation	178.6	Forest Land	-774.6
Manure Management	82 62.4 CH ₄ 19.6 N ₂ O	Cropland	39.7
Agricultural Soils	344.6	Grassland	-8
Liming	2.4	Wetland	-3.9
Urea application & other fertilisers	5.3	Harvested Wood Products	/
Other	15.7	Settlements	-44.4 (land converted to settlements)
Total (Agriculture)	628.6	Total (LULUCF)	-789.2

Source: Country's National Inventory Report 2021 submitted to UNFCCC

In 2019, total gross U.S. greenhouse gas emissions were 6,558.3 million metric tons of carbon dioxide equivalent (MMT CO₂e). Total U.S. emissions have increased by 1.8 percent from 1990 to 2019, down from a high of 15.6 percent above 1990 levels in 2007. Emissions decreased from 2018 to 2019 by 1.7 percent (113.1 MMT CO₂ Eq.). Net emissions (including sinks) were 5,769.1 MMT CO₂ Eq. Overall,

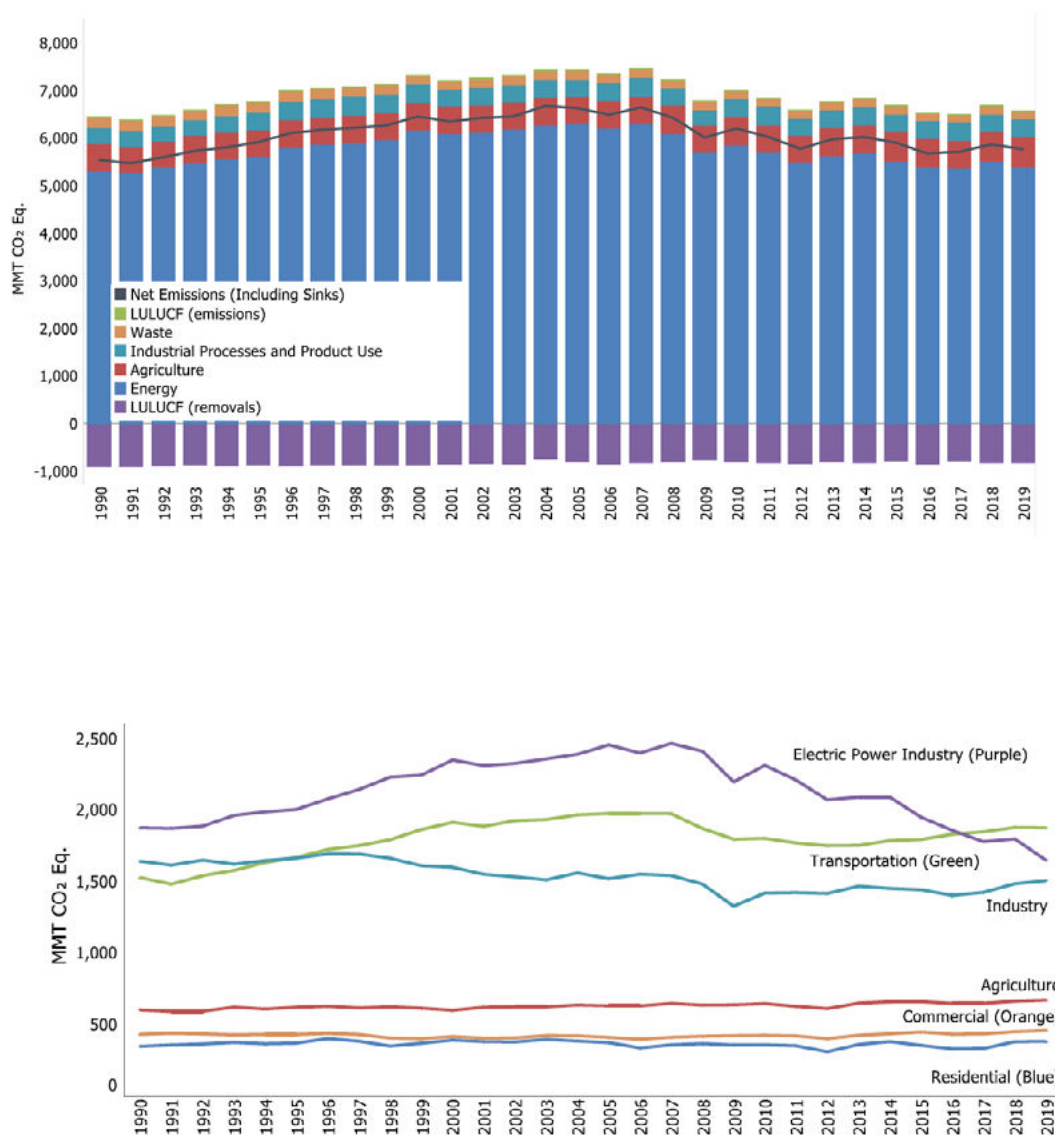
net emissions decreased 1.7 percent from 2018 to 2019 and decreased 13.0 percent from 2005 levels (see figure below).

Figure 2.2.4.a: U.S. Greenhouse Gas Emissions and Sinks by IPCC Sector

Source: *Country's National Inventory Report 2021 submitted to UNFCCC*

Figure 2.2.4.b: U.S. Greenhouse Gas Emissions by Economic Sector

Source: *Country's National Inventory Report 2021 submitted to UNFCCC*



Note: Emissions and removals from Land Use, Land Use Change, and Forestry are excluded from figure above. Excludes U.S. Territories.

Table 2.2.4.d: Number of heads in the main livestock categories in the USA (in million head)

	2000	2010	2020
Cattle and calves	106	100.8	102
Milk cows	9.2	9.1	9.3
Beef cows	34	31.7	32

Source: USDA

Measures and actions

- ➔ Scaling of climate smart agricultural practices (i.e. cover crops), reforestation, rotational grazing, and nutrient management practices.
- ➔ Federal and state governments will invest in forest protection and forest management, and engage in intensive efforts to reduce the scope and intensity of catastrophic wildfires, and to restore fire-damaged forest lands
- ➔ Increased support to nature-based coastal resilience projects including pre-disaster planning as well as efforts to increase sequestration in waterways and oceans by pursuing “blue carbon.”
- ➔ To address non-CO₂ GHG emissions, the US will improve agricultural productivity through practices and technologies that reduce agricultural methane and N₂O emissions, such as improved manure management and improved cropland nutrient management.

According to the Fourth National Climate Assessment report (USGCRP 2018), in 2015, U.S. farms contributed \$136.7 billion to the economy, accounting for 0.76 per cent of gross domestic product (GDP) and 2.6 million jobs (1.4 per cent of total U.S. employment; Figure 10.1). About half of the farm revenue comes from livestock production. Other agriculture- and food-related value-added sectors contributed an additional 4.74 per cent (\$855 billion) of GDP and accounted for 21 million full- and part-time jobs (11.1 per cent of U.S. employment). U.S. agriculture enjoys a trade surplus in which the value of agricultural exports (both bulk and high-value products) accounts for more than 20 per cent of total U.S. agricultural production. Top high-value exports include feedstocks, livestock products, horticulture products, and oilseeds and oilseed products, and these exports help support rural communities across the Nation.

Agricultural activities contribute directly to emissions of greenhouse gases through a variety of processes, including the following source categories: agricultural soil management, enteric fermentation in domestic livestock, livestock manure management, rice cultivation, urea fertilization, liming, and field burning of agricultural residues.

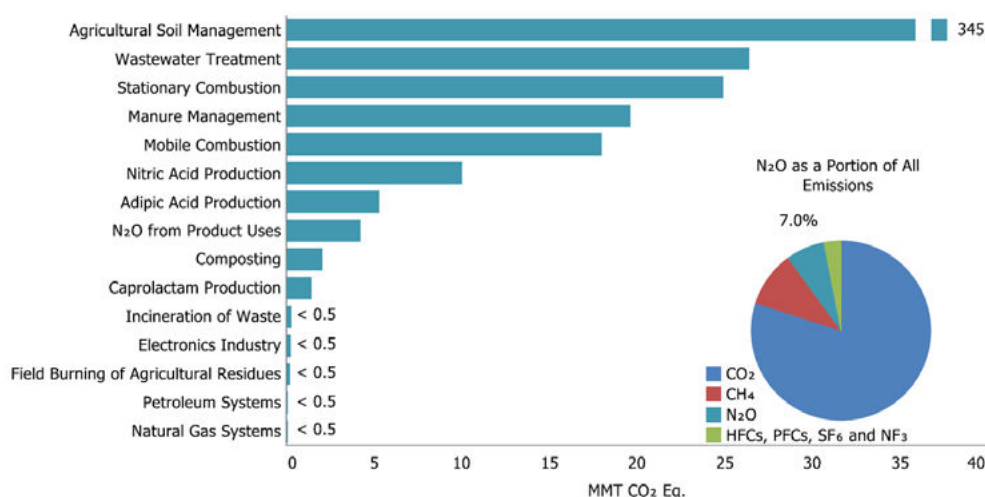
In 2019, agricultural activities were responsible for emissions of **628.6 MMt CO₂e.**, or **9.6 percent of total U.S. greenhouse gas emissions**. Methane emissions from enteric fermentation and manure management represented approximately **27.1 percent and 9.5 percent of total CH₄ emissions** from

anthropogenic activities, respectively, in 2019. Agricultural soil management activities, such as application of synthetic and organic fertilizers, deposition of livestock manure, and growing N-fixing plants, were the largest contributors to U.S. **N₂O emissions in 2019, accounting for 75.4 percent of total N₂O emissions**. Carbon dioxide emissions from the application of crushed limestone and dolomite (i.e., soil liming) and urea fertilization represented 0.1 percent of total CO₂ emissions from anthropogenic activities⁵¹.

Significant trends for the largest sources of U.S. emissions of CH₄ and N₂O include the following:

- Between 1990 and 2019, CO₂ and CH₄ emissions from agricultural activities increased by 9.9 percent and 17.5 percent, respectively, while N₂O emissions from agricultural activities fluctuated from year to year, but increased by 10.4 percent overall.
- Agricultural soils accounted for 75.4 percent of N₂O emissions and 5.3 percent of total greenhouse gas emissions in the United States in 2019. Estimated emissions from this source in 2019 were 344.6 MMT CO₂e. Annual N₂O emissions from agricultural soils fluctuated between 1990 and 2019, although overall emissions were 9.1 percent higher in 2019 than in 1990.
- From 1990 to 2019, emissions from enteric fermentation have increased by 8.4 percent. From 2018 to 2019, emissions increased by 0.3 percent, largely driven by an increase in beef cattle populations. While emissions generally follow trends in cattle populations, over the long term there are exceptions. For example, while dairy cattle emissions increased 9.8 percent over the entire time series, the population has declined by 3.1 percent, and milk production increased 58 percent (USDA 2019). These trends indicate that while emissions per head are increasing, emissions per unit of product (i.e., meat, milk) are decreasing.

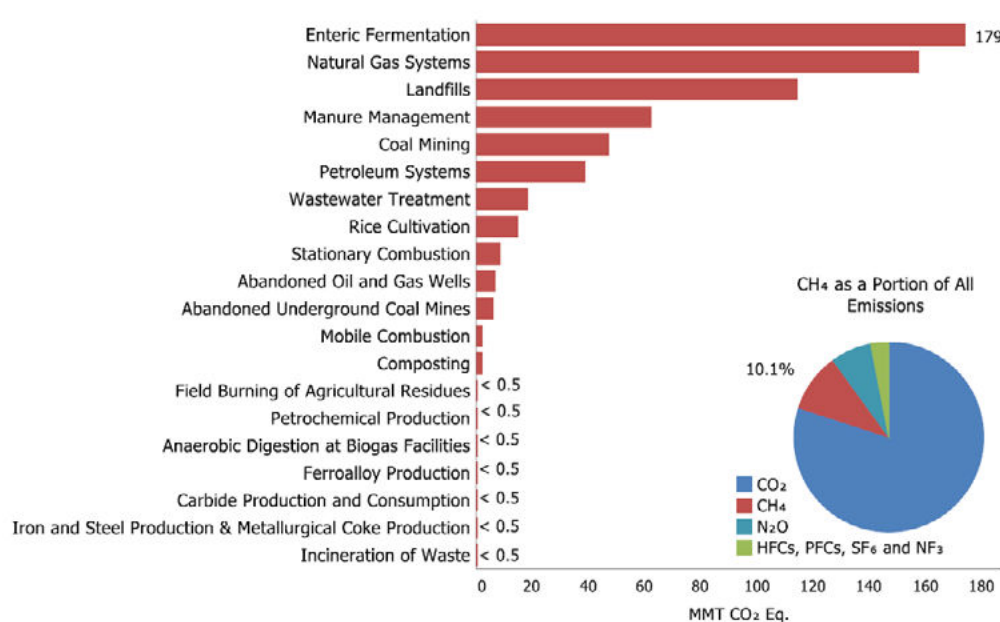
Figure 2.2.4.c: 2019 Sources of N₂O Emissions



51 <https://unfccc.int/documents/272415>

Within the United States, the main anthropogenic sources of CH₄ include enteric fermentation from domestic livestock, natural gas systems, landfills, domestic livestock manure management, coal mining, and petroleum systems (see Figure below).

Figure 2.2.4.d: 2019 Sources of CH₄ Emissions



Measures to Meet the Climate Targets Regarding the Land Agri-Food System

After re-joining the Paris Agreement in 2021, the Biden Administration has committed to increased ambition in the updated US National Determined Contribution (NDC) with an objective to reach climate neutrality by 2050.

In the lands and waters sector, the US have committed to reduce emissions from forests and agriculture and enhance carbon sinks through a range of programmes and measures for ecosystems ranging from forests to agricultural soils. Since January 2021, the US Department of Agriculture (USDA) has published various updates of its positioning and strategies to support the country's ambition to tackle climate change. This includes:

- ➔ A 90-Day Progress Report⁵² on a Climate-Smart Agriculture and Forestry Strategy and a related 2022 Progress Report⁵³;

52 <https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf>

53 <https://www.sustainability.gov/pdfs/usda-2022-cap.pdf>

- ➔ An Action Plan for Climate Adaptation and Resilience⁵⁴;
- ➔ The Biden-Harris Administration released the Nature-Based Solutions Roadmap⁵⁵ in November 2022, an outline of strategic recommendations to unlock the potential of nature-based solutions to address climate change, nature loss, and inequity.

