EUROPEAN
COMMISSION

Brussels, 21.5.2021
SWD(2021) 115 final

COMMISSION STAFF WORKING DOCUMENT

EVALUATION

of the impact of the Common Agricultural Policy on climate change and greenhouse gas emissions

{SWD(2021) 116 final}

Table of Contents

1. INTRODUCTION 3

2. BACKGROUND TO THE INTERVENTION 5

3. IMPLEMENTATION/STATE OF PLAY 13

3.1. Relevant Pillar I measures 13

3.2. Relevant Pillar II measures 16

4. METHOD 18

4.1. Short description of methodology, tools and definitions 18

4.2. Limitations and robustness of findings 20

5. ANALYSIS 22

5.1. Effectiveness 22

5.2. Efficiency 38

5.3. Coherence of CAP measures 42

5.4. Relevance to needs 46

5.5. EU added value 50

6. CONCLUSIONS 52

ANNEX 1: PROCEDURAL INFORMATION 57

ANNEX 2: SYNOPSIS REPORT ON THE STAKEHOLDER CONSULTATION 60

ANNEX 3: METHODOLOGY 68

ANNEX 4: CAP CLIMATE MEASURES - COHERENCE AND ADDED VALUE 71

Glossary

AECM	Agri-Environment-Climate Measure
ANC	Areas facing Natural Constraints
CAP	Common Agricultural Policy
CH_4	Methane
CO_2	Carbon dioxide
CO_2eq	CO_2 equivalent
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agriculture Guarantee Fund
ECA	European Court of Auditors
EEA	European Environment Agency
EFA	Ecological Focus Areas
EIP	European Innovation Partnership
ESPG	Environmentally Sensitive Permanent Grassland
EU	European Union
EUR	Euro, Eurozone currency
FA	Focus Area
FADN	Farm Accountancy Data Network
FAS	Farm Advisory System
GAEC	Good Agricultural and Environmental Condition
GHG	Greenhouse Gas
Ha	Hectare
ILUC	Indirect Land Use Change
IPCC	Intergovernmental Panel on Climate Change
LU	Livestock Unit
LUC	Land Use Change
LULUCF	Land Use, Land Use Change and Forestry
M	Measure
MFF	Multiannual Financial Framework
N_2O	Nitrous oxide
NGO	Non-Governmental Organisation
NH_3	Ammonia
R&D	Research and Development
SAPS	Single Area Payment Scheme
SFS	Small Farmers Scheme
SMR	Statutory Management Requirement
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Coupled Support
WFD	Water Framework Directive
WTO	World Trade Organisation

1. INTRODUCTION

Most climate change scenarios[1] predict a minimum increase in average global temperatures of 2°C above pre-industrial levels by 2050. Such a rise is expected to alter ecosystems, changing long-term trends in localised temperatures and rainfall patterns, and increasing the frequency and intensity of extreme weather events such as storms, droughts and intense precipitation, with far-reaching socio-economic implications. Climate change is therefore a threat to the wellbeing of our society and the functioning of our economy, affecting our ecosystems and our natural and socio-economic environment.

The agricultural and forestry sectors are among the most vulnerable to the effects of climate change, as they directly depend on climatic conditions and healthy ecosystems. Although agriculture contributes to climate change through the release of greenhouse gases (GHG) into the atmosphere, the sustainable management of land results in removals of carbon from the atmosphere. EU agricultural activities, including emissions and removals from land use and land use change (i.e. from the management of grassland and cropland) created 12% of total EU-28 GHG emissions in 2018[2], making it the fifth biggest contributor to GHG emissions in the EU, after the energy, transport, residential and commercial sectors.

The EU is addressing climate change through ambitious policies[3] and in close cooperation with international partners. The EU is on track to meet its GHG emissions reduction target for 2020[4], with estimates showing that, in 2018, EU GHG emissions were 23% below the 1990 level, exceeding the 20%. However, in view of the climate emergency, the Commission is aiming to boost efforts and ambition through the European Green Deal[5] to make Europe the first climate-neutral continent by 2050[6]. One result is the Commission's proposal for a higher emission reduction target by 2030 (-55% compared to 1990[7]).

---

1 Climate scenarios of the United Nations Framework Convention on Climate Change (UNFCCC); European Environment Agency (EEA) scenarios: https://www.eea.europa.eu/data-and-maps/figures/climate-change-scenarios-data

2 https://agridata.ec.europa.eu/extensions/DashboardIndicators/Climate.html?select=EU28_FLAG,1

3 For an overview of EU policy, legislation and action to address climate change, see https://ec.europa.eu/info/energy-climate-change-environment/topics/climate-change_en
As part of the European Green Deal, on 4 March 2020 the Commission proposed the first European Climate Law to enshrine the 2050 climate-neutrality target into law: https://ec.europa.eu/clima/policies/eu-climate-action/law_en

4 The EU 2020 climate and energy package (https://ec.europa.eu/clima/policies/strategies/2020_en) introduced a clear approach to achieving a 20% reduction in total GHG emissions from 1990, which is equivalent to a 14% reduction from 2005. This objective is to be achieved through a 21% reduction from 2005 for emissions covered by the emissions trading scheme, and a 9% reduction for sectors covered by the Effort Sharing Decision (No 406/2009/EC of the European Parliament and of the Council of 23 April 2009).

5 The European Green Deal provides an action plan to boost the efficient use of resources by moving to a clean, circular economy and to restore biodiversity and cut pollution. For more information, see https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

6 The climate neutrality objective has been endorsed by the European Council (European Council conclusions, 12 December 2019) and Parliament (European Parliament resolution of 14 March 2019 on climate change and resolution of 28 November 2019 on the 2019 UN Climate Change Conference in Madrid, Spain (COP 25)) and is laid down in a legally binding manner in the proposed European Climate Law.

7 In September 2020, the Commission proposed to increase the 2030 EU target to -55% of net GHG emissions compared to 1990 levels. On 21 April 202 the Council and the European Parliament reached a provisional political agreement setting into law the objective of a climate-neutral EU by 2050, and a collective, net, greenhouse gas emissions reduction target. For more information, see https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en

While EU non CO_2 GHG emissions from agriculture have fallen by more than 20% since 1990, they have stagnated since 2010, highlighting the need for agriculture to accelerate its transition to more climate-friendly practices.

The 2013 reform of the common agricultural policy (CAP) aimed to improve the targeting, efficiency and coherence of policy instruments to address the long-term objectives of sustainable management of natural resources and climate action, along with viable food production and balanced territorial development. This was laid down in Article 110(2) of Regulation (EU) No 1306/2013 ('Horizontal Regulation')[8].

The **legal context** of the evaluation is set out in Article 110(5) of the Horizontal Regulation that requires the Commission to present a report on the performance of the CAP to the European Parliament and the Council by 31 December 2021. The findings and lessons learned from this evaluation will feed into that report.

Accordingly, **the purpose** of this evaluation is to assess, notably through counterfactual analysis, the net impact of the relevant policy instruments of the CAP 2014-2020 on adaptation to climate change and GHG emissions, regardless of whether or not the measures were specifically designed to address climate action.

The **measures covered** by the evaluation are the relevant ones set out in the basic regulations of the CAP 2014-2020 regarding Direct Payments[9], Rural Development[10], and the Horizontal Regulation.

Besides helping to meet the legal reporting obligation, the **evaluation has contributed to other performance reporting requirements**, including the Commission's annual budget discharge exercise. Its preliminary results, particularly on effectiveness and efficiency, were available for the preparation of the impact assessment[11] accompanying the 2018 legislative proposals on the 'CAP beyond 2020', presented by the Commission on 1 June 2018[12]. The evaluation is also particularly relevant to the objectives of the European Green Deal.

The **geographical scope of the evaluation** is the European Union of 28 Member States, including the UK. In-depth empirical analysis was carried out through case studies in 10 Member States.

The **evaluation covers the period** following the implementation of the 2013 CAP reform, notably the period after 1 January 2015 for direct payments and after 1 January 2014 for other measures.

The evaluation covers all **the evaluation criteria**, assessing the effectiveness of the relevant measures, with respect to their climate impact, as well as their efficiency, relevance, coherence and EU added value. This staff working document is **primarily based on the corresponding external evaluation support study**[13] and draws from additional analysis and

[8] Regulation (EU) No 1306/2013 of the European Parliament and of the Council of 17 December 2013 on the financing, management and monitoring of the common agricultural policy, OJ L 347, 20.12.2013, p. 549-607.

[9] Regulation (EU) No 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy, OJ L 347, 20.12.2013, p. 608-670.

[10] Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), OJ L 347, 20.12.2013, p. 487-548

[11] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A392%3AFIN

[13] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cmef/sustainability/evaluation-cap-climate-change-and-greenhouse-gas-emissions_en

data from internal Commission and external sources. In the subsequent chapters, any reference to analyses, interviews, findings, etc. should be interpreted as coming from the evaluation support study, unless otherwise indicated and referenced.

2. BACKGROUND TO THE INTERVENTION

Agriculture is one of the sectors that contributes most to global GHG emissions. There are three powerful greenhouse gases that are the by-products of agricultural activity, but the non-CO_2 greenhouse gases have a much bigger global warming potential than CO_2:

- methane (CH_4) from livestock digestion processes (enteric fermentation), manure management and rice cultivation;
- nitrous oxide (N_2O) from the use of organic and mineral nitrogen fertilisers and from manure management;
- carbon dioxide (CO_2) from agricultural soil and biomass, as a result of land management activities, ploughing, conversion of land uses, e.g. from grassland to cropland, resulting in a mineralisation of the soil organic carbon to CO_2 emitted in the atmosphere, and from fossil energy consumption[14].

Agriculture can mitigate climate change not only by reducing GHG emissions but also by avoiding further carbon losses, increasing removals through the sequestration of carbon in vegetation (e.g. hedges) and soils and increasing the contribution towards renewable energy production.

Agricultural activities in the EU-28 generated 486 million tonnes of CO_2 equivalents (CO_2eq) in 2013[15] (at the time of developing the CAP 2014-2020), corresponding to about 10% of total GHG emissions. Emissions from agriculture decreased consistently for two decades between 1990 and 2010, notably due to declines in herds. However, emissions have stagnated under the CAP 2014-2020. Due to the parallel decrease in emissions in other sectors of the economy, the share of total EU emissions that can be attributed to the agricultural sector has increased.

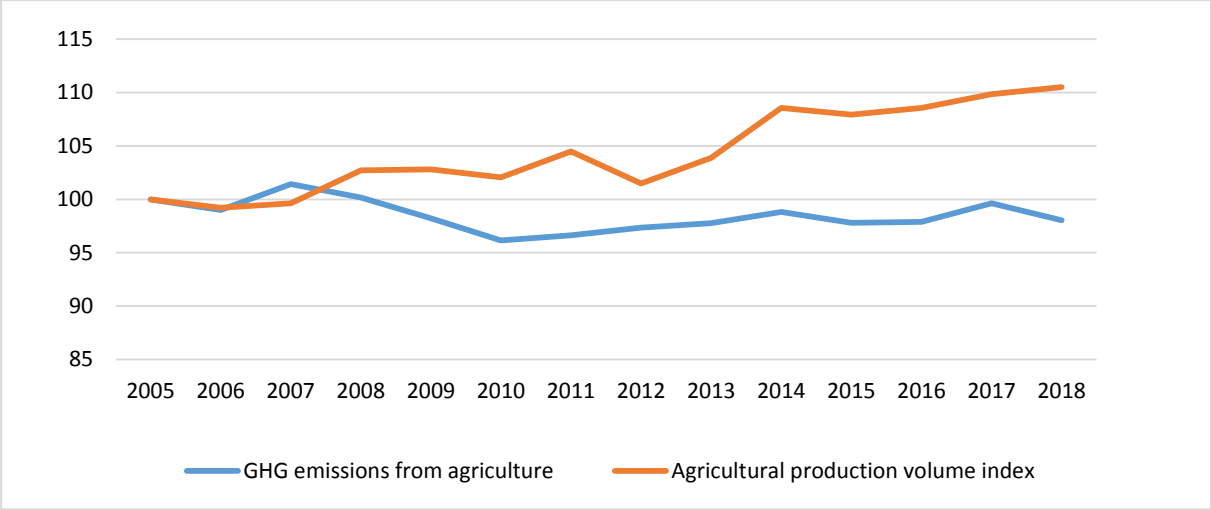
In 2018, the agricultural sector emitted 487 million tonnes of CO_2eq in the EU-28, corresponding to 12% of total EU GHG emissions. At the same time, agricultural production increased by 9% in volume, highlighting a significant increase in production efficiency (i.e. a reduction of emissions per unit produced).

[14] Fossil energy is used in the form of fuels for agricultural machinery, as an energy source for heating greenhouses and livestock buildings, or for operating tools and other devices on the farm.

[15] Unless explicitly mentioned, figures on GHG emissions from agriculture include emissions from reporting category 3, subject to the Effort Sharing Decision (ESD) targets, as well as category 4 on emissions from agriculturally managed land under Land Use, Land Use Change and Forestry (LULUCF):

- enteric fermentation (3A) (CH_4);
- manure management (3B) (CH_4 and N_2O);
- rice (3C) (CH_4);
- managed agricultural soils (3D) (N_2O);
- cropland (including land converted to cropland) (LULUCF) (4B) (CO_2);
- grassland (LULUCF) (4C) (CO_2).

Figure 1: Development of GHG emissions and agricultural production (Index, 2005 = 100)



Source: DG Agriculture and Rural Development

Moreover, agriculture is highly vulnerable to the impacts of climate change (e.g. crop failures and tree dieback from droughts, storms, floods, or pest and disease outbreaks) and is facing increasing climate-related risks. The farming sector needs to adapt to climate change (by, for example, improving soil quality and water management, establishing hedge rows, planting more resilient crop varieties, and adopting more diverse crop rotation practices) to secure future yields[16].

Therefore, the CAP has considerable potential to support climate mitigation and adaptation by guiding and requiring how individual farmers choose to manage their land, crops and livestock and how they use inputs, including energy, fertilisers and water, and their by-products, wastes, residues and other non-food raw materials. In the 2017 public consultation on 'modernising and simplifying the CAP'[17], 37% of respondents (other than farmers and organisations) replied that the most relevant Commission priority[18] for the future CAP was 'mitigating and adapting to the impact of climate change and providing renewable energy'.

At the time of developing the CAP 2014-2020, EU climate policy was mainly defined by the **'EU 2020 climate and energy framework'**, which introduced three key targets for 2020: to reduce GHG emissions by 20% from 1990 levels, to increase the share of renewable energy to 20% and to improve energy efficiency by 20%. These targets became legally binding through the **'EU climate and energy package'** in 2009[19].

Agriculture is one of the sectors covered under the Effort Sharing Decision, by which EU countries have taken on binding annual targets until 2020 to reduce GHG emissions compared to 2005[20]. This Decision does not set a sector-specific emission reduction target for agriculture, but rather requires Member States to achieve a target that covers several sectors.

[16] Communication COM(2021) 82 final – Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change

[17] Running from 2 February 2017 to 2 May 2017 (see: https://ec.europa.eu/info/consultations/modernising-and-simplifying-common-agricultural-policy_en).

[18] https://ec.europa.eu/commission/publications/factsheets-commissions-10-priorities_en

[19] See footnote 4.

[20] The Effort Sharing Decision No 406/2009/EC establishes annual GHG targets for Member States for 2013-2020. These targets concern emissions from most sectors not included in the EU emissions trading scheme, such as transport, buildings, agriculture and waste.
The Effort Sharing Regulation (EU) 2018/842 sets binding annual GHG emission reductions for each Member State from 2021 to 2030, helping to meet commitments under the COP21 Paris Agreement.

Emissions and removals from land use and land use change, including in cropland and grassland, are not part of the 2020 climate framework. However, the Land Use, Land Use Change and Forestry (LULUCF) Decision[21] requires Member States to provide information on emissions and removals through cropland and grassland management and to provide national reports on mitigation actions in these sectors.

EU climate policy in the 2014-2020 period was also shaped by the **EU strategy on adaptation to climate change**. It encouraged Member States to adopt comprehensive adaptation strategies, to build up their adaptation capacities and to take adaptation action in key vulnerable sectors, including agriculture (through insurance against natural and man-made disasters, for instance). Furthermore, it helped address the existing knowledge gaps on adaptation in the agricultural sector. On 24 February 2021 the Commission announced a new, even more ambitious EU Strategy on Adaptation to Climate Change, which commits the EU and Member States to make continuous progress to boost adaptive capacity, strengthen resilience and reduce vulnerability to climate change[22].

Climate action is an integral part of the CAP 2014-2020 general objectives, notably the objective on 'sustainable management of natural resources and climate action', with a focus on GHG emissions, climate adaptation, biodiversity, soil and water. The 2013 CAP reform also sought to align the CAP with the goals of the Europe 2020 strategy on smart, sustainable and inclusive growth[23].

The Commission's proposal for the **2014-2020 Multiannual Financial Framework** (MFF) introduced climate mainstreaming of the EU budget, with a general target of at least 20% to be spent on climate-related measures. In addition, a specific target of a minimum of 30% of the European Agricultural Fund for Rural Development (EAFRD) has been reserved for measures relevant to climate change mitigation and adaptation and the environment[24].

Furthermore, with the introduction of the 'greening payment', a 30% share of the budget for direct payments is provided to farmers adopting or maintaining mandatory climate and environment-friendly practices. Farmers who do not comply with greening receive reduced direct payments.

Beyond the general objective of the CAP 2014-2020 on climate action, the two pillars of the CAP contain specific objectives and a broad range of instruments and measures to address climate mitigation and adaptation.

The **Pillar I** specific objective on climate action refers to providing public goods (mainly environmental) and pursuing climate change mitigation and adaptation. This objective is pursued mainly through the 'greening payment' and the cross-compliance standards for Good Agricultural and Environmental Conditions (GAECs) linked to CAP payments (see below). Cross-compliance rules supplemented by greening help to provide a foundational level of action on the environment and climate (as well as other concerns of EU citizens). Other direct payments[25] could also have indirect effects on mitigation and adaptation, as described in the next chapters.

---

[21] Decision No 529/2013/EU of the European Parliament and of the Council of 21 May 2013

[22] https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/eu_strategy_2021.pdf

[23] https://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf

[24] Article 59(6) of the EAFRD Regulation (EU) No 1305/2013

[25] Basic payment scheme, single area payment scheme, voluntary redistributive payments, payments for farmers in areas with natural constraints, voluntary coupled support, small farmers scheme.

The greening measures have already been the object of a separate evaluation[26] and comprise:

- maintenance of permanent grassland, particularly for carbon sequestration, with two components: (i) maintaining the ratio of permanent grassland to agricultural area – the ratio of permanent grassland compared to the total agricultural area is set and monitored by Member States at national or regional level with a 5% margin of flexibility (i.e. no decrease above 5%); (ii) protecting the most environmentally sensitive permanent grasslands (ESPG) from ploughing-up and converting in order to support carbon sequestration, biodiversity and soil protection;
- crop diversification, to improve soil quality: this covers farms with 10 to 30 hectares, or more than 30 hectares, of arable land, which have to grow at least two or three types of crops respectively. The main crop may not cover more than 75% of the land, although there are exemptions to the rules, e.g. farmers with a large proportion of grassland, which is in itself environmentally beneficial;
- ecological focus areas (EFA): primarily in order to safeguard and improve biodiversity on farms and entailing an obligation to dedicate at least 5% of the arable land exceeding 15 hectares as an EFA, comprising a combination of areas or landscape features as set out in the relevant regulation[27] and selected by Member States as a menu of choices for farmers.

The requirement to maintain permanent grassland is very important for protecting existing carbon stocks and sequestering carbon from the atmosphere. The possibility for greater crop diversity also has positive implications for carbon sequestration and a greater variety of crops makes soil and ecosystems more resilient. EFA, such as trees, hedges or land left fallow, are mostly beneficial for biodiversity and habitats, but also have co-benefits for climate mitigation and adaptation.

Voluntary coupled support (VCS) is intended for certain sectors or regions where specific types of farming or specific agricultural sectors, that are particularly important for economic, environmental and/or social reasons, experience certain difficulties. The eligible animal-based sectors and the protein crops sector are the largest VCS beneficiaries in the EU. It may have a positive or negative impact on the climate depending on which activity and under which conditions the support is granted.

The relevant **Pillar II** climate-specific objectives (also referred to as 'priorities for rural development') include:

- promoting resource efficiency and supporting the shift towards a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors (priority 5); and
- restoring, preserving and enhancing ecosystems dependent on agriculture and forestry (priority 4).

On top of this, three cross-cutting objectives were defined for rural development, namely innovation, environment, and climate change mitigation and adaptation. These three objectives should be integrated/reflected in Member States' strategies and choices of instruments.

---

[26] https://ec.europa.eu/agriculture/evaluation/market-and-income-reports/greening-of-direct-payments_en. The greening measures were also the subject of a special report by the European Court of Auditors (https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=%7BD7000953-AF55-4CF5-9EB5-D88635FCD332%7D). The special report concluded that, of the three greening measures, only the maintenance of permanent grassland could be considered as relevant for the climate.

[27] Regulation (EU) No 1307/2013, EU delegated regulation 639/2014, EU implementing regulation 641/2014

All the rural development priorities are broken down into specific areas of intervention, known as 'focus areas'. The rural development programmes set quantified targets under the focus areas and outline the programme measures and their allocated funding that will be used to reach the targets. The most climate-relevant focus areas under priorities 4 and 5 aim to:

- increase efficiency in water use by agriculture (focus area 5A – addressing both mitigation and adaptation);
- increase efficiency in energy use in agriculture and food processing (focus area 5B);
- facilitate the supply and use of renewable sources of energy (focus area 5C);
- reduce GHG and ammonia emissions from agriculture (focus area 5D);
- foster carbon conservation and sequestration in agriculture and forestry (focus area 5E);
- prevent soil erosion and improve soil management (focus area 4C);
- improve water management, including management of fertilisers (focus area 4B – addressing both mitigation and adaptation).

Some of the CAP Pillar II measures have an 'explicit intervention logic' towards climate change mitigation or adaptation, i.e. the EAFRD Regulation refers to climate-relevant objectives for these measures. These include agri-environment-climate commitments, forest-environment-climate commitments, cooperation, forest investments, investments in physical assets, advisory farm management and relief services and disaster risk reduction (see Table 1).

One of the highest profile climate-relevant rural development measures is the **agri-environment-climate measure (AECM, measure 10)**. This voluntary measure for farmers promotes a potentially wide range of practices (designed by Member States/regions within their rural development programmes) which go beyond the baseline of mandatory requirements, including those of cross-compliance[28]. The beneficiaries are compensated for additional costs and income foregone due to implementing the commitment. AECMs can cover all the key issues of climate change, water, soil, air, biodiversity and landscapes (sub-measure 10.1), as well as genetic diversity (sub-measure 10.2). Measure 10 is mandatory and thus included in all rural development programmes.

Support for **investments in physical assets (measure 4)** explicitly addresses not only economic but also environmental improvements, mainly in the farming and food sectors. Relevant interventions offer considerable mitigation potential – in relation to manure management, support for renewable energies and energy efficiency improvements, and improvements to the natural value of a given area. Measure 4.4 provides support for **non-productive investments** linked to the achievement of agri-environment-climate objectives. This can include, for instance, the planting of hedges or the restoration of wetlands or peatland.

Looking beyond farming, forestry is covered specifically by two measures which, between them, have area-based and investment-based components – **investments in forest area development (measure 8)**[29] and **forest-environmental and climate services and forest conservation (measure 15)**. These serve both to establish new forests (agroforestry systems as well) and to improve the environmental and economic value of existing forests, including better protection against fires and other disasters, and thus contribute to climate change mitigation and adaptation.

[28] While the AECM has to go beyond the cross-compliance rules, its relationship with greening payments is subject to the EU rule of 'no double funding', i.e. greening is not part of the regulatory baseline for the AECM. Thus, the AECM cannot fund practices which are remunerated by greening payments.

[29] Support for afforestation/creation of woodland; establishment and maintenance of agroforestry systems, prevention and restoration of damage to forests from forest fires, natural disasters and catastrophic events; improving the resilience and environmental value of forest eco-systems; investments in forestry technologies.

Rural development policy supports the development of physical as well as human capital – in ways that can be linked to the environment and climate. Support for more individually tailored advice and other services can come through the measure on '**advisory services, farm management and farm relief services' (measure 2)**, which can also be used to set up the farm advisory system (FAS) (see section 2.2.). The **cooperation measure (measure 16)** has a very broad scope and is an important vehicle for funding innovation through the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI). The EIP is based on the 'interactive innovation model' and seeks to involve farmers actively in the co-creation of innovative solutions to practical problems. Various parties with complementary knowledge – farmers, advisers, researchers, businesses, NGOs and others – work together on projects in 'operational groups' to develop such solutions and communicate their results widely.

Another climate-relevant rural development measure is **measure 5**, which aims to support agricultural holdings' resilience to climate change through better **risk reduction**. Measure 5 supports preventive actions through sub-measure 5.1, as well as restoration after damage through sub-measure 5.2.

Some measures were not designed with explicit climate-relevant objectives, but can contribute significantly towards more environmentally friendly practices that help meet climate objectives, such as:

- The **organic farming measure** (measure 11), which supports farmers in converting to and maintaining organic agriculture[30]. The measure can contribute to carbon sequestration in particular, thanks to the specific methods and land management practices of organic farming, such as organic fertilisation and crop rotation. Moreover, greenhouse gas emissions from the production of artificial fertiliser are avoided in organic farming
- **Natura 2000 and Water Framework Directive payments (measure 12**), which support farmers and foresters in areas subject to disadvantages and restrictions resulting from implementing relevant directives[31]. Such payments can support the conservation of wetland and peatland, or conversion from arable land to grassland (e.g. in floodplains), thus contributing to carbon sequestration and climate change adaptation.

Measure 17 supports **risk management** and improves farms' economic resilience to shocks linked to the effects of climate change (increased incidence of climatic hazards, price volatility, etc.). The measure can support crop, animal and plant insurance premiums (sub-measure 17.1), the creation of mutual funds for adverse climatic events, animal and plant diseases, pest infestations and environmental incidents (sub-measure 17.2) and the introduction of an income stabilisation tool (sub-measure 17.3). These aim to compensate farmers for revenue losses due to extreme events; however, unless there are specific conditions attached to the underwriting of these tools to help farmers adapt their production systems to climate change (e.g. diversification of production), they do not guarantee the long-term resilience of production systems.

Payments to areas facing natural or other specific constraints (measure 13) compensate farmers for difficulties arising from the inherent biophysical constraints in mountain areas and other areas facing natural or other specific constraints (related to altitude, climate, soil and

[30] As set out in Regulation (EC) No 834/2007 on organic production and labelling of organic products.

[31] Birds Directive: Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. Habitats Directive: Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Water Framework Directive: Directive 2000/60/EC.

steep slopes as designated in Article 32 of Regulation (EU) 1305/2013). However, the measure does not require any change in land management practices beyond mandatory requirements and its contribution to climate objectives is not certain.

