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EXECUTIVE SUMMARY

Deliverable D5.2 is the second output of Work Package 5: Finance and Policy. Building on the analysis presented in *D5.1, Mapping Report on Agroforestry Sector Finance and Policy 1*, which reviewed the evolution of European agroforestry finance, policies, and regulations, D5.2 provides an in-depth examination of current financing mechanisms and policy developments. It focuses particularly on the Common Agricultural Policy (CAP) 2023–2027 and emerging carbon farming schemes that can stimulate agroforestry adoption. This report reviews current financing mechanisms and policy frameworks for agroforestry, highlighting the potential of carbon farming to accelerate its uptake across Europe. In line with the European Green Deal's ambition to address climate change, environmental degradation, and food security, agroforestry offers a multifunctional land-use approach that delivers significant environmental, economic, and social benefits.

The policy landscape supporting agroforestry is expanding within the Common Agricultural Policy (CAP) and other EU frameworks, including the Green Deal, the Biodiversity and Farm to Fork Strategies, and the EU Forestry Strategy for 2030. Under the CAP (2023–2027), Pillar I ("Income Support") provides payments that promote sustainable farming and fair income distribution, while Pillar II ("Rural Development") supports long-term environmental and economic sustainability. Agroforestry is recognised within this "green architecture," with funding available through eco-schemes and agri-environment-climate measures. Additional support may come from state aid, rural development programmes, and private investment mobilised through the EU Sustainable Finance framework. Insurance mechanisms - especially parametric insurance - can further strengthen resilience by compensating farmers for losses based on pre-defined indicators, helping to close protection gaps and encourage adoption of agroforestry practices.

Despite this supportive framework, agroforestry uptake remains limited. Key barriers include complex and costly establishment, land-use reclassification issues, income uncertainty, insufficient advisory services, inconsistent regulations, and expensive monitoring, reporting, and verification (MRV) requirements. Addressing these challenges requires innovative financing instruments that reward ecosystem services and promote integrated land management combining climate mitigation, biodiversity, and rural development goals. Carbon farming schemes—whether action-based, result-based, or hybrid—can play a vital role. Hybrid schemes are particularly promising, combining flexibility for farmers with measurable environmental outcomes. Their success depends on clear indicators, robust methodologies, skilled implementation, stakeholder engagement, and reliable MRV systems.

In conclusion, agroforestry has strong potential to support the EU's transition to sustainable agriculture and to help achieve climate and biodiversity targets. Realising this potential calls for coherent policy development, institutional and financial support, and innovative carbon farming mechanisms that make agroforestry a viable and attractive option for farmers across Europe.

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LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
AECCs	Agri-environment-climate commitments
AECMs	Agri-environmental-climate measures
AES	Agri-environmental schemes
AKIS	Agricultural Knowledge and Innovation System
ANCs	Areas facing natural or other specific constraints
BECCS	Bioenergy with carbon capture and storage
BISS	Basic income support for sustainability
CAP	Common agricultural policy
CH_4	Methane
CIS	Coupled income support
CISYF	Complementary income support for young farmers
CM	Centimeter
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent
CRISS	Complementary redistributive income support for sustainability
DACCS	Direct air capture with capture and storage
EAFRD	European agricultural fund for rural development
EAGF	European Agricultural Guarantee Fund
EFAs	Ecological focus areas
EIP	European Innovation Partnership
EUGBS	EU green bond standard
Eq	Equivalent
ESG	Environmental, social and governance
ESMA	European Securities Markets Authority
EU ETS	EU Emissions Trading Systems
EU	European Union
FAO	Food and Agriculture Organisation
GAECs	Good agricultural and environmental conditions
GT	Gigatonne
LULUCF	Land Use and Land Use Change and Forestry
MRV	Monitoring, report and verification
Mt	Million metric tonnes
NGO	Non-governmental organisation
N_2O	Nitrous oxide
PSF	Payments for small farmers
RDPs	Rural development programmes
SAPS	Single area payment scheme
SOC	Soil organic carbon
SMRs	Statutory management requirements
VCS	Verified Carbon Standard
WP	Work package

1. INTRODUCTION

This report provides a detailed examination of the recent developments in finance and policy currently applicable to European agroforestry. With the growing ambition of the European Green Deal to address current challenges related to climate change, environmental degradation and food security, policy initiatives and sustainable practices are needed to transform the European Union (EU) into a more integrated and resource-efficient economy. As a multifunctional land use, agroforestry systems could be at the centre of this transition due to their environmental, economic and social benefits. Recent studies have highlighted the urgent need for a policy framework that integrates food systems, agriculture, forestry, and rural development to achieve a holistic approach to environmental, economic, and social sustainability (e.g., Donham et al., 2022; Hajdukovic, 2023). To achieve this transition, the socio-economic value of the ecosystem services provided by agroforestry systems needs to be identified and integrated into the financial focus. The policy landscape for agroforestry is evolving, with support embedded in the Common Agricultural Policy (CAP) and major EU legislation, including the European Green Deal, the Biodiversity and Farm to Fork strategies, and the EU Forestry Strategy for 2030. Innovative financial instruments and policies based on payments for ecosystem services need to be further developed to overcome barriers to the uptake of agroforestry and enable farmers to achieve multiple objectives, such as food production, carbon sequestration, and biodiversity enhancement.

In this context, this report examines the current financing mechanisms, policy frameworks, and the potential of carbon farming to support the uptake of agroforestry in Europe. The study is based on information and secondary data gathered from policy documents, academic papers, and online sources. The remainder of the report is divided into four distinct sections. Section 2 describes the background and methodology, defining the objectives and expected outcomes of the study. Section 3 provides an overview of recent financial and policy developments in the European agroforestry sector. It first describes the policy landscape for agroforestry, with a particular focus on the CAP (2023-2027) and State aid. From a different perspective, this section then provides insights into how sustainable finance can support the uptake of agroforestry in Europe. Finally, it examines the role of agricultural, forestry and parametric insurance in protecting farmers and enhancing the uptake of agroforestry. This section aims to highlight the evolving landscape of financial instruments, policies, and strategies, providing a clear understanding of how they can influence the European agroforestry sector.

Given the known benefits of agroforestry, it is essential to investigate how carbon farming can facilitate the adoption of agroforestry systems across Europe and contribute to achieving the EU's climate and environmental objectives. To this end, section 4 provides a review of the scientific literature and policy developments, focusing on several key aspects of carbon farming in Europe. First, the section defines carbon farming and identifies the benefits and challenges of adopting agroforestry as a carbon farming practice. It examines the role of carbon farming in promoting the adoption of agroforestry systems, with a focus on their potential to deliver co-benefits for climate and biodiversity. Building on this framework, the section explores the potential of action-based, result-based and hybrid carbon farming schemes for agroforestry. With an emphasis on the role of carbon farming as a business model, it describes potential financing mechanisms and sources for agroforestry carbon farming initiatives. The section then examines how carbon farming can safeguard biodiversity, outlining the risks and opportunities, the potential of agroforestry to enhance biodiversity, the challenges of integrating biodiversity co-benefits into carbon farming schemes, and possible approaches to enhancing biodiversity through carbon farming initiatives. This section concludes by examining the prospects for carbon farming and agroforestry in Europe from a policy perspective. Section 5 provides a summary of the findings of this study and the concluding remarks. Overall, this report aims to identify gaps and opportunities for improving the current financing mechanisms, as well as regulatory and policy frameworks, in the European agroforestry sector. This research can lay the foundations for the future

development of innovative and sustainable agroforestry financing schemes, emphasising payments for ecosystem services.

2. AGROFORESTRY SECTOR FINANCE AND POLICY

2.1 BACKGROUND AND MOTIVATION

ReForest is an interdisciplinary project within the field of social science (co-creation, stakeholder engagement, knowledge transfer), with the integration of ecosystem science (ecosystem services), agronomy (productivity), technology development (remote sensing and neural networks), and economics (business models, value chains, finance and policies). The project's overall objective is to improve the sustainability of food production in the EU by co-creating solutions to key barriers that prevent farmers from adopting agroforestry more widely. The most critical barriers to agroforestry adoption in Europe include the lack of knowledge and experience, the impact of tree planting on farm business, and unclear policy support positioned between agriculture and forestry. Farmers need policy support for several reasons.[1] Firstly, the average income of farmers remains significantly lower than that of the rest of the EU economy. Secondly, farming is a risky and often costly endeavour because agriculture relies more heavily on the weather and climate than other sectors. There is also an obvious time lag between consumer demand and farmers' ability to increase supply. Finally, farmers are under pressure from increasing global trade in food products and trade liberalisation. Globalisation and fluctuations in supply and demand have also made agricultural market prices more volatile, adding to farmers' concerns. The business uncertainties in agriculture and the importance of securing food production in the EU justify the crucial role of the public sector in providing a safety net for farmers' incomes and enabling them to adopt sustainable practices, such as agroforestry.

With this in mind, the ReForest project aims to promote the adoption of agroforestry systems by accelerating effective and sustainable financing of the agroforestry sector at the national and EU levels. Carbon sequestration and biodiversity enhancement are good examples of ecosystem services for which enabling payments can incentivise farmers to adopt agroforestry systems. Payments for ecosystem services can make business models for agroforestry farms more attractive by internalising the value of carbon sequestration and biodiversity enhancement. This will require strong legislative, institutional and policy support for agroforestry to overcome the barriers to its wider uptake in Europe.

2.2 AGROFORESTRY DEFINITION

Agroforestry is receiving considerable attention from the scientific community and is recognised as a multifunctional land-use practice with multiple environmental, social, and economic benefits. Agroforestry systems can help mitigate climate change, protect soils, enhance biodiversity and water quality, and improve the overall condition of the landscapes.[2] Farmers who adopt agroforestry practices can diversify their production, reduce certain costs and improve their productivity.

Although agroforestry is a traditional form of land use, its definition in the regulatory environment is often rudimentary or non-existent and differs across countries. The Food and Agriculture Organisation (FAO) of the United Nations gives the following definition of agroforestry:[3] "*Agroforestry is a collective*

[1] European Commission (n.d.). Agriculture and rural development Income support explained. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/income-support-explained_en

[2] Jose, S. (2009). Agroforestry for ecosystem services and environmental benefits: An overview. *Agroforestry Systems*, *76*, 1-10. https://doi.org/10.1007/s10457-009-9229-7

[3] Food and Agriculture Organisation of the United Nations (2015). Agroforestry. Available at: https://www.fao.org/forestry-fao/agroforestry/80338/en/

name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence". According to the FAO, agroforestry can also be defined as: "*A dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels*".

In other words, agroforestry enables farmers to continue producing food while significantly enhancing the environmental sustainability of their operations.

Many studies have attempted to classify the existing agroforestry systems in the EU. This is a very challenging task given the number of possible combinations of woody components, crops, and livestock and the variety of criteria to be considered. In this report, we refer to the classification used by the AGROMIX project, which provides a simplified list of the main "spatial" forms of agroforestry:[4]

- Silvopastoral: Combination of woody vegetation (trees and shrubs) with forage and animal production.
- Silvoarable: Woody vegetation (trees and shrubs) intercropped with annual or perennial crops;
- Hedgerows, windbreaks and riparian buffer strips: Lines of natural or planted perennial vegetation (trees and shrubs) bordering croplands, pastures and water sources to protect livestock, crops, soil and water quality.
- Forest farming: Forested areas are used to produce or harvest natural-standing speciality crops such as mushrooms or medicines for medicinal, ornamental, or culinary purposes.
- Home gardens: A combination of trees and/or shrubs with vegetable production.

Silvopastoral and silvoarable systems are extensive forms of agriculture that feature a spatial mixture of trees and crops, or livestock grazing, in an open wooded area.

In contrast, in linear systems such as hedgerows, windbreaks and riparian buffer strips, perennial vegetation is not interspersed within the cropping/grazing field. It is located exclusively on its margins.

As a multifunctional land use, agroforestry can contribute to multiple Sustainable Development Goals.

2.3 Objectives and expected outcomes

D5.2 is the second deliverable of Work Package (WP) 5, *Finance and Policy*. Building on the analysis presented in D5.1, *Mapping Report on Agroforestry Sector Finance and Policy 1*, which reviewed the evolution of European agroforestry finance, policies, and regulations over recent decades, this report provides an in-depth examination of current financing mechanisms and policy developments. It focuses particularly on the Common Agricultural Policy (CAP) for 2023–2027 and emerging carbon farming schemes that can stimulate the adoption of agroforestry. The report examines how these mechanisms can help address existing policy and financial gaps, support the development of innovative financing models, and improve payments for ecosystem services provided by agroforestry systems. The findings are intended to inform the next connected project deliverables, D5.4 and D5.5.

[4] Donham, J., Venn, R., Schmutz, U. and Migliorini, P. (2022). Global inventory of current policy contexts, instruments and operational means for the support of mixed farming and agroforestry systems. Deliverable D6.1 for AGROMIX (862993). https://agromixproject.eu/project/

The objectives and expected outcomes of this report are to:

- Highlight the evolving landscape of financial instruments, policies and strategies related to European agroforestry, with a focus on the CAP (2023-2027) and State aid, to provide a clear understanding of how they can influence the European agroforestry sector;
- Identify the gaps in existing financing mechanisms (public and private) and policies for European agroforestry and opportunities for improvement;
- Examine how sustainable finance can support the uptake of agroforestry systems;
- Provide insights into how traditional agricultural, forestry and parametric insurance can protect farmers against unforeseen events and enhance the uptake of agroforestry;
- Examine how carbon farming can promote the adoption of agroforestry systems and identify the benefits and challenges of adopting agroforestry as a carbon farming practice;
- Explore the potential of action-based, result-based and hybrid carbon farming schemes for agroforestry and identify financing mechanisms for carbon farming and agroforestry;
- Provide insights into the contribution of carbon farming to safeguarding biodiversity, outlining the risks and opportunities, the potential of agroforestry to enhance biodiversity, the challenges of integrating biodiversity co-benefits into carbon farming standards, and potential approaches to enhance biodiversity through carbon farming initiatives;
- Lay the foundation for the development of sustainable financing schemes for agroforestry based on payments for ecosystem services to make agroforestry business models more attractive.