Key initiatives have been announced in the last couple of years including the following:

- ➔ Launched the America the Beautiful challenge to conserve 30 percent of U.S. lands and waters by 2030⁵⁶ by accelerating locally led conservation, leveraging \$1 Billion in public and private investments⁵⁷, and putting natural solutions to work in our fight against climate change while strengthening local economies.
- ➔ Announced a \$1 Billion-dollar investment in Climate-Smart Agriculture through a partnership initiative⁵⁸ that will create new market opportunities for commodities produced using climate-smart practices.
- ➔ Accelerated the restoration of the Great Lakes with a \$1 Billion investment from the Bipartisan Infrastructure Law⁵⁹ to provide clean drinking water, economic opportunities and environmental benefits for communities in the region.
- ➔ the US Department of Agriculture (USDA) has developed a climate-smart agriculture and forestry strategy⁶⁰ and plans to engage with a range of stakeholders to explore opportunities to encourage the voluntary adoption of 'climate-smart' agricultural and forestry practices.
- ➔ The Growing Climate Solutions Bill was reintroduced in April 2021 in the US Senate, officially signed into law by President Biden at the end of 2022. This bill will allow the Department of Agriculture (USDA) to establish a voluntary Greenhouse Gas Technical Assistance Provider and Third-Party Verifier Certification Program to help reduce entry barriers into voluntary environmental credit markets for farmers, ranchers, and private forest landowners.
- ➔ The Infrastructure Investment and Jobs Act and Inflation Reduction Act made unprecedented investments in nature-based solutions. These laws place forests, agricultural lands and coastal wetlands front and center in the climate fight. For example, \$20 billion is directed to farmers, ranchers and private forest owners working to increase carbon storage and reduce emissions. Another \$5 billion is for forest management actions that can reduce wildfire risk, store carbon, and cool communities. These laws also weave nature into infrastructure investments. Over \$8.7 billion

54 <https://www.sustainability.gov/pdfs/usda-2021-cap.pdf>

55 <https://www.whitehouse.gov/wp-content/uploads/2022/11/Nature-Based-Solutions-Roadmap.pdf>

56 <https://www.doi.gov/priorities/america-the-beautiful>

57 <https://www.whitehouse.gov/ceq/news-updates/2022/04/11/biden-harris-administration-launches-1-billion-america-the-beautiful-challenge-to-support-and-accelerate-locally-led-conservation-and-restoration-projects/>

58 <https://www.usda.gov/media/press-releases/2022/02/07/usda-invest-1-billion-climate-smart-commodities-expanding-markets>

59 <https://www.epa.gov/newsreleases/president-biden-epa-announce-1-billion-investment-bipartisan-infrastructure-law-will>

60 <https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf>

will support nature-based solutions and other approaches to build climate resilience into transportation systems from the ground up. Another \$8.6 billion will restore and conserve coastal habitats.

It must also be noted that a number of States have released their own climate action plans in the past years, generally outlining GHG emissions reduction targets and specific measures to reach those goals. An overview of the plans can be found [here](#).

LULUCF

In 2020, the net CO₂ removed from the atmosphere from the LULUCF sector was 14 per cent of total US GHG emissions. Forest fires, extreme weather events and land use change have caused the extent of carbon sinks to decrease since 1990. Between 1990 and 2020, total carbon sequestration in the LULUCF sector decreased by 12 per cent due to a decrease in the rate of net carbon accumulation in forests, as well as an increase in CO₂ emissions from urbanisation (U.S. Environmental Protection Agency, 2022b). In the submission of the Nationally Determined Contribution (NDC) the US commits to reduce emissions from forests and agriculture and enhance carbon sinks through a range of programs and measures for ecosystems ranging from forests to agricultural soils.

Actions mentioned in the NDC include, for example, that federal and state governments will invest in forest protection and forest management, engage in intensive efforts to reduce the scope and intensity of wildfires, and restore fire-damaged forest lands. Alongside these efforts, the US will support nature-based coastal resilience projects including pre-disaster planning as well as efforts to increase sequestration in waterways and oceans by pursuing “blue carbon” (US Government, 2021).

The measures related to these needs and areas of action are described in the table 2.2.4.e below.

Table 2.2.4.e: Description of Measures under the United States’ Climate Action Programme

Measures in Climate Action Plan / Programme
Focus Area: Livestock
- Adjusting feeding practices and other management methods to reduce the amount of methane resulting from enteric fermentation. - Improving pasture quality to increase animal productivity, which can reduce the amount of methane emitted per unit of animal product. Also, increased productivity in livestock can be introduced through improved breeding practices. - California is the largest dairy-producing state, home to one in five U.S. dairy cows. To date, methane emissions reductions from the dairy and livestock sector have mainly been driven by a decreasing animal population and the growing adoption of manure management strategies, including anaerobic digesters and conversion to dry manure systems and pasture systems. CARB recently completed a detailed analysis of the emission reductions expected by 2030 and the estimated additional investment needed to reach the dairy and livestock sector methane reduction target⁶¹. Despite the considerable methane emissions mitigation potential of enteric strategies like feed additives, little progress has been made, as few products with proven mitigation potential have become commercially available, and unlike manure management strategies, there is a lack of financial incentives for their adoption. Market conditions favoring farm consolidation and improved production efficiencies have driven reductions in the California and U.S. dairy population over the past decade. These efficiency gains have allowed California to maintain production levels despite the decreasing population. If demand for dairy and beef products remains steady or increases, continued improvements in production efficiency and adoption of effective manure management and enteric mitigation strategies will be important to support dairy and livestock methane emission reductions (California 2022 Climate Change Scoping Plan). - The State of California also wants to accelerate demand for dairy and livestock product substitutes such as plant-based or cell-cultured dairy and livestock products to achieve reductions in animal population (California 2022 Climate Change Scoping Plan).

61 CARB. 2021. Analysis of Progress toward Achieving the 2030 Dairy and Livestock Sector Methane Emissions Target. June. <https://ww2.arb.ca.gov/resources/documents/dairy-livestock-sb1383-analysis>

Focus Area: Manure Management

- Controlling the way in which manure decomposes to reduce nitrous oxide and methane emissions. [Capturing methane from manure](#) decomposition to produce renewable energy.
- Handling manure as a solid or depositing it on pasture rather than storing it in a liquid-based system such as a lagoon would likely reduce methane emissions but may increase nitrous oxide emissions.
- Storing manure in anaerobic lagoons to maximize methane production and then capturing the methane to use as an energy substitute for fossil fuels.
- For more information on capturing methane from manure management systems, see [EPA's AgSTAR Program](#)⁶², a voluntary outreach and education program that promotes recovery and use of methane from animal manure.
- The State of California is promoting anaerobic digesters that maximize air and water quality protection, maximize biomethane capture, and direct biomethane to sectors that are hard to decarbonize or as a feedstock for energy.

Focus Area: Land and Crop Management⁶³

- Adjusting the methods for managing land and growing crops.
- Fertilizing crops with the appropriate amount of nitrogen required for optimal crop production, since over-application of nitrogen can lead to higher nitrous oxide emissions without enhancing crop production.
- Draining water from wetland rice soils during the growing season to reduce methane emissions.
- USDA's Action Plan for Climate Adaptation and Resilience calls on to increase implementation of on-farm adaptation strategies and practices (i.e. cover crops, reduced and no tillage, and improved irrigation systems).
- It also supports 'active landscape-scale management and disturbance responses'.
- Improved access to climate and climate related data is also being prioritized to help producers better understand changing conditions and adjust their management decisions accordingly.
- In light of reduced water supply, more intense and frequent drought, degraded water quality, excess soil moisture, and greater flooding, water quantity and quality has become a critical issue for the US. To address the issue, USDA strongly supports the uptake of a variety of practices to increase resilience and soil health. Programs like EQIP, RCPP, and the Soil Health Initiative help promote practices such as cover crops, reduced tillage, and prescribed grazing that can improve soil health and build more resilient landscapes.
- USDA also recommends to invest in water management infrastructure and adaptive irrigation systems
- Innovative technologies and approaches are also being considered: drought-adapted varieties, dynamic and data-driven irrigation technology, and increasingly efficient delivery, storage, and recycling of water will be important adaptation tools.

Focus Area: Carbon storage/ sequestration

- California's approach to climate action in the 'Natural and Working Lands' sector is not solely focused on maximizing carbon stocks but instead on supporting carbon management that holistically fosters ecosystem health, resilience, provision of overall climate function, and other co-benefits (California 2022 Climate Change Scoping Plan).
- California also strongly considers the [role of blue carbon](#) (also known as carbon captured and held in coastal vegetation and soils, such as seagrasses, seaweeds, and wetlands). The United States was the first nation to include blue carbon in its national GHG emissions inventory. California's Ocean Protection Council and San Francisco Estuary Institute are partnering to create a new coastal wetlands, beaches, and watersheds inventory.

Focus Area: Energy mitigation⁶⁴

- To help support the development of renewable liquid biofuels and their infrastructure, grant, loan guarantee, and other programs from both the USDA and the U.S. Department of Energy (DOE) also have provided vital financial assistance to spur development and adoption of biofuels.
- [Bioenergy](#): Unlike the rapid growth in U.S. PV and wind energy markets over the past decade, power generation from biomass and biogas (jointly bioenergy) has been largely flat. Between 2014 and 2018, net annual electricity production from bioenergy feedstocks declined by 3 percent in aggregate to 61,901 gigawatt-hours (GWh). Annual production from bioenergy declined further to 58,412 GWh in 2019 (EIA, 2020a, table 1.1.A). In total, bioenergy power generation systems accounted for less than 2 percent of all U.S. electricity production in 2019, but 8 percent of total renewable electricity production, including hydropower.
- Biomass power generation is eligible for a blend of Federal incentives through the tax code and USDA programs.

62 <https://www.epa.gov/agstar>

63 <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#agriculture>

64 Source: Schultz, Craig, et al., 2021. Renewable Energy Trends, Options, and Potentials for Agriculture, Forestry, and Rural America. March 2021. U.S. Department of Agriculture, Office of the Chief Economist

3. Recommended policy insights for the transformation of the land-agri-food system in Ireland



Overall, Section 2 shows that the EU countries analysed have set clear emissions reduction pathways for agriculture towards 2030 (except for Italy and Poland). Non-EU countries analysed in this report, except for New Zealand, have set up Climate Strategies outlining scenarios to reduce the impact from agriculture on climate, however, these plans are not supported by clear medium-term sectoral reduction targets or carbon budgets.

Drawing on the insights on measures undertaken in the context of the Climate Action Plans and CAP Strategic Plans of other countries compiled in the previous section, there are a number of measures and best practices that can be recommended for consideration regarding Ireland's efforts to reach its climate targets in the land-agri-food system. Table 3.1 provides an overview of key measures in national climate action plans and CAP Strategic Plans that seem relevant for Ireland.

Drawing on individual policy insights gained from other countries, the measures brought together in this section set out a portfolio of policy recommendations aimed at systemically transforming the land agri-food system. They address three different, but interrelated pathways, namely:

- ➔ **Crosscutting** policies aimed at transforming the agri-food sector's vision
- ➔ **Green House Gas Emission Pricing** policies aimed at transforming the agri-food sector's economic framework, and

For each of these pathways some of the most promising insights on progressive/effective policies of countries are described. They cover key elements and enabling conditions, process, important lessons learnt, and how they align with pathways and/or key measures outlined in the recently released Irish Climate Action Plan 2023.

The recent [Climate Action Plan 2023](#)⁶⁵, adopted by the Irish Government end of 2022, lays out pathways and a range of measures related to the land agri-food sector that provide a good foundation for action in the coming years, and it resembles many of the above listed measures.

However, just drawing on existing or planned measures alone will most likely not be sufficient to achieve the transformation of the Irish land-agri-food system that would be needed to reach the 2030 targets, let alone the target of climate neutrality by 2050.

According to the EEA, which analysed the progress and prospects for decarbonisation in the agricultural sector in Europe ([EEA, 2022](#))⁶⁶, reductions in emissions between now and 2040 are projected to be too insignificant to help the EU become climate neutral by 2050. Even taking the policies and measures planned under the 2021-2027 CAP Strategic Plans into account, a reduction in agricultural emissions of only 5 per cent between 2020 and 2040 is projected. For Ireland, with its significant agricultural sector, this challenge is even larger.

Therefore, while any incremental improvement to further decarbonisation of the sector is valuable, the way to significantly reduce emissions of the Irish land-agri-food system must aim at bringing together some of the boldest measures under **a coherent and overarching long-term vision aiming to systemically transform the sector itself**. Next to such a coherent and overarching long-term vision for the agri-

65 Government of Ireland (2022) Climate Action Plan 2023: Changing Ireland for the Better, <https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/>

66 EEA (2022) Progress and prospects for decarbonisation in the agriculture sector and beyond, <https://www.eea.europa.eu/publications/Progress-and-prospects-for-decarbonisation>

cultural sector providing for an overall direction, other important elements of such a policy-portfolio are suggested to include **a regulatory framework for the pricing of greenhouse gas emissions in the land agri-food sector** aimed at transforming the sector's economic framework, and policies in support of land use options and productive systems aimed at **diversifying agricultural business models**.

The following sub-sections describe in more detail for each of these pathways some of the most promising insights on progressive policies observed in other countries, and how they align with pathways and/or key measures outlined in the recently released Irish Climate Action Plan 2023.