Other rural development measures which can be relevant for climate objectives, depending on how they are designed and targeted, include **knowledge transfer and information actions (measure 1), quality schemes (measure 3), support for farm and business development (measure 6), basic services in rural areas (measure 7) and LEADER (M19)**.

In addition to the interventions covered by the two pillars, a number of **cross-cutting measures** help to address climate targets.

Cross-compliance is a mechanism that links elements of both pillars of the CAP to farmers' compliance with various basic standards and their application of fundamental good practice. It aims to help agriculture develop sustainably and to link the CAP better to other EU policies, including environmental and climate policies. It includes two types of obligations:

- Statutory management requirements (SMRs), which are 13 packages of requirements arising from non-CAP EU legislation on the environment, food safety, animal and plant health and animal welfare (e.g. nitrates, birds and habitats), and which are applicable to all farmers whether or not they receive CAP income support.
- Standards for **GAECs**, which have their legal basis within the CAP. The seven EU standards relate to management of water, soil and carbon stocks, and landscape features. Member States must translate these EU standards into national standards, taking into account local needs and situations. GAEC 6 (maintenance of soil organic matter, including the ban on burning arable stubble) contributes to climate mitigation by preventing the direct release of CO_2 into the atmosphere. GAEC 4 (minimum soil cover) and GAEC 5 (site-specific conditions limiting erosion) may have an impact on climate change adaptation and mitigation by limiting soil erosion, protecting water courses, improving resilience against floods and improving water retention.

Through the provisions of cross-compliance, when farmers who receive Pillar I direct payments (with the exception of payments under the small farmers scheme) or Pillar II area-based payments do not respect the standards concerned, their payments under these schemes can be reduced.

Another set of cross-cutting provisions concerns the Farm Advisory System (FAS), which all Member States are required to set up/designate (this can be done with the support of a rural development measure). In general terms, the FAS should help CAP beneficiaries become more aware of the relationship between farm practice and management, and of various standards[32].

Regarding climate-relevant CAP measures, it is important to point out that only some of the interventions that are covered by this evaluation have been specifically designed to include intended environmental and climate impact objectives. However, several measures that lack an explicit intervention logic towards climate action may still have relevant climate effects, for example the management of EFA.

[32] Among the topics on which the FAS must offer advice to farmers, the following are directly linked to the environment and climate: the rules of cross-compliance; the requirements of greening payments; the basic requirements of maintaining agricultural area with regard to eligibility for direct payments; the Water Framework Directive and the Sustainable Use of Pesticides Directive.

Table 1: The main climate-relevant CAP measures

	Measure (M)/instrument	Objective in the Regulation	Measures targeting	
			Mitigation	Adaptation
	Pillar I -			
1	Greening measure (permanent grassland ratio)	Environmental benefits (carbon sequestration)	**Yes**	No
2	Greening measure (environmentally sensitive permanent grassland)	Environmental benefits (carbon sequestration)	**Yes**	No
	Horizontal measures/standards			
3	GAEC 4 (minimum soil cover)	Limit soil erosion, protect water courses and improve resilience against floods and water retention	**Yes**	**Yes**
4	GAEC 5 (site-specific conditions limiting erosion)		**Yes**	**Yes**
5	GAEC 6 (maintenance of soil organic matter)	Prevent the direct release of CO_2 into the atmosphere	**Yes**	**Yes**
6	Farm advisory system	Awareness raising about farm practices and environmental and other standards	**Yes**	**Yes**
	Pillar II – Rural development			
7	M1: Knowledge transfer and information actions	Spread knowledge and improve access to information	**Yes**	**Yes**
8	M2: Advisory farm management and relief services	Improve access to advice	**Yes**	**Yes**
9	M4: Investments in physical assets	Support provision of physical infrastructure	**Yes**	**Yes**
10	M5: Disaster risk reduction	Support to reduce probable consequences of natural disasters; investments to restore land and production potential	No	**Yes**
11	M7: Basic services and village renewal	Investments in small-scale infrastructure, (also renewable energy and energy saving)	**Yes**	No
12	M8: Forest investments	Extend and improve forest resources (including agroforestry) as climate-friendly land use; support investment and management (resilience and fire prevention)	**Yes**	**Yes**
13	M10: Agri-environment-climate commitments	Support agricultural practices beneficial for the environment and climate (going beyond the baseline of legal requirements)	**Yes**	**Yes**
14	M11: Organic farming	Support organic farming practices relevant to carbon sequestration	**Yes**	**Yes**
15	M12: Natura 2000 and Water Framework Directive	Support, notably, conservation of wetland and peatland	**Yes**	**Yes**
16	M15: Forest-environment-climate commitments	Support for forest land and thus carbon stocks	**Yes**	**Yes**
17	M16: Cooperation	Support joint actions to secure greater environmental and climate benefits	**Yes**	**Yes**

Source: DG Agriculture and Rural Development

3. IMPLEMENTATION/STATE OF PLAY

Under the Multiannual Financial Framework 2014-2020, a total of EUR 408.3 billion is earmarked for the CAP, of which EUR 308.7 billion is allocated to Pillar I via the European Agriculture Guarantee Fund (EAGF); the remaining EUR 99.6 billion is allocated to Pillar II via the European Agricultural Fund for Rural Development (EAFRD). The rural development policy of the CAP is implemented over a seven-year period, through rural development programmes designed by national or regional managing authorities. Overall, 118 rural development programmes have been implemented in the 28 Member States over the 2014-2020 period. Adding the co-funding by national, regional and private resources, the total amount of funding for the CAP's rural development policy is EUR 161 billion.

Based on the climate tracking methodology defined for the current programming period[33], in line with the OECD's 'Rio markers'[34], the CAP's contribution to climate actions is estimated at 26%, or EUR 102.8 billion, i.e. well above the 20% commitments.

3.1. Relevant Pillar I measures

In 2018, 154 million hectares (86%) of all EU agricultural land was supported under the direct payment scheme and therefore subject to compliance with the relevant practices that Member States have established under good agricultural and environmental conditions (GAECs) and statutory management requirements (SMRs).

Member States have translated the core obligations of **the three GAECs aimed at protecting soil and carbon stocks** in different ways that fit their own circumstances. Under **GAEC 4 (minimum soil cover)**, all Member States must have minimum soil cover, with a particular focus on areas with a high risk of erosion and on setting time-specific rules; Member States have differed in the way they identify land under this obligation.

Under **GAEC 5 (minimum land management reflecting site specific conditions to limit erosion)**, the main measures set by Member States tackled land with high slopes, usually defined as more than 10% slope. More than half (15) of Member States have cultivation requirements (transversal to the contour of the slope and minimal tillage), a third (8) limit the crops to be planted (crops with a small canopy, e.g. potato), and a few (3) ban ploughing during a certain period (generally winter). Three Member States add additional requirements related to improving/maintaining drainage systems, soil vegetation cover, banning tillage on waterlogged and flooded soils, promoting preservation of terraces, stonewalls and ditches, banning overgrazing or requiring inter-row green cover for permanent crops.

All Member States implement the main measure of the ban on stubble burning **under GAEC 6 (maintenance of soil organic matter level through appropriate practices, including a ban on burning arable stubble, except for plant health reasons)**. A few Member States go beyond this core requirement by requiring a soil analysis with possible corrective actions, soil coverage with nitrogen-fixing crops, incorporation of crop residues, crop rotation, and a ban on cultivation in species-rich and semi-natural habitats.

In 2019, **142 million hectares of agricultural areas**, corresponding to 80% of EU agricultural land, was subject to **one or more greening obligations**. Around 3.8 million hectares, covered

[33] The methodology for climate tracking for the EAFRD is set out in Annex II of Commission Implementing Regulation (EU) No 215/2014 of 7 March 2014. This includes a list of coefficients for calculating the amount of support for climate change objectives under the EAFRD.

[34] Since 1998, the Development Assistance Committee (DAC) of the Organisation for Economic Cooperation and Development (OECD) has set up the 'Rio markers' system. This consists of policy markers to monitor and statistically report on development finance flows targeting the themes of the Rio Conventions, namely biodiversity, desertification, climate change mitigation (i.e. reductions in or absorption of GHG emissions) and climate change adaptation (including climate risk mitigation and vulnerability reduction).

by Small Farmer Scheme (SFS) and 9.6 million hectares of organic areas **were exempted from greening**. Compared to 2015, the area under the SFS exemption halved and organic areas increased by two thirds.

In 2015, the area of **declared permanent grassland** amounted to **48.5 million hectares**, compared to 44.3 million hectares in 2012, which served as a reference year for establishing greening obligations (excluding Croatia, which has 2013 as a reference). The **change between 2012 and 2015** was due to several factors: the effects of the 2013 admission of Croatia as an EU Member State; expansion of the areas eligible as permanent grassland in the current period to include, for example, shrubs and trees that can be grazed; creation and conversion of permanent grassland; and changes in the population benefiting from direct payments. The situation differed between Member States; while some saw little or no change in additional permanent grassland areas, others registered a substantial increase (by more than half in Spain, Italy, Lithuania, Croatia and Bulgaria, and ten times more in Finland). The new definition of permanent grassland influenced especially the southern Member States characterised by agro-pastoralism.

Some of the amendments introduced in the 'Omnibus Regulation' in 2018[35] allowed for a narrower definition of 'permanent grassland'. For example, nine Member States (Bulgaria, Croatia, Cyprus, Germany, Greece, Italy, Lithuania, Slovakia and Spain) decided to apply the newly introduced criterion, according to which grassland is not classified as permanent grassland if it has been ploughed within a period of 5 years. Other Omnibus amendments to the definition allowed for its scope to be expanded. For example, Member States could expand areas with shrubs and/or trees which produce animal feed, provided that the grasses and other herbaceous forage remain predominant. In 2019, overall, **51.7 million hectares of permanent grassland was declared** under the direct payment scheme, reflecting the changes to land use in Member States but also the effects of the above-mentioned amendments. It represents 85% of the total EU permanent grassland reported in the annual land use survey[36].

In accordance with **greening rules**, almost all Member States decided to manage the ratio of permanent grassland at national level. Only four (Belgium, France, Germany and the UK) opted to calculate the ratio at regional level.

At EU level, the **area of permanent grassland under the greening ratio** obligation amounted to 44.0 million hectares in 2015 and **increased** by 8% to **46.7 million hectares in 2019**. The figures under the greening ratio do not include exempted areas of the SFS and organic producers. Between 2015 and 2019, 16 Member States registered an increase in the annual ratio, while seven Member States and 19 regions (in the case of the four Member States that made regional calculations) saw reduced annual ratios in 2019 compared to the figures for 2015.

For the comparison of annual ratios to the 2015 reference ratio ('the comparison ratio'), the **mechanism of reconversion** was activated four times in two Member States (Cyprus, in 2015 and 2016, and Estonia, in 2016 and 2018) to reverse the more than 5% drop in the annual ratio. As of 2019, the comparison ratio registered negative values in nine Member States and 10 regions of the four Member States that made regional calculations, but none exceeded the 5% threshold.

However, in most cases the **changes in national/regional annual ratios** under greening and **in the 'comparison ratio'** resulted from a reallocation of permanent grassland areas within the terms of the ratio rather than their actual decrease. Between 2015 and 2019, permanent grassland increased in 17 Member States, with a relative +/- 1% stabilisation in eight Member States and a decrease of more than 1% in two Member States (Estonia and the UK). Instead, the

[35] Regulation (EU) 2017/2393 (the so-called 'Omnibus Regulation'), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R2393

[36] The statistical definition of permanent grassland is narrower, as permanent grassland is not normally included in the crop rotation on the holding for 5 years or more, i.e. it is not ploughed. For greening, ploughing of grassland may not change its classification.

figures reflected the combined effects of a substantial increase of/conversion to organic permanent grassland and, to a lesser extent, of decreasing permanent grassland under the SFS. It was also affected by changes to agricultural areas. While seven Member States deemed such situations sufficient to adapt the reference ratio, others did not do so, resulting in lower or negative figures for the 'comparison ratio'.

In 2019, of 16.6 million hectares of **permanent grassland in Natura 2000 areas**, **9.3 million hectares** (56%) were **designated as ESPG** and **5.7 million hectares** (34%) **were declared by farmers**. Compared to 2015, while the area of Natura 2000 permanent grasslands remained stable (16.5 million hectares in 2015), the designated and declared ESPG areas rose by more than 1 million hectares (8.2 million hectares of designated and 4.4 million hectares of declared ESPG in 2015). This translates to 18% of all permanent grassland declared under the direct payments scheme being designated as ESPG (ranging from 0.2% in Portugal to just above 57% in Cyprus), and thus protected from ploughing.

These figures reflect differences in delineating/selecting Natura 2000 areas when implementing the underlying Nature and Birds Directives and Member States' decisions to designate permanent grassland within Natura areas. Eight Member States[37] designated all permanent grasslands within Natura 2000 as ESPG, while others designated only a proportion. The lowest proportions of permanent grassland in Natura areas **designated as ESPG** in 2019 were in Portugal (1.3%) and Ireland (4.0%). In terms of **ESPG declared by farmers**, these ranged from 0.1% of permanent grasslands in Natura 2000 in Portugal and 2% in Austria to 100% in Greece and in Sweden.

Four Member States (Belgium, Czechia, Italy and Latvia) also designated permanent grasslands **outside Natura 2000 areas** as ESPG, protecting an additional 0.6% of all EU permanent grasslands under the CAP.

In 2019, **69% of EU arable land fell under the EFA obligation** (72.4 million hectares). This reflected the exemptions from the EFA obligation (Small Farmers' Scheme, organic farmers and farmers with less than 15 hectares of arable land) and the additional specific exemptions[38] added by the Omnibus Regulation for certain types of farms. The **selection of EFA areas and features** differed between Member States, with some opening the whole range of EFA types and others only a narrow range. Between 2015 and 2019, Member States' choices remained relatively stable. The major change from 2018 onwards came from the Omnibus Regulation, which added three EFA types and increased weighting factors for nitrogen-fixing crops and short rotation coppice, and from the delegated legislation that restructured some types of landscape features and banned the use of plant protection products on fallow land and productive EFA types (such as protein crops).

In absolute terms, 9.5 million hectares were declared as EFA in 2019, representing 13.7% of arable land under obligation. **In terms of uptake by farmers, the most frequently declared EFA types** in 2019 were those linked to land lying fallow (21%) and to productive EFA: catch crops (55%) and nitrogen-fixing crops (22%). However, **the composition of EFA areas changed** compared to 2015: in 2015, areas under catch crops and nitrogen-fixing crops both represented about a third of all EFA areas, and the share of fallow land was higher, corresponding to a quarter of all EFA areas. In contrast, EFA areas under landscape features increased in this period, both in physical terms and, as a share of the total, to 2%.

In 2019, 74% of EU arable land fell under the **crop diversification obligation** (77.7 million hectares), compared to 75% in 2015 (80.5 million hectares). This reflected changes to the areas benefiting from direct payments, changes to areas exempted from the obligation (SFS, organic farms and exemptions specific to crop diversification) and the additional

[37] Bulgaria, Czechia, Greece, Italy, Hungary, Netherlands, Slovakia, Finland and Sweden.

[38] Article 46 of Regulation (EU) No 1307/2013.

exemptions specific to crop diversification that were added by the Omnibus Regulation for certain types of farms.

Of the farms applying crop diversification, 87% of arable land was under the obligation to have at least three crops and the remaining 13% under the obligation to have at least two crops, though the figures differ between Member States depending on the average size of the arable land of farms. While six Member States (Bulgaria, Estonia, France, Latvia, Slovakia and the UK) have 95% or more of arable land under the three-crop obligation, three Member States have a more balanced distribution, with around half (Slovenia and Finland) or more (Greece) of arable land under two crops. In Malta, all farms follow the two crops rule only.

Member States can allocate up to 8% or, in the case of some Member States, up to 13% of their national ceiling for direct payments to **voluntary coupled support (VCS)**. Funding can be increased by a further 2% to support protein crops. In 2018, the most supported sectors in the EU-28 were: (i) beef and veal (23 Member States, 41% of all payments effected under VCS); (ii) milk and dairy products (19 Member States, 20%); (iii) sheep and goat meat (21 Member States, 12%); (iv) protein crops (15 Member States, 11%); (v) sugar beet (11 Member States, 4%); (vi) fruit and vegetables (19 Member States, 4%). Germany is the only Member State not applying VCS.

3.2. Relevant Pillar II measures

For the period 2014-2020, EUR 68.6 billion and EUR 6 billion were programmed under priorities 4 and 5 respectively, which corresponds to 45.6% and 6.4% of the total planned public expenditure on rural development[39] (EUR 151 billion). At the end of September 2020, the EU-28 had executed 76% (under Priority 4) and 46% (under Priority 5) of the planned public expenditure. It is worth pointing out that many environment/climate measures programmed under Priority 4 also contribute to climate action, but the budget can be allocated to one priority only. It explains in part the low budget allocated to Priority 5, which has the most climate-relevant focus areas (5D and 5E).

The main measures programmed under Priority 4 are the support for areas facing natural constraints and agri-environment-climate commitments. Under Priority 5, three quarters of the budget is programmed under investments, included in forestry under focus area 5E. Several climate-relevant measures were entirely or close to 100% programmed under these two priorities: agri-environment-climate commitments, Natura 2000 payments, support for organic farming, ANC payments and support for forests. By contrast, less than 50% of the planned advice budget, around 30% of knowledge transfers and 20% of investments aimed to address climate change and protect natural resources.

[39] Not taking into account additional national financing (i.e. ‘top-ups’ to national co-financing).

Table 2: Measures programmed (total public) under priorities 4 and 5

Measures	Priority 4		Priority 5		Share of the measure programmed under priorities 4 and 5
	EUR million	%	EUR million	%	
M01 Knowledge transfer/information	363	1%	125	1%	34%
M02 Advisory services	305	0.4%	62	0.6%	46%
M04 Investments in physical assets	2 119	3%	4 767	50%	20%
M06 Farm business and development		0%	146	2%	2%
M07 Basic services and village renewal	1 398	2%	258	3%	16%
M08 Forest investments	3 055	4%	2 487	26%	92%
M10 Agri-environment-climate	24 021	35%	1 193	12%	100%
M11 Organic farming	11 549	17%	131	1%	100%
M12 Natura 2000	808	1%	7	0%	100%
M13 Areas facing natural constraints	24 226	35%	221	2%	97%
M15 Forest-environment-climate	286	0.4%	3	0%	100%
M16 Cooperation	427	1%	208	2%	25%
Total	68 558	100%	9 608	100%	52%

Source: DG Agriculture and Rural Development

At the beginning of the programming period, Member States fixed targets for a series of common result indicators, so their progress in implementing their rural development programmes can be followed. The achievements of the EU-28 in implementing measures planned under priorities 4 and 5 up to the end of 2018 can be summarised as follows:

- **focus area 5A - increasing efficiency in water use by agriculture:** by the end of 2018, 5% of irrigated land had been switched to more efficient irrigation systems, achieving 40% of the target;
- **focus area 5B - increasing efficiency in energy use in agriculture and food processing:** 18% of the target planned for 2023 (EUR 1.04 billion) was achieved in terms of total investment in energy efficiency;
- **focus area 5C - increasing the supply and use of renewable sources of energy, and of by-products, wastes and residues, for the purpose of bio-economy:** 17% of the target planned for 2023 (EUR 1.19 billion) was achieved in terms of total investment in renewable energy production;
- **focus area 5D - reducing GHG and/or ammonia emissions:** in 2018, around 2% of agricultural land was under management commitments that aimed to reduce GHG and/or ammonia emissions, and more than 80% of the target was achieved. Less than 1% of EU livestock units were concerned by investments to reduce emissions, achieving 61% of the target;
- **focus area 5E - carbon sequestration and conservation:** less than 1% of EU agricultural and forest land was under management that contributed to carbon sequestration and conservation, achieving close to 90% of the target;
- **focus area 4B - water quality (covering fertiliser management):** 12% of agricultural land and 0.1% of forest land were under contracts to improve water management by the end of 2018. While 84% of the target was achieved for agricultural land, only 14% was achieved for forest land;
- **focus area 4C - prevention of soil erosion and improvement of soil management:** 11% of agricultural land and 0.22% of forest land were under management contracts to help prevent soil erosion and improve soil management in 2018. While 85.9% of the target was achieved for agricultural land, only 16.9% was achieved for forest land;

- **focus area 3B - farm risk prevention and management:** the share of farms participating in risk management schemes was close to 6% in 2018, achieving 28.3% of the target.

Member States went far beyond the regulatory obligation to reserve at least 30% of the Pillar II budget for measures addressing climate and environmental objectives, achieving almost 55% on average. However, it is worth noting that payments for areas facing natural or other specific constraints, whose actual contribution to the climate objectives is weak, are the largest contributor to this target (20%). They are followed by the agri-environment-climate measures (17%) and organic farming (10%).

4. METHOD

The evaluation builds on the external support study conducted in 2015-2017, complementing it with internal (DG Agriculture and Rural Development) analysis based on more recent data and information, and including relevant findings from available external analyses and assessments.

Considering the wide range of topics under evaluation, the methodological approach of the evaluation support study combines theoretical and empirical approaches and includes a variety of methods, both quantitative and qualitative. Due to the complexity, the robustness of the evaluation faces a number of limitations.

4.1. Short description of methodology, tools and definitions

The starting point for the evaluation was the development of the intervention logic (see Annex 4). This was the basis for assessing the potential impact of each measure on climate action and for analysing budget allocations for climate action across the CAP.

The impact of CAP measures was quantified where appropriate and feasible, given the suitability and reliability of data available to the study. This is based in part on measure uptake data submitted by Member States in their annual implementation reports for the EAFRD (the reports for 2015 and 2016 for the support study, complemented with figures for 2017-2019). However, given the low implementation level at the beginning of the programming period, an accompanying qualitative review of CAP measures addresses gaps in the analysis where quantification of GHG impacts was not possible. This strengthens the understanding of causality between the use of measures and the impact in terms of climate mitigation, and provides information relating to potential emission leakage effects. The qualitative assessment is also used to understand better the combined impact of CAP measures.

The evaluation support study used a simulated quantification of GHG emissions and removals. For the GHG simulation, the 'GAINS' (Greenhouse gas – Air Quality Interaction and Synergies) quantitative model[40] was used to establish the baseline for simulating emission

[40] The GAINS model contains information about the expected evolution of GHG emissions and activity variables for a number of scenarios. In GAINS, activity drivers for emission projections enter calculations externally using projections from different internationally-recognised sources. In the specific case of agricultural scenarios for Europe, these come from the CAPRI model, in line with the macroeconomic scenarios developed for the EU by DG ECFIN. CAPRI is a modelling system for the EU agricultural sector and uses a unified, complete and consistent data base, which is derived from various sources such as national statistics and regional statistics. This model also allows the effects of different policy initiatives on activity variables to be considered. With these activities, GAINS estimates GHG emissions by applying a consistent methodology across all countries.

The use of GAINS emissions projections is useful for contextualising the estimated mitigation of GHG from CAP reporting data in terms of the expected evolution of such emissions until 2020. For example, the estimated mitigation of GHG produced by a measure using a specific uptake value, used in conjunction with the trend of the projections, may indicate whether its presence can bring about reductions, stabilisations or even increases in the tendency depicted by the GAINS emissions.

reductions and removals associated with the individual CAP measures according to their mitigation potential. This was based on uptake data reported by Member States (for 2015-2017) with relevant emission pathways and factors from literature.

A variety of tools and techniques were used to develop the evaluation support study, such as:

- *Stakeholder consultations*, including: a public consultation on modernising and simplifying the CAP[41]; consultation of the relevant Civil Dialogue Groups; interviews with stakeholders and operators in the agri-food supply chain; consultation with relevant academics. The synopsis report of the stakeholder consultation is provided in Annex 2.
- A *survey* of farmers and farm advisers about their experience of climate pressures and relevant CAP instruments. This was also used to gain information from farm advisers on the extent of uptake of different types of innovation.
- *Documentary research, literature review, statistical data analysis* (measure uptake data reported by Member States in their annual implementation reports). This also included data from the Farm Accountancy Data Network (FADN) and expenditure data derived from the EU out-turn budget and Member States' financing plans.
- *Case studies* were carried out to gather detailed information about CAP implementation and climate action in 10 Member States[42] that represent a range of farming systems, biogeographical conditions and climate challenges.
- *Cost-effectiveness analysis* of budget allocations for climate action across the CAP. The EU's climate tracking methodology was used to track climate spending in the EAGF and European Structural and Investment Funds, including the EAFRD. The calculation used to estimate the contribution of the CAP to climate funding is based on allocating one of three possible climate markers (0%, 40% or 100%) to each item of expenditure[43].
- *Coherence matrix and scoring*: to analyse coherence between regulations and/or intervention logics and assess the internal and external coherence of the CAP measures.

Emissions leakage

The occurrence of GHG emissions outside the boundary of the local agricultural production system, as a result of local change (e.g. implementation of an agricultural measure to modify environmental impact), may be referred to as 'leakage'. The term is used to describe net emission change, including emissions, mitigation of emissions, and removals (removals from the atmosphere of GHGs, also called 'sequestration') outside the system boundary. Hence, to fully account for GHG emissions and removals which result from changes to agricultural systems within the EU caused by the CAP, there is a need to consider any resultant GHG emissions elsewhere. Many CAP measures change or influence production at a local level, which will have an economic and market influence beyond the agricultural system concerned. The main pathway for leakage considered in the evaluation support study is the net change in GHG emissions outside of the Member State implementing the measure that is induced by a change in production. Production changes include:

- changes in crop production for food, livestock feed, energy and fibre;
- changes in production from livestock farming, predominantly production of food.

[41] https://ec.europa.eu/agriculture/consultations/cap-modernising/2017_en

[42] Croatia, Czechia, France, Germany, Hungary, Ireland, Lithuania, the Netherlands, Romania and Spain. The case studies were carried out at national level, but with a particular focus on a single administrative region in the federal Member States (Aquitaine in France, Saxony-Anhalt in Germany and Andalucía in Spain).

[43] For the EAFRD, the method applies different coefficients to different EAFRD priorities and focus areas (no matter which measures are programmed under these priorities/focus areas).

The net change in emissions elsewhere (the leakage) is a mix of emissions from production systems and from land use change.

For further details on the methodology and estimation of leakage, see Annex 3.

4.2. Limitations and robustness of findings

The limitations of the analysis affect the robustness of findings due to the limited availability of accurate, detailed and homogenous data, the very limited observation period when the support study was carried out and the limited evidence to establish the link between CAP measures and climate mitigation. The first year of implementing the direct payments scheme was 2015 and the rural development programmes for 2014-2020 were approved by the Commission between December 2014 and November 2015. Consequently, the evaluation support study could only rely on 2 years (2015-2016) of data from Eurostat and 1 year (2015) of data from the FADN and the Clearance of Audit Trail System (CATS).