The primary target audiences of this report are policy and financial stakeholders involved in sustainable agriculture, agroforestry practitioners, and researchers. The findings will also be shared with other relevant target groups, such as private sector actors and NGOs. The project will engage these groups through dedicated workshops, scientific publications, policy papers, webinars, policy debates and direct collaboration to ensure that the findings are effectively disseminated and translated into practical applications and actionable policy recommendations. The ReForest consortium will utilise the information presented in this report to write positioning articles and policy notes on key issues such as insurance and carbon farming in relation to agroforestry.

2.4 Methodological approach and data

This report provides an inventory of data and information on current financing mechanisms and policy instruments supporting the European agroforestry sector. The methodological approach of this study is based on desk research and the compilation of information from a wide range of existing resources.

This research draws on information and secondary data from policy documents, academic papers, and online sources (e.g., EU institutions' websites). It also builds on the ReForest project's "D5.1 Mapping report on agroforestry sector finance and policy 1" and previous EU-funded agroforestry projects, such as AGFORWARD and AGROMIX. Information on relevant EU policies and legislation was obtained from the European Commission's website and law databases such as EUR-Lex. The research on the role of carbon farming in supporting the adoption of agroforestry in Europe is primarily based on resources available on the European Commission's website, academic papers, and online sources. The full list of references and data sources is provided in Appendix 1.

The growing interest in agroforestry is also leading to an increasing number of national and EU-funded projects dealing with this discipline. Some of these projects are collaborating to examine and propose improvements to the financing, policy, and regulatory frameworks that influence agroforestry. "Carbon farming: An emerging opportunity for agroforestry" in section 4 is also part of a joint study on

agroforestry initiated by the Transition project and benefits from the work of researchers from different institutions. The authors who contributed to this study are acknowledged in Section 4.

3. EU AGROFORESTRY SECTOR FINANCE AND POLICY: LATEST DEVELOPMENTS

This section provides an overview of the latest financial and policy developments for the European agroforestry sector. Subsection 3.1 begins with an overview of the policy landscape for agroforestry. Subsection 3.2 then examines the CAP for the period 2023-2027, elucidating its main features and implications for agroforestry. Building on this foundation, subsection 3.3 examines how the agricultural State aid guidelines can complement the CAP measures and provide a financing option for agroforestry. Subsection 3.4 offers insights into how sustainable finance initiatives can facilitate the adoption of agroforestry systems, aligning with the objectives of the European Green Deal. From a different perspective, subsection 3.5 examines how agricultural, forestry and parametric insurance can protect farmers against unforeseen events and support the uptake of agroforestry. The aim of this section is to highlight the evolving landscape of financial instruments, policies and strategies, and to provide an understanding of how they can influence the European agroforestry sector.

3.1 OVERVIEW OF THE POLICY SITUATION IN EUROPEAN COUNTRIES

The "Mapping report on agroforestry sector finance and policy 1" provides an overview of the policy landscape for agroforestry in 20 European countries (17 EU and 3 non-EU countries) by examining the role of agroforestry in each country, the implementation of the CAP at the national level, and existing national policies. The group of European countries included in the study consists of 17 EU countries (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Spain, Sweden) and three non-EU countries (Albania, Switzerland, United Kingdom). The study covered the previous CAP periods (2007-2013 and 2014-2020) and the CAP (2023-2027), which entered into force on January 1, 2023. Additionally, the study investigated whether EU countries have incorporated agroforestry into their CAP strategic plans.

The study revealed that the policy landscape for agroforestry in Europe is steadily expanding. The CAP was the main source of support for agroforestry for the 2007-2013 and 2014-2020 periods. Agroforestry is supported under the CAP (2023-2027) and by key EU legislations, including the European Green Deal, the Biodiversity and Farm to Fork strategies, and the EU Forestry Strategy for 2030. Additionally, several European countries have developed national policies to promote the adoption of agroforestry. Table 1 provides an overview of the policy landscape for agroforestry in Europe.

The uptake of agroforestry in European countries in the CAP 2007-2013 was low. The European Commission defined agroforestry as a *"land use system in which trees are grown in combination with agriculture on the same land"*.[5] This definition did not include the other types of woody vegetation. Agroforestry has been more widely adopted in the CAP 2014-2020 due to the recognition of woody vegetation and the five-year compensation granted for maintaining agroforestry systems.

In the CAP 2007-2013 and 2014-2020, agroforestry was directly supported through measures 222 and 8.2, respectively. These two measures aimed to establish trees on arable land. While Measure 222 only supported the establishment of agroforestry systems, Measure 8.2 also supported the five-year maintenance. However, the specific Measure 8.2 had a low level of implementation at the national level across the EU. Agroforestry could also be supported under measures 221 "First afforestation of

[5] EUR-Lex (2013). 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) and repealing Council Regulation (EC) No 1698/2005. Available at: http://data.europa.eu/eli/reg/2013/1305/oj

non-agricultural land" CAP (2007-2013), 223 "First afforestation of non-agricultural land" CAP (2007-2013) and 8.1 "Support for afforestation/creation of woodland" CAP (2014-2020). However, the most beneficial policies for agroforestry are those that specifically support traditional systems, introduce new systems and provide annual support for managing these systems.

Country	National policies for agroforestry	CAP implementation of Measure 8.2 (2014-2020)	Inclusion of agroforestry in the CAP strategic plan (2023-2027)
Albania	No	CAP does not apply	CAP does not apply
Austria	No	No	No
Belgium (Flanders)	Yes	Yes	Yes
Belgium (Wallonia)	Yes	No	No
Bulgaria	Yes	No	Yes
Croatia	Yes	No	No
Czech Republic	No	No	Yes
Finland	Only reindeer husbandry	No	No
France	Yes	Yes	Yes
Germany	Yes	No	Yes
Greece	No	No	No
Hungary	Yes	Yes	Yes
Ireland	Yes	No	Yes
Italy	No	Yes	Yes
Netherlands	No	No	Yes
Poland	No	No	Yes
Portugal	Yes	Yes	Yes
Spain	No	Yes	Yes
Sweden	Only reindeer husbandry	No	No
Switzerland	Yes	CAP does not apply	CAP does not apply
United Kingdom	Yes	Yes	CAP does not apply

Table 1: Policy landscape of agroforestry in European countries. Source: Hajdukovic, I. (2023).

In the CAP 2007-2013, only 5 Member States (Belgium, France, Hungary, Italy and Portugal) supported agroforestry with measure 222, whereas in the CAP 2014-2020, measure 8.2 was implemented by 7 Member States (Belgium, France, Hungary, Italy, Portugal, Spain and the United Kingdom). The degree of implementation of Measure 8.2 varies considerably within each country. For example, Hungary supported agroforestry within the CAP nationwide, while other countries, such as Italy, Spain, and the United Kingdom, supported agroforestry only in specific regions. Moreover, farmers' uptake was low in some countries, leaving large unspent budgets that could have been used for agroforestry.

The CAP (2023-2027) has the same structure as previous CAPs, with two pillars of support for farmers. However, it has a new policy approach that prioritises results and performance over rules and compliance and gives EU countries more flexibility to adapt measures to local conditions. Each EU country has designed and implemented a national CAP strategic plan. It combines various targeted interventions to meet the country's specific needs. It delivers tangible results in relation to EU-level objectives while contributing to the European Green Deal's ambitions. Twelve Member States (Belgium (Flanders), Bulgaria, the Czech Republic, France, Germany, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, and Spain) have included agroforestry in their CAP strategic plans.

In addition to analysing the implementation of the CAP measures at the national level, the study also examined existing national policies for agroforestry in twenty European countries. Twelve countries (Belgium, Bulgaria, Croatia, Finland, France, Germany, Hungary, Ireland, Portugal, Sweden, Switzerland,

United Kingdom) have national policies to promote agroforestry practices.[6] The most extensive policy support for agroforestry can be found in France and Portugal. The policy approaches to agroforestry in non-EU countries are informative. However, none of them is currently suitable for EU conditions.

3.2 THE COMMON AGRICULTURAL POLICY (2023-2027)

3.2.1 Objectives of the EU's Common Agricultural Policy

Launched in 1962, the CAP[7] is one of the EU's most important structures for agricultural development. It is a partnership between agriculture, society, Europe and farmers. The CAP is a common policy for all EU countries, managed and funded at the European level from the EU budget's resources.

It is based on two pillars covering three measures:

- Pillar I: Direct payments (income support and market measures)
- Pillar II: Rural development (rural development measures)

Through these two pillars, the CAP aims to:

- Support farmers and improve agricultural productivity to ensure food security;
- Protect EU farmers so that they can make a reasonable living;
- Contribute to the fight against climate change and ensure the sustainable management of natural resources;
- Maintain rural areas and landscapes across the EU, and protect biodiversity;
- Keepthe rural economy alive by promoting jobs in farming, agri-food and other related sectors.

In 1992, the CAP introduced measures to support the planting of trees on agricultural land for the first time.

3.2.2 The CAP (2023-2027) and its specific objectives

The CAP (2023-2027) aims to play a crucial role in shaping the future of agriculture and forestry, as well as in achieving the objectives of the European Green Deal. It is a modernised policy with a strong focus on results and performance. The CAP is designed to secure a sustainable future for European farmers, provide targeted support for smaller farms, and give EU countries more flexibility to adapt measures to local conditions. It is built around ten objectives that focus on environmental, social, and economic objectives.[8] The EU countries designed their CAP strategic plans around these objectives.

[6] See Hajdukovic, I. (2023) for a detailed description of the national policies of the 20 European countries studied.
[7] European Commission (n.d.). Agriculture and rural development The common agricultural policy at a glance. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en
[8] European Commission (n.d.). Agricultural and rural development Key policy objectives of the CAP 2023-27. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27/key-policy-objectives-cap-2023-27_en

Figure 1: Ten objectives of the CAP (2023-2027). Source: European Commission (n.d.).

These objectives should support the transition towards sustainable agriculture and forestry in the EU, and contribute to a greener and fairer CAP. The CAP aims to strengthen the resilience of the agricultural sector and rural areas, thereby ensuring food security and facilitating a transition to sustainability.

EU countries have all developed national CAP strategic plans to be implemented. Each plan combines a wide range of targeted interventions that address the country's specific needs and deliver tangible results in relation to the objectives of the European Green Deal.

The CAP strategic plans address the following three specific objectives:[9]

- to support viable farm incomes and the resilience of the EU agricultural sector to enhance long-term food security and agricultural diversity, and to ensure the economic sustainability of agricultural production;
- to enhance market orientation and increase the competitiveness of farms both in the short and long term, including a stronger focus on research, technology and digitalisation;
- to improve the position of farmers in the value chain.

Progress on economic sustainability and the fairness of support

All countries' CAP strategic plans support viable farm incomes and the resilience of the agricultural sector as a key objective. The provision of direct payments ensures the continuation of farming activities. It addresses the persistent gap between agricultural income and the average wage in the economy, as well as income disparities between agricultural sectors and farms.[10] The CAP strategic plans also support progress in redistributing income support from larger to smaller farms.

Advancing on climate and environmental sustainability

The CAP strategic plans provide a wide range of interventions to support the achievement of the EU's climate and environmental objectives[11]. They aim to reduce greenhouse gas emissions and increase

[9] European Commission (n.d.). Agricultural and rural development Key policy objectives of the CAP 2023-27. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27/key-policy-objectives-cap-2023-27_en

[10] European Commission (2022). Common Agricultural Policy for 2023-2027. 28 CAP strategic plans at a glance. Available at: https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en?prefLang=en

[11] Ibid.

carbon sequestration by protecting and enhancing carbon sinks, as well as addressing emissions from mineral fertilisers and livestock. Farmers should continue to change their production methods to remove more carbon from the atmosphere. The strategic plans aim to incentivise land managers to store carbon in soil and biomass, and reduce emissions on 35% of the EU's agricultural area through appropriate management practices, such as extensive grassland management, growing leguminous and catch crops, organic fertilisation, and agroforestry. Concerning natural resources, the strategic plans aim to help farmers protect soils and maintain their fertility, improve water resilience, reduce pollution from fertilisers and pesticides, and minimise the use and risks associated with pesticides.

The CAP strategic plans also reward farmers for creating space for nature on agricultural land and improving ecological connectivity in several ways.[12] Firstly, agroforestry and landscape features are now more eligible for income support, helping to protect landscape features by recognising them as an integral part of agricultural production systems. Secondly, non-productive areas and features on arable land are strengthened through increased conditionality, requiring farmers to maintain and protect landscape features on at least 3% of their arable land. Finally, various types of CAP interventions (e.g., eco-schemes, agri-environmental climate measures, and non-productive investments) will support farmers in improving, managing, and creating new landscape features and non-productive areas on farmland. These measures will also contribute to the EU Biodiversity Strategy's 2030 target of 10% of EU agricultural land with high-diversity landscape features.

Agroforestry can undoubtedly contribute to the green architecture of the CAP. In particular, the eco-schemes under Pillar I and interventions under the agri-environment-climate measures (AECMs) under Pillar II are designed to encourage the adoption of sustainable practices, such as agroforestry.[13]

Key highlights of the CAP strategic plans *(Source: European Commission, 2023)*

- EU countries' CAP strategic plans allocate 32% of the CAP funding to delivering specific environmental benefits for climate, water, soil, air, biodiversity, and animal welfare, and promote practices that go beyond the conditionality.
- 24% of direct payments are allocated to eco-schemes, and 48% of rural development spending from EU funds is earmarked for the environment and climate.

Advancing on social sustainability

CAP strategic plans aim to help rural areas address several challenges, including depopulation, access to and improvement of basic services, employment opportunities and connectivity.[14] Some EU Member States are allocating additional resources to support farm succession, promote gender equality in rural areas and strengthen the position of women in farming.[15] Most strategic plans recognise the importance of gender issues and the need to increase women's participation in farming.