Table 3.1: Overview of key measures in national climate action plans and CAP Strategic plans

Livestock	- Support sustainable and better animal welfare practises for livestock farming, rather than decreasing livestock farming (UK, FR, IT) - Support measures to reduce emissions due to manure management and storage (BE, DK, NL, FR, DE) - Develop potential of feed additives for livestock (UK, FI, US, DK, BE, FR) - Develop genetic selection methods (BE, FI, FR) - Introduction of a pricing scheme for agriculture emissions (NZ) - Encouraging diversification options (crop-livestock farming) (FR)
Reduction in crop and soil N2O	- Increase the uptake of agroecological practices (i.e. reduction in the use of mineral fertilisers, encourage crop rotation, increase soil cover, hedge planting, agro-forestry) (BE, NL, FR, IT, DK, CA) - Mandatory nitrogen emissions reduction targets through reduction of use of synthetic fertilisers (DK, NL, NZ, DE) or voluntary targets (CA). - Develop smart and precision farming to minimise inputs and improve nitrogen efficiency (BE, IT, FR, US, FI) - Expand organic farming through support schemes for conversion (DE, FR, DK, FI, UK) - Support to diversification of crops, in particular with legumes (FR, DE) - Introduction of carbon pricing schemes (NZ, CA, US, FR)
Carbon sequestration	- Afforestation to increase carbon sinks (all countries) - Investments in research and innovation to develop sequestration potential with new technologies such as pyrolysis (DK) - Tree planting initiatives (CA, FR, NZ, UK, DE) - Encouraging sustainable forest management practices which increase carbon sinks (all countries) - Provide advice on diversifying forestry regimes, including alternative species, in order to develop new types of forest crops that deliver new products or woody biomass (NZ) - Conservation and conversion from temporary to permanent grassland (all EU countries – measure supported by CAP)
Energy mitigation	- Supporting schemes for increasing biogas and biomethane production (all countries) - Increase the share of renewable energy sources and the use of bio-based materials from agricultural and forestry origin (FR, BE) - Improve energy efficiency in agriculture and horticulture (NL, DE)
Wider food system	- Increased support to climate research: financial resources have increased significantly in the last years for all countries through different funding programs and investment initiatives (e.g. Canada's Agriculture Clean Technology Program) - Consumer-targeted information will be developed to incentivize behaviour change to food consumption with low environmental impact and reduce food waste (NL, DK, BE, FR) - Investment programs to support fundamental and applied research supporting a path to net zero emissions, knowledge transfer, and developing metrics (to support development and adoption of clean technology) (all countries)
Restoration of peatlands	- Investment plans and new funding schemes to restore and enhance wetlands and peatlands (CA, UK, DE) - Rewetting of peatlands (NL, DE) - Development of paludiculture activities (FI, DE)

3.1 Framing crosscutting policies according to coherent vision aiming at transforming the agricultural sector to achieve its vision

3.1.1 A roadmap towards circular agriculture by 2040 – the case of the Netherlands

Ireland has the ambition to transform the Agri-Food system, as described in Food Vision 2030. It has clear targets to reduce GHG emissions and immediate actions need to be taken to realise these targets.

From the case of the Netherlands presented below, some important lessons can be learned, including the following:

- ➔ How to develop a true integrated and long term sustainable vision for the future Agri-Food system sector.
- ➔ How to co-design with stakeholders, a vision for the future of agriculture in 2050 that provides integrated solutions for the set of challenges that need to be addressed; Climate (Methane emissions), Nitrogen, water quality, air quality, biodiversity, soil health, good income for farmers, mental health and wellbeing, export ambitions etc.
- ➔ How to explore the potential of setting regional based targets for climate mitigation, nature, tree planting and water management; make use of the national smart specialisation strategy⁶⁷.
- ➔ How to explore the potential of setting regional based targets for climate mitigation, nature, tree planting and water management.
- ➔ How to invest in capability building of the government, its policy makers and implementers.
- ➔ How to explore innovation needs and seek the potential to team up with the Netherlands when it comes to European policy/lobbying on, e.g., (i) processed manure as fertilizer as the expansion of tillage will require fertilisers, and (ii) reduced import of soy and other livestock feed in order to develop a European market for 'circular feed'.

A roadmap towards 2040 (Agricultural Agreement)

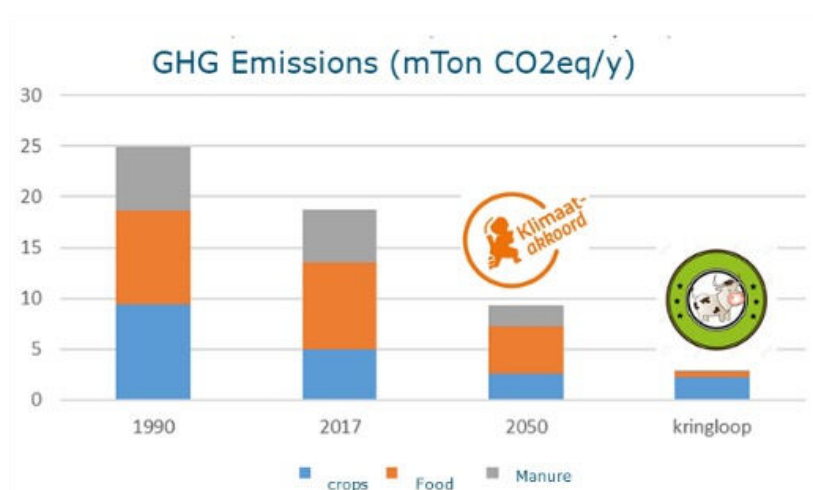
Dutch farming, horticulture and fisheries are constantly innovating, making the Netherlands with an export value of €104.7 billion in 2022 the world's second largest exporter of agri-food products. However, the highly intensive production methods are not without costs. In 2018, it was concluded that the Netherlands was facing significant social and ecological challenges, which were worsened by the recent nitrogen crises. To prevent further depletion of soil, freshwater supplies and raw materials, to

67 <https://enterprise.gov.ie/en/publications/publication-files/national-smart-specialisation-strategy-for-innovation-2022-2027.pdf>

halt the decline in biodiversity and fulfil their commitments to the Paris climate agreement, the Netherlands presented its vision 'Agriculture, nature and food: valuable and connected'⁶⁸, in 2018. This vision describes circular agriculture as the logical and conclusive answer to these issues. This means closing cycles of minerals and other resources as far as possible, strengthening the focus on biodiversity, and respecting the Earth's natural limits, preventing waste and ensuring farmers are paid a fair price for their hard work.

The vision was prepared, and the potential impact was calculated in close collaboration with Wageningen University and Research. They calculated that by implementing the concept of circular agriculture the mitigation potential surpasses the potential of the measures that were described in the climate agreement of 2017 due to improved use of side-streams for feed, improved use of manure for fertile fields, smarter use of fields and meadows for the production of food for humans and increased potential to store carbon in soils and vegetation (Scholten)⁶⁹, figure 3.1.1.a.

Figure 3.1.1.a: Measured and estimated GHG according to the Climate agreement and when applying circular agriculture (Scholten)



68 Ministry of Agriculture, Nature and Food Quality of the Netherlands (2018) Agriculture, nature and food: valuable and connected – The Netherlands as a leader in circular agriculture, https://www.uu.nl/sites/default/files/Vision%2BMinistry%2Bof%2BAgriculture%2BNature%2Band%2BFood%2BQuality_English%281%29.pdf

69 https://youtu.be/NPrEqNe6_B4

Figure 3.1.1.b: Plan of action for the implementation of circular agriculture in the Netherlands



Shortly after the launch of the vision, the [plan of action towards realisation of circular agriculture](#)⁷⁰ was presented which identified the needs, tools and financing instruments necessary to realize the ambitions of circular agriculture.

Whilst the Ministry of Agriculture was implementing circular agriculture, in the period between 2020 and 2022 a range of events happened (the nitrogen crisis, The floods in Limburg in July 2021, the drought of the summer of 2022) that further emphasized the need for an even further integration of policies and implementation plans to offer a long-term perspective for the agricultural sector and rural areas. The Remkes report, developed upon request of the House of Representatives with the title 'What is possible' addresses the options for agriculture and follows three lines:

- ➔ Line 1: Unlocking the Netherlands, preventing further deterioration of nature and create space for permit granting.
- ➔ Line 2: A future-proof Dutch agriculture in 2040, preferably in the form of an Agricultural Agreement.
- ➔ Line 3: A place-based realisation of the transition, revising the National Programme for Rural Areas

70 Ministry of Agriculture, Nature and Food Quality of the Netherlands (2019) , Plan of action – The Dutch government's plan to support the transition to circular agriculture, <https://www.government.nl/documents/policy-notes/2019/11/30/plan-of-action---supporting-transition-to-circular-agriculture>

Line 1: Unlocking the Netherlands

Unlocking the Netherlands is a major task, through which we must ensure that the quality of nature, water and soil, environment and climate improves. For the short term, in consultation with the provinces, a large group of agricultural companies (order of magnitude 2,000–3,000) will be enabled to make choices based on a set of criteria yet to be specified. This applies to both agricultural companies and industrial peak loaders. They must make the choice for the future of their company within one year. This can be done for agricultural companies in various ways: making it considerably more sustainable through a combination of innovation, switching and extensifying, moving, or voluntarily stopping (see section 2). For agricultural entrepreneurs (primary producers) there will be an exit scheme that is as attractive as possible. This will be the only scheme proposed.

On February 10th 2023 the Dutch government provided an update on progress. The government is taking new steps in the task of reducing nitrogen and greenhouse gas emissions, to address climate mitigation and restore vulnerable nature in the Netherlands. The first step is to look at the companies that emit the most, as part of an approach for the so-called agricultural and industrial peak taxpayers. In a letter⁷¹ to the House of Representatives, this approach is further elaborated. The government is also fleshing out the nitrogen targets for other sectors and the climate target for the agricultural sector in order to give direction to the area programmes that provinces are currently working on.

The government has decided to start discussions with 3,000 peak emitters – both agricultural and industrial companies – to significantly reduce nitrogen emissions as of 2023. These companies will have the opportunity to significantly reduce nitrogen emissions by making their business operations more sustainable, relocate or stop. Because this has a major impact on entrepreneurs, they are supported in making their choice. The support includes a website for general information, personal advice for company specific solution and specialized advice in case of financial, legal or other specifics to be able to identify the most financially attractive schemes.

The Ministry of Agriculture, Nature and Food Quality (LNV) will design schemes and train people – in close coordination with provinces and municipalities – who can guide farmers and companies in making the most appropriate choices for them. The implementation will start in April 2023. With the help of a website, companies can get a good indication of whether they belong to the group of entrepreneurs (farmers and industry) who generate the most nitrogen emissions and which schemes they can use.

To achieve a large range and substantial reduction, the government is making every effort to reduce nitrogen precipitation in the Netherlands by approximately 100 moles (measure of the atomic weight of a molecule) per hectare per year. This effort obligation is an addition to the existing commitment and can help in completing the task in the various area processes.

71 <https://www.rijksoverheid.nl/documenten/kamerstukken/2023/02/10/uitwerking-piekbelastersaanpak-en-voortgang-pas-melders>

Line 2: A future-proof Dutch agriculture in 2040

The letter 'Future of Agriculture' describes the future agricultural landscape in The Netherlands as an agriculture that continues to operate at regional, national, European, and global levels. The Netherlands is and will remain an important exporting country, but because of the challenges and market developments, agriculture will gradually decrease in size. Agreements are recorded in an Agricultural Agreement, which includes elements 1) earning capacity, 2) transition paths and 3) spatial planning.

The envisaged Agricultural Agreement has a twofold objective:

- ➔ The agreement describes the future-proof position of agriculture as a strategically important economic sector, producer of sustainable food and raw materials and essential for a vital countryside. Parties make agreements about the support and the (legal) frameworks that are necessary to maintain this position, by making real earning capacity possible for farmers in different types of areas.
- ➔ The agreement describes the way in which the agricultural sector will play its part in the major challenges of nature restoration, water, and climate. The assignments are far-reaching and require more or less major adjustments from all stakeholders. The assignments are worked out differently per sector and per area.

Future proof Dutch agriculture is developed under the overall vision of circular agriculture. In this context the themes of feed, manure, soil, and animal welfare are developed with the aim of making qualitative and quantitative agreements with the stakeholders in the Agricultural Agreement; specifically addressing support and instruments needed to make the route to circular agriculture promising. In this context the themes of feed, manure, soil and animal welfare are developed with the aim of making qualitative and quantitative agreements with the stakeholders in the Agricultural Agreement. Agreements will specifically address support and instruments needed to make the transition towards a circular agriculture.

For feed, the focus is on the local production of feed via side and residual flows. Import from outside Europe will be limited. For manure, European agreements will be developed to allow processed manure as fertilizer and an upper standard will be introduced for livestock units per hectare as of 2032. For soil, all agricultural soils will be managed sustainably by 2030 and additional carbon will be stored annually in mineral agricultural soils for the benefit of the climate. This concerns 0.5 MtCO₂ eq/MtCO₂e extra storage annually. To stimulate sustainable use of leased lands a long-term perspective will be central in new lease contracts. Animal welfare will be aimed at providing conditions that provide for the animals' physical and mental needs, which are in balance with public health and limits the risk of zoonoses.

Through the area-based approach, farmers will be supported in the development of plans for the future of their farms. A budget of €226.6 million for 2023 and 2024 will be set aside in anticipation support the measures of the program that will boost the transition. Within this framework, €101 million will be earmarked for independent advice to individual entrepreneurs (€64 million) and sustainable practical tests on farms (€37 million).

Line 3: A place-based realisation of the transition

The transition is to be realised in a place-based manner, allowing each region to adjust to its particular situation. For this the the National Programme for Rural Areas it to be revised. To take more account of water and soil within the spatial planning in the Netherlands, a series of structuring choices have been made. Many of these choices are preconditions with which provinces, together with all stakeholders involved, can draw up an area-oriented approach towards a sustainable and climate neutral region. This is tailor-made because there are big differences between the different provinces. To continue to make sustainable use of the countryside, the water and soil system will have to lead. The major challenges for climate, water, nitrogen reduction and nature are tackled using an integrated approach. Through the National Programme for Rural Areas (NPLG), among others, clarity is offered about what can and cannot be done. Together with national and regional authorities, the cooperation becomes more concrete by redesigning the area, co-developing the goals in dialogue with local stakeholders. This offers a huge opportunity to jointly develop a rural area where it is possible to work, live, do business and participate in recreation that is pleasant, safe and healthy.