A key limitation has been the impossibility to quantify the overall net impact of all the CAP measures on emissions. It is also difficult to deliver an overall assessment of the individual CAP 2014-2020 measures against their desired climate objectives, particularly at EU level, because of the wide range of implementation choices by individual Member States.

The limitations implied that the emission effects of some measures could not be assessed quantitatively. The quantitative method used in the evaluation support study to estimate the impact of CAP measures on emissions is limited. It is questionable whether the impact of a measure on emissions is suitable for quantification at all. Even when uptake figures are available for a certain measure, sometimes there is not a direct enough link between the use of the measure and the impact it has, if any, on climate change mitigation or adaptation. For example, there is not a direct enough link between the provision of advice to farmers and any changes they may make in their land management practices to assess the impact of advice measures on the reduction of emissions to be quantified.

The main limitations of the method, due to lack of data (short period of implementation) and the impossibility to construct counterfactual situations for all measures[44], can be summarised as follows:

- the impossibility of quantifying the overall net impact of direct payments on emissions. Direct payments, including coupled support to extensive livestock systems, prevent land abandonment and contribute to the maintenance of permanent grasslands. When the land is abandoned, the mitigation impact depends on the alternative use of this land: on one hand it is negative if the land is ploughed, kept bare-fallow or constructed (soil sealing), on the other hand it is positive if the land is afforested or left for spontaneous revegetation;
- the difficulty of establishing the extent to which the CAP measures support mitigation actions, due to the lack of a counterfactual situation[45], the level of detail in some uptake data, the wide range of potential biogenic emissions and the difficulties aggregating GHG emissions reported at project level;
- the lack of specific indicators for the individual measures with respect to their impact on mitigation and adaptation, and the fact that complementary result indicators (see Chapter 3) were not available in time for the evaluation support study;

[44] A key limitation has been the absence of data to show whether permanent grassland has been kept unploughed, ploughed then reseeded, or converted and ploughed.

[45] The CAP applies for a long time and covers a very large area.

- the difficulty of assessing the effectiveness of the permanent grassland ratio and measures to protect environmentally sensitive permanent grassland , isolating this from the effectiveness of other measures such as Natura 2000;
- the difficulty of constructing the counterfactual situation in case of no support and analysing what would happen to fallow land;
- the scarcity of available data with which to assess the effect of innovations on climate action, meaning it was not possible to assess the overall impact of innovations on climate objectives;
- the lack of evidence with which to assess the impact of 'soft' measures, such as advisory measures, or training and advice.

With these caveats, the contractor nevertheless has developed a GHG simulation according to the mitigation potential of CAP measures.

As regards adaptation, the assessment of the measures' impact was particularly difficult, as there are no legally binding or concrete, quantified objectives for adaptation, apart from the budget requirements mentioned in Chapter 2. The requirement to allocate 30% of EAFRD funds in each rural development programme to measures addressing environment and climate objectives has not been an effective driver since, in most cases, most of this support went to measure 13 - areas facing natural constraints, which could have little relevance to adaptation.

Furthermore, it was also difficult to derive a robust general picture from the opinions presented in the case studies, given the very different situations and particularly the implementation choices in the Member States covered by the case studies.

Despite the lack of some data, the solid methodology, particularly the modelling analysis and the in-depth case studies, ensured the validity of the main findings of the evaluation.

5. ANALYSIS

5.1. Effectiveness

This chapter aims to assess the extent to which the relevant CAP 2014-2020 measures are effective in contributing to climate change mitigation and adaptation.

Trend of GHG emissions and the evidence base for assessing the CAP's impact

In 2018, the agricultural sector emitted 486 million tonnes of CO_2eq in the EU-28 (of which 435 million tonnes were non-CO_2 GHG), corresponding to 12% of total GHG emissions[46]. Emissions decreased significantly between 1990 and 2010 and have stagnated under the CAP 2014-2020. In view of the EU climate targets, the agricultural sector will need to step up its efforts to contribute to the EU's climate ambition. In 2018, 44% of EU-28 agricultural non-CO_2 emissions were related to enteric fermentation of ruminant livestock (methane - CH_4), 37% to fertilisation of agricultural soils (nitrous oxide - N_2O and, to a lesser extent, CO_2), 14% to the management of manure (CH_4 and, to a lesser extent, N_2O); the management of cropland and grassland together resulted in net emissions of 64 million tonnes of CO_2eq.

Overall, within the agricultural sector CH_4 represents 55% and N_2O 43% of GHG emissions. The agricultural sector is responsible for 54% of total EU CH_4 emissions (6% of the total EU GHG emissions) and for 79% of total EU N_2O emissions (4% of the total EU GHG emissions). These data show that reduction efforts must focus as much on N_2O as on CH_4. Furthermore, the role of agriculture in protecting carbon stocks and providing carbon sequestration should also be enhanced.

5.1.1. CAP measures' effectiveness in contributing to climate change mitigation

Results of the simulation on GHG emission reductions

Only some CAP measures are expected to have a direct quantifiable impact on GHG emissions and only certain CAP measures had suitable uptake indicators available for the purpose of the simulation. Therefore, only a selection of CAP measures could be included in the simulation. Notable omissions include fallow land (EFA), for which the simulation cannot calculate a single year's impact on emissions, the permanent grassland ratio and most direct payments.

In the evaluation support study, three simulations were carried out, reflecting the impact of a low, medium and high scenario in terms of emission factors, i.e. the potential of measures to reduce emissions. In addition, for Pillar II, the simulation was based on 2016 uptake; however, to take into account the fact that uptake is increasing over time, an additional 2020 simulation was run, simulating an uptake at target level[47].

At best, based on 2016 uptake, the reduction in emissions reaches 8.8% compared to the simulated baseline without the CAP, with a medium scenario at 4.7% and a low at 0.3%. **Pillar I** contributes most to this reduction, via greening and, more specifically, protection of environmentally sensitive permanent grasslands (ESPG) and the ecological focus areas (EFA). In the medium scenario, in the absence of these two measures, emissions from agriculture would have been 3.5% higher (19.8 million tonnes CO_2eq).

[46] See footnote 15.

[47] For example, the measures targeting GHG and ammonia emission reductions applied on 1.5% of agricultural land in 2016 and 2.4% in 2018. The target is set at close to 3% for 2023.

Table 3: Simulated impact on EU-28 GHG emissions (simulated Pillar I CAP measures, compared to the baseline of 1 000 t CO_2eq/ year)

CAP measure	Scenario	Emitted as CO_2	Emitted as N_2O	% reduction compared to the baseline (net CO_2eq)
EFA (except fallow land)	Low	19	152	0.0%
	Medium	20	4 005	0.7%
	High	21	7 858	1.4%
ESPG	Low	1 466	0	0.3%
	Medium	15 764	0	2.8%
	High	30 061	0	5.3%
EFA + ESPG	Low	1 486	152	0.3%
	Medium	**15 784**	**4 005**	**3.5%**
	High	30 082	7 858	6.7%

Source: Evaluation support study

Table 4: Simulated impact on EU-28 GHG emissions (selected Pillar II CAP measures, medium scenario, 2016 uptake, compared to the baseline of 1 000 t CO_2eq/year)

CAP measure (ranked by percentage reduction)	CH_4	CO_2	N_2O	% reduction compared to the baseline (net CO_2eq.)
Baseline	287 394	38 677	240 201	
Natura 2000 (measure 12.1)	0	3 881	0	0.7%
Agri-environment-climate commitments (measure 10.1)	0.13	170	1 125	0.2%
Organic (measure 11)	0	0	874	0.2%
Forestry (measure 8)	0	367	0	0.1%
Investments (measure 4)	13	0	0	0.0%
Total Pillar II Low	6	812	432	0.2%
Total Pillar II Medium	**13**	**4 418**	**1 999**	**1.1%**
Total Pillar II High	20	8 024	3 566	2.1%

Source: Evaluation support study

The quantified results need to be treated with caution, because they may overestimate the emission reduction from some of the measures analysed. This is particularly the case for the environmentally sensitive permanent grassland (ESPG) measure, which assumes that all the benefit of protecting ESPG can be attributed to the greening measure (while 96% of the ESPG is in Natura 2000). It also uses an emission factor, established from literature, which relates to the GHG removal benefits arising from restoring wetlands and peatlands. The literature makes clear that such large removals are achievable in a limited range of circumstances, so that the 'medium' simulation result is very likely to be an overestimate. Where the Natura 2000 management plans already ban ploughing, the reductions in emissions cannot be attributed fully to the greening measure; however, greening enhances implementation of the ploughing ban, all the more in those Member States which translated the Habitat Directive into voluntary commitments in Natura 2000 areas (e.g. France).

Pillar II measures for which the impact was quantifiable (i.e. investments in physical assets - measure 4, investments in forest area development - measure 8, agri-environment-climate - measure 10.1, organic farming - measure 11 and Natura 2000 payments – measure 12.1) have helped to reduce GHG emissions by ~6.4 million tonnes CO_2eq/year. This corresponds to 1.1% of total emissions from agriculture based on the 2016 uptake of measures.

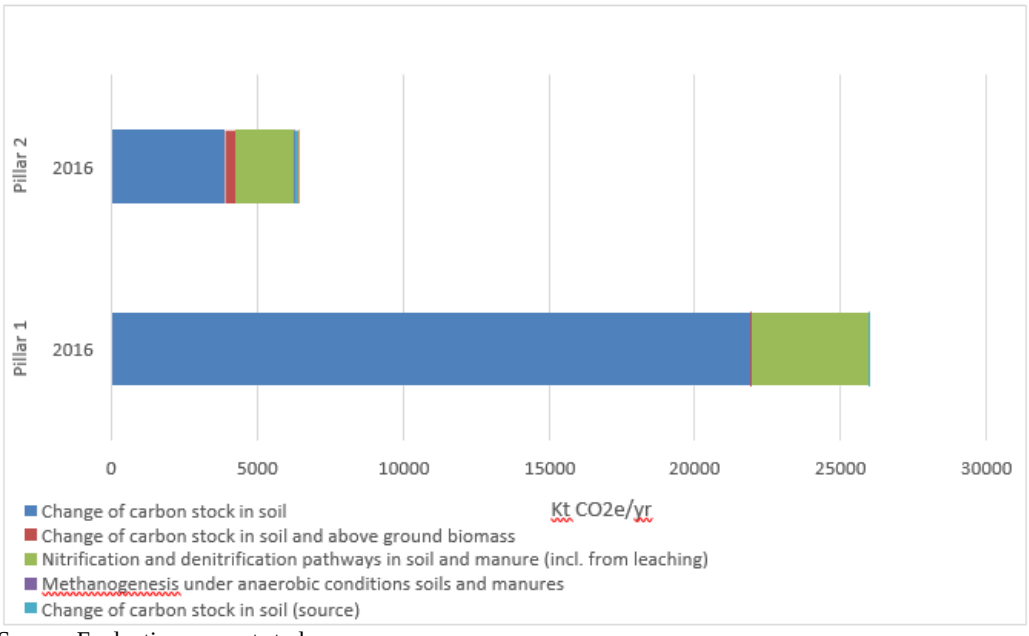
Most of the reduction is associated with carbon sequestration due to Natura 2000 payments. Although the simulation result exaggerates the impact of this measure, which compensates

farmers for the cost of complying with restrictions which are already in place, it is reasonable to associate some mitigation impact with the payment. In its absence, protection might have been more difficult to put in place due to farmers' opposition, and management plans might have been less well complied with once they were in place. As the simulation could not account for such factors, the whole impact on GHGs associated with Natura 2000 protection has been attributed to Natura 2000 payments - measure 12.1. In addition, under the CAP, areas under greening cannot be compensated with Natura 2000 payments for the same restriction[48]; however, the simulation modelled each measure separately, implying some double counting with the modelling of the ESPG under greening.

Under the medium scenario, full uptake (at target level) of the measures that Member States have programmed would yield reductions equivalent to 1.5% (compared to 1.1% based on 2016 uptake). The extent of success should be considered alongside wider sectoral aspects, notably:

- Livestock production: CH_4 emission reductions may be achieved by certain operations under the agri-environment-climate measure (10.1) with respect to manure management and feed, and investments in physical assets (measure 4) with respect to manure storage and livestock housing.
- Fertiliser use: N_2O and CO_2 emission reductions are only reported for agri-environment-climate commitments (measure 10.1) with respect to management of inputs.
- Preserving carbon sinks and enhancing carbon sequestration: CO_2 reductions and removals may arise from practices that are supported by CAP measures included in the simulation but which are small in relation to wider reductions and removals in the sector.

Figure 2: Simulated emissions impact of CAP measures by source, medium scenario (1 000 t CO_2eq/year), 2016 uptake, compared to baseline



Source: Evaluation support study

As shown in Figure 2, the mitigation impact is dominated by the effects of CAP measures on change in **soil carbon stocks** (the balance of emissions mitigation and increased removal of carbon from the atmosphere) and change in N_2O emissions from soil and manure. It is estimated that 15.8 million tonnes of the 19.8 million tonnes reduction in emissions of CO_2eq in the medium scenario for Pillar I measures come from changes in soil and biomass carbon stocks; the

[48] Regulation (EU) No 1306/2013 requires Member States to deduct from the measure 12.1 payments any amount associated with restrictions that a farmer is already required to comply with as a result of the greening measure.

corresponding figure for the simulated Pillar II measures is 4.4 million tonnes CO_2eq out of a total emission reduction of 6.4 million tonnes (2016 uptake).

N_2O emissions from soil and manures across the EU-28 would have been 4 million tonnes CO_2eq per year greater without the relevant Pillar I measures (0.71% of baseline emissions) and 2 million tonnes CO_2eq per year higher without the Pillar II measures (0.35%) per year (2016 uptake). The agri-environmental commitments accounted fully for this result.

Reductions in **CH_4 emissions** - from enteric fermentation and manure management - do not feature highly in the simulation results. Other work[49] has shown that livestock mitigation measures have low potential, due to the technical difficulty in reducing emissions in the livestock sector. As highlighted in the Farm to Fork Strategy and in the Methane Strategy, changes in consumption patterns towards more sustainable diets would also be an effective way to decrease livestock emissions, while avoiding any reduction in herds leading to increased GHG emissions outside the EU (leakage).

CO_2 emissions associated with energy consumption are higher in some sectors (especially horticultural farms and specialised dairy farms, poultry and pig meat farms), but the relevant mitigation actions are site-specific and could not be simulated.

The effect of CAP measures on CO_2 removals

CO_2 is of great importance in the agricultural sector's GHG balance, because of the very large stock of carbon in soils. Soils in Europe are accumulating carbon: grassland and forest soils are, on average, a carbon sink that is estimated to grow by 80 million tonnes every year[50], and around 90% of this carbon sequestration takes place in forests. This amounts to approximately 0.1% of all EU soil stocks (75 billion tonnes), so a small increase relative to existing stocks would have a large effect on net GHG emissions from the agricultural sector.

Agricultural soils in Europe are a carbon sink, but they are losing carbon. Looking at agricultural land across the EU, the combination of grassland and cropland had a net emission of 68 million tonnes CO_2eq in 2018 according to GHG inventory reporting[51]. These emissions have significantly decreased since 1990, when they were at around 90 million tonnes. However, it soil carbon is currently the 'blind spot' in the land/climate nexus, as its monitoring needs significant improvement and investment. Soils can be a net source or sink for atmospheric carbon, depending on land use and management. Decreases in soil organic carbon through cultivation can be mitigated by minimising soil disturbance and tillage, permanent soil organic cover, crop rotation practices, or with special practices on cultivated peatlands (carbon-rich soils). Removal of CO_2 into soils, without changing land use, depends on the balance between carbon additions (crop residues and organic matter additions) and carbon losses, mainly through organic matter decomposition. The most effective means of removing CO_2 is changing land use from annual crop production to perennial grassland and/or woodland. In the simulation, the main mitigating impact of the CAP is realised through CO_2 removals. According to the simulation, CAP measures result in removals between 3.6% (with Pillar II 2016 uptake) and 4% (at target level) of net agricultural GHG emissions.

Soils rich in organic matter and, consequently, in carbon are better suited to withstanding the impact of climate change because they are more resistant to erosion and retain water better, especially during extreme events such as droughts.

[49] Martineau et al (2016), Effective performance of tools for climate action policy - meta-review of Common Agricultural Policy (CAP) mainstreaming.

[50] Frelih-Larsen et al (2016), Updated inventory and assessment of soil protection policy instruments in EU Member States.

[51] EEA Data viewer https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

An important initiative on soil carbon is the '4 per 1 000' initiative[52], which aims to increase soil organic matter and carbon sequestration through agricultural practices adapted to local environmental, social and economic conditions, such as agro-ecology, agroforestry, conservation agriculture and landscape management. The initiative commits stakeholders to a transition towards productive and highly resilient agriculture, based on appropriate management of lands and soils, creating jobs and income and consequently promoting sustainable development. This project highlights the fact that the carbon stock in permanent grassland is close to its maximum (hence, the importance of maintaining it), but that there is significant potential to increase carbon stocks in arable land.

Emission mitigation impacts across Member States

There is no clear regional pattern to the pathways leading to net changes in GHG emissions; however, there are differences between Member States depending on their geography, farming systems and policy implementation choices. The majority of Member States' CAP measures have had a similar mitigating effect on climate change to that for the EU-28 as a whole. Member States with little opportunity to establish or protect permanent grassland (e.g. Malta, Cyprus) have the lowest potential to decrease emissions, while Member States with a large area of permanent grassland (e.g. Spain, Italy, Romania, Czechia and Greece) have the highest potential to have an impact on GHG emissions. Lower emissions are attributable to the large areas of land designated as ESPG within certain Member States and the potentially high benefit resulting from protecting these carbon stocks.

It can be **concluded** that mitigation will mainly be achieved by maintaining permanent grassland and thus carbon stocks. The main contribution from arable systems comes through EFA (nitrogen-fixing crops and, to a lesser extent, from catch and cover crops).

Measures whose impact could not be simulated

The **permanent grassland ratio** may potentially have significant effects on carbon emissions or removals. Compared to the counterfactual scenario in which there are no CAP measures, the ratio could theoretically prevent up to 95% of the 36.1 million hectares of permanent grassland from being ploughed without reseeding as grassland.
However, its impact could not be simulated due to the significant uncertainty relating to the management of permanent grassland, the soil types concerned and the age of the grassland. Unlike ESPG, where ploughing is banned and designation (should) guarantee that soil carbon is locked in and sequestration can continue, various types of management with very different consequences for mitigation are possible in the case of land which is not ESPG and which is only protected through the permanent grassland ratio[53]. The European Court of Justice in 2013[54] made clear that land classed as permanent grassland can be ploughed and re-seeded without it losing its 'permanent grassland' status.

Alternative scenarios are presented in the evaluation support study on the impact of converting soils to arable, ploughing them then reseeding as grassland, or not ploughing at all. These scenarios show that, for each percentage point of declared permanent grassland that remains

[52] This initiative is part of the Global Climate Action Plan (GCAA), adopted by the UNFCCC at COP 22 as a follow-up to the COP 21 Lima-Paris Plan of Action, and contributes to the goal of reaching a land-degradation neutral world.

[53] Appropriate management of grassland may facilitate CO_2 removal, such as: reducing nitrogen fertiliser inputs in highly intensive grass covers; increasing the duration of grass covers; converting grass covers to grass-legume mixtures or to permanent grasslands; and moderately intensifying nutrient-poor permanent grassland. However, intensifying nutrient-poor grasslands on organic soils may lead to large carbon losses.

[54] The Court judgment of 2 October 2014 in the case C-47/13 clarified the definition of permanent pasture. 'Permanent grassland' must be interpreted as agricultural land which has been, for 5 years or more, used to grow grass and other herbaceous forage, even though that land has been ploughed up and seeded with another variety of herbaceous forage other than the one previously grown on it during that period.

unploughed, there will be an estimated avoidance of net CO_2 emissions from soil of between 0.7 and 1.8 million tonnes CO_2eq (depending on soil type and climate), compared to a situation where the soil would otherwise have been ploughed then reseeded. A greater avoidance of emissions (1.2 to 4.5 million tonnes CO_2eq) is achieved if grassland would otherwise be converted to arable use.

The above-described model could not simulate the GHG impact of most **direct payments** either (single payment scheme or single area payment scheme, the redistributive payment, the small famers' scheme and payments to areas facing natural constraints). However, the results of another modelling study[55] on the impact of direct payments on production using the CAPRI model show that, overall, direct payments are helping to keep land in agricultural production. While land abandonment occurs in practice, the modelled results suggest that more land would have been abandoned if direct payments had not been in place, and thus production and associated emissions would have been lower.

Maintaining extensively managed farmland, particularly semi- natural pastures, is key for conserving biodiversity and preserving the cultural landscape. Therefore, direct payments contribute to the provision of these public goods, but principally in marginal areas, since relatively productive land would be farmed in any case (i.e. even without the CAP). The higher agricultural output in marginal areas brought about by direct payments also causes higher levels of GHG emissions. These higher GHG emissions for the EU are, to some extent, moderated by lower emissions in the rest of the world. Nevertheless, the net effect of direct payments is slightly higher global GHG emissions.

Determining the potential impact of the **small farmers' scheme** in particular is further hindered by the fact that agricultural holdings under this scheme are exempt from greening obligations and from cross-compliance penalties. Therefore, the simulated reduction in emissions from the greening measure could have been larger without this exemption. In addition, since the impact of cross-compliance itself cannot be quantified, neither can the impact of not applying its sanctions to certain farms. Thus, depending on the effectiveness of these obligations, there is a risk of a missed opportunity to mitigate GHG emissions (this is also discussed in relation to the evaluation criteria for 'coherence').

The evaluation support study concluded that the impact of **measures supporting areas facing natural constraints** on livestock production, the most usual type of farming in these areas, is difficult to establish. Since this payment is not coupled, the impact on production and thus GHG emissions is unlikely to be significant. As direct payments, the measure is intended to enable farming to continue in areas where it otherwise might not.

There is potential for reducing GHG emissions if the abandonment of previously farmed land is followed by vegetation (herbaceous, shrub and wood) and forest. However, erosion effects with subsequent loss of soil carbon are also possible, and these can take a number of forms. For instance, in Scotland there have been instances where the replacement of sheep farming by uncontrolled grazing by wild deer has increased erosion. Elsewhere, in regions where soil is held in place on steeply sloping ground through terrace systems, the abandonment of such systems may result in the loss of significant soil carbon.

For **horizontal measures**, the simulation could not quantify the impact of cross-compliance on GHG emissions due to the difficulty in determining the specific areas of land to which the often widely different rules set by Member States apply in practice. Member States have tended to set rules based on existing good practices and not beyond. Ensuring the 'status quo' is nevertheless important: by ensuring that there are no reversal trends, the carbon stock is protected.

Although no simulation could be made, it is understood that **'soft measures'** to support climate mitigation actions will indirectly contribute to GHG reductions by changing behaviour and

[55] Brady et al (2017), Impacts of Direct Payments: lessons for CAP post-2020 from a quantitative analysis.

improving capacity. The most common CAP measures used to improve capacity and uptake are the Farm Advisory System as a horizontal measure and the measures supporting **knowledge transfer (measure 1)** and **advisory services (measure 2)** under Pillar II.

The CAP measure supporting **knowledge sharing networks** by establishing and running operational groups of the EIP for agricultural productivity and sustainability **(measure 16)** has led to a number of initiatives to support capacity for climate mitigation at farm level and helps research results to be translated in practice on the ground. Additional soft measures are identified in the literature review as having the potential to contribute to GHG reductions. These measures include: the use of business plans to support energy efficiency on farms and in rural businesses (via the farm and business development measure, **measure 6**); and support for operations (including local renewable energy production, community energy efficiency, localised food chains, sustainable mobility, etc.) under the community-led local development strategies (**LEADER, measure 19**).

The impact of voluntary coupled support

VCS is intended to aid certain production activities which experience difficulties and which are important for economic, social and/or environmental reasons. Its potential impact on GHG emissions varies according to the type of production supported and any eligibility requirements. Support to maintain ruminants contributes to keeping enteric emission levels, while helping to maintain permanent grassland and thus carbon stock. Support for protein crops could reduce emissions of N_2O and increase sequestration compared to a counterfactual scenario in which other crops were grown.

Academic and other literature does not present a clear picture of the impact of coupled support on production or GHG emissions. Using the CAPRI model, Jansson et al[56] show that removing coupled support for **ruminants** would reduce beef production by 1% and total agricultural GHG emissions in the EU by 0.5%. However, about three quarters of this reduction would be cancelled out by emissions leakage (i.e. increased emissions outside the EU) due to an increase in imports from countries with relatively higher emissions per unit of product (emission intensities), like Brazil[57]. This emissions leakage would significantly limit the positive impact on global warming that could come from removing coupled support in the EU.

A reduction in direct emissions from livestock might also be accompanied by changes in land use whose impact is difficult to predict. Land previously used for grazing or for the production of feed could be abandoned, set aside or brought into another form of production (e.g. grassland could be converted into arable land or vice versa). If abandoned, the effect can be positive for climate (e.g. afforestation, conversion to grassland) or negative (e.g. conversion to settlements or increased soil erosion). The benefit of stopping livestock production therefore depends on how land is managed.

With regard to production effects, in certain cases coupled payments support the continuation of agricultural activity on carbon-rich soils, which is less GHG-intensive than alternative uses for the land[58]. An extensively grazed pasture which is no longer supported by coupled support might be ploughed and converted to arable production, releasing soil carbon and also emissions from the use of fertilisers. However, the extent to which such changes can occur is constrained by

[56] Jansson et al (2020), Coupled Agricultural Subsidies in the EU Undermine Climate Efforts.

[57] In a no-coupled support scenario, beef production in the EU would decrease by 89 000 tonnes, while consumption would decrease by only 50 000 tonnes despite higher prices. The market balance would be maintained by a reduction in EU exports (-22 000 tonnes) and by increased imports to the EU (+17 000 tonnes).

[58] In the EU-28, most suckler cows, ewes and she-goats are raised extensively. 68% of suckler cows, 41% of dairy cows, 62% of sheep and 50% of goats are held on farms with a livestock density below 1.4 LSU/ha. These numbers are calculated on the basis of the Eurostat Farm Structural Survey of 2013. In this respect, DG Agriculture and Rural Development estimated that the share of VCS spending granted to extensive systems is around 30%.

other policy instruments, notably by the permanent grassland ratio and the designation of environmentally sensitive permanent grassland, in addition to the physical characteristics of the land which may make it unsuitable for arable farming. Therefore, the evaluation support study could not conclude that reduced emissions from a reduction in livestock numbers would automatically be offset by increased emissions from ploughing.

A smaller proportion (10%) of Member States' coupled support budget has been set aside for **protein crops**, which can reduce GHG emissions. The EU protein crop area increased by close to 60% between 2013 and 2019, to 2.16 million hectares[59]. Beside coupled support, market factors, the eligibility of protein crops for EFA and the crop diversification measure also contributed to this increase. The evaluation support study reports that reductions in direct GHG emissions from improved nitrogen efficiency of between 0.033 and 0.159 tonnes/hectare/year are achievable via nitrogen management measures, including the planting of protein crops.