Another key objective of the CAP is to modernise agriculture and rural areas by promoting and improving knowledge, innovation and digitalisation. Farmers need to consider various challenges and solutions to support the transition to more resilient and sustainable agriculture and rural areas. This

[12] European Commission (2023). Approved 28 CAP Strategic Plans (2023-2027) Summary overview for 27 Member States Facts and figures. Available at: https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en?prefLang=en
[13] Guyomard, H., Détang-Dessendre, C., Dupraz, P., Delaby, L., Huyghe, C., Peyraud, J.-L., Reboud, X. and Sirami, C. (2023). How the Green Architecture of the 2023-2027 Common Agricultural Policy could have been greener. *Ambio*, *52*, 1327-1338. https://doi.org/10.1007/s13280-023-01861-0
[14] European Commission (2022). Common Agricultural Policy for 2023-2027. 28 CAP strategic plans at a glance. Available at: https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en?prefLang=en
[15] European Commission (2023). Approved 28 CAP Strategic Plans (2023-2027) Summary overview for 27 Member States Facts and figures. Available at: https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en?prefLang=en

transition will require increased efforts in advice, training and other knowledge exchange activities to help farmers and other rural actors to implement the necessary changes. Member States have detailed their strategies for knowledge sharing and innovation in their CAP strategic plans, including their contribution to the digital transformation of agriculture and rural areas.[16]

The strategic plans promote support for advice, demonstration and training to help farmers make the transition to a more resource-efficient, resilient and sustainable farming system. More than 6 million people are expected to benefit from CAP-funded advice, training and knowledge exchange or to participate in innovation projects under the European Innovation Partnerships. Some of these innovation projects will have a specific focus on climate and environmental performance, as well as social and rural aspects. The strategic plans also support investment in digital technologies and services to optimise resource efficiency. Emphasis will be placed on developing farmers' digital skills and tools for knowledge exchange among farmers, advisors, and researchers, as well as increased data sharing.[17]

3.2.3 Conditionality

To receive EU income support, farmers must comply with a set of rules known as “conditionality”.[18]

Conditionality (previously known as cross-compliance) encourages farmers to meet high EU standards for public, plant, and animal health and welfare, and to maintain good agricultural and environmental conditions.

Farmers are expected to comply with the following two rules:

- Statutory management requirements (SMRs)

All farmers, whether they receive CAP support or not, must respect statutory management requirements (SMRs). The SMRs encompass EU rules on public, animal, and plant health, as well as the environment. These rules have evolved, and new ones have been added for each successive CAP period.

- Good agricultural and environmental conditions (GAECs)

In addition to the SMRs, farmers receiving CAP support must comply with EU standards on GAECs.

These standards aim to:[19]

- maintain a stable area of permanent grassland;
- protect wetlands and peatlands;
- maintain soil organic matter and soil structure by banning the burning of arable stubble;
- protect water from pollution by establishing buffer strips along water courses;
- prevent soil erosion through appropriate practices;
- protect the soil by defining rules for minimum soil cover;
- preserve the soil potential through crop rotation;
- maintain non-productive areas and landscape features and ensure the maintenance of landscape features, for example, by prohibiting the cutting of hedges and trees during the breeding and rearing season of birds;

[16] Ibid.
[17] Ibid.
[18] European Commission (n.d.). Agricultural and rural development Conditionality.
Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/conditionality_en
[19] Ibid.

- protect environmentally-sensitive permanent grasslands in Natura 2000 sites.

The CAP (2023-2027) includes strengthened conditionality with “greener” requirements. Under the previous CAP, farmers received green direct payments for carrying out three practices: Crop diversification, the maintenance of permanent grassland, and the dedication of land to ecological focus areas (EFAs.) These practices are now incorporated into new conditionality rules in the current CAP. These include, for example, GAECs on soil protection and quality, as well as on biodiversity and landscape.

Conditionality ensures that all beneficiaries of CAP payments adhere to a baseline of practices that exceed the legal minimum, thereby contributing to climate and environmental objectives. Farmers who fail to comply with EU legislation on environmental protection, public health, animal welfare, or land management will have their EU support reduced and may face additional penalties. For example, direct payments and most rural development payments (e.g., area-based payments including agri-environmental and climate commitments, areas with natural constraints, NATURA 2000 measures, afforestation, forest environmental payments, agroforestry and organic farming) may be reduced.[20]

3.2.4 CAP Pillar I: Income support

Income support for farmers

The EU provides income support or “direct payments” to farmers to:[21]

- act as a safety net and make farming more profitable;
- ensure food security in Europe;
- assist them in producing safe, healthy and affordable food;
- reward them for providing public goods not normally paid for by markets, such as taking care of the countryside and the environment.

Farmers generally receive income support based on the size of their farms in hectares. All EU countries must provide a basic payment and a payment for the climate, environment and animal welfare to encourage sustainable farming practices (eco-schemes). These payments are compulsory.

EU countries can also choose to provide targeted payments for specific sectors or types of farming. Various schemes offer additional support for small and medium-sized farms, young farmers, and those operating in areas with natural constraints and/or sectors experiencing difficulties.

The EU links most income support for farmers to two main criteria:[22]

- Farmers are paid according to the number of hectares they farm rather than the quantities they produce, encouraging them to adapt to market demand and optimise profitability. This decoupling of payments from production quantities reduces the risk of overproduction.
- Compliance with environmental, plant health, and animal welfare standards is key to promoting sustainable agriculture. Formerly known as "cross compliance" until 2022, it has evolved into enhanced "conditionality" under the CAP (2023-27). Non-compliance with EU regulations can result in reduced or no payments.

[20] Ibid.
[21] European Commission (n.d.). Agricultural and rural development Income support explained. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/income-support-explained_en
[22] Ibid.

Each year, farmers must submit an aid application declaring all the agricultural parcels on their farm. While the basic rules for income support are set at the EU level, each country implements them on the ground. National authorities are responsible for administering and controlling income support for farmers in their country ("shared management"). Within the EU legal framework, each country also has some flexibility in making these payments to account for national farming conditions, which vary widely across the EU.

Eligibility conditions

Farmers must meet several eligibility conditions to receive income support:[23]

- Their farm must be located in the EU.
- The minimum requirements to receive income support must be met. Income support is not granted for amounts of less than € 100 to € 500 (depending on the EU country) and/or if the eligible area is less than 0.3 to 5 hectares.
- They must carry out an agricultural activity (e.g., production, rearing or growing of agricultural products, maintaining land in good agricultural condition) on the agricultural area (e.g., encompassing arable land, permanent crops and grassland) at their disposal.
- They must meet the mandatory definition of "active farmer". The requirements are defined by the EU countries and relate to minimum levels of agricultural activity, lists of ineligible economic activities, pluri-activity/part-time farmers, and reduced administrative burden.

The level of financial support available

Income support benefits around six million farms in the EU and represents a significant proportion of farm income.[24] Over the last ten years, income support has accounted for almost half of farmers' income. The level of income support can vary considerably between farms, countries and regions. The EU's "external convergence" mechanism aims to gradually adjust (either upwards or downwards) income support payments per hectare in each country to bring them closer to the EU average level. The planned EU budget for income support is almost € 188 billion for 2023-27.[25]

The CAP (2023-2027) has three compulsory and three voluntary payments.

Table 2 provides an overview of the income support schemes under the CAP.

Income support scheme	**Type**
1. Basic income support for sustainability (BISS)	Compulsory
2. Young farmers	Compulsory
3. Eco-schemes	Compulsory
4. Coupled income support (CIS)	Voluntary
5. Complementary redistributive income support for sustainability (CRISS)	Voluntary
6. Payment for small farmers (PSF)	Voluntary

Table 2: Overview of the income support schemes under CAP Pillar I.

The six income support schemes are described in more detail below.

[23] Ibid.
[24] European Commission (n.d.). Agricultural and rural development Income support explained. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/income-support-explained_en
[25] Ibid.

Compulsory payments

1. *Basic income support for sustainability (BISS)*

The basic income support for sustainability (BISS) mechanism replaces the basic payment scheme (BPS) and the single area payment scheme (SAPS) under Regulation (EU) 1307/2013 for the CAP 2023-27.[26] The BISS mechanism is a compulsory type of intervention for all EU countries. It provides an annual area-based decoupled payment paid for each eligible hectare declared by the farmers. The EU budget fully finances the BISS, which remains the main CAP instrument for supporting farmers' incomes in the EU. EU countries that used payment entitlements in their previous basic payment scheme may continue using entitlements to grant BISS. In the latter case, payments are only made for eligible hectares for which a payment entitlement has been activated, and the payment amount is based on the value of the payment entitlement. The BISS acts as a safety net by guaranteeing a minimum income to all active farmers in the agricultural sector.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- On average, 51% of the European Agricultural Guarantee Fund (EAGF) budget or 31% of total CAP public expenditure is earmarked for BISS in the CAP strategic plans.

For farmers, eligibility for the BISS mechanism is a condition for support under the following direct payment schemes:

2. *Young farmers*

As the farming population ages (only 11% of all farm holdings in the EU are run by farmers under the age of 40), the EU is stepping up its efforts to encourage young people to take up farming by providing start-up grants, income support and the provision of additional training.[27]

Young farmers can receive funding through the payment for young farmers.[28] Strategies to support young farmers include a combination of several interventions and actions, such as the complementary income support for young farmers (CISYF) and the installation of young farmers, new farmers and rural business start-ups. EU countries must allocate at least 3% of their direct payment budget to support young farmers. This support can be income, investment, or start-up aid for young farmers. The CISYF is a voluntary direct payment scheme that provides enhanced income support to young farmers setting up for the first time and eligible for basic income support. The support is an annual payment per eligible hectare or an annual lump sum.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- 26 CAP strategic plans provide for the CISYF in the form of an annual payment per hectare linked to the size of the farm or a lump sum per farm (except Denmark, Portugal).
- 27 EU Member States will support young farmers through a grant to set up their business in the form of a lump sum and, in some cases, additional financial instruments.

[26] European Commission (n.d.). Agriculture and rural development The basic income support for sustainability (BISS). Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/biss_en
[27] European Commission (n.d.). Agriculture and rural development Young farmers.
Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/young-farmers_en
[28] Ibid.

3. Eco-schemes

Eco-schemes are a new direct payment instrument to support farmers in their transition towards sustainability for practices that go beyond conditionality rules and benefit the climate, the environment and animal welfare.[29] The annual payment per hectare granted for eco-schemes can be a payment in addition to the basic income support or a payment to compensate for potential income losses resulting from the commitment to certain practices. Eco-schemes are designed to support farmers who adopt farming practices that benefit the climate and the environment. They reward them for preserving natural resources and providing public goods that benefit society and are not reflected in market prices. Eco-schemes are mandatory for EU countries and optional for farmers.

To be supported by eco-schemes, agricultural practices should cover activities related to climate, environment, animal welfare and antimicrobial resistance. They must be based on the needs and priorities identified at the national and regional levels in the countries' strategic plans. EU countries had the flexibility to tailor the eco-schemes to specific national climate and environmental needs. Under the CAP (2023-2027), 25% of the direct payments must be allocated to eco-schemes to strengthen incentives for climate and environment-friendly farming practices.

The European Commission has published a list of agricultural practices that could be supported by eco-schemes under the CAP. This instrument can support practices, such as organic farming, agroecological practices, precision farming, **agroforestry, carbon farming,** and animal welfare improvements.[30] Eco-schemes must also include interventions that make a significant contributition to the CAP's ten objectives. They are a new way of rewarding farmers for being environmentally friendly. While AECMs under Pillar II require national or regional co-funding, eco-schemes are fully funded by the EU. They can support commitments annually, based on needs identified in CAP strategic plans, or on a multi-annual basis, as decided by EU countries. During the two-year "learning period" (2023 and 2024), countries can spend less than 25% of the direct payments if farmers' uptake is lower than planned. However, most shortfall must be compensated by the end of 2027.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- The CAP strategic plans set out 158 eco-schemes, of which 18% provide payments beyond the BISS. The remaining 82% provide payments intended to compensate farmers for the additional costs and income foregone resulting from these commitments.
- The eco-schemes providing payments in addition to the BISS are those with requirements for non-productive biodiversity/landscape features, those following a "whole farm approach," and those not linked to specific land uses.
- Member States have taken different approaches to the design of eco-schemes. While most eco-schemes are implemented annually, some plans include multi-annual schemes.

Voluntary payments

Additional optional schemes provide other income support to specific sectors facing difficulties and help small and medium-sized farms by achieving a fairer distribution of income.

[29] European Commission (n.d.). Agriculture and rural development Eco-schemes.
Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/eco-schemes_en
[30] European Commission (2021). Agriculture and rural development. Commission publishes list of potential eco-schemes.
Available at: https://agriculture.ec.europa.eu/news/commission-publishes-list-potential-eco-schemes-2021-01-14_en

There are three categories of schemes:

4. *Coupled income support (CIS)*

Under the CAP, the link between the receipt of income support payments and the production of specific products has been progressively removed to avoid overproduction of certain products and ensure that farmers respond accurately to market demand.[31] However, targeted aid to a specific agricultural sector or sub-sector may be necessary when it faces difficulties in certain situations.

Coupled income support (CIS) aims to prevent the occurrence of these difficulties, which could lead to the abandonment of production and affect other parts of the supply chain, potentially increasing unemployment in already economically depressed rural areas. EU countries can therefore continue to link limited income support payments to specific sectors or products.

However, CIS is subject to several conditions and strict limits to reduce the risk of market distortions. The potentially eligible sectors are cereals, oilseeds, protein crops, including legumes and mixtures of legumes and grasses, flax, hemp, rice, nuts, starch potatoes, milk and milk products, seeds, sheep meat and goat meat, beef and veal, olive oil and table olives, silkworms, dried fodder, hops, sugar beet, cane and chicory roots, fruit and vegetables and short rotation coppice.[32]

The support is paid per animal or hectare in the sector and is subject to important conditions and strict limits to reduce the risk of market distortion. As a general rule (with exceptions in duly justified cases), EU countries cannot use more than 13% of their direct payment budget to grant CIS. However, this can be increased by up to 2 percentage points to support the production of protein crops, given the horizontal difficulties of this sector and the high import dependency at the EU level.

The CIS can only be granted to sectors specified in Regulation (EU) 2021/2115, which requires EU countries to justify their inclusion in their CAP strategic plans. They have to outline the sector-specific challenges and justify the long-term objective, such as improving competitiveness and sustainability, while emphasising each targeted sector's socio-economic and environmental importance.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- With the exception of the Netherlands, all EU countries offer CIS to specific sectors. However, the level of funding and the range of sectors covered varies considerably between countries.