The NPLG not only gives substance to the area-oriented realization of the transition in the rural area up to 2030, but also lays the foundation for the period thereafter. This is closely intertwined with a long-term vision and perspective for agriculture that is elaborated in the Agriculture Agreement.

In the coming period, several important steps will be taken by the National Programme for Rural Areas. These are:

- ➔ In early 2023, the cabinet will inform the House about the provincial goals for climate and nature and the structuring choices, at the same time as the nitrogen targets for industry and mobility, among other things.
- ➔ Conclusion of the Agriculture Agreement in the first quarter of 2023.
- ➔ The MER (environmental effect report) for NPLG will be published simultaneously with the draft National Programme for Rural Areas, expected in mid-2023.
- ➔ In July 2023, all provinces will have completed the first provincial area programmes in concept.
- ➔ After July 2023, the area programmes will be tested by the ecological authority and the central government will assess the area programmes in their entirety. The area programs from the provinces will be adopted in the second half of 2023.
- ➔ The start of the multiannual programme is foreseen from 2024. This includes the overview of the progress of the package measures (with the financing).

The 'peak emitters' approach (see Line 1) gives an impetus to the broader transition of the rural area, for which the area-oriented programs that the provinces are now developing from the National

Programme for Rural Areas (NPLG)⁷² are of great importance. In this programme, the challenges in the field of nature, nitrogen, soil, water and climate and the transition of agriculture are tackled together. The approach differs per area, as each area has its unique characteristics. Together with the Agricultural Agreement – targeted to be concluded in April – the area-based approach should lead to a healthy rural area with prospects for agriculture. The Agricultural Agreement on the future of the agricultural sector must, where applicable, be in line with the objectives of the National Programme for Rural Areas.

The national climate target for all sectors is a 55 per cent reduction in greenhouse gas emissions by 2030, compared to 1990. The national task for livestock farming is a reduction of 5 MtCO₂e by 2030, of which 3.8 Mt are to be reduced by methane, as presented in the coalition agreement. The government has developed a proposal for the distribution of the GHG emission reduction per province. This helps provinces to draw up area programs, which with a mix of national (think of mandatory feed and management measures to achieve CO₂ reduction and circular agriculture) and provincial measures (will achieve the goals in the areas of nitrogen, nature, water and climate. With all programme areas together, the central government can assess whether the national climate challenge and methane reduction will be achieved.

The government announced the indicative nitrogen reduction targets for ammonia (NH₃) in June 2022. The achievement of this goal requires a reduction in NH₃ emissions by the agricultural sector of 41 per cent by 2030. The government considers it important that all sectors make a proportionate contribution to solving the nitrogen problem. Hence the government now provides reduction targets for nitrogen oxides (NO_x) for the mobility, industry and energy sectors. These sector targets are: mobility: 25 per cent reduction in NO_x and industry and energy sector: 38 per cent reduction in NO_x emissions in 2030 compared to 2019. These targets are set by exploring the contribution of this reduction to nature, the challenges for clean air and the climate objectives for each sector.

72 <https://www.rijksoverheid.nl/documenten/kamerstukken/2023/02/10/voortgang-integrale-aanpak-landelijk-gebied-waaronder-het-nplg>

3.2 Greenhouse Gas Emission Pricing aimed at transforming the agricultural sector's economic framework

The [Climate Action Plan 2023](#)⁷³ makes a strong case for environmental taxation and carbon pricing in general and lays out pathways to support the transition to alternative land uses through diversification options for agriculture in particular. It recognises that taxation policy can play a central role in encouraging the changes necessary to reduce greenhouse gas (GHG) emissions and to support additional environmental benefits and commits to having in place a taxation framework that plays its part in incentivising, along with other available policy levers, the necessary actions to reduce our emissions.

3.2.1 A farm-level split-gas levy to price agricultural greenhouse gas emissions – the case of New Zealand

A proposal for a new emission pricing framework

The Government of New Zealand is committed to pricing agricultural emissions by 1 January 2025, based on a polluter-pays principle. A proposal to be approved in 2023 suggests a farm-level, split-gas levy to price agricultural greenhouse gas emissions^{74,75}. A proposal, currently in consultation, suggests [a farm-level, split-gas levy to price agricultural greenhouse gas emissions](#). A split gas levy means that methane and all other GHGs are priced separately. This is unlike in the EU and most of the rest of the world where methane is included with all other GHGs. A final proposal⁷⁶ is to be approved early 2023. If such an alternative pricing system is not implemented by 2025, the Climate Change Response Act 2002 states that agricultural emissions will be priced under the New Zealand Emissions Trading Scheme (NZ ETS). If established, this would be the world's first scheme that will require farmers to pay for their agricultural greenhouse gas emissions.

The proposal builds on the recommendations of a Primary Sector Climate Action Partnership (established in 2019, delivered recommendations mid-2022), and independent scientific advice from New Zealand's Climate Change Commission.

Key aspects/elements/enabling conditions:

-
- 73 Government of Ireland (2022) Climate Action Plan 2023: Changing Ireland for the Better, <https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/>
 - 74 <https://www.beehive.govt.nz/sites/default/files/2022-10/Pricing%20agricultural%20emissions%20summary%20of%20the%20consultation.pdf>
 - 75 A split gas levy means that methane and all other GHGs are priced separately. This is unlike in the EU and most of the rest of the world where methane is included with all other GHGs.
 - 76 Ministry for the Environment and the Ministry for Primary Industries, New Zealand (2022) Pricing agricultural emissions: Report under section 215 of the Climate Change Response Act 2002 <https://consult.environment.govt.nz/climate/agriculture-emissions-and-pricing/>

- ➔ **Emissions would have to be paid for by farmers and growers** that are registered and meet certain livestock and fertiliser-use thresholds, and business owners have a legal responsibility to report and pay for emissions annually.
- ➔ **Emission prices would be separate for long-lived gases (carbon dioxide and nitrous oxide) and biogenic methane.** Long-lived gas prices will be set annually and linked to the New Zealand Unit price (this price is discounted and will be phased down over time). The biogenic methane levy will be a unique price that is adjusted based on progress toward domestic methane targets (reviewed annually or every three years). Ministers, with advice from the Climate Change Commission and in consultation with the agriculture sector and iwi/Māori, set these prices.
- ➔ **For reporting and payment, farmers and growers are required to provide information** to a centralised calculator to determine their emissions bill, including on farm area, livestock numbers, livestock production, nitrogen fertiliser use.
- ➔ **The revenue of the pricing system is to fund incentive and sequestration payments.** The remaining revenue will fund the administration of the pricing system and the joint government, industry and Māori revenue recycling strategy.
- ➔ **Emission reductions are to be incentivised by payment for a range of on-farm emissions- reduction technologies and practices.** These incentives will attach a value to approved mitigations and can help farmers and growers reduce their total emissions bill.
- ➔ **Sequestration from vegetation is to be recognized.** In the long term, the Government considers the NZ ETS the most appropriate mechanism to reward all sequestration from vegetation. In the short term, the Government proposes a simple system that sits adjacent to the farm-level pricing system, and pays farmers and growers (from levy revenue) for additional sequestration occurring in riparian vegetation and arising from managing indigenous vegetation.
- ➔ **To govern the scheme a revenue recycling advisory body or bodies are being proposed.** These will also advise on the strategy for the use of system revenue.
- ➔ **Emissions from synthetic nitrogen fertiliser** will either be priced in at farm-level and included in a farmer or grower's on-farm emissions bill, or required to be paid for by manufacturers and importers of synthetic nitrogen fertiliser via the NZ ETS.
- ➔ **Support to farmers and growers is to help the transition** by providing transitional support for specific rural and Māori communities impacted by the introduction of an agricultural emissions-pricing system. A higher level of support may be needed for sub-sectors such as sheep and beef.

Impacts of pricing agricultural emissions

The modelling on various options for agricultural emissions pricing, including both farm-level (farm-level levy) and processor-level (processor-level NZ ETS and processor-level levy) options, suggests that pricing agricultural emissions at the farm level using a split-gas levy with a low methane price (€ 1.71

per tonne CO₂-e / € 0.05 per kilo CH₄) is the best of these options and could achieve sufficient reductions to meet or exceed New Zealand's biogenic methane target by 2030.⁷⁷

Table 3.2.1.a: Emissions reductions in 2030 compared with 2020 in New Zealand

	Processor-level NZ ETS (%)	Processor-level levy (%)	Farm-level levy		
			Low price (%)	Medium price (%)	High price (%)
Biogenic methane reductions	18	10	12	13	15
Nitrous oxide reductions	10	5	3	5	5
Total agricultural GHG reductions	16	9	10	11	12

Emissions reductions are expected to come from: land-use changes to low-emissions land use; emissions-mitigation technologies and increased farm efficiency. The sheep and beef sectors are expected to be the most impacted, with possible reductions of net revenue relative to 2030 baseline of around 18 per cent (compared to only 6 per cent in the dairy sector). As Aotearoa New Zealand is a large exporter of dairy and meat products, any reductions in production will have flow-on effects on the economy and communities. There are likely to be disproportionate impacts on Māori due to the large proportion of Māori ownership in the sheep and beef sectors.

Table 3.2.1.b: Changes in sector net revenue relative to 2030 baseline in New Zealand

	Processor-level NZ ETS (%)	Processor-level levy (%)	Farm-level levy		
			Low price (%)	Medium price (%)	High price (%)
Dairy	-10	-6	-6	-6	-7
Sheep and beef	-32	-17	-18	-21	-24
Other	1	-1	-1	-1	0
Total	-6	-4	-4	-5	-5

The cost and availability to consumers of some food and fibre products may change, at least in the short term, as farmers, growers and the wider agriculture sector adjust to internalising the new cost on emissions. In the longer term, resulting shifts in land use may result in greater availability of lower-emissions food and fibre products.⁷⁸

77 Ministry for Primary Industries. 2022. Impacts of climate change mitigation policy scenarios on the primary sector. Retrieved from <https://www.mpi.govt.nz/dmsdocument/53632-Impacts-of-CC-mitigation-policies-on-the-primary-sector> (accessed 6 October 2022).

78 <https://www.beehive.govt.nz/sites/default/files/2022-10/Pricing%20agricultural%20emissions%20summary%20of%20the%20consultation.pdf>

Ministry for the Environment and the Ministry for Primary Industries, New Zealand (2022) Pricing agricultural emissions: Report under section 215 of the Climate Change Response Act 2002 <https://consult.environment.govt.nz/climate/agriculture-emissions-and-pricing/>

Further, pricing of agricultural emissions will likely lead to significant changes in farming practice in New Zealand that will present both challenges and opportunities to rural communities. Potential challenges could include a change in spending across rural communities and of quality of life, while opportunities could include new jobs and retraining arising from alternative land uses (reference: consultation document).

Positive impacts from the levy include (i) bolstering Aotearoa New Zealand's reputation as a low-emissions provider of agricultural products, (ii) recognition and support for farming businesses that are already reducing their emissions, and (iii) avoiding the significant cost of abatement for any emissions above Aotearoa New Zealand's Nationally Determined Contribution.

Perception and criticisms

According to the Guardian⁷⁹, there are rumblings of discontent over the announcement in New Zealand. But those working in agriculture and climate policy say the turnaround in the government/farmer relationship is not to be underestimated. There seems to be a growing division within the sector between those who are "ready to be part of the solution", and those who feel "very oppressed by not only climate change measures but all government regulation".

The government has largely accepted the scheme's proposals, which include reduced levies and generous incentive pay-outs, but rejected two major recommendations: that farmers set their own levy and that all on-farm planting leading to carbon sequestration be recognised in a bespoke scheme to offset levy costs. Some farmers are not happy about the rejected recommendations, as the Guardian quotes, "The plan would 'rip the guts out of small-town New Zealand'", says Andrew Hoggard, the Federated Farmers president."

On the other hand, environmental groups are concerned that dairy is not being targeted more, and believe that herd sizes must be dramatically reduced, the use of synthetic fertiliser slashed and a shift to plant-based regenerative organic farming prioritised.

A senior scientist at AgResearch⁸⁰, interviewed by the Guardian, believes the proposal "seems sensible" and that the government has got the balance broadly right. "It's evidence-based, it has recognised the essential need for a split-gas approach, and it has also taken a farm-level approach. I think that's important as well, because our farmers will be motivated by being recognised for what they do."

It is widely perceived that the Primary Sector Climate Action Partnership between farmers and the government and the consultation are key for the current advances in this policy. Also the OECD⁸¹ finds that the partnership provides a promising framework to consider farmer-led approaches and engage key stakeholders towards operational solutions.

79 <https://www.theguardian.com/world/2022/nov/12/19-years-after-the-fart-tax-new-zealands-farmers-are-fighting-emissions>

80 <https://www.agresearch.co.nz/news/robyn-dynes-on-proposed-agricultural-emissions-pricing/>

81 <https://www.oecd.org/climate-action/ipac/practices/new-zealand-s-plans-for-agricultural-emissions-pricing-d4f4245c/>

3.2.2 A voluntary certification framework offsetting carbon – the French Label Bas Carbone

Introduction and context

The French government launched a voluntary carbon certification framework in 2019 called 'Low carbon label' (Label bas carbone⁸²). It is a result of a project called VOCAL (Projet VOLuntary CARbon Land Certification) led by the Institute for Climate Economics (I₄CE) together with other partners. The tool is a key measure to address climate change mitigation and will contribute to the targets outlined in the French Low Carbon Strategy (for further details, please refer to section 2.1.3).

The objective of the label is twofold:

- ➔ Promoting the emergence of local actions that contribute to climate mitigation efforts and which can help disseminate good practices;
- ➔ Mobilising innovative financing for climate action from a wide range of stakeholders.

The label is a certification tool which guarantees that projects actively contribute to GHG emissions reduction and to carbon sequestration in a transparent manner and in compliance with reliable and verified methodologies.