The overall net impact of coupled support on GHG emissions within the EU is difficult to judge. Additional enteric emissions and emissions from manure management associated with livestock numbers that are higher than would be expected in a counterfactual scenario must be balanced against the risk of emission leakage and any positive impacts from protecting sensitive soils, while also depending on its use and management. The small positive impact of additional protein crop production must also be taken into account. The scale of support for the livestock sector qualitatively suggests that negative impacts (i.e. increase in GHG emissions) are likely to outweigh positive impacts (i.e. climate change mitigation). However, model results also show that, due to leakage (increase of emissions outside the EU), the net-negative impact of VCS might be very small.

The assessment of the impact of voluntary coupled support, decoupled direct payments and support for areas facing natural constraints highlights that the debate on livestock emissions cannot be simply narrowed down to reducing livestock numbers to a more sustainable level, but should also make a distinction between intensive and extensive livestock systems. This was highlighted in the Commission's report on the 'Future of EU livestock'[60]: besides the risk of emissions leakage, it is important to consider that ruminants in extensive livestock systems maintain marginal land whose biomass is not mechanically harvestable (humid and dry mountain areas, humid zones, etc.), with positive effects on biodiversity and landscape management, such as on fire risk prevention, depending on site-specific conditions. In addition, to produce meat and milk ruminants use cellulose, which is not digestible for human beings.

A holistic approach to livestock systems when assessing their impact is necessary, by also looking at relation with impact of feed production and unsustainable consumption patterns.

5.1.2. CAP measures' contribution to climate adaptation and climate resilience of the agricultural sector and society

With close to 800 natural catastrophes worldwide in 2018[61], the number of extreme events affecting agriculture is rising. Climate adaptation was an overarching objective of the five European Structural and Investment Funds for 2014-2020, including the EAFRD, and a cross-cutting objective of the CAP 2014-2020. However, there are no legally binding or concrete, quantified objectives for adaptation, apart from the budget requirements. The requirement to allocate 30% of EAFRD funds in each rural development programme to measures addressing environment and climate objectives has not been an effective driver, since much of this

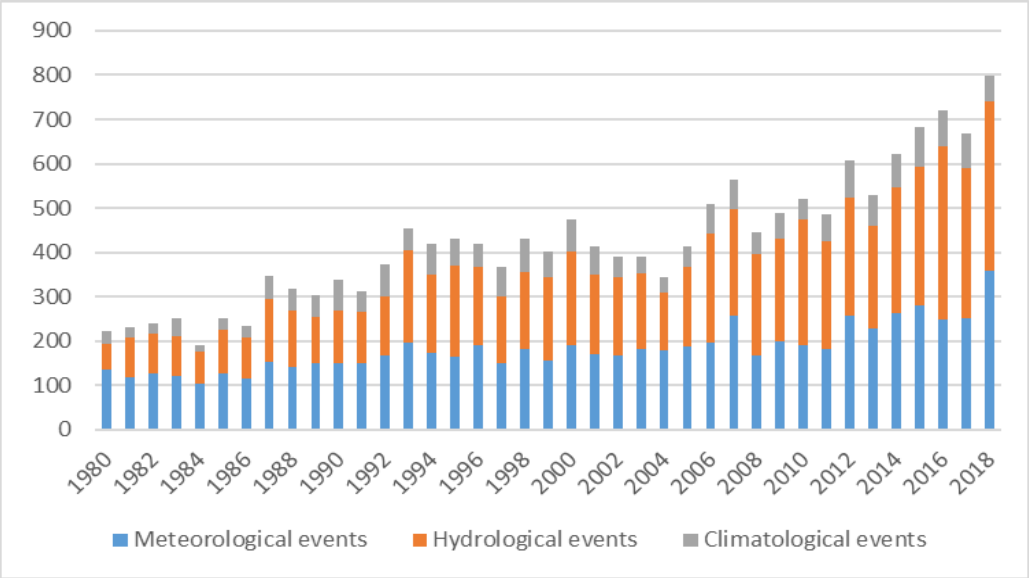
[59] Short-term outlook for EU agricultural markets, Statistical Annex, https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/short-term-outlook-statistical-annex_en.pdf

[60] Dr Jean-Louis Peyraud (INRAE) and Dr Michael MacLeod (SRUC), European Commission, Future of EU livestock: how to contribute to a sustainable agricultural sector.

[61] Meteorological events: tropical storm, extra-tropical storm, convective storm, local storm. Hydrological events: flood, mass water movements. Climatological events: extreme temperature, drought, forest fire.

percentage was made up of measure 13 (support for areas facing natural constraints). This measure has little relevance for environment and climate objectives, including adaptation.

Figure 3: Number of natural catastrophes worldwide



Source: Münchener Rückversicherungs-Gesellschaft, Geo Risks Research, NatCatService
Note: The graph refers to the natural catastrophes occurred in general and not only in agriculture.

Member States' national strategies include plans to adapt the agricultural and forestry sectors. The planning process for rural development programmes required Member States to integrate adaptation into their policies. Unfortunately, however, there were no such requirements under the Direct Payments and Horizontal Regulations. In Pillar II, very little reference is made in the programmes to risk assessments and even less to adaptation strategies and plans. Despite adaptation being considered as a relevant challenge in almost all rural development programmes, only eight addressed climate adaptation explicitly. Nevertheless, although overall the CAP measures were not primarily designed to address climate-related objectives and very few CAP measures make explicit reference to climate adaptation, several measures had some indirect effects on adaptation (see Table 1).

Tracking expenditure on adaptation is very difficult, as **there is no focus area dedicated specifically to adaptation**. In addition, some measures which can address adaptation relate to several focus areas (investments in physical assets, agri-environment-climate commitments, organic farming). At EU level, EUR 7.8 billion have been allocated to support actions explicitly dedicated to preventing or minimising the damage that climate change can cause, corresponding to 5% of the total climate change allocation under the EAFRD. The main contributions are detailed below.

Effects of the Horizontal Regulations on adaptation

Cross-compliance **GAEC** standards can have unintended positive effects on adaptation and can also help to avoid cases of maladaptation, but the extent to which this happens depends on how Member States choose to define the standards. Interviewees in the case study countries pointed out that climate change adaptation had not been a significant driver of GAEC choices (Germany, Spain, except for GAEC soil in 2018, and Romania). In most case study countries, GAEC standards did not change significantly between the CAP 2007-2013 and the CAP 2014-2020, showing no strong commitment to furthering climate change adaptation. Overall, Member States have not directly tailored GAECs for adaptation purposes, so their potential is not fully used.

As regards the standards most likely to benefit adaptation, for GAEC 6 (**maintenance of soil organic matter**[62]), most Member States (15) did not go beyond the EU minimum requirement, a ban on stubble burning. Furthermore, compared to the CAP 2007-2013, the number of Member States which defined additional requirements for the maintenance of soil organic matter decreased. These requirements include: restrictions on entering land when it is waterlogged or frozen; use of crop rotations; not growing successive crops with a high soil carbon demand; application and/or monitoring of organic matter; soil testing; and stubble management[63]. Part of these requirements, previously under GAEC 6, are reflected in the CAP 2014-2020 in the crop diversification obligation under greening.

GAEC 2, which concerns compliance with **authorisation procedures for irrigation water**, is mostly defined by Member States as a requirement to hold a permit for irrigation and, in some Member States, to have a water meter. The EU framework does not include any requirement to link the quantity of water used to the quantitative state of the water resource in the area, which would have been beneficial to avoid cases of poor adaptation.

With regard to the **Farm Advisory System** (FAS), the advisers interviewed also reported on the high complexity in advising on adaptation given: 1) the uncertainty of climate change impacts; 2) the fact that knowledge of adaptation issues is still developing; and 3) the fact that the vulnerability of a given farming system is very dependent on its context and location. Although climate change has been included in the scope of the FAS from 2014, it is difficult to assess accurately to what extent climate change has been included in advice to farmers. Case study interviews hint that the situation varies across Member States and that the integration of climate-related actions has been low. There is thus room to improve how adaptation is incorporated into the FAS.

Effects of the first pillar's measures on adaptation

Crop diversification is likely to have positive effects on adaptation by agricultural holdings and on territorial adaptation. Increased crop diversity and crop rotation promoted by the measure improve farms' resilience to climatic events such as droughts and to economic shocks from price volatility. Crop rotation also helps to improve soil quality and resilience to pests, while diversifying into less water-demanding crops may lower dependence on water resources in traditionally irrigated areas.

In 2016, 23% of farms in the EU had three crops or more. The crop diversification measure required changes of crop on less than 1% of EU arable land, but it encouraged farmers to maintain diversification. In 2016, 27% of EU farms had one crop only, and mono-cropping remains a dominant practice in a number of countries and regions in the EU (Italy, Romania, Spain, Poland, north-western Germany and south-western France). Nevertheless, the impact of crop diversification under greening was higher locally in areas with high levels of mono-cropping (e.g. 2.8% of the agricultural area had to be diversified in Spain). According to the evaluation support study on greening, most farmers that had to diversify mainly planted leguminous plants instead of cereals, and they mainly did it in rotation; both practices were identified as being positive for adaptation by favouring resilience to pests and droughts and improving soil structure.

The permanent grassland ratio can improve adaptation, since permanent grass cover limits soil erosion and improves resilience to floods. It helps to maintain a level of diversity in farming systems, which has been identified as crucial for adaptation.

---

[62] There is a growing consensus that soil quality (and especially soil organic carbon) is key for both mitigation and adaptation.

[63] Hart et al (2017), Research for AGRI Committee, The consequences of climate change for EU agriculture. Follow-up to the COP21 - UN Paris Climate Change Conference.

In **EFA**, planting of catch/cover crops, adopted by many farmers to comply with the obligation, favours adaptation by improving soil organic carbon content and maintaining soil moisture, which is good for resilience to droughts, while also limiting the risk of soil erosion. The maintenance of (non-bare) fallow land and landscape elements is also beneficial for resilience to floods and protection from soil erosion.

Direct payments can potentially facilitate investments necessary to adapt to new climate conditions, and hence facilitate a transition towards more resilient systems. They can also lower farmers' economic sensitivity to shocks that may be directly or indirectly due to climate changes, such as climatic events or price volatility, by improving income stability. A fairer distribution of direct payments through the voluntary redistributive payment could favour adaptation by supporting farm diversity through support for smaller farms. However, the measure was implemented only in 10 Member States, which limited the potential benefits. VCS favours systems that are experiencing difficulties, which might relate to the resilience of a region (e.g. an important employer in a region already marked by high structural unemployment), and in doing so it promotes farm diversity[64] more broadly. As Scenar 2030[65] shows, a 'no CAP' scenario would lead to more specialised systems, implemented on a smaller agricultural area, located in the most favourable places, thus reducing diversity.

Direct payments can also have **unintended negative effects** on adaptation. They may support the maintenance of vulnerable farms, slowing some structural changes that could be necessary for adaptation in some cases or supporting risk-prone behaviour. Such cases have been reported during the case study interviews in Spain, where interviewees pointed out that the basic payment scheme was still strongly linked to historical payments; for example, farmers working on irrigated systems located in arid zones continue receiving higher levels of CAP payments. However, these systems are going to be increasingly vulnerable to the effects of climate change and they may lead to higher vulnerability of the whole territory through their use of ground water from aquifers that are already quite depleted.

Also in Spain, coupled support is available for rice and tomatoes, even though these irrigated crops require high levels of water consumption and are grown in areas facing water scarcity issues. However, rice is typically produced on areas near to the sea, where the salinity of the soil is so high that rice production often has no alternative. This highlights trade-offs between the different pillars of sustainability, in this case environmental versus social sustainability. All cases are very context-dependent and cannot be generalised, while the screening for **maladaptations** means considering socio-economic indicators in conjunction with natural resource indicators.

Effects of the second pillar's measures on adaptation

Almost all rural development measures have intended or unintended effects on adaptation. However, assessing the effects of measures is rather difficult, as they not only support practices that are beneficial for adaptation but usually also encompass other actions or types of operation that are not relevant for adaptation. In addition, information on budget allocation and uptake are not available for different types of operation, so the adaptive effects are probably over-estimates in most cases.

- *Soft measures*

Training (measure 1) and advisory services (measure 2): even though climate change adaptation is often mentioned as an objective of these measures, most supported actions focused primarily on economic or other environmental subjects. Furthermore, the effects of the measures

[64] Examples include coupled support for nuts in rain-fed areas in Spain, avoiding abandonment of terraces that limit erosion in mountainous areas and, in the Netherlands, support for very extensive grazing in natural areas which do not meet the criteria for the basic payment scheme.

[65] M'barek et al (2017), Scenar 2030 - Pathways for the European agriculture and food sector beyond 2020.

have been hindered by a low level of programming and delays in implementation, which is problematic given the fact that, in several Member States or regions, there is no funding allocated to training activities beyond rural development support (e.g. in Romania).

Cooperation (measure 16) can promote adaptation to climate change thanks to support for the development and diffusion of innovative practices, better planning of resource management and support for diversification of agricultural holdings' activities; the measure has been programmed by most managing authorities. An example of using this measure for adaptation is the funding of operational groups, comprised of farmers and other stakeholders, created in the Agro-ecology project in France. They promote collective experimentation and knowledge exchange, facilitating a transition toward more sustainable practices.

Measure 19 (LEADER): a review of LEADER projects supported in the previous programming period (2007-2013) across the EU-28 showed that, overall, climate-relevant projects mostly focused on capacity building and energy efficiency, with a limited focus on more explicit adaptation activities[66].

- *Investment measures*

Measure 4 (investments in physical assets) has strong potential to support climate change adaptation, since investment in equipment and infrastructure can enable vulnerable farms and forest holdings to adapt to climate change through, for instance:

- improved resource efficiency for agricultural holdings (water efficiency, reduced soil tillage);
- storage facilities to increase water resource availability in agricultural holdings (including rain water collection);
- modernisation of livestock production units (recycling water or improving ventilation of buildings).

Non-productive investments linked to the achievement of agri-environment-climate objectives are also very relevant for climate change adaptation. Support is available, for instance, for the planting of hedges and trees against erosion, or the restoration of wetlands or peatland.

Interviewees in Spain (Andalusia) pointed out that the modernisation of irrigation systems improves the capacity of farmers to cope with droughts. However, it may also lead in some cases, in the long run, to poor adaptation in areas where the water resource is already depleted (as a result of increasing water demand with increases in irrigated areas, rather than changes in cropping patterns in these regions). Moreover, water savings that could be achieved by more efficient irrigation systems can be over-compensated by increasing the irrigated area or by switching to more water-intensive crops.

Another example of potentially poor adaptation concerns support for high-cost investments (heavy machinery), which can lead to a high level of specialisation by farms (to achieve economies of scale) and can lock farmers into specific systems that are more challenging to adapt to climate change. In addition, farmers who are financially weakened by heavy investments are also more economically vulnerable to climate shocks.

Measure 8 (forest management and investment) can also support a wide range of actions that are beneficial for adaptation of forests, and covers similar potential climate benefits to those of measure 4 (investment) and measure 5 (risk prevention). Through afforestation, it can: provide sustainable use of former agricultural land that would become marginal because of the effect of climate change; support agroforestry, which has multiple climate change adaptation benefits; improve forest resilience through improved risk mitigation (pest control, fire prevention, restoration); and improve the resilience of forests to climate change (introduction of adapted species, mixed stands, etc.). However, in few cases afforestation is done with fire-prone species

[66] Frelih-Larsen et al (2014), Mainstreaming climate change into rural development policy post-2013.

such as eucalyptus, thus increasing the risk of fires and the potential damage caused by these fires.

In most case study countries where the measure is implemented (seven out of eight), the measure is likely to have had some positive effect on farmers' adaptive capacity. For instance, in Aquitaine (France) and in Andalusia (Spain) sub-measure 8.3 (promoting fire protection) has been widely used to build infrastructure to mitigate fire risk; however, it is used much less to promote preventive actions (planting of resilient species, etc.).

Measure 7 (basic services and village renewal) has no intended effects on adaptation, but it may support various actions, such as the maintenance of pastoral activities (in Aquitaine), which are considered resilient to climate change.

- *Risk management measures*

Only a very low share of the EAFRD budget (0.8%) has been attributed to **measure 5 - disaster risk reduction**, which aims to support agricultural holdings' resilience to climate change. This measure supports preventive actions, e.g. investments in drainage systems in northern regions where more rain is expected in the coming years, the establishment of flood plains, or the planting of trees against erosion, as well as restoration after damage to improve the resilience of farming systems to climate change. According to the case study analysis, measure 5 has probably helped to reduce the vulnerability of some farmers, foresters and/or territories in Saxony-Anhalt and Croatia, where some adaptation-relevant projects have been funded.

Measure 17 supports risk management and thus improves economic resilience to shocks linked to the impact of climate change. However, this type of support may also have adverse effects on adaptation, by promoting risk-prone behaviour by farmers who feel protected. At least one risk management tool is available in the rural development programmes of Italy, France, Romania, Portugal, Hungary, Croatia, the Netherlands, Lithuania, Latvia and Malta, and of two regions: Castilla y León (Spain) and Flanders (Belgium). However, although CAP support for agricultural risk management has increased compared to the previous programming period, its share in the overall CAP budget remains very low (around 2% of Pillar II). The low level of programming for measure 17 is largely due to the fact that some Member States finance risk management using national funds (insurance in Spain) and that managing authorities tend to avoid measures that may lead to under-use of resources.

Part of **measure 6** (support for farm and business development) supports the diversification of activities on agricultural holdings. However, this sub-measure has been opened by only a minority of managing authorities and represents a limited share of total public expenditure at EU level. Therefore, the measure is unlikely to have significantly enhanced the diversification of activities across the EU. However, the measure also includes support for young farmers (sub-measure 6.1); up to 2018, 109 000 young farmers set up in business with CAP support. Case study interviews and the literature review have shown that young farmers are more likely to adopt new practices and technologies, taking into account sustainability issues such as adaptation to climate change and, more generally, sustainable management of resources.

- *Land management measures*

The **agri-environment-climate measure (AECM – measure 10)** has diverse potential effects on adaptation. A number of interventions under this measure help to improve the resilience of farms and society more generally by establishing areas of semi-natural vegetation and landscape elements, and by promoting practices that improve soil health and water retention in soils, limit soil erosion, improve resilience to floods, etc. For instance, cover crops, crop rotation, improved management of landscape features, zero tillage and increased use of forage crops are some practices that can be promoted by this measure and which can, in certain circumstances, be beneficial for adaptation. Furthermore, the measure may also improve resilience thanks to the conservation, use and development of varieties more resilient to droughts.

In most case study countries and regions, most commitments have been designed to address environmental objectives related to biodiversity, landscape and natural resources, particularly soil and water, but in all these Member States at least one scheme promotes adaptive practices. Assessing the effects of the measure on climate change adaptation is challenging, as most Member States have offered a wide range of measures pursuing several objectives, among which climate change adaptation is just one. To be more effective for adaptation, measures should tackle specifically the main climate challenges, which are most often location-specific.

Organic farming (measure 11) has the potential to build resilient food systems, mainly through crop diversification and improved soil quality. 8.0% of EU agricultural area is farmed organically and close to 65% of this area is covered by EU organic support.

Natura 2000 and Water Framework Directive payments (measure 12) can contribute to territorial adaptation through the protection of biodiversity and wetlands, as highlighted in case studies in Germany (Saxony-Anhalt), Czechia, France (Aquitaine), Ireland and Lithuania.

Areas facing natural or specific constraints (ANC – measure 13) supports the maintenance of farms in remote areas, thus limiting land abandonment and preventing higher fire risk. Importantly, it maintains a diversity of products, farming systems and habitats (including grassland) that is deemed important for adaptation at a higher level (by regions and EU society). However, in most case study countries, interviewees pointed out that the measure is seldom tailored to ensure that it supports systems resilient to climate change or adaptive activities.

In **conclusion**, several CAP measures have the potential to contribute to climate adaptation, mostly by maintaining or enhancing the diversity of crops and farming systems, protecting against soil erosion and floods, protecting against shocks and supporting necessary investments to adapt to new climate conditions. In addition, some GAECs can address climate adaptation, but generally Member States have not tailored GAECs sufficiently for this purpose, so their potential is not fully used. Case study interviews indicate that advising farmers on how to improve climate performance has been a low priority. In addition, some measures might have some unintended negative effects for adaptation depending on specific conditions, slowing some structural changes that could be necessary for adaptation. Obviously, the biggest contributions come from measures specifically designed to contribute to adaptation.

5.1.3. The contribution of technological and social innovation to achieving the CAP's goals on climate change

Innovation is identified as a key element of the Europe 2020 strategy to manage the multiple climate change challenges facing the agricultural and forest sectors. In the agricultural sector, both technological and social innovations have strong potential to contribute to the CAP's climate action goals by helping to limit GHG emissions and adapt to climate change in the livestock and crop sectors.

Based on the literature and interviews in case study countries, the evaluation support study compiled a non-exhaustive list of social and technological innovations, with potential effects on climate objectives. **Technological innovations** can be divided into different categories, such as:

- genetic improvement: e.g. increasing crops' resistance to heat/drought; better adapting crops' agro phenology (e.g. early variety selection); increasing crops' resistance to pests; increasing feed efficiency; improving animals' resistance to heat and disease; gender-selected (i.e. sexed) semen;
- biological innovations: e.g. on-farm anaerobic digesters (i.e. methanisation), which implies the digestion of organic material (e.g. manure, slurries and crop residues) by bacteria in sealed tanks to yield biogas and digestate; feed additives to reduce methane emissions (e.g. linseed, nitrate, or propionate precursors); low nitrogen feed to reduce ammonia emissions; nitrification inhibitors in soil (suppressing the microbial conversion

of NH_4 to N_2O); bio-control agents for plant protection (e.g. with auxiliary insects or bacteria);
- mechanical innovations: optimised irrigation equipment (e.g. drip irrigation, micro-sprinklers); optimised soil management equipment (e.g. direct seeding or shallow tillage equipment);
- knowledge based-innovations: assisting fertilisation with digital technologies (e.g. with GIS or field sensors); assisting irrigation with digital technologies (e.g. field sensors to map irrigation needs); information systems providing timely information to steer farm management mobile applications to recognise in-field diseases;
- climate-controlled environment: climate-controlled buildings for livestock, climate-controlled greenhouses.

Social innovations can vary, since they rely on stakeholders who decide to organise themselves to answer local needs. They can be related to:

- sharing knowledge: e.g. collaborative online tools, groups of farmers and stakeholders meeting in workshops or field visits, financing through crowdfunding and sponsorship;
- sharing resources on water management, sharing equipment;
- financing and insurance: through crowdfunding and sponsorship, mutual funds, forward contracts, insurance products;
- land conservation and management;
- breeding: organisation, conserving, selling seeds of ancient or local varieties;
- labelling: climate labels, participatory guarantee systems;
- organisation of food production systems: local food systems.

Climate objectives are rarely the sole or main objective pursued by stakeholders through these social innovations. However, many of them can significantly impact climate objectives directly (e.g. water management groups) or indirectly (e.g. organisations for conserving, exchanging or selling seeds of ancient and local varieties).

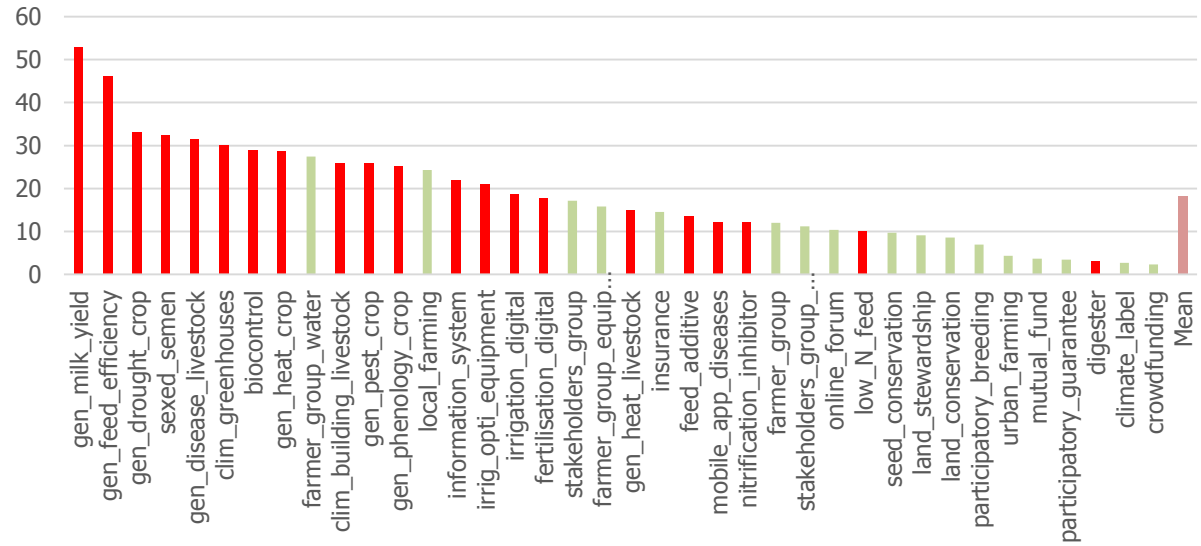
Data on the proportion of farmers using innovations at EU level is scarce. Therefore, a survey of farmers' advisers and representatives was carried out for the evaluation support study, gathering the results on **adoption rates** for the 10 case study countries. The results show that adoption of innovations is, on average, higher for **technological innovations** (24%) than for social innovations (11%), while the cost-effectiveness of mitigation technologies is strongly related to the regional specificities of the farming sector. For technological innovations, the use of genetically improved seeds or animals is quite common at EU level, as is the use of sexed semen and climate-controlled greenhouses and livestock buildings. For example, EU average milk yield has increased by 67% since 1990, allowing for a production increase of 5%, while the number of dairy cows has decreased by close to 40%, contributing significantly to the GHG emission reductions in Europe since 1990.

In this context, it is important to mention that, as highlighted by Peyraud et al[67], designing climate-friendly, innovative livestock systems (to e.g. reduce emissions per unit of output) cannot be pursued at the expense of other dimensions, such as animal welfare and reducing the risk of developing antibiotic resistance.

Social innovations are less frequently implemented by farmers, except for those participating in water management groups (and, to a lesser extent, in other stakeholder and farmer groups) and in local farming systems. The adoption rate also differs greatly between Member States: some, such as the Netherlands, Germany and France, seem to rely extensively on both technological and social innovations, as confirmed by the survey results; others, such as Lithuania, Ireland, Croatia and Hungary, rely less on innovations.