5. *Complementary redistributive income support for sustainability*

The complementary redistributive income support for sustainability (CRISS) replaces the redistributive payment scheme of the previous CAP.[33] It ensures fairness by redistributing income support from larger to smaller and medium-sized farms. Under the CAP (2023-2027), EU countries must allocate at least 10% of the adjusted direct payment envelope to the CRISS. However, they can only derogate from this mandatory requirement if they demonstrate that other EAGF instruments sufficiently address the redistribution needs.

[31] European Commission (n.d.). Agriculture and rural development Coupled income support. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/additional-schemes/coupled-income-support_en

[32] Ibid.

[33] European Commission (n.d.). Agriculture and rural development Complementary redistributive income support for sustainability. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/additional-schemes/criss-payment_en

The CRISS is an annual decoupled payment per eligible hectare to farmers entitled to a payment under the BISS. EU countries have considerable flexibility, within the limits set by the CAP legal framework, to tailor the design of the CRISS to their redistribution needs and farm structure. The CRISS is an extra payment for the first hectares for farmers eligible for the BISS. To improve the targeting of this complementary support and to take into account the different farm structures across the EU, countries have the flexibility to provide complementary support for different ranges of hectares and/or to differentiate the level of payment according to the regions or groups of territories defined in the BISS.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- Member States will allocate 10.7% of the adjusted direct payments envelope to the CRISS, which is 2.5 times the amount allocated to the redistribution payment in the previous CAP.

6. Payment for small farmers (PSF)

More than three-quarters of farms in the EU are small (less than 10 hectares, with a large number of farms of less than five hectares). The payments for small farmers (PSF) aim to achieve a more balanced distribution of support, promote the vitality of rural areas, where small farms play an important economic role, and minimise the administrative burden for beneficiaries and managing authorities.[34] EU countries can implement this mechanism voluntarily, in the form of an identical lump sum for all farmers or a payment per hectare. The PSF replaces all other forms of income support payment, including the BISS, eco-schemes, CISYF, CRISS and CIS. The maximum payment amount is set at the national level and cannot exceed €1,250 per year.

Farmers applying for the PSF are not eligible to receive any other direct payment. The eligibility conditions are the same as for the BISS. Farmers must comply with the active farmer provisions and the minimum requirements set out in Article 18 of Regulation (EU) 2021/2115, which lays down the rules for support for CAP strategic plans. The PSF does not exempt farmers from conditionality controls. This mechanism replaces the Small Farmers Scheme under Regulation (EU) 1307/2013.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- 5 Member States (Malta, Latvia, Czech Republic, Portugal, Bulgaria) choose PSF to promote a more balanced support distribution and reduce the administrative burden for beneficiaries receiving small amounts, including an intervention for small farmers replacing the other forms of direct payment support. Around 110’000 farmers will receive PSF.

3.2.5 CAP Pillar II: Rural development

Rural development

The CAP helps to keep rural areas vibrant and economically viable by funding and taking action to support rural development. Rural development is the “second pillar” of the CAP.

It reinforces the “first pillar” of income support and market measures by strengthening the social, environmental and economic sustainability of rural areas.

[34] European Commission (n.d.). Agriculture and rural development Payments for small farmers. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/additional-schemes/payments-small-farmers_en

The CAP has three long-term objectives to support the sustainable development of rural areas:[35]

- Fostering the competitiveness of agriculture and forestry;
- Ensuring the sustainable management of natural resources and climate action;
- Achieving a balanced territorial development of rural economies and communities, including creating and maintaining jobs.

Under the CAP (2023-2027), Pillar II "Rural development" dedicates a greater share of its resources to climate and environmental interventions. At least 35% of funds must be allocated to measures to support climate, biodiversity, the environment and animal welfare.[36] By comparison, 30% of rural development funds were allocated to the environment and climate under the previous CAP.

Rural development programmes

EU countries implement European Agricultural Fund for Rural Development (EAFRD) funding through Rural Development Programmes (RDPs). They are co-financed from national budgets and can be prepared at the national or regional level. While the European Commission approves and monitors the RDPs, the national and regional managing authorities decide on the selection of projects and grant payments.

In the CAP 2014-2020, there were six priorities for the EU rural development policy:[37]

- Fostering knowledge transfer and innovation in agriculture, forestry and rural areas;
- Enhancing the viability and competitiveness of all types of agriculture and promoting innovative agricultural technologies and sustainable forest management;
- Promoting food chain organisation, animal welfare and risk management in agriculture;
- Promoting resource efficiency and supporting the transition to a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors;
- Restoring, preserving and enhancing ecosystems related to agriculture and forestry;
- Promoting social inclusion, poverty reduction and economic development in rural areas.

EU Member States and regions were required to address at least four of these priorities in their RDPs.

The EAFRD priorities were divided into 18 specific focus areas. In their previous programmes, countries established targets for their chosen priorities and focus areas, along with a strategy to achieve these targets. In addition, they also had to choose from a list of 20 policy measures, which could be tailored to national and regional circumstances, to implement one or more of the EAFRD priorities.[38]

The future of rural development

Under the CAP (2023-2027), the EAFRD funding is applied through eight broad policy measures.[39] By reducing the number of measures and broadening their scope, the European Commission aims to give EU countries more flexibility to tailor policy interventions to their needs.

[35] European Commission (n.d.). Agriculture and rural development Rural development. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_en

[36] European Commission (n.d.). Agriculture and rural development Key reforms in the CAP. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27/key-reforms-new-cap_en

[37] European Commission (n.d.). Agriculture and rural development Rural Development. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_en

[38] Ibid.

[39] European Commission (n.d.). Agriculture and rural development Rural development measures. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development/measures_en

Under the CAP Strategic Plan Regulation, the eight policy measures for rural development are: [40]

- Environmental, climate and other management commitments;
- Natural or other area-specific constraints;
- Area-specific disadvantages resulting from certain mandatory requirements;
- Investments;
- Installation of young farmers and rural business start-ups;
- Risk management tools;
- Cooperation;
- Knowledge exchange and information.

From 2023 onwards, all new rural development actions will be integrated into national CAP strategic plans. Each national plan is based on key social, environmental, and economic objectives for the EU's agricultural, forestry, and rural areas. Within this framework, the European Commission aims to make rural development actions more responsive to current and future challenges while continuing to support European farmers in a sustainable and competitive agricultural sector. Rural development actions will also make a strong contribution to the key objectives of the European Green Deal.

The eight types of measures are described below.

Article 70: Environmental, climate-related and other management commitments

Agri-environment-climate commitments (AECCs)

Member States shall include agri-environmental and climate commitments (AECCs) among the interventions in their CAP strategic plans and may also include other management commitments. Article 70 provides for payments to be made to farmers or beneficiaries who voluntarily undertake commitments that contribute to achieving specific objectives beyond the SMRs and GAECs standards. Member States determine the payments based on the additional costs incurred and income foregone resulting from the commitments made. They are granted annually and may cover transaction costs. Member States may also promote collective schemes and result-based payment schemes to encourage farmers or other beneficiaries to achieve significant improvements in environmental quality on a larger scale or in a measurable way. Commitments are typically made for five to seven years, with flexibility for longer or shorter periods as needed.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- The number of AECCs per Member State ranges from two (Netherlands) to more than 40 (Italy), with more than 200 AECC interventions across the EU. Some of these interventions cover the whole country. In contrast, others target a specific geographical area with clearly defined habitats or ecosystems in need of protection (e.g., alpine pasture management in Austria, wetland/peatland in Sweden).

[40] EUR-Lex (2021). Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013. Available at: https://data.europa.eu/eli/reg/2021/2115/oj

Article 71: Natural or other area-specific constraints

Payments for areas facing natural or specific constraints

Areas facing natural or other specific constraints (ANCs) are more difficult to farm effectively due to specific problems caused by natural conditions. ANC payments are a voluntary type of rural development intervention that provides an annual payment per hectare of agricultural area, based on a calculation of the difference in income and costs between constrained and unconstrained areas.[41]

They are intended to compensate farmers fully or partially for the disadvantages to which agricultural production is exposed as a result of natural or specific constraints in their activity area. Member States may design and include payments for these areas to compensate farmers for income foregone and additional costs associated with their agricultural activity. This compensation aims to ensure a fair income and enable farmers to continue farming, thereby avoiding land abandonment.

To be called an ANC, the land must fall into one of the following three categories:[42]

- Mountain areas are defined according to their altitude or the steepness of their slopes;
- Areas facing significant natural constraints, based on eight biophysical criteria and a "fine-tuning" process;
- Other areas are affected by specific constraints, which are limited to 10% of the country's total area and are defined by the EU country itself.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- ANC payments are foreseen in 23 CAP strategic plans (Austria, Belgium-Wallonia, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Greece, Spain, Finland, France, Croatia, Ireland, Italy, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Sweden, Slovenia and Slovakia). They aim to support an estimated 29% of the EU's agricultural area yearly.
- 17 CAP strategic plans provide support in areas defined as mountainous (except Belgium-Wallonia, Germany, Ireland, Lithuania, Luxembourg and Malta).
- 21 CAP strategic plans provide support in areas defined as non-mountainous (except Germany and Malta).
- In financial terms, the support for areas facing natural constraints represents about 17% of total public funding for rural development and 6% of the total public funding of the CAP.

Article 72: Area-specific disadvantages resulting from certain mandatory requirements

Article 72 allows Member States to make annual payments per hectare to farmers, forest holders, and land managers to compensate for area-specific disadvantages resulting from mandatory requirements under Directives 92/43/EEC, 2009/147/EC, or 2000/60/EC. Areas with disadvantages include Natura 2000 agricultural and forest areas, other nature protection areas with environmental restrictions, and agricultural areas included in river basin management plans. Payments are granted annually per hectare and aim to compensate for all or part of the additional costs and income foregone related to the area-specific disadvantages, including possible transaction costs.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

[41] European Commission (n.d.). Agriculture and rural development Natural or other area-specific constraints. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/additional-schemes/anc-payment_en
[42] Ibid.

- 19 CAP strategic plans (Belgium (Wallonia), Bulgaria, Czech Republic, Germany, Denmark, Estonia, Greece, Spain, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Austria, Portugal, Slovenia, Slovakia) provide for payments for Natura 2000 and/or Water directive requirements on a total of 1.9 million hectares of agricultural land and forests.

Article 73: Investment and Article 74: Investment in irrigation

Member States may provide support for investments in tangible and intangible assets to achieve the specific objectives outlined in Articles 6(1) and (2). For larger holdings, support for the forestry sector is conditional on the submission of relevant information from a forest management plan.

Article 73 sets the rates of support for investments. Member States are required to limit support to a maximum of 65% of the eligible costs. However, certain investments, such as those made by young farmers and in the outermost regions, may increase by up to 80%, and those made by small farms by up to 85%. Higher rates of up to 100% may be applied to investments in afforestation, the establishment and regeneration of agroforestry systems, basic services in rural areas, and agricultural and forestry infrastructure. Additionally, rates may be applied to the restoration of agricultural or forestry potential following natural disasters or climatic events, as well as the maintenance of forest health and non-productive investments.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- All Member States included targeted environmental interventions to address climate change mitigation and adaptation needs, sustainable development and efficient management of natural resources and/or biodiversity conservation.

Article 75: Setting up of young farmers and new farmers, and rural business start-up

Member States may grant support for the setting up of young farmers and for the start-up of rural businesses. Member States may grant support in the form of lump sums, financial instruments, or a combination of both. Support is limited to a maximum amount of aid of € 100,000.

EU countries can include rural development interventions in their CAP strategic plans:[43]

- **Installation of young farmers, new farmers and rural business start-ups**: EU countries can implement this voluntary intervention under the CAP rural development funds to help farmers and rural businesses get started.
- **Cooperation** schemes apply to generational renewal at the farm level in the context of farm succession.

This support for young farmers may include grants, loans, and guarantees for the development of rural businesses, as well as advice on how to set up a farming operation effectively.

Article 76: **Risk management tools**

Article 76 outlines the provisions for supporting risk management tools within the Member States' CAP strategic plans. The support is designed to help active farmers manage production and income risks related to their agricultural activities that are beyond their control. Member States may support different risk management tools, including financial contributions to insurance premiums and mutual

[43] European Commission (n.d.). Agriculture and rural development Young farmers.
Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/young-farmers_en

funds. They should define the eligibility conditions, such as the types and coverage of eligible risk management tools, the methodology for calculating losses and triggering factors for compensation, and the rules for the constitution and management of the mutual funds. Support is limited to losses exceeding 20% of the farmer's average annual production or income in the preceding three-year period, or a three-year average based on the preceding five-year period, excluding the highest and lowest entries. Member States must avoid any overcompensation resulting from the combination of the interventions with other risk management schemes.

Key highlights from the CAP strategic plans *(Source: European Commission, 2023)*

- CAP strategic plans allocating funds for risk management aim to reach almost 15% of EU farms through rural development and sectoral programmes.
- Fourteen Member States (Germany, Estonia, France, Croatia, Hungary, Italy, Lithuania, Latvia, the Netherlands, Poland, Portugal, Romania, Slovakia and Bulgaria) include support for risk management tools in their strategic plans and propose 25 interventions for support through insurance schemes and mutual funds.
- Several Member States do not foresee risk management tools financed by the EAFRD and use nationally funded insurance schemes.

Article 77: Cooperation

Article 77 outlines the conditions under which support may be granted, including for projects of the European Innovation Partnership (EIP) operational groups, LEADER, quality schemes, producer groups, smart village strategies, and other forms of cooperation. This support aims to encourage new forms of cooperation involving at least two actors and contributing to the specific objectives outlined in Article 6(1) and (2) of the Regulation. Costs related to all aspects of cooperation may be covered, with support being granted as an overall amount or for specific activities. However, Member States cannot provide support for cooperation involving research bodies. In the context of cooperation on farm succession, support is limited to farmers who have reached the retirement age set by the Member States, and it is available for a maximum duration of seven years. There are also restrictions on support for information and promotional actions for quality schemes, as well as for setting up producer groups or organisations.