The framework provides funding opportunities to local projects which support additional climate mitigation efforts while providing opportunities for companies, public authorities or individuals to offset their GHG emissions. However, this scheme cannot be used to compensate carbon emissions in the scope of regulatory obligations such as the European Trading System (EU ETS).

There have been 357 projects in France benefiting from the low carbon label so far. This represents an estimated impact of 1.4 MtCO₂e. France wants to further develop this type of certification scheme to help amplify the contribution from agro-forestry in the pathway towards climate neutrality.

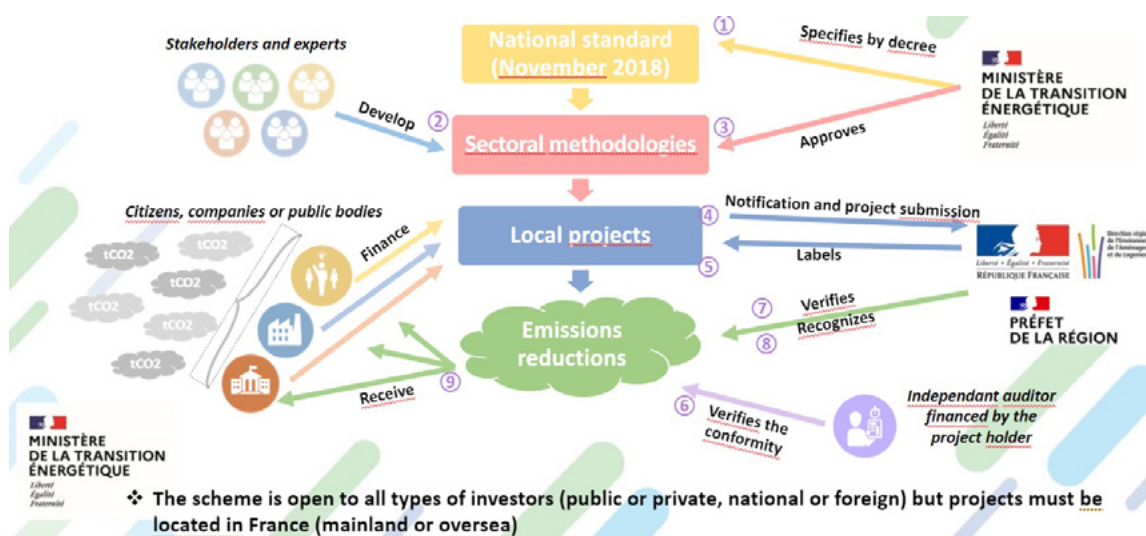
How does it work?

Figure 3.2.2a summarises the process of development of the certification scheme which is based on four main steps:

- ➔ The launch of a national standard ('label bas carbone') developed and validated by the Ministry for the Energy Transition;
- ➔ Development of sectoral carbon certification methodologies with the support of specific stakeholders and experts, then approved by the Ministry;
- ➔ Project holders can then apply, on a voluntary basis, for a certification. Projects will be assessed to determine whether they comply or not with the relevant sectoral methodology. Regional authorities review and approve applications. Once projects are certified, investors will be guaranteed to fund activities which demonstrate a positive climate impact.
- ➔ Emission reductions are monitored accurately and verified by an independent and qualified auditor.

82 <https://label-bas-carbone.ecologie.gouv.fr/>

Figure 3.2.2a: Functioning process of the low carbon scheme

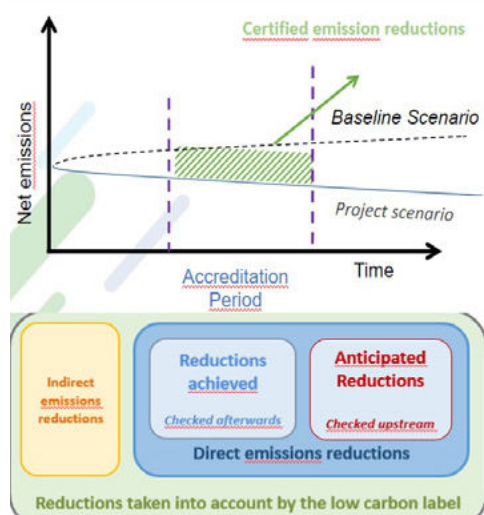


Source: Ministère de la transition énergétique

Additionality is a key criterion in the validation process. A project that only complies with regulations or corresponds to common practices cannot be labelled. The project leader must demonstrate that the emissions reductions are additional, i.e. they would not have taken place if the project was not certified.

Additionality is assessed according to a baseline scenario which takes into account: a similar situation in the absence of labelling; regulatory requirements and common practices and; incentives provided by other instruments. Only emissions reductions that go beyond the baseline scenario are recognised as indicated in figure 3.2.2b.

Figures 3.2.2.b and 3.2.2.c: Scope of carbon emissions taken into account by the low carbon label



Source: Ministère de la transition énergétique

As referred above, the low carbon standard relies on the development of sectoral methodologies that are developed by relevant stakeholders and experts and approved by the Ministry. Each methodology must:

- ➔ Specify eligibility criteria of the projects;
- ➔ Specify how additionality is demonstrated;
- ➔ Evaluate the co-benefits (negative and positive impacts);
- ➔ Take into account the risk of non-permanence and of release of carbon, by applying discounts
- ➔ Determine the procedures to verify the emissions reductions;
- ➔ Specify the procedures to monitor the indicators.

11 methodologies, most of them relating to forestry and agriculture, have been approved so far including the following:

- ➔ Afforestation
- ➔ Reforestation after fire, storm or sanitary disease
- ➔ Saplings selection
- ➔ Orchards plantation
- ➔ Sustainable management of hedges
- ➔ CarbonAgri (livestock-crop farming)
- ➔ SOBAC (input management)
- ➔ Ecomethane (cattle feeding)
- ➔ Field crops
- ➔ Use of local co-working spaces
- ➔ Reuse of building materials in rehabilitation operations

Other carbon emissions reduction and sequestration methodologies are currently under development such as pig farming, agro-forestry, wine growing, forestry with continuous cover and improved protection of wetlands.

A specific initiative has been set up for young/new farmers to give them the opportunity to assess the carbon emissions generated by their farm and further incentivize carbon farming practices. For example, farmers established for less than five years can benefit from a tool called the “Good Carbon Diagnosis” which carries out a carbon diagnosis of farms accompanied by a report allowing farmers to identify the measures which could have a positive climate impact. The initiative is subsidised up to 90 per cent. The farmer will only have to contribute up to 10 per cent of the total cost, i.e., a contribution of around €250. Based on this assessment, an action plan is defined to develop agricultural practices that

promote the reduction or storage of greenhouse gases according to the levers identified by the methodologies of the Low-Carbon Label.

With the right carbon diagnosis, the Government encourages young farmers, from the first years of activity, to develop agro-ecological approaches which can contribute to meet the national emissions reduction targets.

Financing

The framework has attracted a growing number of funders in the last four years, either private or public entities, which are often interested to voluntarily compensate their carbon emissions.

The financing of projects under the low-carbon label and the allocation of the associated emission reductions correspond to the purchase of a service, namely the compensation of the operator's emissions or its voluntary contribution to the climate change mitigation.

There is no specific scheme in place to connect funders together with project holders. It is up to projects to make connections or to go through intermediaries. A single intermediary stakeholder can connect or aggregate funds from several individuals or legal entities who wish to fund a specific project. The Low Carbon Label official webpage also offers a platform where both funders and projects are listed.

There are several financing options which are defined within a contract signed between the funder(s) and the project leader. Funding can be done in one go before, during or after the project. Financing can also be done in several tranches with a final payment provided at the end of the project according to the volume of emission reductions actually verified after the audit.

There is no fixed cost in €/tCO₂e set under the Low Carbon Label. Indeed, the price is decided by mutual agreement between the project leader and the funder(s). The government's approach is not to establish a market price in €/tCO₂e, but to allow projects to attract funding according to the related cost of the project. As an indication, €/tCO₂e avoided varies between 8 and €125/tCO₂ with an average of €35 according to projects that have been certified so far.

Perception and criticisms

Four years after the creation of the voluntary certification framework, the French government has expressed a willingness to further develop the certification framework following first positive results. So far, most of the projects funded in the scope of the scheme relate to the agricultural and forestry sectors. The 'label bas carbone' has been generally positively welcomed by stakeholders and seen as an interesting tool to address climate change mitigation, even though some limits and shortcomings have been observed.

According to a coalition of NGOs⁸³, the scheme might be diverted from its original purpose (funding positive environmental projects at local level) to be used by companies as an offsetting instrument.

83 https://reseauactionclimat.org/wp-content/uploads/2022/04/plan_bas_carbone_22_03_21_en.pdf

There is indeed no legal framework requiring companies or other entity to reduce the emissions generated by their activities when investing in certified projects and benefiting from carbon credits.

Besides, as it stands the certification does not differentiate between emissions reduction and sequestration. It can be difficult to evaluate how much carbon can be stored following the implementation of certified projects and whether carbon removals will be permanent or not.

Therefore, the carbon certification standard may be only one instrument amongst other policies and measures to lead transformational change in the land agri-food sector. Stakeholders also recommend improving the standard to guarantee it can have co-benefits for biodiversity and human and animal welfare and reward systemic change to agricultural practices.

3.3 Policies supporting transition to alternative land uses through diversification options

In support of livestock farmers that volunteer to reducing breeding ruminants, the Irish Climate Action Plan 2023 (Government of Ireland, 2022) lays out a number of diversification options, including in key areas such as organic farming, agri-centric biomethane production, afforestation and drained organic soils.

In this subsection, the report highlights policy insights aimed at diversifying agricultural land use options from three different cases observed in Germany.

3.3.1 A strategic approach to reach 30% of organic farming by 2030 – the case of Germany

Ireland's current level of organic farming, at less than 3 per cent, is low when compared to the rest of Europe, which is at an average of 9.1 per cent. Ireland has committed to increase domestic organic farming from currently 75,000 hectares to 450,000 hectares by 2030. The successful example of the German strategy offers relevant insights on how to reach an almost 5-fold increase in organic farming.

A Successful Strategy for the Future of Organic Farming

Organic farming is the German federal government's guiding principle for sustainable land management, providing answers to the necessary transformation of their food system towards more sustainability (BMEL, 2022⁸⁴). (BMEL, 2022)⁸⁵.

84 https://www.bmel.de/EN/topics/farming/organic-farming/organic-farming_node.html

85 https://www.bmel.de/EN/topics/farming/organic-farming/organic-farming_node.html

Already in 2017, the German Ministry for Food and Agriculture (BMEL), had developed a Strategy for the Future of Organic Agriculture⁸⁶, together with stakeholders from the private sector, policy and research, to reach its target of what was then still 20 per cent of organic production in the agricultural sector by 2030.

The Strategy contains five action areas that are pragmatically based on the key question of what policy makers can do at national level to expand the amount of land used for organic farming:

- ➔ designing a viable and coherent legislative framework;
- ➔ facilitating access to organic farming;
- ➔ fully utilising and continuing to expand the demand potential;
- ➔ improving the productivity of organic agri-systems; and
- ➔ providing adequate remuneration for environmental services.

24 measures are assigned to the respective lines of action and describe and specify the respective instruments and approaches for achieving these objectives (Table 3.3.1.a1a).

In recent years, the organically farmed area has expanded significantly in Germany to currently 10 per cent, and the demand for organic products has also continued to rise with an average annual growth rate of 7.8 per cent in the decade 2010-2019 (and 15.1 per cent in the decade before that). The Strategy for the Future of Organic Agriculture has certainly contributed to this development, as numerous new support measures have been implemented in the meantime. At no time has political support for organic farming been as well anchored as it is today, in Germany (Thünen Institute, 2023).⁸⁷

Assuming annual sales growth of 7 per cent to continue, demand of organic products would double within ten years. It is therefore highly likely that the German government's old sustainability target of 20 per cent organic farming will be achieved in the medium term in the early 2030s, driven by the market alone (Thünen Institute, 2023).

Raising the ambition

The current government of Germany has agreed to **expand the proportion of organically farmed area to 30 per cent of the entire agricultural area in Germany by 2030**. This is a very ambitious target and a corresponding expansion is only conceivable if all relevant players in business, science and politics pull together and increase their efforts.

To reach this goal, and to further improve the overall conditions for organic farms and other operators in the organic sector, the ruling parties intend to expand the Strategy for the Future of Organic Farming to include the entire organic value-adding chain, ranging from production and sales to processing

86 German Ministry for Food and Agriculture (BMEL) (2018) Organic farming - looking forwards strategy, <https://www.bmel.de/SharedDocs/Downloads/EN/Publications/OrganicFarmingLookingForwards.html>

87 <https://www.thuenen.de/de/thema/oekologischer-landbau/zukunftsstrategie-oekologischer-landbau/>

and marketing. The consultative process to further developing the strategy is to lead to a first draft of the Federal Government's strategy in January 2023, open for consultation between February 2023 and May 2023, and a final draft strategy for strengthening the organic agricultural and food sector in Germany to be submitted to the cabinet for approval in early summer 2023.

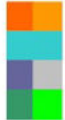
The further development of the strategy is being based on a "[Strategy paper for achieving 30 percent organic for a resilient agriculture and food sector in Germany](#)", provided in July 2022. Derived from reflections of the current strategy so far, the strategy paper proposes four overarching goals for agricultural production, the food industry, and nutrition:

- ➔ **Protect natural resources (biodiversity, soil, water, climate):** Key sustainability goals in Germany can only be achieved if environmental services are integrated into production, which is largely only possible by reducing intensity. A further significant expansion of organic farming is unproblematic, if food losses, the consumption of animal products, and land use by bioenergy crops would be reduced.
- ➔ **Eat better, live better: promoting more sustainable food for all:** a conversion of the agriculture and food industry to ecological methods can only succeed if the entire food industry and especially the nutritional behaviour of the population changes significantly towards plant-based diets. A central lever for socially balanced access to organic products lies in a significant increase in organic food in public catering facilities.
- ➔ **Strengthen the domestic food industry and value chains:** The targeted tripling of the organically farmed area by 2030 can only succeed if the additional organic raw materials produced can be processed in a value-added manner and distributed in retail and out-of-home catering (OOH). The strategy will have to include measures to initiate the ecological and economic impulses of organic value chains and to offer attractive and stable market partners to a large number of farms converting to organic agriculture.
- ➔ **Making ecosystem services visible and using them in the economic cycles of agriculture and the food industry:** External ecological and social costs of conventional agriculture surpass its gross added value, while public services generated by organic farming are not taken into account. A further developed strategy for organic farming needs to provide for measures that would lead to a system that ensures that the social services provided are also visible in the balance sheets of companies and in the economic cycles, such as a reform of corporate taxation aligned with climate and sustainability performance of companies.