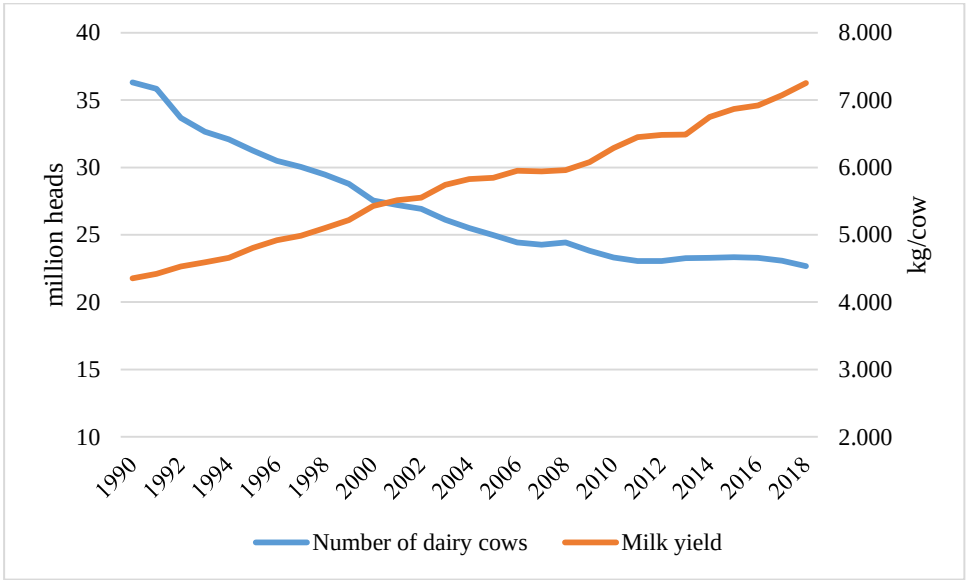
[67] European Commission, Peyraud and MacLeod (2020), Future of EU livestock: how to contribute to a sustainable agricultural sector.

Figure 4: Innovation adoption rate per technological (red) and social (green) innovation (%)*



Note: * For innovation related to livestock (and crop) production, the figure shows the percentage of livestock (and crop) producers who were judged to have adopted the innovations.
Source: Evaluation support study

Figure 5: Development of dairy herds and milk cow yields in the EU-28 since 1990



Source: DG Agriculture and Rural Development, based on Eurostat

'Fostering innovation' is a cross-cutting objective of the CAP. In the EAFRD, innovation is also specifically targeted as both a cross-cutting priority and as the first of the six priorities ('Knowledge transfer and innovation'), so many measures can influence the emergence and adoption of innovations.

According to case study interviews, the mainstreaming of climate change actions in measures 1 and 2 increased but remained generally low in the current CAP, so the impact of these measures on climate-related innovations might be limited. For measure 4, only some Member States specifically target innovations that can have positive effects on climate objectives. For instance, GPS technology for tractors and for spraying machinery are supported in Ireland, irrigation modernisation is supported in France and innovations are specifically targeted by a type of operation in the Netherlands called 'a guarantee for the introduction onto the market of risky innovations'.

Under the EAFRD, 98 out of 112 rural development programmes (in 27 Member States) provide support for more than 3 200 EIP operational groups. Although these groups can work on a wide

range of topics, climate objectives are included within the EIP-AGRI objectives and the work of the operational groups should be in line with these objectives.

Several other EU policies and initiatives are promoting innovations in the agriculture and forest sectors that can have an impact on climate change objectives (e.g. Horizon 2020, the European Institute of Innovation and Technology (EIT), the LIFE programme, and policies supported by European Structural and Investment Funds other than the EAFRD).

For example, LIFE BEEF CARBON is a voluntary European initiative that aims to reduce GHG emissions per unit of beef (carbon footprint) by 15% over a 10-year period on 2 172 farms in four large beef-producing countries. The outcome shows that mitigation practices are not all costly to adopt. There are different solutions that can reduce the carbon footprint of a farm, such as optimising the arrival (births) and departure of animals (slaughterhouse), to reduce the presence of unproductive animals on the farm. Reviewing the cropping system can be another solution; for example, feeding the cattle from the meadows and the fodder produced on the farm reduces emissions linked to feed production and transportation. In addition, using animal manure avoids the purchase of fertilisers.

Technological and social innovations in the agricultural sector have strong potential to contribute to the CAP's climate action goals, but their overall impact depends also on pedoclimatic conditions, farming systems, location and the way in which the innovative solutions are implemented. In addition, the uptake of mitigation practices and technologies depends on their costs and the potential level of incentives. The CAP, or a system of carbon pricing[68], can provide the relevant incentives. According to the JRC's 'Economic assessment of GHG mitigation policy options for EU agriculture'[69], mitigation practices and technologies in the EU have the potential to bring about a decrease in agricultural emissions of between 15 and 35 million tonnes of CO_2eq (for a carbon price between EUR 20 and 100 per tonne of CO_2eq respectively), a reduction of up to 9% compared to business as usual. The effect on LULUCF emissions would represent an additional reduction of 37 to 45 million tonnes of CO_2eq.

5.2. Efficiency

The evaluation assesses the efficiency of the CAP's contribution to achieving the climate action objectives, particularly the targeting, administrative costs and management related to implementing the CAP 2014-2020 measures.

This efficiency assessment could only be done to a limited extent. One of the key methodological difficulties is the absence of quantified information about many of the benefits of the measures under consideration, due to which it has not been possible to quantify the full impact of tracked CAP climate spending. Even the quantified results available with regard to mitigation are subject to significant caveats regarding their accuracy. For adaptation, it has not been possible to quantify any benefits due to the site-specific and uncertain nature of the benefits associated with reducing vulnerability to risk. In addition, the analysis of administrative burdens and costs was impeded by the fact that Member States do not usually record the administrative costs and burdens associated with individual measures.

[68] Carbon pricing is an instrument that captures the external costs of GHG emissions - the costs of emissions that the public pays for - and ties them to their sources through a price, usually in the form of a price on CO_2 emitted. A price on carbon helps shift the burden for the damage from GHG emissions back to those who are responsible for it and who can avoid it. A carbon price provides an economic signal to emitters, and allows them to decide to either transform their activities and lower their emissions, or continue emitting and paying for their emissions (World Bank, https://carbonpricingdashboard.worldbank.org/what-carbon-pricing).

[69] European Commission, Perez Dominguez et al (2020), Economic assessment of GHG mitigation policy options for EU agriculture: A closer look at mitigation options and regional mitigation costs - EcAMPA 3.

5.2.1. Efficiency of first pillar measures

The evaluation support study analysed budget allocations for climate action across the CAP. For that, the EU's climate tracking methodology was used to track climate spending in the EAGF and EAFRD. The calculation for Pillar I is based on allocating one of three possible climate markers[70] (0%, 40% and 100%) to each item of expenditure; it does not distinguish between adaptation and mitigation actions. According to the tracking methodology, the shares of direct payments contributing to climate change through greening measures are 0%, 4% and 10% for crop diversification, for EFA and for the permanent pastures measures respectively, for a total of 14% (i.e. EUR 6.1 billion per year). A further EUR 2.5 billion is attributable to direct payments other than greening.

For mitigation, the evaluation estimated that the environmentally sensitive permanent grassland measure (**ESPG**) **measure** had led to an annual reduction of 15.8 million tonnes of CO_2eq (see Chapter 5.1 on effectiveness); no quantified result could be modelled for the permanent grassland ratio. If all the climate spending associated with the permanent grassland measure were to be attributed to ESPG, the simulated reductions in emissions achieved by the ESPG measure would be obtained at a cost of around EUR 220/t CO_2eq. However, ESPG represented only 16% of permanent grassland subject to greening, with the remaining 84% subject only to the ratio. Therefore, the evaluation assumed that the mitigation benefits of the ESPG measure are obtained at a cost of EUR 0.7 billion or EUR 44/t CO_2eq.

For the **EFA measure**, EUR 1.75 billion of attributed spending is associated with mitigation benefits of 4 million tonnes, at a cost of EUR 437/tonne CO_2eq. It is also worth remembering that climate action is not the primary objective of the EFA measure.

The analysis suggests that, overall, using the tracking methodology and the simulation, EUR 6.1 billion of expenditure on the greening payment in 2016 secured a simulated 19.8 million tonnes of CO_2eq at a cost per tonne of close to EUR 280. This figure is a rough estimate, to be taken with caution in view of the limits in the modelling exercise explained in Chapter 5.1.1 and the simplistic approach of the tracking.

According to the evaluation on **greening**[71], compliance costs for farmers were assessed as being negligible for all except highly specialised arable farmers, for whom the crop diversification measure entailed costs. On the other hand, according to this evaluation, administrative costs for farmers are quite high, especially for the EFA measure. In contrast, according to the Ecorys study on the administrative costs of the CAP[72], farmers perceived compliance with the greening provisions (permanent grassland, EFA) as a higher source of costs than the administrative burden related to submitting aid applications. The study indicated that most farmers did not perceive a substantial increase in their administrative burden due to new rules and requirements (e.g. greening) introduced by the 2013 CAP reform, although the measurement and declaration of EFAs was mentioned as a main administrative task.

For the other **first pillar non-greening payments**, the tracking methodology attributes 20% of those direct payments to climate and assigns it a marker of 40%. On this basis, a further EUR 2.48 billion is considered to be spent yearly on climate. As for cross-compliance, only GAEC 4, 5 and 6 are identified as directly addressing soil and carbon stock, while other GAEC

[70] Since 1998, the Development Assistance Committee (DAC) of the Organisation for Economic Cooperation and Development (OECD) has set up the Rio markers system. This system consists of policy markers to monitor and statistically report on the development of finance flows targeting the themes of the Rio Conventions, namely biodiversity, desertification, climate change mitigation (i.e. reductions in or absorption of greenhouse gas emissions) and climate change adaptation (including climate risk mitigation and vulnerability reduction).

[71] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cmef#evaluation

[72] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cmef/regulation-and-simplification/analysis-administrative-burden-arising-common-agricultural-policy_en

standards and statutory mandatory requirements may indirectly also address mitigation. However, an overall assessment of the cost-benefit of GAECs and statutory mandatory requirements and, more generally, of the non-greening direct payments in respect of climate benefits is not possible due to the lack of reliable quantitative evidence for both benefits and costs.

5.2.2. Efficiency of second pillar (rural development) measures toward climate action

Ten out of the 19 rural development focus areas are considered to be climate-relevant. For Pillar II, the tracking methodology[73] is different to the minimum of 30% spending on measures addressing climate and environmental objectives, which is required by Article 59(6) of the Rural Development Regulation. The tracking methodology allocated coefficients according to how strongly associated with climate each focus area is considered to be. A coefficient was thus associated with each focus area (100% in eight cases, 40% in two), which has to be multiplied by the corresponding budget to calculate the budget dedicated to climate. However, it is important to note that many rural development measures addressing climate-relevant focus areas have rather broader environmental objectives, and not specific climate objectives (e.g. organic farming, Natura 2000 compensation).

A focus area is considered to be beneficial for mitigation when it covers emission limitation, energy saving, improved soil management, enhanced fertilisation and carbon management. A focus area is identified as positive for adaptation when it covers risk management, improved soil management and water management. Based on these criteria, some focus areas have been identified as beneficial for both adaptation and mitigation objectives and other focus areas for only one of these objectives. For priority 4 (restoring, preserving and enhancing ecosystems), expenditure has not been disaggregated between the focus areas. As both focus areas 4B and 4C are positive for both adaptation and mitigation, all priority 4 spending has been treated as positive.

The results show that the budgets dedicated to mitigation and adaptation are similar, EUR 16.5 billion and EUR 16.9 billion respectively in 2015-2016, but they overlap to a considerable extent. The analysis carried out (see Chapter 5.1 on effectiveness) simulated a reduction attributable to Pillar II of 6.4 million tonnes CO_2eq based on the uptake of measures in 2016. It should be noted that some of the Pillar II measures for which mitigation effects could not be quantified account for a large part of the tracked climate budget (especially measure 11 – organic farming). As a result, the calculation for the efficiency of rural development measures might be an underestimate. The evaluation suggests that, if the unquantifiable benefits are not included, simulated reductions achieved by rural development measures are achieved at a cost of EUR 194/tonne.

The vast majority of the budget, EUR 70.7 billion, is programmed under priority 4 (45.8% of Pillar II). This is mainly because the large budgets dedicated to the AECM, organic farming and support for ANC have been mostly dedicated to priority 4. However, as described in chapters 2 and 5.1, neither organic farming (measure 11) nor the support for ANC (measure 13) are measures with a climate-related intervention logic. Indeed, no emission reductions resulting from measure 13 could be simulated, and for measure 11 only some reductions in emissions could be simulated. Nevertheless, it is important to note that organic farming contributes to emission reductions through the limited use of chemicals, the production of which also leads to emissions. It also contributes to agricultural holdings' adaptation towards more resilience.

For priority 5, which has climate as its principal objective, only EUR 11.9 billion (7.7% of Pillar II) has been dedicated to it, and in six rural development programmes priority 5 is not

[73] The methodology for climate tracking for the EAFRD is set out in annex II of Commission Implementing Regulation (EU) No 215/2014 of 7 March 2014.

programmed at all[74]. This is also illustrated by the French case study, which found that some managing authorities have allocated the greatest budget to a single priority (usually priority 4) to reduce administrative complexity. According to case study interviews, the Netherlands chose to address agricultural emissions through its national policies and therefore no measures were programmed under priority 5. The evaluation support study also revealed that certain Member States (e.g. Hungary, Romania, Bulgaria, Portugal and Spain) did plan to spend more than the average on mitigation, while others (Scandinavian Member States, Poland, Austria and Czechia) planned to spend less. Therefore, the targeting of budgets toward priority 5 is quite low and varies between Member States.

5.2.3. Efficiency gains

The scope for efficiency gains in respect of the CAP measures addressing climate action is examined through case study interviews and literature review. They consider how the budget might have been spent so as to achieve better results for adaptation and mitigation.

Economic (via risk management tools) and agronomic (via e.g. diversification) adaptation usually benefits private interests more than the public good, and mitigation schemes may have private co-benefits. The evaluation found that Member States have made little use of measures such as loans and well-designed risk management tools to leverage private finance and internalise risk.

The analysis also pointed out the importance of **targeted approaches** through many cases where better targeting of support would lead to an increase in efficiency. For example, protecting carbon-rich soils such as peatland is particularly beneficial to climate mitigation, compared to protecting other soils. Targeting has been little used in the 2014-2020 CAP, due either to the way measures are designed or to the choices made by Member States. However, there are a few examples where targeting has led to an improvement in efficiency. For instance, under cross-compliance, Germany and Czechia have rules under GAEC 5 (minimum land management reflecting site-specific conditions to limit erosion) which restrict the crops that can be grown and how the soil may be cultivated in areas judged to be at risk of erosion by water. Targeting in this way improves the ratio of benefits to costs.

For the EAFRD, eligibility and selection criteria allow managing authorities to focus on particular localities, social structures and farm types. However**,** the targeting is rarely used to focus on climate action. Interviews in several Member States and regions (Andalucía in Spain, Czechia, Ireland, Lithuania and Saxony-Anhalt in Germany) pointed out that the targeting of mitigation hotspots or vulnerable and/or resilient areas in their rural development programmes is limited and could be significantly improved. An example which illustrates this lack of targeting is the rural development programme in Saxony-Anhalt, which does not address the protection of peatland even though the region has a considerable amount of peatland and protecting/restoring peatland is one of the most carbon-efficient measures available.

As previously described, some measures that do not have explicit climate objectives are nonetheless relevant for climate. To achieve better results, it is thus important to demonstrate the climate benefits which can be achieved through the use of such measures. A recent study for the European Commission calls for a detailed assessment of the climate results and relevance of measures to improve the targeting and monitoring of climate actions[75]. A clearer and more transparent intervention logic for climate could help managing authorities to achieve that.

The evaluation also highlighted the role of **screening for maladaptation** that could avoid public expenditure on infrastructure, or on sectors that may increase vulnerability in the medium to

[74] In Finland-Aland, France-Lorraine, France-Mayotte, Germany-Hesse, Slovenia and the Netherlands.

[75] Forster et al (2017), Climate mainstreaming in the EU budget: preparing for the next MFF.

long term, such as irrigation infrastructure in areas with depleted water resources. It could also avoid promoting excessive specialisation by whole geographical areas, thus improving efficiency. The rural development programmes examined in the case study countries contained no evidence that such screening practices are applied.

5.2.4. Administrative burden and simplification

The annual administrative costs for **national administrations** for both pillars are estimated at around 3.5% of the budget, which is rather cost-effective[76]. For **beneficiaries**, costs related to rural development measures were estimated in 2011 at 4.7% of total public expenditure (including national co-financing).

The evaluation could not quantify the administrative burden of individual measures addressing climate action other than the Pillar I greening measure. The evaluation support study on greening estimated that, for most Member States, the one-off implementation costs of the greening measure are between 0.24 EUR and 0.69 EUR per hectare, with running costs of between 0.12 EUR and 0.60 EUR. They arose mainly from on-farm controls and the obligation to map landscape features into the Land Parcel Information System (LPIS).

Costs to farmers are estimated between EUR 86 million and EUR 217 million a year (i.e. roughly between 0.7% and 1.8% of the total public administration costs). The estimated additional annual administration costs associated with the greening measure account for 3.0 to 8.5% of the total public administration costs associated with the management of direct payments. The administrative burden of the greening measures is especially associated with their management and control, although there has been some simplification since 2015.

Although the analysis could not quantify the administrative burden of rural development measures, some complexities related to the new framework for strategic planning of rural development programming and implementation were reported during case study interviews and also in the literature. These include: the difficulty of implementing the requirements for clear identification of needs, targeting of support and attribution of spending to focus areas and objectives, due to shortages of suitably trained staff; the obligation to enhance coordination between the different European Structural and Investment Funds; and the complexity of some measures (e.g. measures 1 and 2).

Case study interviewees also expressed concern about the additional level of administrative control and monitoring. The complexities involved have led some Member States to include fewer measures in their rural development programmes than in previous programming periods and to fund some actions through national funds instead, to focus measures on a few focus areas to simplify monitoring, or to avoid tailoring measures to local needs.

5.3. Coherence of CAP measures

The evaluation assesses whether the CAP measures and instruments within the CAP 2014-2020 deliver a coherent contribution to the specific objectives of climate action. It analyses whether they are consistent and complement each other, or whether there are conflicting objectives and/or incentives within the CAP (internal coherence) and/or with respect to other EU or national policies (external coherence) that may compromise the effectiveness and/or efficiency of the relevant measures under evaluation.

5.3.1. Internal coherence of the CAP in addressing climate action

The evaluation assesses the internal coherence among CAP 2014-2020 measures contributing to the general objective of climate action. The way CAP measures may be used together is usually

[76] DG Agriculture and Rural Development Annual Activity Report (2019).

coherent, but does not produce synergies with respect to climate action; apart from a few exceptions, the combination of CAP measures does not strengthen the impact that the measures have individually on climate action nor does it worsen it.

In most case study countries, **good examples of coherence** were identified between the **GAEC requirements, greening and some AECMs** in relation to climate action and through the use of soft measures. These measures together have strong potential to protect and enhance soil carbon in agricultural soils. Several CAP measures that promote cultivation of leguminous crops can work in synergy to promote carbon stock increase in soils, including: coupled support for protein crops; the greening EFA measure (27 Member States have allowed leguminous crops as EFAs); and the AECM (e.g. in Spain, France, Poland and Germany, but only in some regions). Also, legumes can give some farmers the option to diversify their cropping pattern under the greening crop diversification measure. Overall, the association of several measures targeting cultivation of leguminous crops gives farmers a greater incentive to grow these crops.

Similarly, the implementation (and/or retention) of landscape features, catch and cover crops, buffer strips and agroforestry were also highlighted as beneficial to carbon stocks and are promoted under various measures, mostly the greening EFA measure, GAECs, AECMs, forestry under measure 8 (for the creation of new agroforestry areas) and investment under measure 4 (e.g. when it supports the creation of landscape features). However, their contribution to the increase of carbon stocks depends on national/regional implementation choices. In particular, the AECM can be used to complement both cross-compliance and EFA measures.

The **permanent grassland measure** prevents the reduction of permanent grassland via ploughing (through the ban of ploughing on ESPG), and thus benefits carbon stocks. In addition, there are several CAP measures with which the permanent grassland measure (both the ratio and ESPG) can interact and may provide synergies to protect carbon stocks. For example, the AECM and the Natura 2000 payment may act in synergy with the ESPG measure, improving grassland management for better carbon sequestration. According to results from the evaluation support study, three Member States have offered payments under AECM for the conversion of arable land to permanent grassland (Germany, Czechia and the UK-England). However, these measures can also be designed to serve other objectives (particularly biodiversity) and therefore the potential synergies depend on whether the main objective was to favour carbon sequestration when designing the measures at national/regional level.

Soft measures can facilitate the implementation of actions which are beneficial for carbon stocks and are promoted under other CAP measures, e.g. cultivation of legumes, grassland management, agroforestry, etc.

There are some exceptions where the analysis shows theoretically synergistic or conflicting relationships between CAP measures, depending on Member States' implementation choices or on certain circumstances. This is referred to as 'relationships having mixed impacts'.

The analysis also identified some instances of theoretical **incoherence**. For example, the CAP allows Member States a considerable degree of flexibility in implementing CAP measures. However, the multitude of general and specific CAP objectives and national, regional and local needs might lead to an inherent degree of incoherence among measures addressing climate change.

Some Member States have designed eligibility criteria for **permanent grassland** in a restrictive way, even where this meets the criteria set out in the Direct Payments Regulation. Doing so means that the carbon stock in the excluded areas cannot benefit from the protection afforded by cross-compliance and support through greening. Excluding areas from these protections is incoherent with climate objectives, although it may serve wider policy objectives important to the Member State concerned, such as focusing income support where it is most needed.

The exemption of beneficiaries of the **small farmers scheme** from greening goes against mitigation. Small farmers account for a large group of beneficiaries and, although the area

covered by small farms only accounts for 6.4 million hectares (7% of the total), their exemption represents a sizeable missed opportunity for climate action.

Voluntary coupled support for livestock gives rise to a number of likely negative relationships. One common example of incoherence is the choice by most Member States to significantly support ruminants, due to the benefits associated with coupled support such as economic and social benefits even though almost half of the agricultural emissions arising within the EU come from enteric fermentation (mainly ruminants) and the management of manures of all livestock[77].

In addition, in a few countries, there are positive examples of targeted location of support and the way the support for livestock is implemented, for example:

- In Andalucía, the livestock systems receiving coupled support are mainly extensive (in contrast to the rest of Spain) and located in ANC with steep slopes which are often prone to water scarcity. This means that the impact of coupled support could be relatively positive for climate in this specific case, by helping to maintain grassland systems on steep parcels which may otherwise suffer from soil erosion following abandonment and for which alternative uses may increase water consumption.
- In France, the negative effects of coupled support for livestock on climate could be limited by the fact that the support decreases with the number of animals.

Coupled support for livestock can have a positive impact on climate, if it supports extensive livestock farming which would otherwise be replaced by arable farming (to the extent that the greening permanent grassland ratio obligation and other constraints permit it). This appears to be happening in, for example, parts of France (Aquitaine) and Spain (Andalucía)[78]. Nevertheless, this support is both widely available and often unconstrained by eligibility rules (such as stocking densities[79]), which could limit its impact on production and emissions.

Beyond livestock, coupled support in other sectors was found to be potentially incoherent in relation to climate adaptation. For example, coupled support is also provided to support the fruit and vegetable, cotton and rice sectors in Andalucía, whose production drives the overexploitation of water resources in the region but also brings significant social benefits in terms of employment.

The availability of **direct payments** to farmers may act as a barrier to afforestation/creation of woodland, supported under measure 8.1 (forest investment). Similarly, inconsistencies were found in some case study countries where direct payments are granted to agricultural activities taking place on peatland/wetland (e.g. the Netherlands and Lithuania) with no conditions to prevent them from being damaged (which results in high levels of GHG emissions). In Hungary, agricultural land for which direct payments are granted often has to be drained to be cultivated, which increases an already high probability of flood risks and flood damage when they occur.

Cases of both **coherence and incoherence** were found among **payments for ANC** (measure 13). Although it is not a climate action measure, it has potentially positive climate effects by maintaining grassland systems (in Aquitaine, Andalucía and Croatia). Most beneficiaries in Andalucía are located in steep or mountainous regions, which means that this support is relatively positive in terms of climate action. This is because it is likely to help maintain agricultural activity that is extensive (this is specific to Andalucía and unlike other regions of

[77] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cmef/farmers-and-farming/future-eu-livestock-how-contribute-sustainable-agricultural-sector_en

[78] Even in these positive cases, from a strict climate mitigation point of view, the net impact would depend on whether the benefits of maintaining grassland systems (carbon stocks, avoided N_2O emissions) outweigh the emissions from the livestock themselves.

[79] The scheme as it is currently designed does not allow for restricting support to certain types of farming where the sector in general is undergoing difficulties.

Spain), prevent soil erosion and limit fire risks (while providing important biodiversity and culturally beneficial outcomes).

One example of potential incoherence is the way this measure is implemented in Hungary, as it helps to retain agricultural production on lower quality land. In some regions, this is likely to require more inputs to generate the same quantity of output, leading to higher emissions in relative terms (i.e. per unit of output, because yields are lower for the same amount of input).

Member States have generally chosen to allocate substantial shares of the rural development budget to measure 13. Although not all Member States have programmed the measure, and there is a high variation as to its overall share of the budget, in total nearly 17% of the EAFRD budget is allocated to this measure. The fact that these significant budget amounts count towards the 30% spending requirement for climate action seems incoherent, given that it is not a climate measure per se and has both positive and negative impacts on climate action objectives.

These examples show that the CAP as a whole could do better in preventing inappropriate land management with respect to climate action. There appears to be a lack of climate safeguards, which would be evident if climate considerations were more systematically taken into account in the implementation decisions.

In **conclusion**, some incoherence between the CAP measures was identified. This limits the coherence of their overall contribution towards the CAP's climate objectives, although CAP measures generally are not intended to respond to climate objectives. While they can interact in a way that incidentally has a positive impact on climate action, this interaction is generally not designed or implemented in a way that seeks to steer their contribution towards more climate action. There is therefore ample scope to improve the CAP's internal coherence.

Details on the combined effect of measures (i.e. whether they are expected to be neutral, to reinforce or to undermine the theoretical impact they are expected to have on climate action) can be found in Annex 4.

5.3.2. Coherence of the CAP in addressing climate action with other CAP objectives and broader EU and national policy objectives

Coherence of the CAP climate measures with the other general objectives of the CAP

The evaluation concluded that, overall, the CAP climate measures are considered to be coherent with the broader aims of the CAP's three general objectives for the 2014-2020 period, namely sustainable management of resources, viable food production and balanced territorial development. The implementation choices are important to avoid conflicts and to secure synergies between CAP climate measures and wider CAP objectives. In some case studies, key measures that were flagged as being potentially highly synergistic (e.g. advisory services), are not always made use of within rural development programmes (in Saxony-Anhalt and Czechia), and there is a wider question of how to maximise the opportunities offered by these potential synergies.