Article 78: Knowledge exchange and dissemination of information

Article 78 outlines the provisions for knowledge exchange and dissemination of information in the Member States' CAP strategic plans. Support may be granted to cover the costs of actions that promote innovation, training, advisory services, and other forms of knowledge exchange and information dissemination, focusing on nature, environment, and climate protection, as well as the development of rural businesses and communities. Advisory services shall be eligible for support if they comply with Article 15(3), and a maximum fixed amount of € 200,000 can be granted for their establishment. Member States shall ensure that the actions supported are consistent with the description of the Agricultural Knowledge and Innovation System (AKIS) provided in their CAP strategic plans.

Summary

Pillar II, "Rural Development," aims to enhance the social, environmental, and economic sustainability of rural areas across the EU. The CAP (2023-2027) emphasises climate and environmental measures, with at least 35% of funds allocated to support climate, biodiversity, environment and animal welfare. The CAP Strategic Plan Regulation introduces eight broad policy measures, giving EU countries greater flexibility to tailor interventions to their specific needs. These measures include environmental commitments, support for areas facing natural constraints and with specific disadvantages, investments, support for young farmers and rural businesses, risk management tools, cooperation initiatives, and

knowledge exchange. The evolving CAP aims to address current and future challenges while promoting a sustainable agricultural sector in line with the objectives of the European Green Deal.

3.2.6 Agroforestry in the CAP (2023-2027)

The CAP Strategic Plan Regulation and its annexes mention agroforestry eleven times. The practice is eligible for support under pillars I and II of the CAP (2023-2027), with a focus on climate and environmental services. EU Member States have had to decide how and to what extent to support agroforestry when preparing their CAP strategic plans. Agroforestry will be essential for the green architecture of the future CAP. In particular, eco-schemes and the interventions under the AECMs are designed to ensure the best climate and environmental practices and may include agroforestry.[44]

The proposed regulation on CAP strategic plans foresees eight types of rural development interventions. Most of them are well suited to support agroforestry, in particular: "Environmental, climate and other management commitments" (Article 70), Natural or other area-specific constraints (Article 71), "Area-specific disadvantages resulting from certain mandatory requirements" (Article 72), and "Investments" (Articles 73 and 74). In addition, Article 78 "Knowledge exchange and information," provides that Member States may grant support for the exchange of knowledge and information on agriculture, forestry, and rural business. Most countries (except Finland, Ireland, Luxembourg, the Netherlands, and Sweden) planned to provide support for forestry under the current CAP, for example, to increase forest or wooded areas, promote agroforestry, restore forests after natural disasters and adverse weather conditions, and improve infrastructure to adapt to climate change.[45]

3.3 State aid for agroforestry systems

The agricultural State aid guidelines help EU countries to correctly apply EU rules on state subsidies in agriculture, forestry and rural areas. Aid must be transparent, published and have an incentive effect.

Most categories of agricultural State aid target key features related to agroforestry, although only a few of them mention agroforestry. Agroforestry is mentioned several times in the EU Guidelines for State aid in the agricultural and forestry sectors and in rural areas.[46] Some examples are given below:

- 2.1.2. Aid for the establishment, regeneration or renovation of agroforestry systems

*o (509) The Commission will consider aid for the establishment, regeneration or renovation of **agroforestry systems** compatible with the internal market under Article 107(3), point (c), of the Treaty if it complies with Part I, Chapter 3, of these Guidelines and with the conditions set out in this Section.*

*o (510) "The aid may be granted for establishing **agroforestry systems** as defined in point (33)(10)."*

*o (511) "The aid covers the costs of the establishment, regeneration or renovation of an **agroforestry system** and an annual premium per hectare may be granted to cover the costs of the maintenance, for a maximum period determined by the Member State."*

*o (512) "Member States must determine the structure and composition of the **agroforestry system**, taking account of local pedo-climatic and environmental conditions, forestry species and the need to ensure sustainable agricultural use of the land."*

[44] Guyomard, H., Détang-Dessendre, C., Dupraz, P., Delaby, L., Huyghe, C., Peyraud, J.-L., Reboud, X. and Sirami, C. (2023). How the Green Architecture of the 2023-2027 Common Agricultural Policy could have been greener. *Ambio*, *52*, 1327-1338. https://doi.org/10.1007/s13280-023-01861-0

[45] European Commission (2023). Approved 28 CAP Strategic Plans (2023-2027) Summary overview for 27 Member States Facts and figures. Available at: https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en?prefLang=en

[46] EUR-Lex (2022). Communication from the Commission Guidelines for State aid in the agricultural and forestry sectors and in rural areas 2022/C 485/01.
Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52022XC1221%2801%29

Research and development in the agricultural and forestry sectors includes a state subsidy for the establishment of agroforestry system projects, "Agroforestry systems (limited to € 7.5 million per agroforestry system establishment project)". State aid for agroforestry systems is designed to cover the costs associated with establishing, regenerating, or renovating such systems.

The following costs are eligible (Article 42: Aid for agroforestry systems):[47]

- *a) the costs for planting trees, including the costs of the plantation material, the plantation, the storage and the treatments of seedlings with the necessary prevention and protection materials;*
- *b) the costs for converting existing forests or other wooded land, including the costs for felling trees, thinning and pruning and protection against grazing animals;*
- *c) other costs directly linked to the establishment, regeneration or renovation of an agroforestry system, such as costs for feasibility studies, establishment plan, soil examination, soil preparation and protection;*
- *d) the costs of silvopastoral, namely, grazing system, watering and protective facilities;*
- *e) the costs of the necessary treatment connected to the establishment, regeneration or renovation of an agroforestry system, including watering and cutting;*
- *f) the costs for replanting during the first year after the establishment, regeneration or renovation of an agroforestry system.*

The annual premium per hectare granted under the aid covers the maintenance costs of the agroforestry system for a maximum period of 12 years from the date the aid is granted.

3.4 EU Sustainable Finance: An untapped potential for agroforestry

This subsection provides insights into how the EU Sustainable Finance can help support the uptake of agroforestry across Europe. The Taxonomy Regulation and the Climate Delegated Act define the EU framework for sustainable finance. The Climate Delegated Act covers forestry, while the inclusion of agriculture has been delayed until the next Delegated Act, pending inter-institutional negotiations on the CAP (2023-2027). Additionally, agriculture and forestry are not considered together in the Climate Delegated Act and the Complementary Climate Delegated Act, which do not mention agroforestry. However, given the known environmental benefits of agroforestry, it is important to examine the potential of the EU Sustainable Finance to channel private investment into sustainable agroforestry projects and initiatives. This subsection first defines sustainable finance and discusses how it can contribute to achieving the objectives of the European Green Deal. It then presents the main tools and standards of the EU Sustainable Finance, emphasising the EU Taxonomy, the new European Green Bond Standard, and environmental, social and governance (ESG) rating activities. Finally, this subsection examines how the EU Sustainable Finance can support the adoption of agroforestry.

3.4.1 What is sustainable finance?

Sustainable finance refers to the integration of ESG considerations into investment decisions in the financial sector, leading to longer-term investment in sustainable economic activities and projects.[48] Environmental considerations include climate change mitigation and adaptation, biodiversity

[47] EUR-Lex (2022). Commission Regulation (EU) 2022/2472 of 14 December 2022 declaring certain categories of aid in the agricultural and forestry sectors and in rural areas compatible with the internal market in application of Articles 107 and 108 of the Treaty on the Functioning of the European Union. Available at: http://data.europa.eu/eli/reg/2022/2472/oj

[48] European Commission (n.d.). Finance Overview of sustainable finance.
Available at: https://finance.ec.europa.eu/sustainable-finance/overview-sustainable-finance_en

conservation, pollution prevention and the circular economy. Social considerations encompass inequality, inclusiveness, labour relations, investment in human capital, community engagement, and human rights. The governance of public and private institutions, including management structures, employee relations and executive remuneration, is essential for integrating social and environmental considerations into the decision-making process. Sustainable finance aims to support economic growth and reduce environmental pressure while addressing social and governance aspects.

3.4.2 How can sustainable finance help achieve the European Green Deal's objectives?

Sustainable finance can help achieve the objectives of the European Green Deal by complementing public funding and redirecting private investment towards the transition to a climate-neutral, resilient, resource-efficient and fair economy.[49]

The European Commission's comprehensive policy agenda on sustainable finance aims to promote the development of a financial system that facilitates and supports the transition to sustainable growth in the EU.[50] The policy agenda includes an action plan for financing sustainable growth, the development of a renewed sustainable finance strategy under the European Green Deal, and a new strategy for financing the transition to a sustainable economy. The EU's sustainable finance agenda supports businesses and the financial sector in this transition by encouraging private financing of sustainable projects and technologies. The European Commission is also coordinating international efforts through its platform on sustainable finance, a forum for dialogue between policymakers.[51] The platform aims to increase the amount of private capital invested in environmentally sustainable investments. The Platform's predecessor was the Technical Expert Group on sustainable finance.

3.4.3 EU Sustainable Finance: Tools and standards

The EU's main sustainable finance tools and standards include the EU Taxonomy, the European Green Bond Standard and ESG rating activities.

EU Sustainable Finance Taxonomy

The EU Taxonomy is a cornerstone of the EU's Sustainable Finance framework and a crucial tool for market transparency. The Climate Delegated Act under the EU Taxonomy outlines technical screening criteria for economic activities in sectors most relevant to achieving the climate and environmental objectives of the European Green Deal.[52] These sectors include, for example, energy, forestry, manufacturing, transport and buildings. It is essential to channel investment into sustainable projects and activities to achieve these objectives. The action plan for financing sustainable growth has led to the creation of a common classification system for sustainable economic activities, known as the "EU Taxonomy", which provides a common language and a clear definition of "sustainability".[53]

The EU Taxonomy categorises environmentally sustainable economic activities and provides companies, investors, and policymakers with clear definitions of economic activities that can be

[49] Ibid.
[50] Ibid.
[51] European Commission (n.d.). Finance International Platform on Sustainable Finance.
Available at: https://finance.ec.europa.eu/sustainable-finance/international-platform-sustainable-finance_en
[52] EUR-Lex (2021). Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives (Text with EEA relevance). Available at: http://data.europa.eu/eli/reg_del/2021/2139/oj
[53] European Commission (n.d.). Finance EU taxonomy for sustainable activities.
Available at: https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

considered environmentally sustainable. These activities must make a significant contribution to at least one of the EU's climate and environmental objectives, while not significantly undermining any of these objectives, and meet minimum safeguards.[54] It is important to note that the EU Taxonomy is not a mandatory list for investors and does not set environmental performance requirements for companies. However, the EU Taxonomy should encourage a transition towards sustainability by increasing investment in the projects and activities needed to achieve the EU's climate and environmental objectives. Its main aim is to provide security for investors, protect them from greenwashing, help companies become more climate-friendly, and reduce market fragmentation.[55]

The first delegated act on sustainable activities for climate change mitigation and adaptation objectives of the EU Taxonomy ("Climate Delegated Act") was published in the Official Journal in December 2021. In June 2023, the European Commission adopted a Taxonomy Environmental Delegated Act, which includes a new set of EU taxonomy criteria for economic activities that make a significant contribution to one or more non-climate environmental objectives.

The six environmental objectives are:[56]

- Climate change mitigation;
- Climate change adaptation;
- The sustainable use and protection of water and marine resources;
- The transition to a circular economy;
- Pollution prevention and control;
- The protection and restoration of biodiversity and ecosystems.

The Taxonomy Regulation defines four general conditions that an economic activity must meet to be considered environmentally sustainable:[57]

- Making a substantial contribution to at least one environmental objective;
- Doing no significant harm to any of the other five environmental objectives;
- Complying with minimum safeguards;
- Complying with the technical screening criteria set out in the Taxonomy delegated acts.

To ensure that an economic activity makes a significant contribution to one of these objectives without significantly undermining any of the other five objectives, the EU has set performance criteria, known as technical screening criteria, in the Climate Delegated Act.

In February 2022, the European Commission approved a Complementary Climate Delegated Act[58], adding certain nuclear and gas energy activities to the list of economic activities covered by the EU

[54] Ibid.
[55] Ibid.
[56] EUR-Lex (2023). Commission Delegated Regulation (EU) 2023/2486 of 27 June 2023 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to the sustainable use and protection of water and marine resources, to the transition to a circular economy, to pollution prevention and control, or to the protection and restoration of biodiversity and ecosystems and for determining whether that economic activity causes no significant harm to any of the other environmental objectives and amending Commission Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities. Available at: http://data.europa.eu/eli/reg_del/2023/2486/oj
[57] European Commission (n.d.). EU Taxonomy Navigator. Available at: https://ec.europa.eu/sustainable-finance-taxonomy/home
[58] European Commission (2022). EU taxonomy: Complementary Climate Delegated Act to accelerate decarbonisation. Available at: https://finance.ec.europa.eu/publications/eu-taxonomy-complementary-climate-delegated-act-accelerate-decarbonisation_en

Taxonomy. The Climate Delegated Act will continue to evolve, with further sectors and activities being added to its scope through amendments. The EU Taxonomy aims to put sectors on the right track to meet the EU's climate and environmental objectives.

European Green Bond Standard

Green bonds play a crucial role in financing the assets necessary for the transition to a low-carbon economy. With the European Green Bond Standard (EUGBS), the EU aims to set a clear standard for green bonds. This voluntary standard relies on the detailed criteria of the EU Taxonomy to define green economic activities, ensures transparency in line with market best practice, and establishes supervision of companies carrying out pre- and post-issuance reviews at the European level.[59]

The EUGBS aims to raise the environmental ambitions of the green bond market.[60] Once adopted by the co-legislators, the proposed regulation will establish a gold standard for how companies and public authorities can utilise green bonds to raise capital in the capital markets, financing large-scale investments while meeting sustainability requirements and protecting investors. The EUGBS will benefit both issuers and investors in green bonds. On the one hand, it will provide issuers with a robust tool to demonstrate that they are financing legitimate green projects in line with the EU Taxonomy.[61] On the other hand, investors buying bonds will have easier access to information and greater confidence in the sustainability of their investments. This, in turn, can reduce the risks associated with greenwashing.