The adjustment of resources for steering, coordination, programs, research and development, citizen information and education to the new objective is a basic requirement for the achievement of the 30 per cent target. Important additional requirements that must be secured by the federal government for a successful implementation include: (i) further alignment of the implementation of the Common Agricultural Policy (CAP) to the new target, (ii) ensuring a coherent regulatory framework, (iii) scaling up research, innovation and development, (iv) unlocking the potential in out-of-home (OOH) catering, (v) strengthen sales for organic products, and (vi) realising more animal welfare through system changes in animal husbandry.

Table 3.3.1.a: Action areas and measures outlined by the Strategy for the Future of Organic Agriculture

		Legal		Financial		Additional	
		EU	Natio- nal	BÖLN / EPS	GAK	BMEL/ Authorities	
Design a future-focused, practice-related legal framework							
M1	Further develop EU legislation on organic production in a problem-related approach						
M2	Implement legal amendments to support cultivation and production of seed and vegetative propagation material for use in organic farming						
M3	Assess potentially valuable protein carriers						
M4	Intensify research on alternative protein feeds						
M5	Support technical processes for the production and processing of protein feeds						
M6	Establish a demonstration network for small-seeded legumes and expand existing networks						
M7	Improve conditions for plant protection in organic farming through changes in the approval process						
M8	Dismantle or prevent barriers in emission reduction legislation						
M9	Make it easier for small businesses to comply with hygiene requirements						
Simplify access to organic farming							
M10	Amend the vocational and education regulations and assess the teaching curriculum						
M11	Initiate networking and exchange between education stakeholders						
M12	Evaluate and enhance teaching materials and teaching modules						
M13	Improve funding for conversion advisory services for agricultural holdings						
M14	Improve funding for vocational and further education and training of advisory staff						
M15	Drive development and provision of advisory instruments/tools						
Fully utilise and expand potential demand							
M16	Promote cooperation management in organic value chains						
M17	Improve funding for organic value chains under the GAK						
M18	Increase the organic share of goods procured with the BMEL remit						
M19	Conduct information campaigns to increase the organic share of goods in public procurement						
M20	Fund advisory services to promote the use of organic products by external food and catering services						
Improve the efficiency and performance of agricultural systems							
M21	Determine and implement federal-level organic research priorities						
Appropriate reward of environmental services							
M22	Secure sufficient funds for area-related organic farming premiums						
M23	Introduce a conversion premium for partially converted holdings						
M24	Develop a model to enable efficient and effective reward of environmental services						



- Introduce / further pursue legal measures
- Introduce / further pursue funding measures
- Introduce / further pursue measures in the areas of research, development and knowledge transfer
- Conduct / continue additional federal level activities

BÖLN: Federal Organic Farming Scheme and other forms of sustainable agriculture

GAK: Most important national funding instrument for supporting agriculture and forestry, developing rural areas and improving coastal and flood protection

3.3.2 The double dividend of biogas based on farm manure of animal origin and agricultural residues – the case of Germany

The Irish Climate Action Plan 2023 commits to deliver up to 5.7 TWh of indigenously produced biomethane by 2030, based on agricultural feedstocks, tripling its ambition from Climate Action Plan 2021. This is meant to provide both a diversification opportunity for farmers and a land-use alternative to livestock production.

The Climate Action Plan 2023 acknowledges that anaerobic digestion and the production of biomethane is at a nascent stage of development in Ireland and would need an all-of-Government approach to deliver on this ambition. The German example of having established quite a significant potential for biogas and biomethane might provide useful insights in this context.

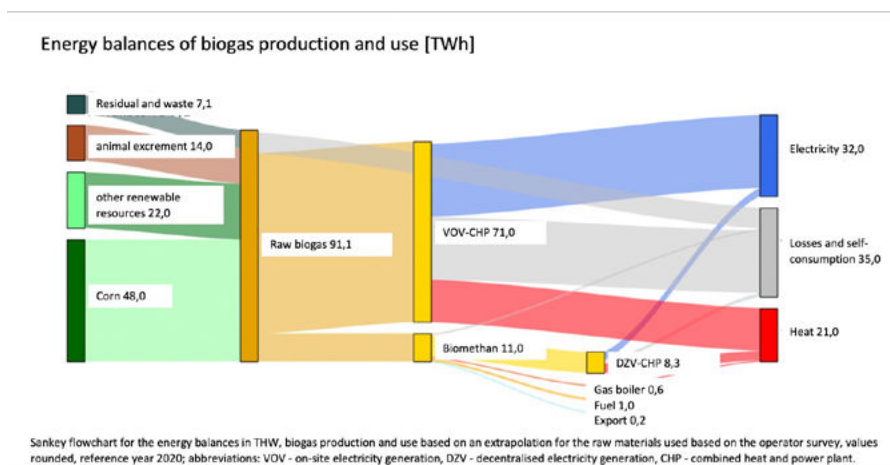
The building of a broad base of biogas plants in Germany

Since the year 2000, the number of biogas plants in Germany has risen steadily to currently more than 9,500 biogas production plants with on-site electricity generation, and more than 200 biomethane or biogas upgrading plants with access to the national gas network. The basis for the steady expansion of biogas plants in Germany was laid by the [Renewable Energy Sources Act \(EEG\)](#)⁸⁸ of 2000, which regulated the preferential feed-in of electricity from renewable energy sources into the electricity grid and guaranteed a fixed feed-in tariff for new plants over a period of first 20 years and now 10 years.

Biogas is an important pillar of the future energy system in Germany, as biogas can be stored, used flexibly and is base-load capable. Without the significant contribution of biomass as a renewable energy source substituting fossil energy, the ambitious goals that the German government has set for the energy transition can hardly be achieved. Currently, biogas plants in Germany generate an electrical output of more than 5,600 megawatts. They supply enough electricity for more than nine million households and cover about 5.4 per cent of German electricity consumption. Added to this is the heat produced by biogas plants, which is sufficient for more than 2.5 million households and accounts for about 10 per cent of the renewable heat produced ([BMEL Biogas website](#))⁸⁹ (see figure 3.3.2a for an overview of the energy balance of biogas production in Germany).

88 <https://www.bmwk.de/Redaktion/EN/Dossier/renewable-energy.html>

89 <https://www.bmel.de/DE/themen/landwirtschaft/bioeconomie-nachwachsende-rohstoffe/biogas.html>

Figure 3.3.2.a: Energy balances of biogas production and use in 2020 (TWh)

Next to the production of electricity and heat, the production of biogas can contribute significantly to the reduction of greenhouse gas emissions in the agricultural sector. In Germany, about 150–190 million tonnes of animal excrements such as liquid manure, slurry, dung or dry chicken manure are produced annually. The storage and spreading of manure releases climate-relevant methane emissions in the order of around 250,000 tonnes per year. Currently, about 30 per cent of the manure produced in Germany is used in biogas plants to generate energy. This avoids greenhouse gas emissions from fossil fuels in the order of about 1.5 MtCO₂e. As such, biogas technology with anaerobic fermentation and use of the resulting methane gas is said to be the only technically and economically established option for reducing GHG emissions, in particular methane emissions, from manure storage (Fachagentur Nachwachsende Rohstoffe – Germany’s official agency on renewable resources)⁹⁰.

The double dividend of using farm manure of animal origin and agricultural residues for the production of biogas is hence based on the avoidance of GHG in two ways by the same process: On the one hand, GHG emissions are reduced by using farm manure in sealed biogas production processes avoiding the emissions which would have been generated by conventional storage. On the other hand, GHG emissions are avoided by substituting fossil energy sources with the biogas produced. Taking these two points together, the Fachagentur Nachwachsende Rohstoffe e. V. (FNR) (Germany’s official agency on renewable resources) estimates that through the current use of the approx. 60 million tonnes of farm manure in biogas plants, greenhouse gas emissions (GHG) amounting to 7.1 MtCO₂e could be avoided. Further, experts assume that the quantities of farm manure used could be doubled by 2030. This would result in an annual GHG savings potential of 11.7 MtCO₂e (Fachagentur Nachwachsende Rohstoffe).

90 <https://biogas.fnr.de/wirtschaftsduenger/wirtschaftsduengervergaerung>

Further expanding the fermentation of farm manure of animal origin

For this reason,⁹¹ the German government has decided to increase the fermentation of farm manure of animal origin, in addition to the EEG. Within Germany's Climate Protection Programme 2030 this is the second most important measure. The [directive on the promotion of investments in emission-reducing measures for the fermentation of farm manure of animal origin and agricultural residues](#)⁹² is intended to increase this share significantly, with estimates targeting the fermentation of 40 per cent of the manure produced by 2030, and an overall reduction of greenhouse gas emissions in the order of about 2.4 MtCO₂e. The joint fermentation of farmyard residues and farmyard manure in biogas plants is also a promising way to further improve the economic viability of smaller farm biogas plants. Together, this use of residual materials for energy purposes complies with the principles of the circular economy, contributes to the generation of renewable energies and to the reduction of greenhouse gas emissions. Funding is available, for example, for the covering of digestate storage facilities (the directive aims to increase the proportion of gas-tight stored slurry from cattle and pig farming to 70 per cent), the conversion of existing plants, specific plant components for new biogas plants or measures accompanying investments.

This funding programme is also addressing some of the concerns that experts have identified: Since 2017, the annual construction of new liquid manure plants has been falling continuously, so that it can be assumed that the easily accessible quantities of liquid manure are already being used in biogas plants. In order to significantly increase the amount of manure used in biogas plants, barriers to manure fermentation must be removed and new incentives for the use of farm manure in biogas plants must be created ([Fachagentur Nachwachsende Rohstoffe](#)).

For biogas in general, high formal requirements, low compensation rates, increased investment and financing risks as well as increasing cost pressure are leading to a growing discrepancy with the expansion targets for biomass. The maintenance of a relevant number and size of biogas plants therefore requires better framework conditions in the future for greater investment security and the adjustment of the feedstock composition, through the reduction of the use of energy crops and the increased use of agricultural residues and waste materials ([Deutsches Biomasseforschungszentrum and Wuppertal Institut, 2022](#)).⁹³

Due to the fact that the fixed EEG tariff for a large number of plants will expire by 2030, new requirements and challenges will arise for the biogas plants. Analysing economically and ecologically feasible

91 And to reduce the proportion of the fermentation of renewable resources explicitly cultivated for the production of biogas, especially corn. In 2021, renewable raw materials for biogas production were cultivated on about 1.57 million hectares. This corresponds to about nine percent of Germany's total agricultural area. Silage maize still dominates with around 56 per cent, other important feedstocks are whole plant silages from grass, grain or legumes and sugar beet (BMEL Biogas website). Not only do these cultivations compete with sustainable food production, they also come with considerable greenhouse gas emissions.

92 <https://wirtschaftsduenger.fnr.de/fileadmin/Projekte/2021/wirtschaftsduenger/Bundesanzeiger.pdf>

93 https://www.dbfz.de/fileadmin/user_upload/Referenzen/Studien/Kurzstudie_Biogas_2022.pdf

operating models for biogas plants, the [Umwelt-Bundesamt \(2020\)](#)⁹⁴ identified and assessed possible plant concepts. For different plant concepts three operating models were analysed in detail: (1) Reduction of the energetic substrate input (share of energy crops) by 50 per cent without significant technical changes at the biogas plant, (2) Flexibilisation of biogas production and electricity provision, and (3) upgrading of biogas to biomethane.

From the point of view of energy system, as well as from an economic point of view, biomethane plants were rated best. However, with regard to the GHG balance, small-scale biogas plants based on manure are the best plant concept for avoiding GHG emissions from conventional manure storage. The Umwelt-Bundesamt concludes that, against the background of the changing energy system, all models for biogas will be important in the future.

However, from the point of view wanting to reduce GHG in the land agri-food system, the small-scale biogas plants based on manure are to be preferred. Further, this on-site electricity generation has also the advantage that significantly lower "economies of scale" apply and thus plants can be operated technically and economically sensibly even at relatively small-rated outputs around 100 kW. Most on-site electricity production biogas plants are well above this threshold. The economic limit for gas processing is higher by a factor of 5 to 10 in relation to the raw gas production, depending on the necessary periphery (filling station, gas feed, etc.). In addition, the logistics of larger gas production units are more complex, especially for residual and waste materials, as these often occur spatially dispersed and are also often subject to seasonal fluctuations in availability.

3.3.3 A Natural Climate Action Programme to address LULUCF emissions – a new proposal and potential milestone in Germany

In its recent Climate Action Plan 2023, Ireland emphasises the role of the LULUCF sector and the need to reduce its emissions and increase its potential as a sink of greenhouse gases.

In the Irish Climate Action Plan 2023, the rehabilitation of peatlands plays an important role in order to ensure that the peatlands, which cover 21 per cent of the land area, and 64 per cent of total soil organic carbon stock, regain their ability to deliver specific ecosystem services, which have considerable potential for initial mitigation gains and future carbon sequestration, as well as additional benefits including increased natural capital, enriched biodiversity, and improved water quality and flood attenuation. To do so, the Climate Action Plan 2023 plans to, e.g., rehabilitate a total of 77,600 ha of peatlands by 2030. It also aims to reduce the management intensity of at least 80,000 ha of drained, agricultural, managed, carbon-rich soils by 2030.