As noted in a number of case studies, including the Netherlands, Lithuania and Romania, the lack of incoherence is passive. It does not necessarily signify active promotion of coherence and a drive to maximise synergies between climate mitigation and adaptation and wider goals.

Coherence with other EU policies

The CAP climate-focused measures are broadly coherent with other EU policies related to climate change (see details in Annex 4). However, there are instances where further opportunities for integration exist, particularly with the EU soil thematic strategy and the Floods Directive. Therefore, although CAP climate-focused measures and other relevant EU policies do not conflict in principle, some of the rules in place do not safeguard against conflicts happening in practice when the measures are implemented.

Coherence with relevant national policies

The analysis of the case studies has identified multiple approaches to national climate delivery, within national climate mitigation and adaptation policies, to the requirements placed on the agricultural sector and to the use of the CAP measures. The CAP and, particularly, the rural development programmes are noted in all case studies as being an important policy through which to deliver climate goals at national and regional level.

However, interviews in the case study countries revealed that choices on implementing the CAP at national level often do not aim to proactively pursue synergies in relation to climate action and delivery. The Lithuanian case study shows that, although CAP rules do not impede proper climate action, interviewees felt that the government took a passive role in this and that they did not seek to actively promote coherence or to maximise synergies. In contrast, France does have in place a mechanism for reviewing its regions' rural development programmes and ensuring that climate goals are taken into account.

In some case studies, interviewees questioned whether the current implementation of CAP support was coherent with the overarching goal of climate mitigation in the long term. For example, analysis of Irish and Dutch policies noted that, while use of CAP measures is not incoherent with climate goals, the approach to the use of CAP measures does not complement the areas of greatest need. Ireland has yet to define how CAP measures can be used to protect peatlands; as noted by agricultural experts, although Ireland's objective is to move towards carbon neutrality in agriculture, it still has to plan what this will actually entail and the means to deliver it. In the Netherlands, CAP funding focuses on renewable energy, biodiversity and manure management without addressing the broader challenges associated with the sector's climate footprint.

A number of case studies (i.e. Czechia, Germany, Romania and France) noted that key policies were not integrated into Pillar I and Pillar II implementation during the 2014-2020 period due to key climate policies still being under development. Overall, in the case study countries, climate issues are increasingly seen as important within the agricultural sector and climate goals are expected to be of increasing importance post-2020 (such as in Germany, where the 2050 national climate protection plan explicitly highlights the future role of the CAP).

5.4. Relevance to needs

Relevance is the extent to which the objectives of an intervention are pertinent to current needs, problems and issues. The evaluation assesses the relevance of the general CAP objective of climate action and the relevance of CAP measures targeting this objective in relation to the actual needs at EU, national and farm level.

5.4.1. Relevance of the CAP objective of climate action to the needs at EU, national and farm level

Climate-related needs at EU level are expressed in a range of legislative and other commitments on GHG emission reductions set out in the EU's climate and energy framework to 2020[80]. The evaluation found that both the CAP's general objective of climate action and the more specific sub-priorities set out in the Rural Development Regulation are broadly framed; as a result, each corresponds to a range of needs expressed at EU, national and, in most cases, farm level. The CAP's objectives of climate mitigation and adaptation are clearly relevant to EU-level needs, represented by the Kyoto commitment and adaptation strategy respectively, while its sub-priorities are relevant to a range of EU needs.

[80] For further details, see Chapter 2.

Relevance to Member States' needs

Agriculture is a significant source of GHG emissions in all 10 of the case study countries, so the CAP's objective of reducing emissions is relevant to all of them. However, only four of them set a target for the sector[81] (Czechia, Germany and France for agriculture as a whole, and the Netherlands for intensive horticulture under glass). In Croatia and Hungary, there are no national policies that require agriculture, forestry or other rural sectors to reduce emissions, while Lithuania and Romania also have no quantified target. Ireland has an aspiration to achieve carbon neutrality (taking both agricultural emissions and LULUCF into account) by 2050.

Member States report more detailed climate needs in their rural development programmes. The CAP sub-priorities relevant to the highest number of needs identified in the case study countries are improved water management (a need explicitly identified in all case study programmes) and more efficient water use (all but Lithuania), followed by preventing soil erosion or improving soil management (all except Czechia and Lithuania). In contrast, few Member States explicitly identified needs to protect and sequester more carbon in agriculture or forests. The Netherlands identified no need relating to forestry, while Croatia and Hungary highlighted the need to increase forest areas and Saxony-Anhalt to preserve them (both of which have the potential to improve carbon conservation and sequestration even if not explicitly done for that purpose).

Relevance to farmers' needs

Evidence of needs at farm level is shown by the results of the public consultation on the future of the CAP carried out for the Commission in 2017, during which farmers identified protecting biodiversity (20%), more sustainable use of pesticides and fertilisers (19%), reducing soil degradation (17%), preserving genetic diversity (15%) and rationalising the use of water (13%) as the most important environmental challenges facing agriculture. Only 5% of farmers selected reducing environmental risks such as fire and floods. 58% of farmers felt that the CAP addressed these challenges only to some extent, or not at all.

According to the participating farmers, the most important objectives the CAP should pursue in order to tackle climate change are 'providing sustainable renewable energy sources' (20%), followed by 'improving climate change adaptation and enhancing the resilience of agricultural systems' (16%) and 'fostering carbon conservation and sequestration in agriculture and forestry' (15%). A high proportion of farmers felt that afforestation (19%) and improved forest resilience (18%) should be objectives of the CAP.

The small-scale survey carried out for this evaluation revealed that individual farmers and foresters do not have explicit mitigation needs. For farms and forests, the sub-priorities of carbon sequestration (per se), increasing the share of renewable energy and GHG mitigation are not necessarily shared by farmers themselves, given that they may not always yield private benefits; unlike failure to adapt, failure to mitigate does not by itself compromise the short-term viability of an individual farm or forest enterprise. Despite this, the survey showed that those farmers and foresters who were aware of which actions would reduce emissions were likely to consider those actions to be relevant to their own farm. The CAP's climate objectives are therefore relevant to the needs of farmers and foresters in this context.

5.4.2. Relevance of CAP measures in contributing to climate action and the related specific objectives

The climate-specific objectives are: pursuing climate change mitigation and adaptation; energy efficiency; and shifting to a carbon neutral and climate-resilient economy. Certain CAP interventions that are relevant or partially relevant to the EU's climate needs are mainly voluntary for Member States. However, key measures such as cross-compliance, the greening

[81] Agriculture is grouped with other sectors under the Effort Sharing Regulation, for which sectoral targets are not required. Instead, there is an overall target for all sectors.

measures, the FAS and the AECM are compulsory for Member States. Cross-compliance and greening are also compulsory for farmers.

In contrast, the relevance of other CAP measures is constrained by the fact that they are voluntary for farmers. While voluntary measures give Member States and farmers the flexibility to target the needs in their territories with the appropriate interventions, there is no requirement for farmers to take up those measures in areas where the highest needs have been identified. This is compounded by the farmers' perceived needs not always corresponding with the climate needs identified by the managing authority, i.e. farmers often focus on adaptation challenges rather than mitigation.

This situation is illustrated in the table below.

Table 5: Relevance of CAP measures to EU climate objectives and needs

EU-level objective	Emission reduction		Increasing removals	Replacing emissions	Climate adaptation
	Reducing GHG emissions	Energy efficiency			
Voluntary redistributive payment	N	N	N	N	N
Greening (crop diversification)	P	N	N	N	P
Greening (PG ratio)	N	N	R	N	N
Greening (ESPG)	N	N	R	N	N
Greening (EFA)	P	N	P	N	P
Voluntary payment ANC	N	N	P	N	N
Voluntary coupled support	P	N	N	N	N
Small farmers scheme	N	N	N	N	N
Cross-compliance	P	N	P	N	P
Farm advisory system	P	N	P	N	R
M1: Knowledge and information	P	P	P	P	P
M2: Advisory services	R	R	R	R	R
M4: Physical assets	R	R	P	R	R
M5: Disaster risk reduction	N	N	P	N	R
M6: Farm business and development	P	P	N	P	P
M7: Basic services	P	P	P	R	P
M8: Forest investments	R	R	R	R	R
M10: Agri-env-climate	R	R	R	N	R
M11: Organic farming	P	N	P	N	P
M12: N2000 and WFD	N	N	P	N	P
M13: ANC	N	N	N	N	P
M15: Forest-env-climate	R	N	R	N	R
M16: Cooperation	P	P	P	P	P
M17: Risk management	N	N	P	N	R
M19: LEADER	P	P	P	P	P

Score	Meaning
N	Not relevant (N)
P	Partially relevant (P)
R	Relevant (R)

Note: There is a distinction between the column for reducing GHG emissions – which is the process by which emissions from agricultural practices are reduced as a result of implementing the measure – compared to the column for the increase in removals

and maintenance of stocks. This is the process by which emissions do not increase as a result of the measure being implemented, or where the measure leads to more emissions being removed from the atmosphere.
Source: Evaluation support study

Despite the fact that the two largest sources of GHG emissions from agriculture in the EU are non-CO_2 emissions (N_2O and CH_4) from livestock and from managed agricultural soils, CAP measures relevant to reducing these emissions from **livestock** are all optional, with the exception of 'statutory mandatory requirement (SMR)' 1 (improving compliance with the Nitrates Directive) in cross-compliance. Optional measures through which Member States may choose to address livestock management can take the form of advice and training, investment support for better collection and management of manure, encouragement of lower or more appropriate stocking density (agri-environment-climate) or the development of innovative approaches (cooperation). Member States are only required to make available the agri-environment-climate measures but are not required to offer options relevant to non-CO_2 emissions[82]; nor are they required to put in place other measures that may help to reduce livestock-related emissions. Furthermore, there are no greening requirements (the only other compulsory environmental measures) that address livestock-related non-CO_2 emissions. The CAP measures do not specifically address a significant proportion of the EU's climate mitigation needs.

Reduction of emissions from managed agricultural **soils** is better addressed than livestock emissions by the measures available in the CAP. The compulsory greening requirements relating to permanent grassland (and ESPG) address conversion and ploughing risks. The framework for cross-compliance GAECs (4, 5 and 6) aims to prevent erosion and maintain organic matter, which can help to reduce soil-related emissions. However, Member States set almost all of the detailed GAEC rules (GAEC 6, under which the Regulation requires a ban on stubble burning, being the exception) and so determine which of these emissions are addressed in practice.

As described in Chapter 5.1 on effectiveness, the way these criteria are defined can lead to significant areas being excluded from the requirements, thereby reducing the relevance of the soil-related GAECs to the EU's climate needs. The 'statutory mandatory requirement (SMR)' which reinforces compliance with the Nitrates Directive is relevant to emissions from arable land in addition to livestock. There are also a number of rural development measures (forest investments, organic farming, Natura 2000 and Water Framework Directive payments, payment for forest-environmental and climate commitments, cooperation) able to address soil-related emissions. However, their voluntary nature for Member States and beneficiaries can limit the relevance of some of these measures in practice when their implementation by Member States is limited. Even the compulsory AECMs' relevance can be limited, given that Member States can choose whether to focus on soil-related emissions, but the principle that AECMs address the needs identified in the rural development programme should limit this risk.

The EU's objective of **minimum spending** on climate and environmental objectives[83] is necessary to focus public money towards addressing climate needs. However, as the EAFRD Regulation does not require addressing climate actions in particular, the 30% ring-fencing covers both environmental and climate objectives. Moreover, support for ANC represents more than half of what is required by ring-fencing.

As the measure itself simply provides financial compensation for the additional costs arising from the fact that farmers operate in mountain areas or areas with other biophysical constraints (environmental and climate conditions), the support farmers receive does not have to be spent adapting to climate change or mitigating emissions. For this reason, support for ANC can be considered at best only partially relevant to the objective of climate action. Thus, only part of

[82] As set out in Council Regulation No. 1303/2015 (Article 32).

[83] 20% of the overall EU budget is to be spent on climate-relevant actions, which is given partial effect by the requirement that at least 30% of the rural development programme budget must be spent on measures addressing climate and environmental objectives (see Chapter 2).

the allocation to the environment- and climate-relevant measures contributes directly to climate objectives. While climate and environmental objectives are highly interrelated, articulating clearly the requirement for climate-relevant expenditure could help to improve implementation and uptake of CAP measures so that they focus more on climate action needs.

Against the EU's climate action needs, more measures appear relevant or partially relevant to **adaptation** than to mitigation, although these are pursued rather for environmental management purposes and much more rarely through dedicated adaptation measures (see Chapter 5.1.2).

Despite the great diversity in needs and in approaches to addressing those needs in the EU, the following general conclusions on CAP measures' relevance to climate action can be drawn:

- Measures relevant for mitigation are not always communicated or articulated as having mitigation benefits. However, this does not detract from their relevance in addressing climate mitigation needs.
- Mitigating emissions from livestock requires a broader combination of approaches and activities than that which is available through current CAP measures. Given that livestock production has the highest contribution to GHG emissions from agriculture, designing specific CAP measures to directly reduce these emissions could help.

Overall, the evaluation revealed that the actual relevance of CAP measures in addressing the EU's climate needs might be influenced by the non-compulsory nature of some of the relevant measures. However, there are measures that are compulsory for farmers (cross-compliance, including the 'statutory mandatory requirement (SMR)' which reinforces compliance with the Nitrates Directive and greening) and which are relevant for carbon sequestration (particularly through the preservation of permanent grassland) and reducing nitrogen fertiliser use.

5.5. EU added value

EU added value is considered to be the value resulting from applying policy measures at EU level, which is additional to the value that would have resulted from public authorities applying similar measures at regional or national level. It is widely understood to be a multi-faceted concept with different meanings and an economic and social or political dimension.

The economic dimension focuses on EU public goods and the efficiency of their delivery through a collective EU approach, the attainment of economies of scale, and addressing positive and negative external factors. The political or social dimension includes legal certainty (objectives and priorities set out under EU policies), better coordination and complementarities between actions[84].

When assessing the added value of climate action under the CAP, it was not possible to consider a simple counterfactual scenario in which the identical measure is taken by Member States acting without the EU. Therefore, the evaluation assumed a hypothetical counterfactual scenario in which there are no EU-funded direct payments and no EU co-financed rural development measures. It would also leave Member States free to determine the contribution their agricultural and forest sectors would make to meeting EU climate and energy targets, and the size of any financial incentives.

The evidence of Member States' implementation choices within the revised GAEC framework and greening requirements does not suggest any strong **mitigation ambition** on the part of most Member States to use these measures to improve protection of water resources and soils generally, or the carbon stores in soils and woody vegetation. Most of their choices have prioritised farmers' economic interests over those of the environment, although the prevalence of nitrogen-fixing crops in EFA implementation has both adaptation and mitigation benefits.

[84] Commission staff working paper on 'The added value of the EU budget', accompanying the 29 June 2011 Commission Communication on 'A budget for Europe 2020', SEC (2011)867.

Therefore, GAEC and greening may have raised climate ambition in certain situations, compared to the counterfactual scenario (where there may be no environmental conditions attached to direct payments). However, more generally they have had a passive effect in preventing further deterioration of soil carbon and quality, and removal of woody landscape features.

The lack of focus among rural development measures on reducing emissions from ruminant livestock and manure handling/storage also suggests a lack of ambition on the part of Member States to address methane emissions.

Based on case studies, the introduction in 2013 of specific EAFRD priorities to address climate actions has provided EU added value by: stimulating a higher level of climate ambition in those Member States which had not yet developed climate action plans for agriculture and forestry (Czechia); refocusing debates on the CAP to encompass climate action (Germany-Saxony and Croatia); or by incentivising governments to do more (Spain, Romania and Ireland), or even offering more support for adaptation (Saxony). This effect on raising ambition is not EU-wide – the Netherlands had already chosen to develop and implement climate policies largely without using CAP funds, and in Lithuania there has so far been limited impact on an agricultural sector that is focused on other priorities.

EAFRD environmental land management measures (principally agri-environment-climate commitments) and also some forest measures had the most significant impact on GHG reduction (mostly CO_2, but also other GHG emissions), thus increasing the effectiveness of climate action. Capital investments contributed little to GHG reduction (and suffered from low uptake), suggesting that they have not raised Member States' ambitions.

The evaluation found it more difficult to judge what effect the CAP has had on **adaptation ambitions** in the agricultural sector. The process of preparing strategic plans for the European Structural and Investment Funds and the ex-ante evaluation for the rural development programme has probably stimulated a number of managing authorities to analyse their climate risks and adaptation needs as part of their policy planning and programming earlier than they would have done in the absence of the CAP. This may also have raised the use of the CAP to support adaptive actions. However, the analysis of Member States' adaptation plans has shown that they have seldom budgeted for, and even less often funded, the actions proposed in their plans. This highlights the potential role of the CAP (and other sectoral policies) to support adaptation, for example through support for preventive actions.

Overall, the rural development measures seem more efficient in terms of targeted climate action than direct payments, but there is still scope for improved efficiency in the rural development programme and, cumulatively, at EU level. The CAP has provided a significant degree of legal certainty, but only for the duration of each programming period. EU funding rules have also provided opportunities for synergies between the EAFRD and other funds.

The evaluation suggests, however, that some Member States acting alone could have possibly devised more efficient and effective means of achieving emission reduction targets. For example, the more ambitious Member States might: target support at areas or production systems where the greatest mitigation or adaptation benefits can be achieved; make any income support payments conditional upon more demanding, targeted requirements for soil management, particularly for carbon-rich (peaty) and wetland soils and to combat soil erosion and improve soil functionality; limit investment in projects that meet threshold criteria for GHG reduction and medium-term adaptation benefits; and support investments in water efficiency in agriculture only if these implement an adaptation plan for all uses of the resource concerned. On the other hand, there would be other Member States where, in the absence of the CAP, particularly the EAFRD, ambition would be low and climate action would be less of a priority.

6. CONCLUSIONS

Agriculture is both impacted by and has an impact on the climate, and EU agriculture has huge challenges ahead to address climate change. In addressing those, progress made by the European agricultural sector in terms of reducing emissions must not be overlooked, especially regarding carbon sequestration, as it provides valuable lessons both from its successes and its limitations.

Effectiveness for climate mitigation

EU GHG emissions from agriculture have fallen by more than 20% since 1990, exceeding the target set for 2020. However, emissions have stagnated since 2010, mainly due to agricultural output increasing by 9%. This highlights **gains in economic efficiency and environmental footprint per unit of output produced, but similar gains in total emissions are needed**.

The assessment of effectiveness has been limited by the available data on the implementation of the measures at the time the support study was carried out, which covered the period 2015-2017. The lack of information on detailed farming practices, including whether permanent grassland has been kept unploughed, has also been a key limitation, particularly with regard to the importance of maintaining the carbon stocks in agricultural soils, especially those of permanent grassland.

To assess the impact of the CAP measures on GHG **emission reductions**, a modelling exercise was carried out in the support study. Only a selection of CAP measures could be included in the simulation. Notable omissions include fallow land (EFA), for which the simulation cannot calculate a single year's impact on emissions, the permanent grassland ratio and most direct payments. Three simulations were carried out, reflecting the impact of a low, medium and high scenario in terms of the measures' potential for emission reduction.

At best, the reduction in emissions is 8.7% compared to a 2016 baseline without CAP, with a medium scenario at 4.6% and a low at 0.3%. **Pillar I** contributes most to this reduction, via greening and, more specifically, protection of environmentally sensitive permanent grassland and EFA. In the medium scenario, in the absence of these two measures, emissions from agriculture would have been 3.5% (19.8 million tonnes CO_2eq) higher. On the one hand, this simulation overestimates the mitigation effect of these Pillar I measures: where Natura 2000 management plans already ban the ploughing of permanent grassland, emission reductions cannot be fully attributed to the greening measure, although it improves implementation of the ploughing ban. On the other hand, not all measures' impact could be quantified, such as the impact of the greening permanent grassland ratio, whose effect on carbon storage depends heavily on whether such grasslands are ploughed, even if not to convert them into arable land.

Direct payments, including coupled support for extensive livestock systems, prevent land abandonment and help to maintain permanent grasslands. Where land is abandoned, the mitigation impact depends on the alternative use of this land: the impact is negative if the land is ploughed, kept bare-fallow or constructed (soil sealing), but positive if the land is afforested or left for spontaneous revegetation. Removing the coupled support would reduce EU beef production and thus GHG emissions. However, in the absence of a significant change in consumption patterns, higher imports would cancel out about three- quarters of this reduction through emission leakage (i.e. increased emissions outside the EU).

The overall net impact of coupled support on GHG emissions within the EU is thus difficult to judge. Additional emissions associated with livestock numbers must be balanced against emission leakage and any positive impacts from protecting permanent grassland and sensitive soils. The positive impact of additional protein crop production must also be taken into account.

For **Pillar II**, the measures for which impact was quantifiable (i.e. investments in physical assets, investments in forest area development, agri-environment-climate measures, organic farming and Natura 2000 payments) have helped to marginally reduce GHG emissions, by 1.1% of total emissions from agriculture, in the medium scenario. Most of this reduction is attributed

to Natura 2000 payments. In the absence of this compensation payment, protection of Natura 2000 areas which do not fall under greening would be jeopardised.

The support for areas facing natural or other specific constraints helps to prevent land abandonment and loss of grassland. This protects carbon stocks in soil, but the positive impact on climate mitigation is not a given, as it depends on farmers' practices on the land.

The debate on livestock emissions cannot be narrowed down to reducing livestock numbers. Besides the risk of emissions leakage, it is important to consider that ruminants maintain marginal land and use cellulose, which is not digestible for human beings, to produce proteins. Moreover, induced land use changes could have some unexpected effects on biodiversity and landscape management. As highlighted in the Farm to Fork Strategy and in the Methane Strategy, changes in consumption patterns towards more sustainable diets would be an effective way to decrease livestock emissions, while decreasing the risk of unexpected effects and avoiding that any reduction in herd would lead to increased GHG emissions outside the EU (leakage). This calls for a holistic approach to livestock systems when assessing their impact and the impact of the CAP on climate.

Among the simulated measures, mitigation will mainly be achieved from extensive livestock grazing systems, feed optimisation, manure treatment including anaerobic digestion and maintaining carbon stocks thanks to the maintenance of permanent grassland. The main contribution from arable systems comes through the support for nitrogen-fixing crops (EFA, coupled support), land management which protects and increases soil carbon stocks, and changes to N_2O emissions from soils and manures. Protecting high carbon soils in predominantly extensively-farmed Natura 2000 areas is particularly important, as the CAP has achieved fewer reductions in intensive grassland or arable farms.

Effectiveness for climate adaptation

The number of **extreme events** affecting agriculture is rising. Despite climate adaptation being considered as a relevant challenge in almost all rural development programmes, only eight programmes targeted it explicitly. Although very few CAP measures make clear reference to climate adaptation, several CAP measures could contribute to climate adaptation.

The CAP helps to maintain or enhance **diversity of crops and farming systems** (slowing down the specialisation of farming systems), notably by maintaining permanent pasture and diversifying crops under greening, and through the redistributive payment, certain coupled payment schemes (protein crops), support for organic farming and assistance for areas facing natural or other specific constraints. In addition, **income support and risk management tools improve economic resilience to shocks** (e.g. drought) linked to the impact of climate change.

Direct payments and investment support can facilitate investments necessary to adapt to new climate conditions, hence supporting a transition toward more resilient systems and decreasing farmers' sensitivity to shocks.

In addition, the CAP limits **soil erosion** and improves **resilience to floods** when protecting permanent grasslands and landscape elements, enhancing catch crops (EFA) and supporting management commitments beneficial for soil.

However, overall, Member States have not tailored cross-compliance for adaptation purposes, so their potential cannot be fully used. Although the strong link between adaptation and mitigation in agriculture makes it difficult to draw a clear line of distinction for the CAP's effectiveness on adaptation, case study interviews indicate that advising farmers on how to improve climate performance has been a low priority. In addition, risk management tools protect farmers against economic losses linked to extreme events but do not incentivise changes towards more resilient production systems.

Furthermore, some measures have **unintended negative effects** on adaptation. Direct payments may support the maintenance of vulnerable farms, slowing some structural changes that could

be necessary for adaptation, while direct payments and risk management tools might support risk-prone behaviour. In terms of water management, modernising irrigation systems through investment support improves the capacity of farmers to cope with droughts; however, in some cases it may also lead, in the long run, to poor adaptation in areas where the water resource is already depleted.

Effectiveness at stimulating innovation

Innovations in the agricultural sector have strong potential to help reduce emissions and facilitate adaptation. Their impact depends on local factors such as pedoclimatic conditions, farm systems and how they are put into practice in specific circumstances.

Technological innovation is more likely to be adopted than social innovation. With regard to **technological innovations** beneficial for the climate, the use of genetically improved seeds or animals is quite common at EU level, as is the use of sexed semen and climate-controlled greenhouses and livestock buildings. Designing climate-smart innovative livestock systems cannot be pursued at the expense of other dimensions, such as animal welfare and reducing the risk of developing antibiotic resistance.

Social innovations are less frequently implemented by farmers, except for those participating in water management groups (and to a lesser extent in other stakeholder and farmer groups) and in local farming systems.

At the EU level, 'fostering innovation' is a cross-cutting objective of the CAP and many CAP measures can affect the rate of innovation and its adoption. However, the use of these measures to specifically target innovations which have an impact on climate objectives depends on management authorities' implementation choices and there is little data available to assess their effects.

Efficiency

Calculating the efficiency with which the CAP secures climate benefits is complicated by the fact that most CAP spending is interlinked with other benefits, such as better soil quality.

The analysis pointed out the importance of targeted approaches through many cases where better targeting of support would lead to an increase in efficiency. For example, protecting carbon-rich soils such as peatland is particularly beneficial for climate mitigation, compared to protecting other soils.

The evaluation also highlighted the role of screening for maladaptation that could avoid public expenditure on infrastructure, or sectors that may increase vulnerability in the medium to long term, such as irrigation infrastructure in areas with depleted water resources. It could also avoid promoting excessive specialisation by whole areas, thus improving efficiency. Unfortunately, the rural development programmes examined in the national case studies contained no evidence that such screening practices are applied.

Coherence

Overall, the CAP climate measures are coherent with the objectives of sustainable management of natural resources, viable food production and balanced regional development. The way CAP measures may be used together is usually coherent. There are few examples of synergies between measures (such as enhancing protein crops and protecting soil carbon in agricultural soils via greening, agri-environment-climate measures and cross-compliance), and more could be done. In addition, a few measures lack coherence under some specific contexts, such as exempting small farmers scheme beneficiaries from greening and coupled support for sectors driving an overexploitation of water resources.