The proposed framework has four key requirements:[62]

- **Taxonomy alignment:** The funds raised by the bond must be fully allocated to projects aligned with the EU Taxonomy.
- **Transparency:** Full transparency on the allocation of bond proceeds through detailed reporting requirements must exist.
- **External review:** An external reviewer must verify all European green bonds to ensure compliance with the regulation and taxonomy alignment of the funded projects.
- **Supervision by the European Securities Markets Authority (ESMA) of reviewers:** To protect investor interests and ensure market integrity, external reviewers providing services to European green bond issuers must be registered with and supervised by the ESMA to ensure the quality of their services and the reliability of their assessments.

The new EUGBS will be available to all issuers of green bonds, including companies, public authorities and issuers outside the EU.

ESG rating activities

ESG ratings are crucial for investors and essential for building confidence in sustainable investments.[63] They provide information on a company's or financial instrument's sustainability performance by assessing its exposure to sustainability risks and/or its impact on people and the environment. ESG ratings are mainly developed and distributed by specialised ESG rating providers, but some financial institutions also develop their own ESG ratings. ESG ratings are increasingly important for investors

[59] European Commission (n.d.). Finance The European green bond standard - Supporting the transition. Available at: https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard-supporting-transition_en

[60] European Commission (n.d.). Finance Commission proposal for a European green bond standard. Available at: https://finance.ec.europa.eu/publications/commission-proposal-european-green-bond-standard_en

[61] Ibid.

[62] Ibid.

[63] European Commission (n.d). Finance ESG rating activities. Available at: https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/esg-rating-activities_en

and companies in building confidence in sustainable investments. Investors utilise ESG ratings as part of their sustainable investment strategies to mitigate risks and/or impacts associated with ESG issues. Companies use them to identify and address operational risks and investment opportunities, as well as to assess their performance on ESG factors compared to their peers.

The EU has agreed a new regulation on ESG rating activities, ensuring that investors and other stakeholders can access reliable and comparable information on ESG rating objectives (what they assess) and methodologies (how they assess).[64] Given the importance of ESG ratings in investment decisions, this will help promote a culture of transparency about companies' impact on people and the environment, thereby reducing greenwashing and promoting sustainable investment.

Disclosures

EU rules require all large companies and all listed companies (except micro-enterprises) to disclose information on what they consider to be their social and environmental risks and opportunities, as well as the impact of their activities on people and the environment.[65] The disclosures are intended to help investors, civil society organisations, consumers, and other stakeholders assess companies' sustainability performance as part of the European Green Deal. The EU has established a transparency framework, the Sustainable Finance Disclosure Regulation (SFDR).[66] By outlining how financial market participants must disclose sustainability information, this framework aims to help investors who wish to invest in companies and projects that support sustainability objectives make informed choices. The SFDR also aims to enable investors to properly assess how sustainability risks are integrated into investment decision-making. The disclosure requirement and the SFDR can help attract private finance to support Europe's transition to a net-zero economy.

3.4.4 How can the EU Sustainable Finance support the uptake of agroforestry?

The EU Sustainable Finance can support the uptake of agriculture, forestry and agroforestry practices by channelling private investment into sustainable projects and activities while providing innovative financial tools and market structures. Through green bonds and loans, the EU Sustainable Finance can encourage investment in sustainable practices, such as organic farming, sustainable forest management and agroforestry. To be considered as environmentally sustainable under the EU Taxonomy, an economic activity must meet several technical screening criteria to ensure that it has a positive environmental impact and does not undermine any other environmental objectives.

The Climate Delegated Act outlines technical screening criteria for forestry, encompassing activities such as afforestation, conservation, management, rehabilitation, and restoration. The European Commission will review these criteria as part of its future policy, in line with the EU's biodiversity and climate objectives.[67] In view of the recent negotiations on the CAP (2023-2027) and to ensure greater coherence between the different instruments for achieving the climate and environmental objectives, the establishment of technical screening criteria for agriculture has been postponed.[68] The European

[64] Ibid.

[65] European Commission (n.d). Finance Corporate sustainability reporting. Available at: https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en

[66] European Commission (n.d). Finance Sustainability-related disclosure in the financial services sector. Available at: https://finance.ec.europa.eu/sustainable-finance/disclosures/sustainability-related-disclosure-financial-services-sector_en

[67] European Commission (2021). Questions and Answers: Taxonomy Climate Delegated Act and Amendments to Delegated Acts on fiduciary duties, investment and insurance advice.
Available at: https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_1805

[68] EUR-Lex (2021). Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate

Commission is expected to adopt a complementary delegated act for the agricultural sector in the near future.

Agroforestry is recognised in the CAP Strategic Plan Regulation and defined in all Member States' CAP strategic plans. However, agriculture and forestry are not considered together in the Climate Delegated Act and in the Complementary Climate Delegated Act, which do not mention agroforestry. Given their known climate and environmental benefits, agroforestry systems have significant potential to meet all six environmental objectives in the Taxonomy Regulation. Agroforestry projects and initiatives that meet the objectives, conditions and criteria set out in the EU Taxonomy can be considered environmentally sustainable. To this end, an important next step will be the recognition and inclusion of agroforestry in the EU Taxonomy's Climate Delegated Act.

The EU Sustainable Finance has untapped potential to support agriculture, forestry and agroforestry. It can provide an opportunity to stimulate investment in environmentally sound projects in line with the objectives of the European Green Deal.[69] Private investment could be directed towards sustainable agroforestry practices through the EU Taxonomy and the EUGBS. With continued efforts to refine existing regulatory frameworks, increase transparency through ESG rating activities and disclosure requirements, and encourage sustainable investment, the EU is well-positioned to play a key role in promoting sustainable finance, thereby helping to achieve its climate and environmental objectives.

3.5 Agricultural, forestry and parametric insurance

This section examines the role of agricultural, forestry, and parametric insurance in protecting farmers and supporting the adoption of agroforestry practices. Forests and agricultural land cover more than three-quarters of the EU's territory and hold a large stock of carbon in the soil and vegetation, providing a way to remove carbon dioxide from the atmosphere. In the face of current climate and environmental challenges, it is imperative to increase the resilience of agri-food systems to natural disasters and climate change by providing access to insurance for all farmers and foresters. Today, traditional indemnity and parametric insurance are commonly used in the agriculture and forestry sectors. Indemnity insurance covers losses related to livestock, trees, or crops and protects against weather risks. In contrast, parametric insurance covers the probability of a pre-defined event occurring rather than reimbursing the actual losses incurred. This subsection describes the recent developments in traditional and non-traditional insurance for the European agricultural and forestry sectors. It focuses on the role of parametric insurance as a promising complement to traditional insurance, particularly in supporting farmers in adopting sustainable practices, such as agroforestry.

3.5.1 Traditional agricultural and forestry insurance

Traditional agricultural insurance

Agricultural insurance is essential for poverty reduction and food security, as it can strengthen resilience, improve production, and provide social protection.[70] Insurance protects individuals against the risk of uncertain outcomes. It is a contract between two parties that transfers the risk of financial loss from an individual or business to an insurer in exchange for regular payments.

change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives (Text with EEA relevance). Available at: http://data.europa.eu/eli/reg_del/2021/2139/oj

[69] European Commission (n.d.). Finance EU taxonomy for sustainable activities.
Available at: https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

[70] Swiss Agency for Development and Cooperation SDC (2022). Guidance Sheet Inclusive Agricultural Insurance.
Available at: https://www.shareweb.ch/site/EI/Documents/FSD/FSD%20Gsh%20agri%20ins.pdf

Agriculture is exposed to various risks and is highly dependent on the weather. In recent decades, extreme weather events and climate change have further increased the risks and uncertainties faced by farmers and agribusinesses. In this context, agricultural insurance can help to reduce the vulnerability of farmers and agribusinesses by protecting against crop losses due to natural disasters, such as droughts, floods, hailstorms, disease outbreaks and other events that can damage crops or livestock.[71] It is an important risk management mechanism that helps farmers and agribusinesses avoid financial losses and continue their farming activities. By reducing uncertainty and financial risk, agricultural insurance enables policyholders to better manage their production and income. In this way, it can help promote stability and prosperous growth in the agricultural sector.

Agricultural insurance can also improve access to credit for households and businesses, as lenders may be more willing to lend money to insured farmers.[72] For example, this can help farmers expand their activities and invest in new equipment or technology. In this respect, government policies can play a crucial role in agricultural insurance by promoting the availability and affordability of a range of insurance products. To achieve this objective, governments can collaborate with the private sector through public-private partnerships, provide subsidies, and develop risk-sharing programmes and supportive regulatory frameworks.[73] These policy measures can support agricultural productivity while reducing the financial risks faced by farmers and agribusinesses.

Forestry insurance: An untapped potential

The EU has approximately 160 million hectares of forest, covering around 39% of its total area.[74] Forests provide a wide range of environmental, social and economic benefits to society. It is therefore essential to protect forests and make them more resilient to climate change to safeguard their multiple functions.

Forestry insurance covers the destruction of trees as a direct consequence of fire, storm, malicious damage, earthquakes and other weather events.[75] It can play a crucial role in forest conservation by closing the protection gap for foresters and ensuring that planted forests are managed in an ecologically and economically sustainable manner.[76] However, natural forests are complex systems and difficult to value for underwriting purposes due to the diversity of tree species and the lack of available information on age, yield class and growth rate. As a result, insurance coverage for natural forests is limited to firefighting cost insurance and carbon offset-related products.[77] On the other hand, planted forests rely on intensive land use and focus on a small number of species, creating a high concentration of value and exposing it to risk. In this context, forestry insurance can be a valuable tool to protect planted forests against fire, wind, storms, floods, ice, and snow, which are the primary risks to forests.[78]

Although only a small percentage of the world's planted forests are insured today, a growing number of commercial plantation managers and institutional investors are seeking protection in the insurance

[71] International Labour Organisation (n.d.) Agricultural insurance. Available at: https://www.ilo.org/global/topics/employment-promotion/social-finance/impact-insurance/WCMS_877361/lang--en/index.htm
[72] Ibid.
[73] Ibid.
[74] European Commission (n.d.). Agriculture and rural development Forestry explained. Available at: https://agriculture.ec.europa.eu/sustainability/forestry/forestry-explained_en
[75] Welten, P., Certain, G., Forichi, L., He, S., Mäder, D., Rebuffoni, G., Ribeiro, C., Studer, J. and Schweizer, N. (2015). Forestry insurance: A large untapped potential. Swiss Re. Available at: https://www.swissre.com/dam/jcr:ecfa4b16-5f34-43ea-9b03-5f0ecd54700d/Forestry_insurance_EN.pdf
[76] Ibid.
[77] Ibid.
[78] Ibid.

market.[79] Given the significant decline in the total global forest area in recent decades, forestry insurance can be an effective approach for forestry stakeholders to close the protection gap and cover their investments in standing timber.[80] Welten et al. (2015) provide evidence that the need and demand for forestry insurance are increasing globally. The study reveals that the planted forest area has expanded by 110 million hectares since 1990, creating a substantial untapped potential for forestry insurance.

3.5.2 Non-traditional solution: Parametric insurance

Parametric insurance was developed in response to the challenges posed by traditional indemnity insurance. These contracts are based on aggregate (e.g., rainfall) or regional events (e.g., crop yield) defined by a single regional index rather than at the farm or plot level.[81] For this type of insurance, the data is generally objective and reliable. All buyers of parametric insurance in the same region are offered the same contractual conditions per unit of insurance coverage and pay the same premium rate.[82]

Buyers receive the same payment rate per insurance unit when an event triggers a payout. In this way, parametric insurance avoids moral hazard. It eliminates the need for costly on-farm inspections and individual loss assessments, making it possible to cover risks that were previously difficult to insure with traditional insurance products. However, parametric insurance introduces a fundamental risk because the indices cannot show the exact relationship between loss and payout for each individual.[83]

Definition of parametric insurance

Parametric insurance is an insurance policy that provides compensation based on a pre-determined parameter or index following weather or other catastrophic events.[84] It contrasts with traditional insurance, which is based on physical assessments of the actual losses. Parametric insurance, also known as event-based or index-based insurance, is primarily used to cover the probability of a predefined event occurring, rather than to compensate for actual losses incurred. As a result, policyholders do not have to prove physical damage to settle claims under parametric insurance.

A parametric solution consists of two elements:[85]

- **A triggering event**

Insurance cover is triggered when the parameters of a pre-defined event are reached or exceeded. It is measured by an objective parameter or index linked to the insured's particular exposure. For example, the event may be an earthquake, a tropical cyclone or a flood, where the parameter or index may be magnitude, wind speed or precipitation, respectively. Natural disasters or weather events are the most common triggers. However, other triggers, such as market indices and crop yields, can also be used. A key requirement is that the insurable trigger is random and can be modelled.

[79] Ibid.
[80] Ibid.
[81] Swiss Agency for Development and Cooperation SDC (2022). Guidance Sheet Inclusive Agricultural Insurance. Available at: https://www.shareweb.ch/site/EI/Documents/FSD/FSD%20Gsh%20agri%20ins.pdf
[82] Ibid.
[83] Ibid.
[84] Swiss Re (2023). What is parametric insurance?. Available at: https://corporatesolutions.swissre.com/insights/knowledge/what_is_parametric_insurance.html
[85] Ibid.

- **A payout mechanism**

A pre-agreed payout is made when the parameter or index threshold is reached or exceeded, regardless of the actual physical loss incurred.

For example, a payout of USD 10 million for a 7.0 magnitude earthquake that occurred in a defined geographical area, or USD 50'000 for each millimetre of cumulative rainfall above a certain threshold.[86]

Parameter index or index

A relevant parameter or index is an objective measure that correlates with the insured's specific risk and financial loss.[87] For example, an earthquake may damage a firm's physical assets, and a drought may delay the implementation of an agroforestry project. Any parameter or index used as the basis for a parametric solution must be objective, verifiable, transparent, and consistent. The insured person must not be able to influence the event or its reporting to avoid moral hazard.

Parametric insurance can be a derivative or a type of insurance contract.