94 https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2020-01-30_texte_24-2020_bio-gas2030.pdf

The Irish Climate Action Plan also acknowledges that afforestation is one of the largest land-based, long-term climate change mitigation measures available to Ireland and that management of its existing forests also provides opportunities to increase carbon stores. The Department of Agriculture, Food and the Marine (DAFM) is to finalise the development of a new Forest Strategy in 2023 that will recognise the multiple benefits that forests provide, focusing on climate, nature, wood, people and the economy. In this context, Ireland aims to (i) increase its annual afforestation rates from approximately 2,000 hectares (ha) per annum in 2021 to at least 8,000 ha per annum from 2023 onwards, to deliver an additional 28,000 ha of afforestation across the first carbon budget period, and (ii) to promote forest management initiatives in both public and private forests to increase carbon sinks and stores, among other actions. Delivering on planting targets has been a persistent issue in Ireland for many years.

A new Nature-based Climate Action Programme to address LULUCF

The German government has tabled a proposal for a Nature-based Climate Action Programme ([Aktion-sprogramm Natürlicher Klimaschutz \(ANK\)](#))⁹⁵ that is to be approved in 2023. In the [recent proposal from February 2023](#),⁹⁶ which was revised after a consultative process, the Natural Climate Action Programme is described as the German government's central instrument for achieving its targets regarding the Land Use, Land Use Change and Forestry (LULUCF) sector.

As legislated with the 2021 amendment of the Federal Climate Protection Act, the emissions balance in the LULUCF sector is to be minus 25 MtCO₂e per year, in the average of the years 2027-2030. For the years 2037 - 2040, the target is an emissions balance of minus 35 MtCO₂e per year; for the years 2042 - 2045, the annual target is minus 40 MtCO₂e. To achieve this, emissions from the LULUCF sector must be reduced as quickly as possible and the existing sinks in which greenhouse gases are incorporated must be stabilised and expanded. With this Action Programme, natural (nature-based) climate protection would become the third pillar of Germany's efforts to address climate change, alongside savings through energy efficiency and the expansion of renewable energies.

With the Natural Climate Action Programme, the Federal Government aims to make a decisive contribution to significantly improving the general condition of ecosystems in Germany and strengthening their climate protection performance. Nature on land and at sea is to become more natural and thus more resilient. Agriculture and forestry are to become more sustainable and leave room for more diverse flora and fauna on the cultivated areas. Sustainability also means involving local people as partners and co-designers, because those who own or manage land, as well as those responsible in municipalities and cities, know where the most urgent needs are. The measures of the Natural Climate Action Programme therefore focus in particular on funding in order to provide financial incentives for the voluntary implementation of natural climate protection measures.

95 <https://www.bmu.de/natuerlicher-klimaschutz>

96 https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Naturschutz/aktionsprogramm_natuerlicher_klimaschutz_2023_bf.pdf

According to the proposal, expenditure totalling 590 million euros is budgeted for 2023, and a total of around 4 billion euros is planned for the period 2022–2026. The Natural Climate Action Programme will include existing measures and those that do not require funding or are funded from the departments' individual budgets. However, new measures financed from the [Klima- und Transformationsfonds](#)⁹⁷ (providing 177.5 billion euro between 2023 and 2026 for climate action and energy transformation) are a focus of the programme. Many measures in the Natural Climate Action Programme are designed in such a way that they must be continued beyond 2026, given that the goals of the Federal Climate Protection Act for the LULUCF sector can only be achieved through long-term measures.

The Natural Climate Action Programme, which is embraced also by environmental groups as “milestone” ([Greifswald Mire Centre](#))⁹⁸, “turning point” ([DUH](#))⁹⁹ or “a game changer” ([NABU](#))¹⁰⁰, identifies ten central fields of action:

- ➔ Protection of intact peatlands and rewetting
- ➔ Near-natural water balance with living rivers, lakes and floodplains
- ➔ Seas and coasts
- ➔ Wilderness and protected areas
- ➔ Forest ecosystems
- ➔ Soils as carbon reservoirs
- ➔ Natural climate protection on settlement and transport areas
- ➔ Data collection, monitoring, modelling and reporting
- ➔ Research and capacity building
- ➔ Cooperation in the EU and internationally

Amongst these fields of action, the Natural Climate Action Programme places particular focus on drained peatlands and forests.

Protection of intact peatlands and rewetting of drained peatlands

According to the Natural Climate Action Programme, the rewetting of drained peatlands, which represent the largest source of greenhouse gas emissions in the LULUCF sector, must be accelerated significantly. In Germany, 92 per cent of peatland soils are currently drained, mostly to be used as arable land, pasture or for peat cutting, with most of the peatland soils to be found in the north of Germany (see figure 3.3.3a). As such, they emit 53 MtCO₂e annually, which corresponds to around 7.5 percent of total

97 <https://www.bundesregierung.de/breg-de/themen/deutsche-einheit/klima-und-transformationsfonds-2065714>

98 https://www.greifswaldmoor.de/files/dokumente/Infopapiere_Briefings/202210_ANK_Stellungnahme.pdf

99 <https://www.duh.de/presse/pressemitteilungen/pressemitteilung/deutsche-umwelthilfe-zum-aktionsprogramm-natuerlicher-klimaschutz-potenzial-dringend-noetige-zeiten/>

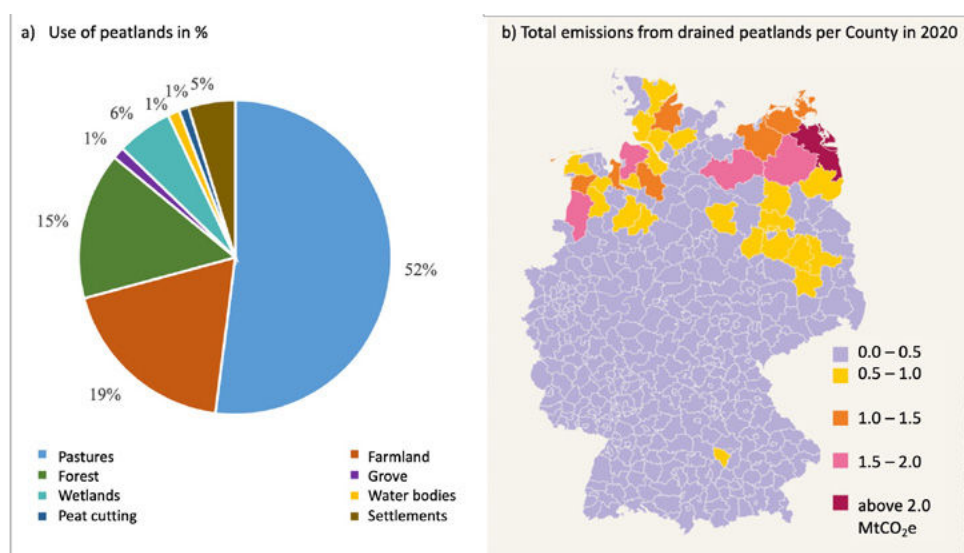
100 <https://kommunalwirtschaft.eu/tagesanzeiger/detail/i52943/c145>

German greenhouse gas emissions, and 37 percent of the greenhouse gases emitted by the agricultural sector, according to figures from 2020.

Figure 3.3.3a:

a) Use of peatlands in Germany, source: Umweltbundesamt (UBA) 2020 Berichterstattung unter der Klimarahmenkonvention der Vereinten Nationen und dem Kyoto Protokol.

b) Total emissions from drained peatlands per County in Germany, source: Umweltbundesamt (UBA) 2023 Mooratlas 2023.



Addressing this issue, the Natural Climate Action Programme builds on both, the Bund-Länder Target Agreement on Climate Protection through Peatland Soil Conservation from 2021, and the National Peatland Protection Strategy adopted November 2022. The [Bund-Länder Target Agreement on Climate Protection through Peatland Soil Conservation](#)¹⁰¹ commits to **reduce annual emissions from peatlands by 5 MtCO₂e by 2030**.

The [National Peatland Protection Strategy](#)¹⁰² provides the political framework for all aspects of peatland protection in Germany and brings together the various measures. Implementing the National Peatland Protection Strategy, the Federal Government advocates, among others, for the (i) anchoring of a pre-emptive right of the public sector for peatland soils; (ii) development and implementation of peatland protection measures on federally owned land; and (iii) improving legal and funding instruments for peatland protection and conservation.

In line with the Bund-Länder Target Agreement and the National Peatland Protection Strategy, the Natural Climate Action Programme has a **focus on measures for the large-scale rewetting of drained peatland soils**. As stated by the National Peatland Protection Strategy *“The cultivation methods and practices currently prevalent in agriculture on peatland soils are fundamentally incompatible with year-round*

101 https://www.bmel.de/SharedDocs/Downloads/DE/_Landwirtschaft/Klimaschutz/moorbodenschutz-blzv.html

102 https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Naturschutz/nationale_moorschutzstrategie_bf.pdf

near-surface drainage. The drainage of agricultural land on peat soils must be dismantled as far as possible by the time climate neutrality is achieved in Germany in 2045 at the latest, or redesigned in such a way that they can contribute to stabilising the soil water balance and the landscape water balance (balancing between precipitation and dry phases). The conversion from drainage-based to wet moorland use requires a reorientation of management practices, which is associated, among other things, with considerable investments in hydraulic engineering facilities and in adapted land use technology. In most cases, farms cannot manage these conversion processes on their own."

The Natural Climate Action Programme acknowledges the implementation of the necessary measures to rewetting peatlands to be a considerable challenge requiring considerable personnel and financial efforts from the various actors in the coming years. In response to the challenges, the Natural Climate Action Programme, proposes a ***Climate Protection through Peatland Soil Conservation Programme*** to support large scale rewetting projects and their accompanying measures, as well as the promotion of site-adapted wet use of peatlands. For the time being, these measures are based on the principle of voluntary action. Further, agricultural or forestry management of the areas should continue to be possible with new management practices even when water levels are raised. In coordination with the Länder, the Natural Climate Action Programme will develop programmes and subsidies that specifically address the concerns of agricultural and forestry use of drained peat soils. To this end, a set of measures for rewetting and change of use (paludiculture) will be developed and implemented in the field, on a voluntary basis.

The development of **new value chains for paludiculture and product marketing** is another action area of the Natural Climate Action Programme, noting that the successful establishment of alternative forms of cultivation, such as paludiculture, on rewetted, formerly drainage-based peatland soils presupposes that there is a market for the products produced. As formulated in the National Peatland Conservation Strategy, various measures are needed to support the production of such products, as well as the initiation of demand. For reasons of resource efficiency, the focus is suggested to be primarily on material use.

In addition, the Natural Climate Action Programme will develop a phase-out plan for peat extraction and use and development of substitutes, and work to improve the condition of unused and protected peatlands and finance renaturation measures to preserve and/or protect the few remaining near-natural and unused peatlands, which are mostly in a poor state of conservation.

Environmental groups explicitly support the peatland protection and rewetting initiative of the federal government. However, they criticise the current target of emission reductions of 5 MtCO₂e by 2030 as not ambitious enough, addressing not even 10 percent of the overall emissions from peatlands (e.g., the **Greifswald Mire Centre**)¹⁰³. Also the **Heinrich Böll Stiftung**¹⁰⁴ (the foundation linked to the Green Party) sees this target as "only a drop in the ocean" and refers to calculations that show that at least

103 https://www.greifswaldmoor.de/files/dokumente/Infopapiere_Briefings/202210_ANK_Stellungnahme.pdf

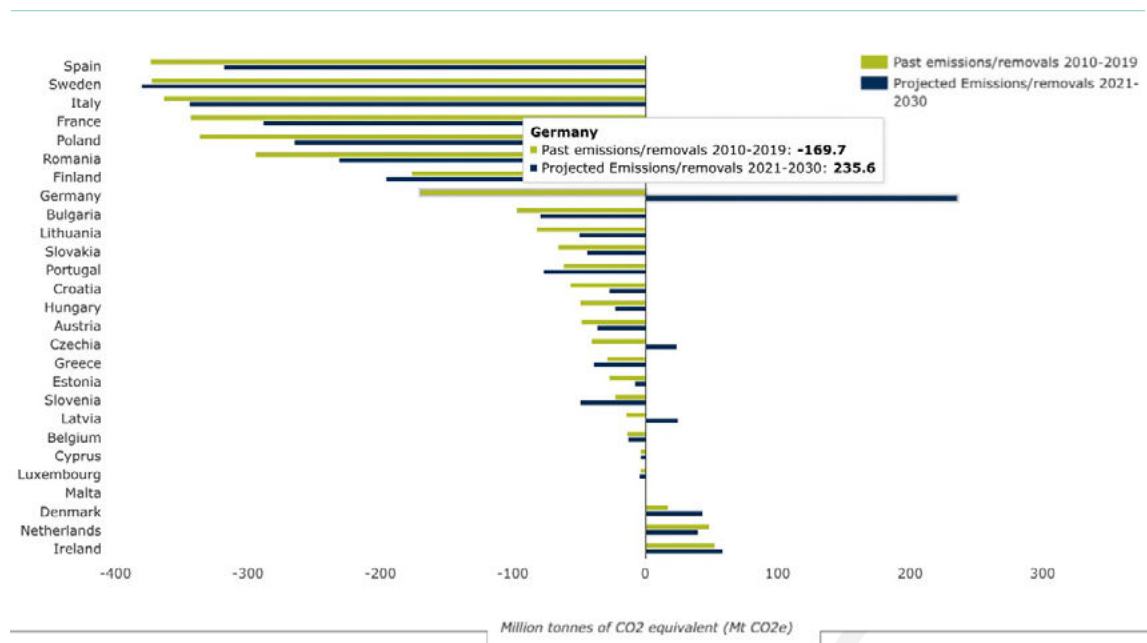
104 <https://www.boell.de/de/2023/01/10/moorschutz-deutschland-warum-die-bundesregierung-jetzt-handeln-muss>

50,000 hectares of moorland would have to be rewetted in Germany every year in order not to miss the goal of the Paris Climate Agreement, while currently only 2,000 hectares per year are being rewetted. They argue, that in its dimension, the necessary paradigm shift in peatland protection can be compared to the coal phase-out, which, as a tried and tested political model, serves as a blueprint for a socially acceptable transformation in the peatlands for several reasons: *“As with the end of coal-fired power generation, peatland protection is firstly about the largest single source of emissions within the respective sector. Secondly, the financial volume for the coal phase-out indicates a political willingness to pay, from which a politically justifiable budget for peatland rewetting can be derived. Thirdly, the federal government could convene a body to promote acceptance for peatland protection in society and the region - modelled on the Coal Commission, which has accompanied the debate on the coal phase-out since 2018.”* However, the Heinrich Böll Stiftung criticises that the limited resources of the Natural Climate Action Programme are not sufficient for such a comprehensive transformation.