Overall, the CAP's climate-focused measures are coherent with other EU policies related to climate change. However, there are instances where further opportunities for integration exist,

particularly with the EU soil thematic strategy reinforced by Horizon Europe's Mission: Caring for Soil is Caring for Life – 75% healthy soils in the EU[85], the Water Framework Directive and the Floods Directive. It is important to note that, although CAP climate-focused measures and other relevant EU policies do not conflict in principle, some of the rules in place do not safeguard against conflicts happening in practice through the implementation of the measures.

In addition, the CAP, particularly the rural development programmes, is coherent with national policies and helps to deliver climate goals at national and regional level.

Relevance

The CAP has objectives which are broad enough to encompass the necessary climate action, and which correspond closely to the needs identified by Member States and at the level of agricultural holdings. However, reduction of emissions from managed agricultural soils is better addressed than livestock emissions by the measures available in the CAP, even if Member States have the possibility to define more tailored voluntary measures within their rural development programmes. This is also due to the different nature of emissions; for example, it is more difficult to tackle enteric fermentation.

Although CAP interventions that are relevant or partially relevant to the EU's climate needs are compulsory for Member States (cross-compliance, the greening measures, the farm advisory services and the agri-environment-climate measures), Member States are left a wide margin to determine the stringency of the measures. This means that the level of ambition as regards climate action differs widely among Member States. Some other key measures are only voluntary (such as advisory services and knowledge transfer, investment support (including for renewables), risk prevention and risk management). In addition, while cross-compliance and greening are compulsory for farmers, the relevance of certain other CAP measures may also be constrained by their voluntary nature for farmers. While voluntary measures give Member States and farmers the flexibility to target their specific needs with appropriate interventions, there is no requirement for farmers to take up those measures in areas where the highest needs have been identified. Farmers also often focus on adaptation challenges rather than mitigation.

The 'climate and environment ring-fence', whereby Member States are required to devote 30% of their rural development budget to measures addressing environment and climate objectives, would be more accurate if spending on measures for ANC was excluded, as the measure itself simply provides financial compensation for the additional costs incurred by farmers for operating in areas with constraints and not for adapting to climate change or mitigating emissions.

EU added value

The EAFRD requirements to address climate priorities have provided EU added value by stimulating a higher level of climate ambition in those Member States which had not yet developed climate action plans for agriculture and forestry. However, the number of targeted measures for climate mitigation and adaptation, as well as the dedicated budget for such measures, could be increased.

In addition, Member States' implementation choices within the revised cross-compliance framework and greening requirements do not suggest any increase in ambition on the part of most Member States or farmers to use these measures to improve protection of water resources and soils generally, or the carbon stores in soils and woody vegetation. Most of the choices have prioritised farmers' economic interests, rather than the overall sustainability of farming (economic, environmental and social).

Lessons learned

[85] https://ec.europa.eu/info/horizon-europe/missions-horizon-europe/soil-health-and-food_en

Based on a thorough analysis of needs, the targeting of climate mitigation and adaptation in Member States' rural development programmes could be improved and better monitored.

The mitigation and adaptation potential of several CAP measures could increase if:

- ploughed grassland would not be classified as 'permanent grassland';
- the ban on ploughing permanent grassland (currently for environmentally sensitive permanent grasslandss) would be extended to more areas;
- small farmers would not be exempted from climate-relevant requirements under current greening;
- fallow land would always be covered;
- protection and restoration of wetlands and peatlands would be enhanced;
- the level of ambition of CAP instruments/measures would increase;
- aid for areas facing natural or other specific constraints would be subject to land management requirements;
- coupled support for livestock would be targeted at extensive systems;
- support would be screened to avoid poor adaptation (e.g. irrigation support in areas in risk of water depletion).

The dissemination of knowledge and improved advice to farmers on techniques and practices which can improve climate performance (both mitigation and adaptation) can be improved.

In terms of monitoring, a review of the data required to understand, manage and evaluate the contribution of agriculture and forestry to climate action, particularly mitigation, is missing. There is a need to cover the availability, granularity (scale), consistency and timeliness of data for, among other things: soil maps covering carbon content and erosion risk; landscape features that can be considered as carbon stocks; fertiliser use and application methods by agricultural holdings; tillage practices on agricultural holdings; manure management arrangements by agricultural holdings; whether livestock housing is cooled or heated.

ANNEX 1: PROCEDURAL INFORMATION

1. Lead DG, Decide Planning/CWP references

Lead DG: Directorate-General for Agriculture and Rural Development (DG AGRI).

Decide planning: PLAN/2017/1023

2. Organisation and timing

This evaluation was included in the DG AGRI evaluation plan and followed the Better Regulation guidelines for evaluations. The evaluation work was carried out through an external evaluation study, conducted in conformity with DG AGRI's procedure for organising and managing policy evaluations by external contractors. The work was supervised under the technical and the contractual management of DG AGRI's Unit C.4, in charge of monitoring and evaluation.

The Commission set up an inter-service steering group (ISG) on 2 May 2017. Its mandate was to provide information, prepare the terms of reference, monitor the work of the external study team, discuss and advise on approving the final report, and comment on the draft evaluation staff working document.

The ISG was composed of the Directorate-General for Agriculture and Rural Development (DG AGRI), the Directorate-General for Climate Action (CLIMA), the Directorate-General for Environment (ENV), the Directorate-General for Research and Innovation (RTD), the Directorate-General for Competition (COMP), the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW), the Joint Research Centre (JRC) and the Secretariat-General (SG).

The ISG started its meetings on 16 May 2017, and held nine meetings throughout the evaluation process.

The evaluation roadmap was published on 9 June 2017. It set out the context, scope and aim of the exercise and presented the questions to be addressed under the five criteria of effectiveness, efficiency, relevance, coherence and EU added value.

During the period in which feedback could be provided on the roadmap (from 9 June to 7 July 2017), five contributions were received[86]. An association of Dutch water companies (Vewin) called for more attention to be paid to water, the WWF's European policy office questioned livestock production, while AnTaisce, an Irish NGO, raised questions about the livestock sector and carbon sequestration in forestry and suggested Ireland as a case study. The European Public Health Alliance (EPHA) called for more sectoral analysis and comparison of livestock and dairy with other sectors. A Hungarian NGO (Senior Corporate Silver Spoon, Environment & Nature Association) asked to include innovation technology as part of the evaluation. To address these reactions adequately, the livestock and dairy sector, integrative aspects and important livestock producing countries like Ireland and the Netherlands were duly covered in the case studies, which played an important role in answering the evaluation questions.

Attention was paid to water management and innovation technology issues when assessing climate adaptation, as far as this was possible within the scope of the study.

3. Exceptions to the Better Regulation Guidelines

There was an **exception in relation to the need to organise a dedicated public consultation** as part of this evaluation, since the large public consultation on modernising and simplifying the

[86] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1408-Evaluation-of-the-impact-of-the-CAP-on-climate-change-and-greenhouse-gas-emissions

CAP had just been held[87], which covered the necessary issues. That consultation, held between 7 February and 2 May 2017, had a very successful response rate of 322 912 replies, with a good spread of different categories of respondents (individual farmers, public authorities, NGOs, and farmers' professional organisations at EU, national, regional and local level).

4. Evidence, sources and quality

An **external and independent evaluation support study provides the basis for the** evaluation. This study ('Evaluation of the Impact of the CAP on Climate Change and Greenhouse Gas Emissions') was commissioned under Framework Contract 30-CE-0807500/00-67 (AGRI 2016-0296). The study was carried out by Alliance Environnement ('the contractor'), following the signature of the contract on 15 August 2017, and concluded on 31 October 2018 with the receipt of the final deliverable.

The contractor has exploited the available data sources, including revisions to statistical analyses when new data became available during the course of the contract and cross-checked the use of data when requested by the ISG. Nonetheless, there were considerable limitations to the analysis due to the limited availability of accurate, detailed and homogenous data and the particularities of the FADN system. From the start of this evaluation, it was clear that the availability of data on implementation would be limited, given the short period during which the reformed CAP policy has been in place and the time it takes before FADN data become available. These limitations are clearly explained in Chapter 4 – methodology.

The evidence in this evaluation is based on interviews with and surveys of key stakeholders, 10 national case studies carried out by experts, a comprehensive literature review, desk research and a modelling exercise to simulate the mitigation achieved by the CAP in 2016 in comparison with a situation of no CAP. In addition, stakeholders were consulted in several Civil Dialogue Groups and at the Environment Working Party of the European Farmers Association Copa-Cogeca.

In view of the data limitations signalled in this evaluation, the case studies are an important part of the evidence. The 10 case study countries (Croatia, Czechia, France, Germany, Hungary, Ireland, Lithuania, the Netherlands, Romania and Spain) chosen for this evaluation represent a range of farming systems, biogeographical conditions and climate challenges. The case studies were carried out at national level, but with a particular focus on a single administrative region in the federal Member States (Aquitaine in France, Saxony-Anhalt in Germany and Andalucía in Spain[88]) to source more detailed information on the way the CAP measures operate in practice and the implications for climate mitigation and adaptation.

All case studies followed the same general approach and applied the same methodology. A case study template and guidance was prepared by the core study team to seek as much homogeneity as possible and to allow the results of the case studies to be synthesised in a streamlined way. The people leading the case studies also received a data pack containing the existing data available to the core study team for their Member State.

An online briefing session was carried out with all case study experts prior to starting the work to explain the context of the evaluation study, its purpose and objectives, the methods and data collection needs in detail. This was followed by regular exchanges throughout the case study work.

The ISG for the external evaluation study carried out a **quality assessment of the contractor's external report on this evaluation**, particularly the quality of the methodology, the reliability of the data and the robustness of the analysis and findings. It judged that the report could be

[87] https://ec.europa.eu/agriculture/consultations/cap-modernising/2017_en

[88] Since adaptation challenges vary to a greater extent between regions than mitigation challenges, the regions were chosen to include adaptation challenges too.

approved, as it complied fully with the conditions of the contract and relevant professional evaluation standards.

To ensure that it incorporates all relevant findings and analysis of available studies and the most up-to-date data on the implementation of CAP measures and instruments, **the evaluation draws on a broad range of additional sources, which have been referenced throughout the document**. As such, it addresses some of the limitations of the evaluation support study, notably related to its limited observation period regarding the implementation of various CAP measures and instruments.

ANNEX 2: SYNOPSIS REPORT ON THE STAKEHOLDER CONSULTATION

A wide range of consultation methods and activities were carried out for this evaluation. They can be grouped in the following manner:

1. **Consultations by the European Commission**: Special Eurobarometer 473[89]; the public consultation on modernising and simplifying the CAP[90]; the consultation of the relevant Civil Dialogue Groups, notably the one on arable crops, cotton, flax and hemp, dried fodder, energy and non-food crops sectors on 25 June 2019, as well as the Civil Dialogue Group on environment and climate change on 8 July 2019; consultation in the Environment Working Party of the European Farmers Association Copa-Cogeca on 17 June 2019; the Special Eurobarometer survey on Europeans, Agriculture and the CAP conducted in August-September 2020.
2. **Consultations by the contractor carrying out the external evaluation study**: interviews with key stakeholders, including farmers, advisers and representatives of the farming, forestry and wider rural sectors, regional and national authorities, climate researchers, academics and NGOs. Within the 10 national case studies, the following stakeholders were consulted through interviews: national and regional authorities, and national and regional agricultural cooperative unions. Climate researchers and academics studying agricultural policy and their works were also consulted. The case studies were supplemented by two short surveys: one to gather specific information on the uptake of adaptation techniques and technologies, which was addressed to advisers and farmers' representatives; and one on the extent of knowledge and uptake of mitigation actions, which was addressed to farmers. In both cases, the short survey questionnaires were sent to a non-representative group of advisers and farmers in the 10 case study countries. On average, nine farmers and 23 farm advisers responded per country, with the response rate by farmers depressed by three Member State administrations that chose to administer the farmer survey themselves for data protection reasons but failed to elicit any responses.

For stakeholders, particularly to avoid consultation fatigue and confusion of the public, no additional public consultation was carried out, as the large public consultation on modernising and simplifying the CAP had just been held[91], which covered the necessary issues.

In view of the CAP post-2020 impact assessment, the Commission's CAP policy proposals and the next MFF, possible misunderstanding with stakeholders had to be avoided where possible.

The **Special Eurobarometer 473** survey (December 2017) showed that EU citizens still consider the CAP to be an important result of the EU in terms of public goods. The independent survey, carried out in the 28 Member States and involving 28 000 participants (report published in February 2018), indicates that the majority of respondents (75%) believe that the CAP is fulfilling its roles, particularly in ensuring a stable, safe and healthy food supply.

There is a consensus on the EU value added of the CAP, with a majority of respondents thinking that the CAP benefits all European citizens and not just farmers (60%). However, the level of agreement on this statement is considerably lower than in 2013 (-16%) in all countries except for Slovenia. Compared to the last survey, the overall acceptance by society of the CAP has declined, but there is an increase in the proportion of respondents that mention providing safe, healthy, high quality food as the main objective of the CAP (62%).

---

89 Special Eurobarometer 473: Europeans, Agriculture and the CAP https://data.europa.eu/euodp/en/data/dataset/S2161_88_4_473_ENG

90 Consultation on modernising and simplifying the CAP, held between February and May 2017. It was open to all interested citizens and organised through a questionnaire available on DG AGRI's website. The results were based on an analysis of replies from 58 520 respondents, of which 36.5% were farmers, 47.7% other citizens and 15.8% organisations.

91 https://ec.europa.eu/agriculture/consultations/cap-modernising/2017_en

In spring 2017, the Commission (particularly DG AGRI) carried out a broad internet-based **public consultation on modernising and simplifying the CAP**. This was open to all citizens and addressed matters that are also relevant for this evaluation.

The public consultation harvested a very high number of opinions from a wide spectrum of stakeholders. 322 912 online replies were received and 1 417 position papers were submitted (after identifying campaigns and excluding duplicates, there were still 58 520 online contributions and 693 position papers).

The contributions were received from all the main categories of stakeholders. The highest contribution came from **citizens** (47.7%, **high interest**), followed by **farmers** (36.5%, **very high interest**) and **organisations** (15.8%). The majority of position papers was submitted by organisations (61.5%), followed by citizens (21.6%) and farmers (16.9%).

The key stakeholders for climate change evaluation are farmers and organisations such as: public authorities responsible for implementing CAP measures in Member States at national, regional and/or local level **(very high interest)**; the agro-food sector **(very high interest)**; the forestry sector **(high interest)**; civil society (e.g. NGOs and organisations from, among others, the agriculture, environment, climate change and forestry sectors) **(very high interest)**; academics, researchers, experts, think-tanks, consultancies **(high interest)**.

Given that the contributions were received only half a year before the evaluation of the impact of the CAP on climate change, the participants would most likely not have amended their responses drastically if there had been a specific public consultation.

The need to guarantee a level playing field within the single market and the existence of cross-border challenges like food security, environment and climate change (with a positive reply of more than 90% of the respondents) emerged as key reasons that justify an agricultural policy commonly managed at EU level. Other justifications include the need to have a common position at international level, the need to maintain economic, social and territorial cohesion across the EU, and the need for a common framework for sharing best practices.

The two surveys also explored, in line with the subsidiarity principle, whether, and to what extent, CAP governance should be executed on a regional, national or European level.

The 2017 public consultation on modernising and simplifying the CAP, in more detail

One of the 33 questions in the public consultation directly addressed climate change: 'Which are the most important objectives for the CAP to better address climate change?'

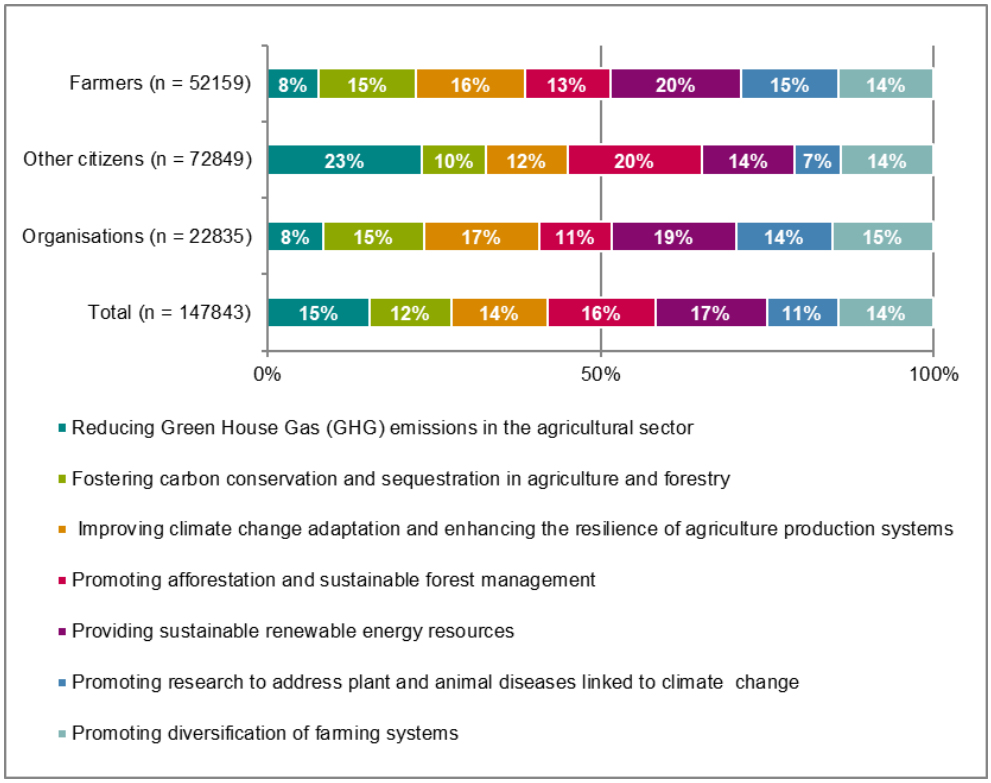
Overall, respondents said the most important objectives are 'Providing sustainable renewable energy resources' (17%), 'Promoting afforestation and sustainable forest management' (16%) and 'Reducing Green House Gas (GHG) emissions in the agricultural sector' (15%).

For farmers, the first choice was 'Providing sustainable renewable energy resources' (20%), followed by 'Improving climate change adaptation and enhancing the resilience of agriculture production systems' (16%) and 'Fostering carbon conservation and sequestration in agriculture and forestry' (15%).

For citizens, the first choice was 'Reducing Green House Gas (GHG) emissions in the agricultural sector' (23%), followed by 'Promoting afforestation and sustainable forest management' (20%) and 'Promoting diversification of farming systems' (14%).

For respondents from organisations, the first choice was 'Providing sustainable renewable energy resources' (19%), followed by 'Improving climate change adaptation and enhancing the resilience of agriculture production systems' (17%) and 'Promoting diversification of farming systems' (14%).

Figure 6: Which are the most important objectives for the CAP to better address climate change?



Note: Respondents were invited to select three choices out of seven options.
Source: The 2017 public consultation on modernising and simplifying the CAP

Other questions where climate change is considered

This analysis focuses on the value given to climate change against other topical issues in agriculture.

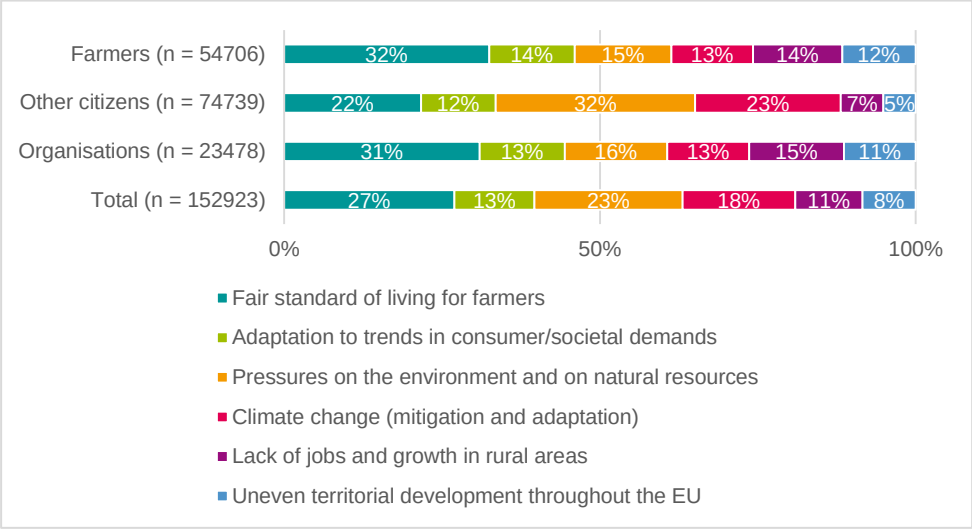
In the following questions, climate change is one topic among many and respondents selected the topics that they considered important. The answers from respondents from organisations vary according to the sector and the type of organisation, so this analysis focuses more closely on the responses of farmers and other citizens.

13% of farmers and 23% of other citizens highlighted climate change as one of the most important challenges for EU agriculture. The main challenge for farmers remains ensuring a fair standard of living for farmers (32%), while for citizens it is pressure on natural resources (32%).

Regarding the current CAP policy tools best suited to meet these challenges, farmers most frequently selected rural development (RD) support (18%) and decoupled payments (15%). Other citizens most frequently selected 'Support for RD environment & climate actions in agriculture and rural areas' (30%), followed by 'Support for RD investments in physical/human capital in agriculture and rural areas' (16%) and 'Regulatory approaches (such as standards and rules)' (14%).

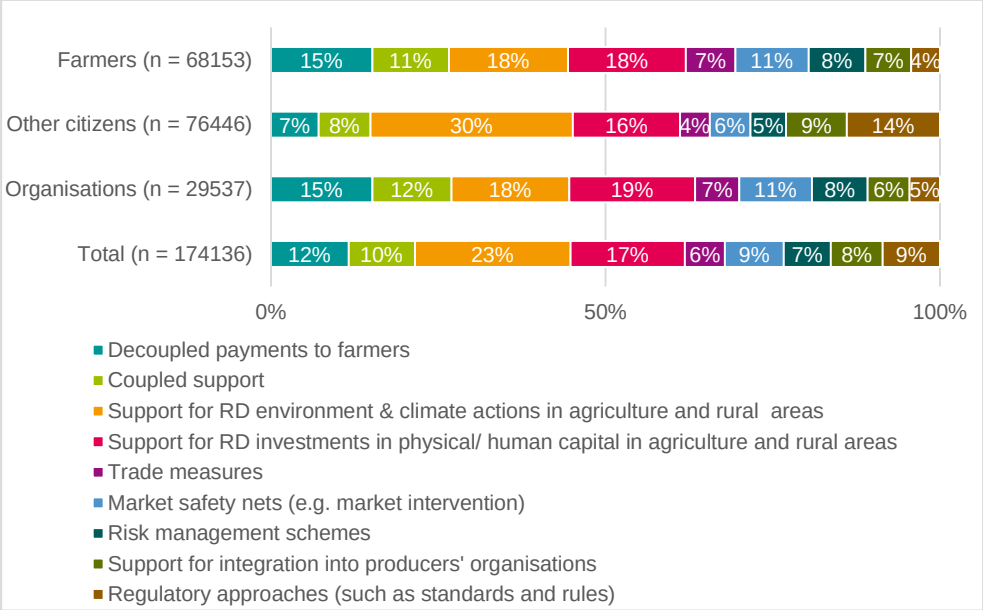
For a majority of respondents, these challenges are successfully addressed only to some extent.

Figure 7: Which are the most important challenges for EU agriculture and rural areas?



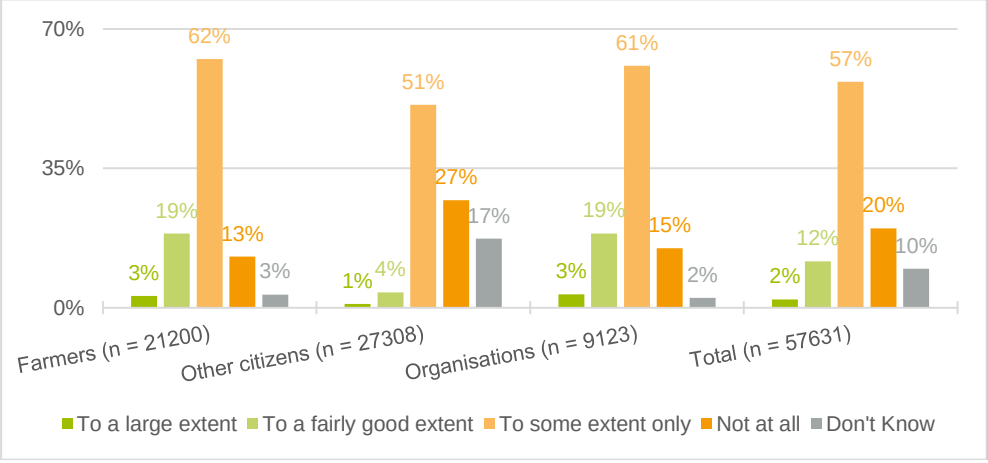
Source: The 2017 public consultation on modernising and simplifying the CAP

Figure 8: Which of the current CAP policy tools are best suited to meeting the challenges identified above?



Source: The 2017 public consultation on modernising and simplifying the CAP

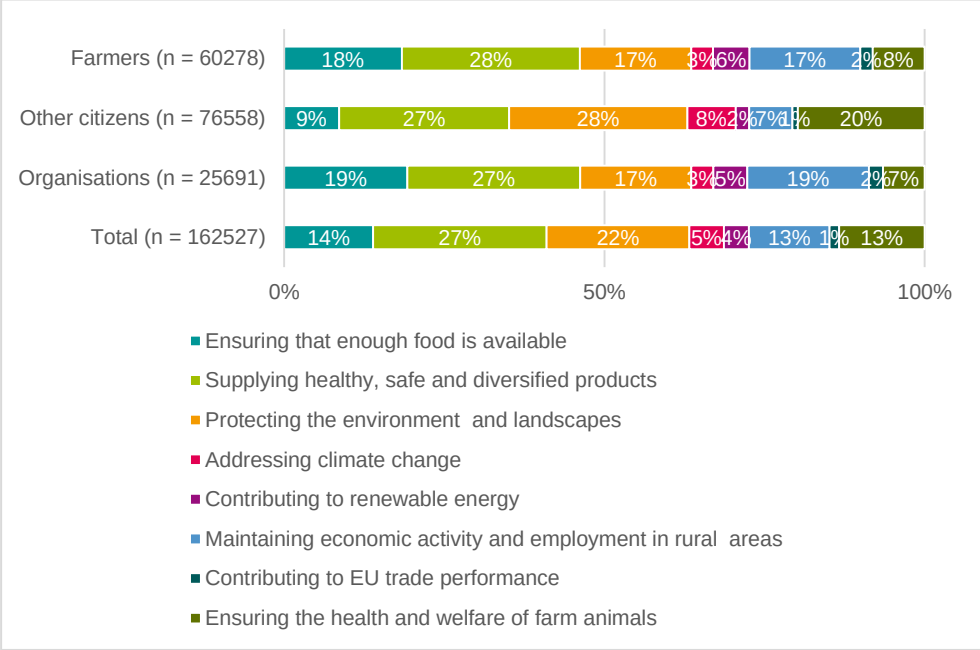
Figure 9: To what extent does the current CAP successfully address these challenges?