Parametric solutions can be either an insurance contract or a derivative, depending on the country's regulatory framework and the client's needs.[88] Parametric insurance offers a pre-determined payout upon the occurrence of specific events, regardless of the actual financial loss suffered by the insured. These covers are usually structured as derivatives. In contrast, "hybrid" covers require both a parametric (pre-determined event parameter) and an indemnity (proof of loss) condition to be met for the policy to trigger a payout. These covers are structured as insurance contracts.[89]

3.5.3 Parametric insurance as a complement to traditional insurance

Parametric insurance is designed to complement traditional insurance programmes. It can fill the gaps in protection left by traditional insurance, such as deductibles, excluded perils, scarce capacity or pure financial risks where the insured has no control over the underlying asset.[90]

The main differences between traditional and parametric insurance are described in Table 3.[91]

	Traditional insurance	**Parametric insurance**
Payment trigger	Payment triggered by the actual loss or damage to a physical asset *Example: A fire causing physical damage to a person's property*	Payment triggered by the occurrence of an event exceeding a parametric threshold *Example: An earthquake with a minimum magnitude of 7.0 in a defined area*
Recovery	Reimbursement of the actual loss incurred *Example: Assessment and claims investigation of a loss due to a fire*	Pre-agreed payment structure based on an event parameter or index value *Example: Increasing payouts according to the magnitude of an earthquake*

[86] Ibid.
[87] Ibid.
[88] Swiss Re (2022). 10 myths about parametric insurance. Available at: https://corporatesolutions.swissre.com/insights/knowledge/10_myths_about_parametric_insurance.html
[89] Ibid.
[90] Swiss Re (2023). What is parametric insurance?. Available at: https://corporatesolutions.swissre.com/insights/knowledge/what_is_parametric_insurance.html
[91] Ibid.

Basis risk	Policy conditions, deductibles and exclusions *Traditional policies often include significant deductibles and exclusions, which are effective instruments to align the interests of the insured and the insurer. However, this can expose the insured party to a significant risk*	Correlation between the chosen index, the payout, and the loss incurred *Basis risk is the risk that the trigger index is not perfectly correlated with the underlying risk exposure, which may result in a loss to the customer without the parametric insurance being triggered. Although basis risk can never be completely eliminated, it can be minimised through more sophisticated structures, such as double trigger events or staggered payout structures. For example, in the case of a tropical cyclone, it is possible to have a partial payout for lower category storms and a progressively increasing payout for stronger storms*
Claims process - loss assessment and payment	Complex and based on the loss adjuster assessment *This can take months or even years, depending on the complexity of the loss*	Transparent, predictable, based on a parameter or index, quick settlement *Payment can be made within four weeks of the event, as no loss adjustment is required. Only the index that needs to be established or measured needs to be covered. This task is usually done by a third-party agent (e.g., national weather services)*
Term	Usually annual *Multi-year contracts are possible, but difficult to structure and less common*	Single or multi-year contracts *Multi-year contracts are common and can last up to five years*
Structure	Standard products and contract wordings, some customisation *The level of customisation for a traditional indemnity solution is usually limited, as the insurer will still be working on the basis of a standard industry wording*	Customised product with high structuring flexibility *Parametric wording templates can be shared to provide a basic sample. There is no general "standard" wording, as each structure has a uniquely tailored index and payout structure. This is tailored to the needs and applications of each customer, and can be a single or multi-trigger*
Form	Insurance contract	Insurance or derivative

Table 3: Comparison between traditional and parametric insurance. Source: Swiss Re (2023).

In summary, parametric insurance solutions can achieve multiple objectives that are not possible with traditional insurance products. One of the main benefits is that they extend the boundaries of insurability and simplify the loss investigation process. Additionally, parametric insurance can provide policyholders with the confidence they need in terms of liquidity and the speed of payout.

3.5.4 How can parametric insurance protect farmers and support agroforestry uptake?

Parametric insurance is emerging as a promising complement to traditional insurance, particularly in supporting farmers and foresters in adopting sustainable practices, such as agroforestry. While traditional agricultural and forestry insurance protects farmers and foresters against various risks,

parametric insurance offers timely payouts based on pre-determined parameters, such as weather patterns or crop yield indices, rather than actual losses. This feature ensures that they receive compensation quickly in adverse conditions, thereby reducing financial uncertainty.

One of the benefits of parametric insurance for agroforestry is its ability to address the specific risks associated with integrating trees into agricultural landscapes. By providing a predictable safety net, it encourages investment in sustainable practices, allowing farmers to diversify their income sources and improve soil fertility, biodiversity, and climate resilience. For example, a farmer transitioning to agroforestry may face the risk of crop and tree failure or a drought due to extreme weather events. Parametric insurance can provide immediate financial protection by automatically triggering payouts based on pre-determined weather or drought thresholds. It allows the farmer to mitigate losses and maintain operations without the delays and uncertainties associated with traditional insurance claims processes, which may require extensive documentation and assessment before compensation is paid.

Parametric insurance offers several other benefits to farmers, foresters and insurance providers. Firstly, it covers previously uninsurable circumstances, thereby filling protection gaps. Secondly, the transparent and objective determination of insurance payouts provides confidence to policyholders, eliminates the need to justify claims and reduces the administrative burden on insurers. Additionally, the involvement of an independent third party in providing parametric cover information ensures transparency and reliability, thereby increasing customer confidence in the insurance product. While parametric insurance offers many benefits, it is important to recognise potential challenges, such as accurately defining parametric triggers and ensuring accessibility for smallholder farmers. Overcoming these challenges will require close collaboration between different stakeholders, including governments, insurers, insurance providers, and agroforestry experts, to design tailored parametric solutions that meet the diverse needs of farmers in agroforestry systems.

In conclusion, parametric insurance has great potential to support farmers in adopting and maintaining agroforestry systems by providing timely and transparent financial protection against specific risks. By incentivising sustainable agricultural practices and reducing financial uncertainty, parametric insurance is essential for promoting resilience and sustainability in agricultural landscapes

4. Carbon farming: An emerging opportunity for agroforestry

This section examines the role of carbon farming in promoting the adoption of agroforestry in Europe, emphasising the potential of agroforestry to deliver environmental, economic and social benefits.[92] It provides an overview of the scientific literature and describes the recent developments in carbon farming and agroforestry in Europe. The research is divided into four subsections, each addressing key aspects of carbon farming and agroforestry. Subsection 4.1 defines carbon farming and identifies the benefits and challenges of adopting agroforestry as a carbon farming practice. Building on this framework, subsection 4.2 emphasises the development of carbon farming schemes for agroforestry and describes potential financing mechanisms and sources for agroforestry carbon farming initiatives. Subsection 4.3 examines how carbon farming and agroforestry can safeguard and enhance biodiversity. Finally, subsection 4.4 discusses the prospects of carbon farming and agroforestry in Europe from a policy perspective, focusing on the challenges and emerging opportunities.

[92] Section 4 is also part of the joint study on agroforestry initiated by the Transition project and benefits from the work of a group of researchers from different institutions. EMEA would like to thank Jaime Coello (Forest Sciences and Technology Centre of Catalonia), Camilla Dibari (University of Florence), Marcos Jiménez Martínez (Rheinische Friedrich-Wilhelms-Universität Bonn), Prajna Kasargodu Anebagilu (Rheinische Friedrich-Wilhelms-Universität Bonn), Sebastian Mayr (University of Freiburg), and Wiebke Niether (Justus-Liebig-Universität Giessen) for their valuable input and collaboration on this study.

4.1 AGROFORESTRY AS A CARBON FARMING PRACTICE: POTENTIAL AND CHALLENGES

4.1.1 Carbon farming options and the potential of soils as carbon reservoirs

Carbon farming options

Carbon farming refers to the management of carbon pools, flows and greenhouse gas fluxes at the farm level with the aim of mitigating climate change. It encompasses the management of both land and livestock, as well as all carbon pools in soils, materials, and vegetation, and the fluxes of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Carbon farming includes farming practices that remove carbon (fixation and long-term storage), avoid emissions (prevent the loss of carbon that has already been stored), and reduce emissions (e.g., reduce carbon dioxide and other greenhouse gas emissions).[93]

Figure 2 shows the greenhouse gas emission sources/removals and processes in managed farmland.

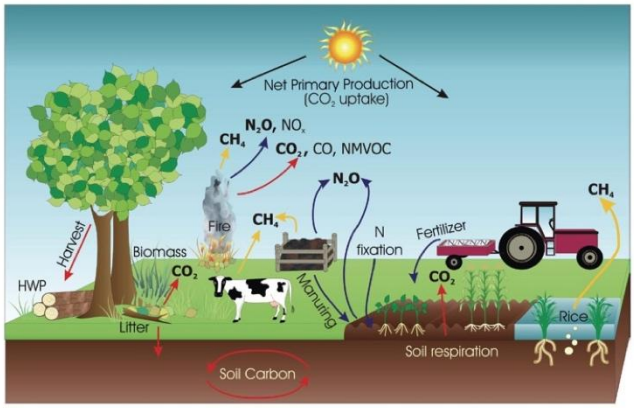

Figure 2: The greenhouse gas emission sources/removals and processes in managed farmland. Source: IPCC (2006).

Carbon farming practices can be divided into five main categories:

- Managing peatlands
- Agroforestry
- Maintain and enhance soil organic carbon (SOC) in mineral soils
- Livestock and manure management
- Nutrient management on croplands and grasslands

Table 4 provides an overview of the main categories of carbon farming, along with their key characteristics.

Assessment criterion	Managing peatlands	Agroforestry	Maintain and enhance SOC on mineral soils	Livestock and manure management	Nutrient management on croplands and grasslands
Carbon farming actions	Peatland rewetting/	Creation, restoration, and	Cropland and grassland management	Technologies to reduce enteric	Improved nutrient planning,

[93] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament. Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf

	maintenance/ management	management of woody features in the landscape		methane, manure management, increased herd and feed efficiency	timing and application of fertilisers; reduction in fertilisers
Total EU mitigation potential (Mt CO2-e/year)	51 - 54 Mt CO_2-e/year	8 - 235 Mt CO_2-e/year	9 - 70 Mt CO_2-e/year	14 - 66 Mt CO_2-e/year	19 Mt CO_2 e/year
Per hectare mitigation potential (t CO2-e/ha/year)	3.5 - 29	0.03 - 27	0.5 - 7	Not available	Not available
Mitigation mechanism	Avoided emissions	Removal	Removal and avoided emissions	Reduced emissions	Reduced emissions
Type of change	Land use	Management	Management and land use	Management	Management
Co-benefits for farmers	Potential for paludiculture (productive use of wet peatlands)	Diversification of outputs protects against single crop failure	Improved water holding capacity and workability of soils, productivity	Lower input costs (feed, fertiliser, energy), soil health, productivity	Lower input costs
Societal co-benefits	Biodiversity, flood regulation, water quality	Improved water retention, microclimate, soil health, biodiversity	Improved water retention, soil health, biodiversity	Decreased nutrient runoff, decreased ammonia emissions	Decreased nutrient runoff, decreased ammonia emissions
Risks	CH_4 emissions (although net GHG benefit), decrease in production	Non-native species' impact on biodiversity	Biochar and off-farm compost impacting soil health/biodiversity	Animal welfare; water quality impacts of feed additives	Water quality impacts of nitrification inhibitors

Table 4: Overview of carbon farming options. Source: McDonald et al. (2021)

These practices can potentially mitigate climate change while delivering multiple environmental benefits, including enhancing biodiversity, improving soil health, and improving water and air quality.

Soils as the largest reservoir of carbon in the terrestrial biosphere

Soils are the largest reservoir of carbon in the terrestrial biosphere, containing 1700 gigatonnes (GT) of carbon in the surface soil layer (up to 100 cm depth), which is four times as much carbon as global vegetation, twice as much as the atmosphere and 155 times as much as the current annual anthropogenic carbon dioxide emission rate.[94] Small changes in SOC stocks can lead to proportionally large contributions to global carbon dioxide emissions.[95] Soils sequester carbon dioxide from the atmosphere, but poor land management can also make them a source of carbon dioxide emissions. For a given area, net SOC sequestration is the difference between carbon inputs into the soil and carbon releases into the atmosphere as carbon dioxide from the decomposition of accumulated organic matter

[94] Friedlingstein et al. (2022). Global Carbon Budget 2021. *Earth System Science Data*, *14*(4), 1917-2005. https://doi.org/10.5194/essd-14-1917-2022

[95] Paustian, K., Lehmann, J., Ogle, S., Reay, D., Robertson, G.P. and Smith, P. (2016). Climate-smart soils. *Nature, 532*, 49-57. https://doi.org/10.1038/nature17174

by soil heterotrophic organisms.[96] SOC sequestration can be defined as a state of the soil in which carbon inputs into the soil exceed carbon releases from the soil, resulting in an increase in soil carbon stocks. Therefore, SOC sequestration can be achieved by increasing soil inputs or reducing losses.[97]

The global terrestrial carbon cycle refers to the continuous exchange of carbon dioxide between the atmosphere, land surfaces, and vegetation. Carbon is absorbed by plants through photosynthesis, stored in vegetation and soils, and released back into the atmosphere through respiration, decomposition, and human activities such as deforestation and land-use change.

Figure 3 shows the global terrestrial carbon cycle. Carbon stocks (boxes) are shown in GT, and fluxes in GT per year. Respiration refers to the accumulation of plant and microbial respiration.

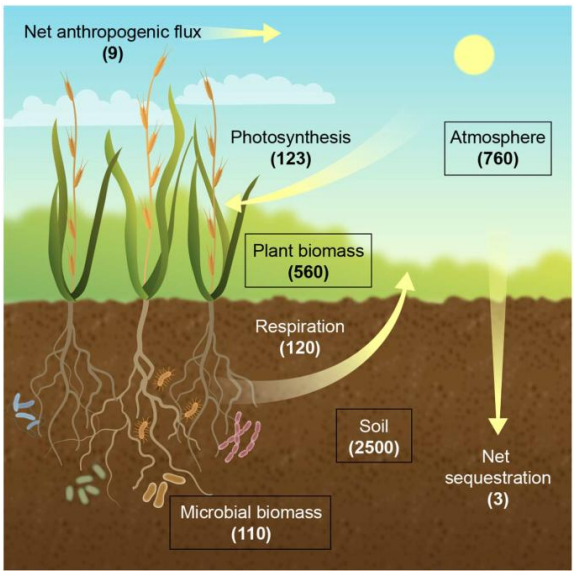

Figure 3: The global terrestrial carbon cycle. Source: Jansson et al. (2021).