Forest Ecosystems

Forests, on the other hand, are the largest land-based greenhouse gas sink in Germany; they can permanently sequester carbon from the atmosphere. However, due to the increasing drought caused by the climate crisis and the fact that forest management is often one-sidedly oriented towards wood production, this sink capacity is threatened. Because of this, the LULUCF sector in Germany risks turning from a significant sink to a significant source of greenhouse gas emissions, as projections of the EEA show (figure 3.3.3b).

Figure 3.3.3b: Comparison of cumulative historical and projected LULUCF emissions and removals by EU Member State, source: EEA: https://www.eea.europa.eu/data-and-maps/daviz/comparison-of-cumulative-historical-and#tab-chart_1



For this reason, Germany is increasing its efforts to **convert its forest stands towards greater species richness and resilience and create 10,000 hectares of new forest annually from 2023 to 2030.**

Increasing the forest area is seen as a suitable measure to increase the sink function of forests in the long term and thus contribute to the goal of climate neutrality. The forest area in Germany is very unevenly distributed. In agriculturally overdeveloped regions, especially in the north of the country, increasing the forest area therefore offers the possibility of increasing structural diversity in the landscape, biotope connectivity and thus habitat quality for many species. At the same time, positive effects on the landscape water balance can be achieved, for example. It is important to note that the increase in forest area must not be achieved at the expense of ecologically valuable open land sites.

The Natural Climate Action Programme the Federal Government suggests, through a Bund-Länder exchange, to discuss possibilities for implementing the largest possible initial afforestation in suitable areas, possibly in pilot regions, according to biodiversity-promoting guidelines.

Another central measure is the creation of species-rich and climate-resilient mixed deciduous forests through restoration and forest conversion. Forests in Germany are not stocked sufficiently close to their natural state in large parts and are thus not sufficiently adapted to the demands posed by climate change. Since extreme weather events will become more frequent with increasing climate change, there is a high urgency to better adapt the existing forests to climate change through active forest conversion and adapted wildlife densities and to restore the already damaged areas as species-rich and thus climate-resilient forests. This also includes measures that are suitable for permanently improving the landscape water balance. This measure addresses both forests in protected areas and managed forest areas. In the first package of measures to implement the Climate Protection Programme 2030, the Federal Government provided a total of around 480 million euros to promote near-natural and therefore climate-stable forest management and to repair damage caused by extreme weather events. This sum was co-financed by the Länder, so that a total of around 800 million euros is available for the period until 2023.

Further, the Natural Climate Action Programme suggests developing suitable funding instruments to increase the share of private and communal forest area that is demonstrably managed in a climate-adapted manner and is close to nature. The aim of the measure is to support private and communal forest owners in strengthening the resilience and climate adaptability of forests, increasing the biodiversity of forests and preserving the valuable natural carbon store in forests. The required actions go beyond the current standard of forest certification systems and thus help to provide additional climate protection and biodiversity services in the forest.

In the Irish Climate Action Plan 2023, the rehabilitation of peatlands plays an important role in order to ensure that the peatlands, which cover 21 per cent of the land area, and 64 per cent of total soil organic carbon stock, regain their ability to deliver specific ecosystem services, which have considerable potential for initial mitigation gains and future carbon sequestration, as well as additional benefits including increased natural capital, enriched biodiversity, and improved water quality and flood attenuation. To do so, the Climate Action Plan 2023 plans to, e.g., rehabilitate a total of 77,600 ha of peatlands by 2030. It also aims to reduce the management intensity of at least 80,000 ha of drained, agricultural, managed, carbon-rich soils by 2030.

3.4 Conclusions

The [Climate Action Plan 2023](#)¹⁰⁵ provides a good base to further integrate the recommended policy insights as outlined above and summarized in the table 3.4.1 below. It makes, for example, a strong case for environmental taxation and carbon pricing in general and lays out pathways to support the transition to alternative land uses through diversification options for agriculture in particular.

What is not yet emerging clearly from the Irish Climate Action Plan 2030 or the Food Vision 2030, is an overarching long-term vision aiming to systemically transform the sector itself, which would provide the overall direction, including for the measures just outlined in the last paragraph. Here the report suggests drawing on the insightful experience that the current policy landscape of the Netherlands is offering as it is developing a Roadmap towards a Circular Agriculture by 2040, including a significant reduction of livestock.

Table 3.4.1: Recommended policy insights

Vision – the Example of the Netherlands

The Dutch government's [Vision on Circular Agriculture](#) from 2018 sets out the ambition of the Netherlands to be a global leader in circular agriculture in 2030. The vision entails a paradigm shift from growth in production volumes and cost price reductions towards optimisation in resource use and food production in harmony with nature. This vision and its action plan supporting the transition to circular agriculture have been reinforced by a number of environmental crises in the past years that have 'locked' the country in terms of rural and urban planning. Three important lines of action are being followed: 1. Unlocking the Netherlands, e.g., by, supporting some 3000 peak agricultural emitters to become more sustainable, relocate or stop harmful practices to drastically reducing nitrogen emissions from the sector. 2. Developing an agricultural agreement for a future-proof circular agriculture, which remains a strategically important economic sector, while playing its part in the major challenges of nature restoration, water, and climate. 3. Reorienting spatial planning of rural areas under a paradigm with the water and soil system in the lead, providing a base for a broader transition of the rural area.

Pricing Greenhouse Gas Emissions in Agriculture – Examples from New Zealand and France

The government of New Zealand is currently discussing a proposal for a pricing system based on a [farm-level split-gas levy](#) that is most effective at reducing emissions, while maintaining a viable and productive agriculture sector. The levy would price emissions from biogenic methane and nitrous oxide (including from fertiliser) separately. Farmers with more than 550 stock units (deer, sheep, cattle) or 50 dairy cattle, or who apply 40 tonnes of synthetic nitrogen fertiliser, have to register and pay for their on-farm emissions. Revenue from the system will be used to fund admin costs, incentive and sequestration payments, a dedicated fund to support Māori, and other activities to reduce emissions.

The French '[Low Carbon Label](#)' is a voluntary carbon certification framework launched in 2019. This is a key tool put forward by the French government to meet its emission reduction targets. The framework provides opportunities for low-carbon projects to receive funding from investors, companies, or public authorities to compensate their emissions. Only projects demonstrating additional GHG emissions reductions (emissions avoided or sequestered) can be certified. Several methodologies have been developed by stakeholders and experts to determine eligibility criteria for projects to be certified in the areas of agriculture and forestry and new ones are being developed.

105 Government of Ireland (2022) Climate Action Plan 2023: Changing Ireland for the Better, <https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/>

Diversification of Land Use Practices – Examples from Germany

Germany has a successful Strategy for the Future of **Organic Agriculture**, aiming for 30 per cent of the entire agricultural area to be organically farmed by 2030. The Strategy focuses on designing a coherent legislative framework; facilitating access to organic farming; fully utilising and expanding the demand potential; improving productivity of organic agri-systems; providing adequate remuneration for environmental services. Supported by the strategy, the organically farmed area has expanded significantly in Germany to currently 10 per cent. Growth of organic farming up to 20 per cent is projected to be driven by the market alone.

Germany's Renewable Energy Sources Act (EEG) of 2000, which regulated the preferential feed-in of electricity from renewable energy sources into the electricity grid and guaranteed a fixed feed-in tariff, laid the foundation for a steady growth of **biogas plants** with currently more than 9,500 biogas production plants with on-site electricity and heat generation, and more than 200 biomethane plants with access to the national gas network. Through the use of approx. 60 million tonnes of farm manure in biogas plants, approx. 4.8 TWh of electricity could be generated in 2020, and GHG emissions of 7.1 MtCO₂e could be avoided.

The German government has recently tabled a proposal for a **Nature-based Climate Action Programme** that is described as the central instrument for achieving LULUCF emission targets. Key fields of action include the protection of intact peatlands and rewetting of organic soils, and an increase of size and diversity of forest ecosystems. By 2030, the rewetting of drained peatlands is to reduce annual GHG emissions by 5 MtCO₂e. Forest stands are to be converted towards greater species richness and resilience and 10,000 hectares of new forest to be created annually from 2023 to 2030.

References

- Department of Agriculture, Food and the Marine (2021), *Food Vision 2030 – A World Leader in Sustainable Food Systems*.
- Department of Agriculture, Food and the Marine (2020), 'Ag Climatise' – *National Climate & Air Roadmap for the Agriculture Sector*.
- Department of the Environment, Climate and Communications (2022), *Climate Action Plan 2023*.
- EEA (2022), *Rethinking agriculture*, EEA briefing no. 25/2021, European Environment Agency.
- EEA (2022), *Progress and prospects for decarbonisation in the agriculture sector and beyond*, EEA briefing no. 17/2022, European Environment Agency.
- Kobylka, K.; Laskowski, K.; Śniegocki, A. (2022), Long-Term Strategies Assessment of the Visegrád Group Countries. WiseEuropa: Warsaw.
- Belgium's Federal Government (2020), *Stratégie à long terme de la Belgique*.
- Denmark's Ministry of Taxation (2018), *Energy Agreement 2018*.
- Denmark's Ministry of Food, Agriculture and Fisheries (2021), *Agreement on green transition of Danish Agriculture*.
- France's Ministry of Agriculture and Food (2021), *Plan d'action climat du ministère de l'Agriculture et de l'Alimentation*.
- France's Ministry for the Ecological and Solidary Transition (2020), *National Low Carbon Strategy*.
- France's Ministry of Agriculture and Food (2021), *Le programme national de la forêt et du bois 2016-2026*.
- Réseau Action Climat (2020), *Position on the French Label Bas Carbone and the Livestock farming methodology*.
- Germany's Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (2016), *Climate Action Plan 2050*.
- Germany's Federal Ministry of Justice (2021), *Federal Climate Change Act*.
- Germany's Federal Ministry of Food and Agriculture (2017), *Organic Farming – Looking Forwards strategy Towards Greater Sustainability in Germany*.
- Wuppertal Institut (2022), *Kurzstudie zur Rolle von Biogas für ein klimaneutrales, 100 % erneuerbares Stromsystem 2035*.
- Germany's Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (2023), *Aktionsprogramm Natürlicher Klimaschutz*.
- Germany's Federal Ministry of Food and Agriculture (2021), *Bund-Länder-Zielvereinbarung zum Klimaschutz durch Moorbodenschutz*.
- Germany's Umweltbundesamt (UBA) (2020) *Optionen für Biogas-Bestandsanlagen bis 2030 aus ökonomischer und energiewirtschaftlicher Sicht. Abschlussbericht*.
- The Netherlands' Ministry of Economic Affairs and Climate Policy (2019), *Long-term Strategy on Climate mitigation*.
- The Netherlands' government (2019), *National Climate Agreement*.
- MacLeod, M.; Gerber, P.; Mottet, A.; Tempio, G.; Falcucci, A.; Opio, C.; Vellinga, T.; Henderson, B.; Steinfeld, H., (2013). *Greenhouse gas emissions from pig and chicken supply chains: A global life cycle assessment*. FAO, Rome, Italy.
- Finland's Government (2022), *Valtioneuvoston selonteko maankäyttösektorin ilmastosuunnitelmasta*.
- Finland's Government (2017), *Government Report on Medium-term Climate Change Plan for 2030 – Towards Climate-Smart Day-to-Day Living*.
- Ministero dell'Ambiente e della Tutela del Territorio e del Mare Ministero dello Sviluppo Economico Ministero delle Infrastrutture e dei Trasporti Ministero delle Politiche agricole, Alimentari e Forestali (2021), *Strategia italiana di lungo termine sulla riduzione delle emissioni dei gas a effetto serra*.
- Prandecki, K.; Wrzaszcz,
- Prandecki, K.; Wrzaszcz, W.; Zielinski, M. (2021), *Environmental and Climate Challenges to Agriculture in Poland in the Context of Objectives Adopted in the European Green Deal Strategy*, Sustainability 2021,13, 10318.

- UK Government (2021), *Net Zero Strategy: Build Back Greener*.
- Scottish Government (2020), *Securing a green recovery on a path to net zero: climate change plan 2018–2032 – update*.
- Welsh Government (2021) *Net Zero Wales. Carbon budgets 2 (2021-2025)*.
- Welsh Government (2022), *Working Together to Reach Net Zero*.
- Department of Agriculture, Environment and Rural Affairs (DAERA) (2019), *Northern Ireland Climate Change Adaptation Programme 2019-2024*.
- Government of Canada (2022), *2030 Emissions Reduction Plan: Clean Air, Strong Economy*.
- New Zealand's Ministry for the Environment (2022), *Towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's first emissions reduction plan*.
- OECD (2017), *OECD Environmental Performance Reviews: New Zealand 2017*, OECD Environmental Performance Reviews, OECD Publishing, Paris.
- USGCRP (2018), *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA
- USDA (2021), *Climate-smart Agriculture and Forestry Strategy: 90-day progress report*.
- USDA (2021), *Action Plan for Climate Adaptation and Resilience*.
- USDA (2022), *Action Plan for Climate Adaptation and Resilience: 2022 Progress Report*.
- Schultz, Craig, D. Man, J. Rosenfeld, M. McCurdy, M. Anderson, K. Jaglo, B. Goossen, M. Kaffel, J. M. Farrell, F. Wissell, T. Hendrickson, J. Lukas, T. Buchholz, I. M. Xiarchos, W. Hanson, J. Lewandrowski, D. Pape (2021), *Renewable Energy Trends, Options, and Potentials for Agriculture, Forestry, and Rural America*, March 2021, U.S. Department of Agriculture, Office of the Chief Economist.



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