Source: The 2017 public consultation on modernising and simplifying the CAP

Addressing climate change is not highlighted as the main contribution of farmers to our society (5% for all respondents). For respondents, the most important contribution of farmers relate to supplying healthy, safe and diversified products (27%), followed by protecting the environment and landscapes (22%).

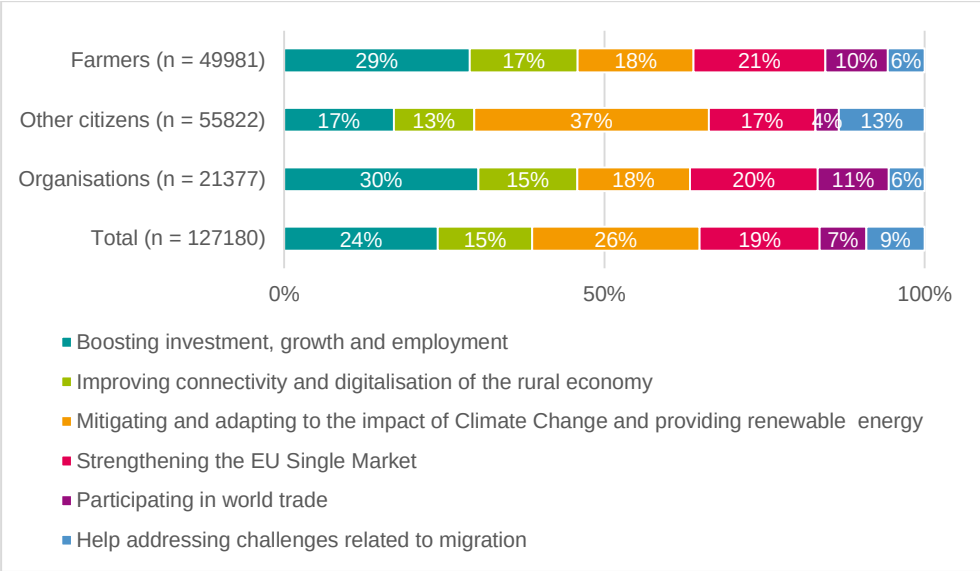
Figure 10: Which of the following do you think are the most important contributions of farmers in our society?



Source: The 2017 public consultation on modernising and simplifying the CAP

However, when asked about the most relevant priorities for the CAP 2014-2020, mitigating and adapting to the impact of climate change comes third for farmers (18%), behind boosting investment, growth and employment, as well as strengthening the EU single market. For other citizens, climate action is the most relevant priority by far (37%).

Figure 11: Of the European Commission's priorities for 2014-2020, which are the most relevant to the CAP?

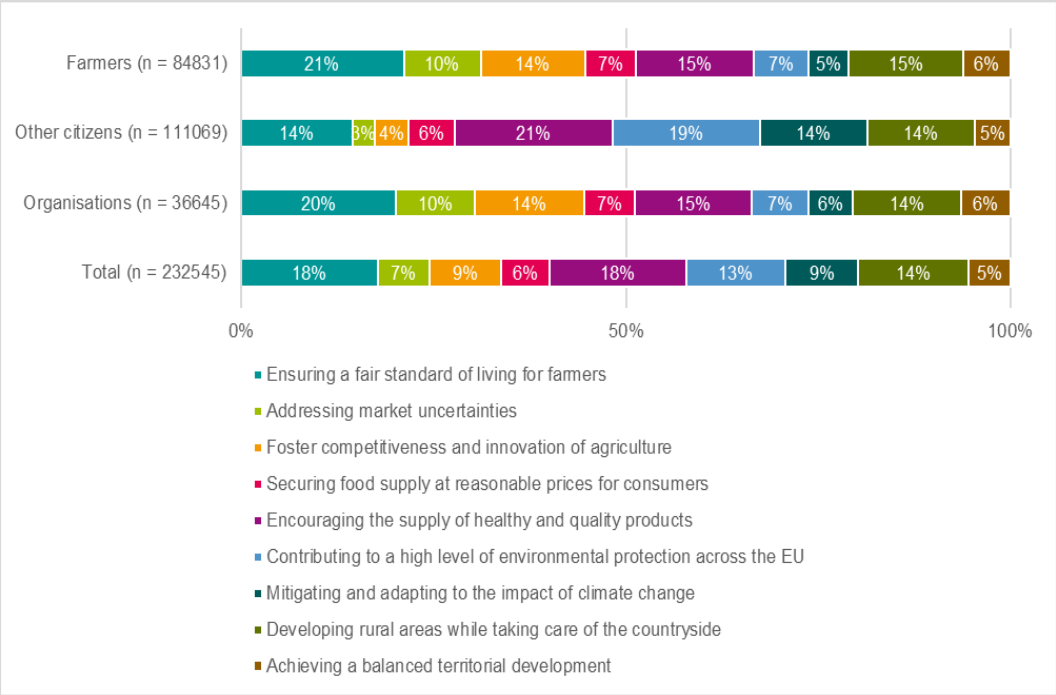


Source: The 2017 public consultation on modernising and simplifying the CAP

When asked about the most important objectives of the CAP, answers are consistent with the answers to the main challenges. For farmers it should be, firstly, ensuring a fair standard of living for farmers (21%) and, secondly, ensuring the supply of healthy and quality products as well as developing rural areas. Climate action comes last (5%).

For citizens, climate action ranks higher (14%), still behind the supply of healthy and quality products and the contribution to environmental protection.

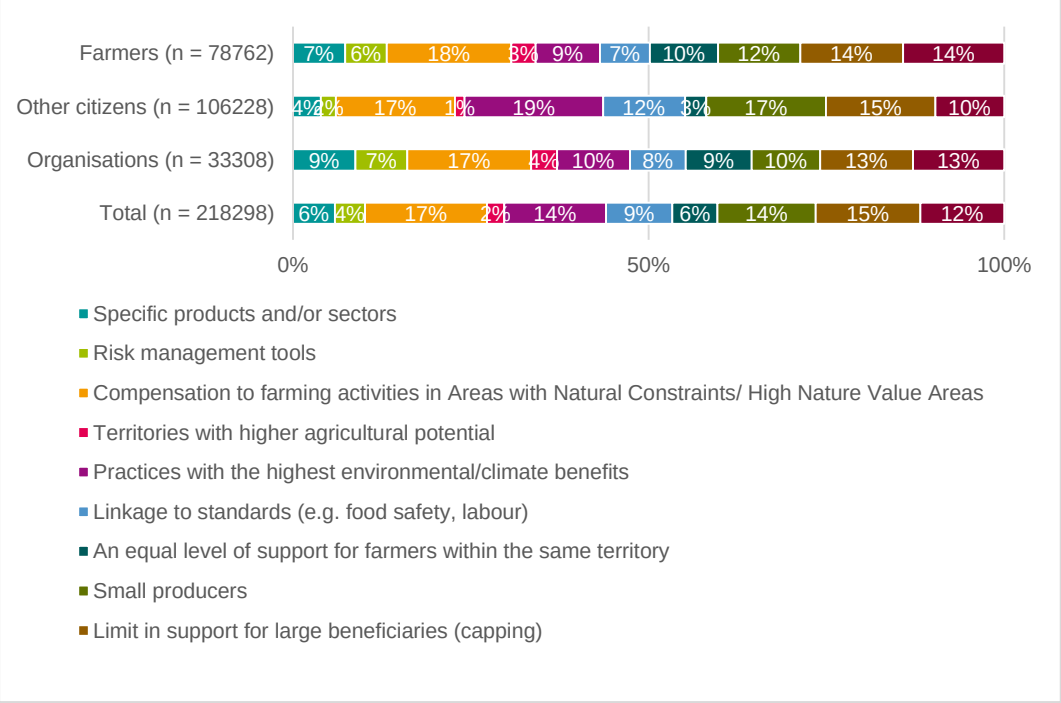
Figure 12: Which of the following should be the most important objectives of the CAP?



Source: The 2017 public consultation on modernising and simplifying the CAP

According to other citizens, the most relevant criteria when allocating direct support is practices with the highest environmental/climate benefits (19%), while for farmers the most relevant is compensating for farming activities in ANC (18%).

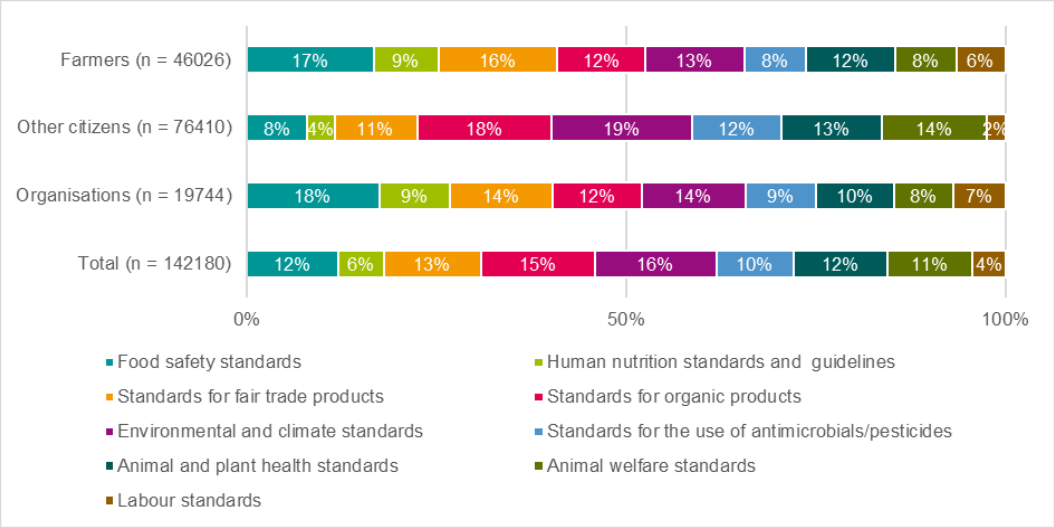
Figure 13: Which of the following criteria are most relevant when allocating direct support?



Source: The 2017 public consultation on modernising and simplifying the CAP

For 19% of other citizens and 13% of farmers, environment and climate standards are the main element for which the linkage between CAP and standards can be improved.

Figure 14: Considering consumer and wider societal demands, where can the linkage between CAP and standards be improved?



Source: The 2017 public consultation on modernising and simplifying the CAP

Analysis of the open questions

The 2017 public consultation on the CAP also included five open questions, two of which (questions 12 and 13) are relevant to climate.

Question 12: What are the main problems/obstacles preventing the current policy from successfully delivering on its objectives? What are the drivers behind these problems?

The most discussed topics were the 'environment', 'simplification', 'politics and decision-making' and 'subsidies'.

The responses to the topic of the 'environment' emphasised environmental pollution and lack of attention to sustainability: environmental pollution, especially of soil, water, air, climate and biodiversity, are indicated by the participants as important problems. In relation to these issues, participants included the lack of attention to sustainability, which poses a barrier to attaining environmental objectives. The use of pesticides, fertilisers and herbicides is mentioned as an obstacle both in the sense that they are used too much and that the rules on their use are too strict.

Question 13: Which elements of the current CAP are the most burdensome or complex, and why?

Under this question, the most discussed topic was 'simplification' linked to 'greening', 'application', 'controls - too many, too much' and 'bureaucracy'. Answers regarding greening indicate it to be a burdensome element, making specific references to the definition of permanent grassland and EFA, especially the declaration of landscape elements. Many of the participants referring to greening also indicate cross-compliance as complex and burdensome.

The **Special Eurobarometer survey on Europeans, Agriculture and the CAP**, conducted in **August-September 2020**, revealed that 51% of EU citizens think that one of the main objectives of the EU in terms of agriculture and rural development policy should be 'Protecting the environment and tackling climate change'.

Although the number of EU citizens thinking that agriculture is one of the major causes of climate change has increased over the last 10 years to 42%, up by 13 points, more people also recognise that the agricultural sector has already made significant contributions to tackling climate change (54%, +8pp). In addition, a larger share of Europeans are even prepared to pay 10% more for agricultural products that are produced in a way that limits their carbon footprint

(66%, +8pp). Despite this, more respondents think that EU farmers need to change the way they work in order to fight climate change, even if it comes at the price of making EU agriculture less competitive (69%, +2pp). 27% of Europeans think that one of the main responsibilities of farmers is protecting the environment and tackling climate change (+2pp).

More people (62%, +5pp) think that the CAP is fulfilling its role, among others, in protecting the environment and tackling climate change. In terms of the new priorities of the CAP, the vast majority of people participating in the survey consider each priority important (ranging from 83% to 92%), and particularly the priorities of 'Ensuring sustainable management of natural resources' (92%) and 'Helping tackle climate change' (90%).

ANNEX 3: METHODOLOGY

The methodological approach to the evaluation combined quantitative and qualitative analysis, including a literature review, desk research, econometric analysis, surveys, interviews and case studies, primarily as part of the external and independent evaluation support study carried out by Alliance Environnement. DG AGRI further complemented the study with additional analysis (using up-to-date statistics) and synthesis of newly available literature. The wide range of consultation methods and activities carried out for this evaluation are described in Annex 2.

Table 6: Description of the data collection and analytical tools

Method/Tool	Brief description of tool	Type of tool	Relevant evaluation question
Data collection tools			
Simulation	To quantify the impact of CAP measures on GHG emissions by combining uptake data reported by Member States with relevant emissions factors from literature, using a modelled baseline with which to contextualise the results.	Quantitative	1-4
Documentary research / Literature reviews / Statistical data analysis	To draw on the available literature, key unpublished grey literature and other datasets (statistical, etc.) to: - establish the counterfactual situation; - map Member States' and regions' implementation decisions; - examine the causal relationship between the actions or management practices supported by a policy instrument or measure and the main outcomes, and how these might differ geographically in different biophysical or climatic situations; - establish the key drivers and pressures influencing the agriculture and forest sectors, and rural areas more generally, the state of the environment and key threats, to help inform the counterfactual/baseline situation and enable an assessment of their relevance; - review the effects of previous CAP instruments/measures; - review the range of factors influencing, among other things, the effectiveness and efficiency of measures' implementation. To identify any issues of coherence.	Qualitative & quantitative	All
Questionnaire-based surveys	Used to gather data from a small, non-representative sample of farmers in each of 10 case study countries on their experience of climate pressures and relevant CAP instruments. Also used with farm advisers to gain information on the extent of uptake of different types of innovation.	Qualitative (because of sample size)	5,6,10
Case studies	Used to provide a detailed picture of CAP implementation and climate action in 10 Member States.	Qualitative & quantitative	All
Analytical tools			
Cost-effectiveness analysis	Comparison of the benefits of a policy instrument with the costs involved in securing them.	Quantitative	7
Coherence matrix and scoring	Used to analyse the coherence between regulations and/or intervention logics. Standardised approach used for the assessment of the internal and external coherence of different CAP instruments and the way they have been applied in Member States/regions.	Qualitative	10 & 11

Source: External evaluation study

Methods for estimating leakage

Estimating leakage in an agricultural context is complex and subject to high levels of uncertainty. The consequences of changes in production are related to market and political forces and occur in an industry which is highly dispersed and disaggregated, with many small operators (farmers) throughout the world. Furthermore, production is related to yield (e.g. production per unit area for crops) and the area of land used for production. A change in production area will not necessarily lead to an increase in production area elsewhere (with potential land use change), because the change in production area may incentivise, perhaps indirectly, improvements in yield.

It is certain that net GHG emissions occur from activity related to land use change, and that the emissions can be large relative to emissions from annual agricultural production of a particular product. However, the allocation or attribution of these emissions to particular production sectors or particular production changes is not known, and is difficult to estimate.

The methods used to estimate leakage in the context of agricultural production mainly focused on emissions associated with Indirect Land Use Change (ILUC), in the context of the GHG mitigation potential of biofuels.

Two main types of method have been used, with some methods that combine aspects of both:

- **Modelling approaches.** Econometric models have been used to predict changes in trade flows as a consequence of policy- or market-driven scenarios for change in agricultural production. Changes in land use and GHG emissions are then also predicted.
- **Simplified allocation.** GHG emissions from land use change, for each region or country in the world, are estimated using land use statistics and carbon stock change factors. The emissions are allocated to the land used for agricultural production in various ways, depending on the detail of the method. Weightings can be applied for yield or the proportion of production traded internationally, for example.

Full quantification of leakage, even when complex modelling is involved, is subject to high uncertainty. Quantification of leakage requires predictions of future impacts, and the results cannot easily be validated because the actual allocation of LUC to policy and activity changes in another place cannot be observed or measured (European Commission, 2010). An attempt to compare modelled vs observed LUC has concluded that most ILUC models overestimate ILUC emissions as they do not properly account for cropland that is not fully used (O'Connor, 2015).

The use of case studies

The case studies provide detailed and context-specific qualitative and quantitative information to complement the EU-wide information collected to inform the analysis and answers to the evaluation questions. The information was gathered through interviews with key stakeholders, including advisers and representatives of the farming, forestry and wider rural sectors, government officials and climate researchers and NGOs, and by sourcing and analysing national/regional literature, statistics and other data sources. All information from the case studies has been carefully interpreted to determine what generic conclusions can be drawn from them for the analysis and answers to the evaluation questions.

Analytical model

To calculate the emission reductions brought about by the CAP measures in 2016, the evaluation used the GAINS model (Greenhouse gas-Air pollution Interactions).

The emissions with the 24 CAP measures in place were compared with a GAINS scenario that assumed these measures were absent, from which the mitigation due to the CAP measures was calculated. To distinguish between the effect of both CAP pillars, two scenarios were run, one without the Pillar I measures and the other without the Pillar II measures.

The GAINS model explores cost-effective emission control strategies that simultaneously tackle local air quality and greenhouse gases, so as to maximise benefits at all scales. GAINS is now used for the whole world, distinguishing 165 regions, including 48 European countries.

GAINS provides an authoritative framework for assessing strategies that reduce emissions of multiple air pollutants and greenhouse gases at least cost, and minimise their negative effects on human health, ecosystems and climate change.

GAINS estimates historic emissions of 10 air pollutants and 6 GHGs for each country, based on data from international energy and industrial statistics, emission inventories and on data supplied by countries themselves. It assesses emissions on a medium-term time horizon, with projections being specified in five-year intervals until 2050. GAINS estimates for each country/region the potential emission reductions that are offered by about 2 000 specific emission control measures and their costs.

For user-specified packages of measures, GAINS calculates resulting effects on ambient air quality (fine particles, ground-level ozone, deposition of sulphur and nitrogen), and the subsequent impacts on human health and ecosystems.

The GAINS model can be operated in two ways:

- In ‘scenario analysis’ mode, it follows emission pathways from sources to impacts, providing estimates of regional costs and the environmental benefits of alternative emission control strategies.
- In ‘optimisation’ mode, it identifies where emissions can be reduced most cost-effectively. The model identifies a balance of concrete measures for different pollutants, sectors and countries/regions that achieve air quality and GHG reduction targets at least cost, considering the contributions of different pollutants to different air quality and climate problems.

ANNEX 4: CAP CLIMATE MEASURES - COHERENCE AND ADDED VALUE

Table 7: Summary of the theoretical internal coherence analysis of CAP measures

	Number of positive relationships identified	Number of neutral or no relationships	Number of negative relationships identified	Number of relationships identified as having mixed impacts
Basic payment scheme (BPS)	1 (FAS)	21		1 (FAS may be used by MS to advise farmers on climate issues which may help BPS recipients to mitigate their emissions)
Greening crop diversification	4 (CC, FAS, nitrogen-fixing crops (NFC) in VCS and in EFA)	18	1 (SFS)	
Greening permanent grassland	2 (CC and FAS)	19	1 (SFS)	1 (VCS)
Greening EFA	4 (CC, FAS, NFC in VCS and crop diversification)	18	1 (SFS)	
Voluntary coupled support	3 positive relationships for VCS for protein crops (CC, crop diversification and NFC options in EFA)	15	3 potential negative relationships for VCS for livestock (potentially exacerbating negative climate impacts when used in conjunction with M13)	2 for VCS for livestock (greening PG ratio may help maintain livestock systems, similarly to VCS for livestock, but their climate impact is context-specific) FAS may be used by MS to advise farmers on climate issues
Small farmers scheme		19	3 (exemptions from the 3 greening obligations)	1 (FAS)
M1 Knowledge transfer/Information	6 (knowledge, training and advice can maximise the climate benefits potentially arising from M8, M7, M10, M15, CC and FAS)	10	-	7 (M2, M16, M4, M3, M11, M5, M17), depending strongly on MS/region's implementation choices
M2 Advisory services	6 (knowledge, training and advice can maximise the climate benefits potentially arising from M8, M7, M10, M15, CC and FAS)	10	-	7 (M2, M16, M4, M3, M11, M5, M17), depending strongly on MS/region's implementation choices
M16 Cooperation	4 (M7.2, M10, M15, M5.1)	12	-	7 (M1, M2, M4, M8, M3, M11 and FAS), depending strongly on MS/region's implementation choices
M4 Investments	3 (M4.3 and M4.4 in particular can support the potential positive climate effects arising from M10, M15 and CC)	14	-	6 (M1, M2, M16, M3, M11 and FAS)
M6 Farm/business development	-	22	-	1 (FAS)
M8 Forest investment	4 (M1, M2, M15, CC)	16	1 (VCS-livestock and M8.1-8.2 can contradict each other)	2 (FAS and M16)
M7 Basic services and village renewal	3 (M1, M2 and M16)	19	-	1 (FAS)
M10 Agri-environment-climate	5 (M1, M2, M16, M4 and CC)	14	1 (VCS-livestock)	3 (M3, M11 and FAS)

	Number of positive relationships identified	Number of neutral or no relationships	Number of negative relationships identified	Number of relationships identified as having mixed impacts
M15 Forest-environment-climate	6 (M1, M2, M16, M4, M8 and CC)	16	-	1 (FAS)
M11 Organic farming	1 (CC)	15	-	7 (M1, M2, M16, M4, M3, M10 and FAS)
M12 Natura 2000	1 (CC)	22	-	-
M13 Areas facing natural constraints	1 (CC)	20	1 (potentially exacerbating negative climate impacts when VCS-livestock is combined with M13)	1 (FAS)
M5 Risk reduction	1 (M16.5 can maximise M5.1 impact)	19	-	3 (M1, M2, FAS)
M17 Risk prevention	-	20	-	3 (M1, M2, FAS)
Cross-compliance (CC)	15 (because CC is conditional on a range of measures and is beneficial for climate, it positively interacts with BPS, the 3 greening obligations, VCS, M1, M2, M4, M8, M10, M15, M11, M12, M13 and FAS)	8		-
Farm advisory system	6 (FAS must cover CC and the 3 greening obligations and can maximise the benefits from M1 and M2)	2	-	15 (BPS, SFS, M16, M4, M6, M8, M3, M7, M10, M15, M11, M13, M5, M17 and VCS)

Note**:** CC: cross-compliance (in this table it refers to GAEC 1, 4, 5, 6, and 7); SFS: Small farmers scheme; VCS: Voluntary coupled support; FAS: Farm advisory system.
Source: Evaluation support study

Table 8: External coherence of the CAP climate measures

Policies/mechanisms/strategies aiming at:		Greening			RDP soft measures (M 1, 2, 16)	M4 Investments in physical assets	M5 Disaster risk reduction	M8 Investment forest	M10 Agri-environment-climate	M15 Forest-environment-climate	Cross-compliance (GAEC standards)
		EFA	PG	Diversification							
MITIGATION	Mitigation of non-CO_2 emissions • Nitrates Directive • Emission Trading System • Effort Sharing Decision • Low-carbon economy roadmap • National Emissions Ceiling Directive										GAEC 1, 4
	Mitigation of CO_2 emissions • EU Soil Thematic Strategy • Low-carbon economy roadmap • LULUCF Decision • EU Forest Strategy • Circular Economy Package										GAEC 1, 4, 5, 6, 7
	Improved energy efficiency • Energy Efficiency Directive										GAEC 5
	Development of renewable energies • Renewable Energy Directive • ILUC Directive • EU Bioeconomy Strategy										
ADAPTATION • EU Forest Strategy • Floods Directive • Water Framework Directive											GAEC 1, 4, 5, 6, 7
INNOVATION • EU Bioeconomy Strategy • LIFE programme • Horizon 2020 • European Innovation Partnership											

Legend: Yellow = Neutral; Green = Coherent; Blue = Mixed
Source: Evaluation support study

Table 9: EU added value of CAP mitigation and adaptation measures

Potential	CAP measures	Counterfactual	EU added value
A higher level of ambition for climate action at EU level	**Mitigation:** only the EAFRD has been shown to foster a higher level of ambition for climate action. The implementation choices of the other CAP measures show little evidence of increased ambition overall, yet GAEC and greening may have prevented a decline in ambition. There is an evident lack of ambition in addressing CH_4 reductions across all the CAP measures. **Adaptation:** the strategic planning process required for programming the EAFRD may have stimulated integration of adaptation in rural development programmes (RDP).	MS would not necessarily attach environmental conditions to direct payments, or replace EAFRD measures with incentives to address EU climate mitigation or adaptation, through land management and investment support, or through 'soft' measures such as knowledge transfer and advice.	Yes, for mitigation there is strong evidence of the added value of the EAFRD. To a limited extent for adaptation ambition, but only for the EAFRD.
Increased effectiveness through EU action	**Mitigation**: EAFRD funding rules promote the use of agri-environment-climate commitments that benefit both mitigation and adaptation (particularly for soil and carbon protection). These, and some of the forest measures, also contribute to adaptation. Theoretically, the EAFRD has considerable potential for transboundary adaptation actions in both agriculture and forests, but data is lacking on the extent to which this has occurred. **Adaptation**: FAS and RDP measures also strengthen the Agricultural Knowledge and Innovation Systems in many MS. Such support is an essential complement to other measures (e.g. M4, M10), improving their effectiveness.		Yes

Coordination gains	Work by the European Network for Rural Development and EIP-AGRI has promoted sharing of good practice relevant to climate action.	None	Yes
Efficiency gains	The flexibility available in the design and targeting of the EAFRD allows managing authorities to achieve high levels of efficiency, but this potential has not yet been fully realised.	None	Yes, for the EAFRD, but the potential for environmental efficiency has not yet been fully realised.
Legal certainty and policy framework	EAFRD environmental land management contracts for 5-7 years provide certainty for contract holders or between programming periods.	MS could choose to provide an improved level of certainty if they wished (for example, through longer contracts for soil management).	Yes, to some extent, for EAFRD land management contracts.
Promoting complementarity and synergy	CAP measures are designed to complement each other and to be used coherently, although the extent to which synergies are achieved depends on Member States' implementation choices. EAFRD and other ESI Funds are used synergistically.	More risk of double funding under combinations of national schemes and other EU funds.	Yes

Source: Evaluation support study