4.1.2 How can carbon farming and agroforestry contribute to EU's climate objectives?

Carbon farming in the EU: An emerging opportunity for climate change mitigation

Agricultural and forest land covers more than three-quarters of the EU's territory, offering a significant opportunity to remove carbon dioxide from the atmosphere and combat climate change.[98] Land can act as a carbon sink (absorbing more carbon from the atmosphere than it emits, for example through plants and soils) or as a carbon source (releasing carbon dioxide into the atmosphere, for example through deforestation). The EU land-use sector currently absorbs more greenhouse gases than it emits, making it a net carbon removal or sink.[99] However, carbon removals have decreased significantly in recent years, and the land sink function is declining. Carbon removals are therefore essential to reverse the trend of declining carbon sinks, as it is not possible to eliminate emissions completely. The land sector is also particularly vulnerable to climate change and environmental degradation. In this context,

[96] Jansson, C., Faiola, C., Wingler, A., Zhu, X.-G., Kravchenko, A., de Graaff, M.-A., Ogden, A. J., Handakumbura, P. P., Werner, C. and Beckles, D. M. (2021). Crops for Carbon Farming. *Frontiers in Plant Science, 12*, Article 636709, 1-12. https://doi.org/10.3389/fpls.2021.636709

[97] Moinet, G.Y.K., Hijbeek, R., Van Vuuren, D.P. and Giller, K.E. (2023). Carbon for soils, not soils for carbon. *Global Change Biology*, *29*(9), 2384-2398. https://doi.org/10.1111/gcb.16570

[98] European Commission (n.d.). Climate Action Land use sector. Available at: https://climate.ec.europa.eu/eu-action/land-use-sector_en

[99] Ibid.

the EU supports innovative approaches such as carbon farming to promote sustainable and resilient practices in the agriculture and forestry sectors.

Carbon farming is a way of rewarding farmers and foresters for implementing climate-friendly practices that increase carbon storage in forests and soils or reduce greenhouse gas emissions from soils.[100] This innovative approach can create new economic opportunities for farmers and foresters, enabling them to diversify their income streams by implementing sustainable practices that protect the environment and improve the economic performance of their land.

The European Commission's *Communication on Sustainable Carbon Cycles* and the *Proposal for a Regulation on an EU Certification for Carbon Removals* promote carbon farming practices in Europe.[101] These initiatives are in line with EU policies, such as the Land Use and Land Use Change and Forestry (LULUCF Regulation), the Farm to Fork strategy, and the EU Member States' strategic plans under the CAP (2023-2027), which include measures to support carbon farming practices. The Communication promotes the adoption of carbon farming as a green business model. It encourages farmers to adopt practices that promote the absorption of carbon dioxide in the soil and biomass, helping to mitigate climate change. In conjunction with these policy initiatives, the LULUCF Regulation sets out how the land sector can contribute to the EU's climate objectives and support the transition to a low-carbon economy by removing carbon dioxide from the atmosphere.[102] The revised LULUCF Regulation sets, for the first time, a separate land-based net carbon removal target of 310 Mt of CO_2 equivalent by 2030.

Carbon can be removed and stored in three main ways:[103]

- Permanent storage: Carbon can be captured from the air and stored in a stable form using industrial technologies such as direct air capture with capture and storage (DACCS) or indirectly through the processing of bioenergy with carbon capture and storage (BECCS);
- Carbon farming: Carbon can be stored naturally on land through practices that increase carbon capture in soils and forests (e.g., agroforestry, forest restoration, better soil management), and/or reduce the release of carbon from soils to the atmosphere (e.g., peatland restoration).
- Carbon storage in products: Atmospheric carbon captured by trees or industrial technologies can also be stored in long-lasting products and materials (e.g., wood-based or carbonate-bonded construction materials).

Carbon farming involves practices that remove carbon dioxide from the atmosphere, while providing other important ecosystem services. They can contribute to the EU's target of -310 Mt of net carbon dioxide removals from the LULUCF sector. Carbon removal activities need to ensure that the carbon removed is stored for as long as possible and that the risk of carbon release is minimised to contribute to environmental objectives and provide new economic opportunities for farmers.

[100] European Commission (n.d.). Climate Action Carbon Removals and Carbon Farming. Available at: https://climate.ec.europa.eu/eu-action/certification-permanent-carbon-removals-carbon-farming-and-carbon-storage-products/carbon-farming-and-carbon-storage-products_en#carbon-farming

[101] EUR-Lex (2021). COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0800

[102] EUR-Lex (2018). Consolidated text: Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (Text with EEA relevance) Text with EEA relevance. Available at: http://data.europa.eu/eli/reg/2018/841/2023-05-11

[103] European Commission (2022). Press corner Questions and Answers on EU Certification of Carbon Removals Available at: https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_7159

EU support for agroforestry as a carbon farming practice

Together with the CAP, the European Commission's legislative proposal for a regulatory framework for the EU carbon removal certification scheme, as well as the Commission's Communication on Sustainable Carbon Cycles, promotes carbon farming practices, including agroforestry. In 2021, the European Commission's Communication identified potential means of removing carbon and outlined short- and medium-term actions to address the challenges of carbon farming. These include: [104]

- Promoting carbon farming practices under the CAP and other EU programmes;
- Enhancing the standardisation of monitoring, reporting and verification methodologies to provide a clear and reliable framework for carbon farming;
- Providing enhanced knowledge, data management and tailored advisory services to farmers.

The European Commission's Communication on Sustainable Carbon Cycles states that "*by 2028 every land manager should have access to verified emission and removal data*", and that "*carbon farming should support the proposed 2030 net removal target of 310 Mt CO_2 eq*".

The Communication lists several carbon farming practices, including agroforestry:

- *"Afforestation and reforestation that respect ecological principles favourable to biodiversity and enhanced sustainable forest management, including biodiversity-friendly practices and adaptation of forests to climate change";*
- ***"Agroforestry and other forms of mixed farming combining woody vegetation (trees or shrubs) with crop and/or animal production systems on the same land";***
- *"Use of catch crops, cover crops, conservation tillage and increasing landscape features: protecting soils, reducing soil loss by erosion and enhancing soil organic carbon on degraded arable land";*
- *"Targeted conversion of cropland to fallow or of set-aside areas to permanent grassland";*
- *"Restoration of peatlands and wetlands that reduces oxidation of the existing carbon stock and increases the potential for carbon sequestration".*

Agroforestry is recognised as a practice that has the potential to make a significant contribution to climate change mitigation in the EU. However, significant challenges in monitoring, verifying, and reporting carbon sequestration must be overcome to clarify the quality of carbon removals and address the lack of standardisation in existing certification frameworks.

Provisional agreement on a regulation to establish an EU certification framework for carbon removals

The Council and the European Parliament reached a provisional political agreement on a regulation to establish the first EU certification framework for permanent carbon removals, carbon farming, and carbon storage in products. The voluntary framework aims to facilitate and accelerate the deployment of high-quality carbon removal and soil emission reduction activities in the EU, thereby contributing to the ambitious target of achieving climate neutrality by 2050, as outlined in the European Climate Law.

The regulation covers the following carbon removal and emission reduction activities, and distinguishes between four corresponding types of units:[105]

[104] EUR-Lex (2021). COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0800

[105] European Council (2024). Climate action: Council and Parliament agree to establish an EU carbon removals certification framework. Available at: https://www.consilium.europa.eu/en/press/press-releases/2024/02/20/climate-action-council-and-parliament-agree-to-establish-an-eu-carbon-removals-certification-framework/

- Permanent carbon removal (storage of atmospheric or biogenic carbon for several centuries);
- Temporary carbon storage in long-lasting products (e.g., wood-based construction products) of a duration of at least 35 years and that can be monitored on-site during the entire period;
- Temporary carbon storage from carbon farming (e.g., forest and soil restoration, wetland management, seagrass meadows);
- Reduction of soil emissions (from carbon farming), which includes carbon and nitrous oxide reductions from soil management and activities that reduce soil carbon emissions or increase carbon removals in biological matter (e.g., wetland management, no tilling and cover crop practices, reduced use of fertiliser combined with soil management practices).

Overall, this extends the scope of the regulation to include soil emission reductions, reflecting a broader approach compared to the original proposal. To be certified, temporary carbon storage from carbon farming and soil emission reduction activities must last at least five years. It must not result in land being acquired for speculative purposes to the detriment of rural communities. Additionally, activities that do not result in carbon removals or reductions in soil emissions, such as avoided deforestation or renewable energy projects, are excluded from the scope of the regulation.

The provisional agreement upholds the European Commission's proposal that carbon removal activities must meet four overarching criteria, including quantification, additionality, long-term storage, and sustainability.[106] The European Commission, in collaboration with an expert group, will develop tailored certification methodologies for various carbon removal activities. The agreement also emphasises the voluntary nature of the certification and the understanding of sustainability objectives. At least one biodiversity co-benefit (including soil health and prevention of land degradation) must always be generated by a carbon farming activity. Certified carbon removal and soil emission reduction activities will generate corresponding units equal to one metric tonne of CO_2, equivalent to the certified net benefit generated by one of the carbon removal or soil emission reduction activities. The certified units can only be used for the EU's climate objectives and nationally determined contributions. The agreement outlines clear monitoring obligations and liability rules for operators, along with mechanisms to address cases of reversal and non-compliance. Finally, it calls for establishing a common and transparent EU-wide electronic registry four years after the regulation's entry into force, to make certification and unit information publicly available.

In summary, the provisional agreement will be endorsed by the representatives of Member States in the Council and the Parliament's environment committee, followed by formal adoption by both institutions if the text is approved. Overall, this framework represents a significant step towards integrating carbon removal schemes into EU climate policy, with the goal of promoting the development of innovative carbon removal technologies and sustainable agricultural practices.

4.1.3 Contextual background and potential of agroforestry

Agroforestry deliberately integrates woody vegetation (trees or shrubs) with crops and/or livestock on the same plot of land. Den Herder et al. (2017) estimate that the total area under agroforestry in the EU-27 countries is approximately 15.4 million hectares, representing about 3.6% of the territorial area and 8.8% of the utilised agricultural area. This indicates a significant presence of agroforestry systems across Europe, encompassing various systems, including arable, livestock (the largest), and high-value tree systems. For example, Spain and Portugal have large areas of Dehesa and Montado in their drylands, while in south-eastern Europe, there are permanent crop and pastoral systems. Wood pasture and bocage (hedgerow) landscapes are prevalent in northern countries and can also be found

[106] Ibid.

in many Western, Central, and Eastern countries.[107] Additionally, new agroforestry systems have been established on both arable and grassland farms throughout Europe.

Agroforestry systems can provide a range of environmental, economic, and social benefits. They can help mitigate climate change, protect soils, enhance biodiversity and water quality, and improve the condition of the landscapes. Agroforestry can positively modify the microclimate and water balance of croplands, thereby reducing drought damage and increasing resilience to climate impacts.[108] Furthermore, farmers can benefit from diversified production and income sources, reduced costs and increased land productivity. Much of the literature focuses on investigating the potential of agroforestry to sequester carbon. The AGFORWARD project estimated the carbon sequestration potential of agroforestry in the EU (plus Switzerland) to be between 0.3 and 27 t CO2-e/ha/year, or a total of 7.7 and 234.8 Mt CO_2-e/year. This estimate does not include below-ground SOC, which means that the total sequestration potential of agroforestry is likely to be underestimated. In addition, agroforestry systems can potentially reduce nitrogen-related emissions on land where trees are planted.[109]

The impact of agroforestry on climate change mitigation is influenced by several factors, including the type of agroforestry system implemented, local climatic conditions, and the type of land use.[110] As highlighted in Feliciano et al. (2018), the potential of agroforestry lies in its role in supporting climate change mitigation through soil and above-ground carbon benefits, achieved through practices such as silvopastoral, silvoarable, forest farming, and home gardens. Additionally, agroforestry holds great promise for scalability, as it can be applied to a wide range of farm types. Finally, when considering the potential for introducing new agroforestry systems, it is also important to recognise the importance of maintaining and enhancing the contribution of existing agroforestry systems in the EU to climate change mitigation and the provision of other ecosystem services.[111] Overall, the existing scientific literature provides clear evidence of the untapped potential of agroforestry as a sustainable practice.

4.1.4 Cross-cutting challenges for promoting agroforestry as a carbon farming practice

Barriers to the adoption of agroforestry

There are several barriers to the adoption of agroforestry by farmers:

- The potentially permanent nature of changing the land classification with economic and legal implications, the financial risk and income uncertainty, and the complexity of agroforestry, which requires specific knowledge and expertise on the part of farmers;

[107] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122

[108] Jacobs, S. R., Webber, H., Niether, W., Grahmann, K., Lüttschwager, D., Schwartz, C., Breuer, L. and Bellingrath-Kimura, S. D. (2022). Modification of the microclimate and water balance through the integration of trees into temperate cropping systems. *Agricultural and Forest Meteorology*, *323*, 109065. https://doi.org/10.1016/j.agrformet.2022.109065

[109] García de Jalón, S., Graves, A., Palma, J. H. N., Williams, A., Upson, M. and Burgess, P. J. (2017). Modelling and valuing the environmental impacts of arable, forestry and agroforestry systems: A case study. *Agroforestry Systems*, *92*, 1059-1073. https://doi.org/10.1007/s10457-017-0128-z

[110] Kay, S., Graves, A., Palma, J. H. N., Moreno, G., Roces-Díaz, J. V., Aviron, S., Chouvardas, D., Crous-Duran, J., Ferreiro-Domínguez, N., García de Jalón, S., Măcicăşan, V., Mosquera-Losada, M. R., Pantera, A., Santiago-Freijanes, J. J., Szerencsits, E., Torralba, M., Burgess, P. J. and Herzog, F. (2019). Agroforestry is paying off - Economic evaluation of ecosystem services in European landscapes with and without agroforestry systems. *Ecosystem Services, 36*, 100896. https://doi.org/10.1016/j.ecoser.2019.100896

[111] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122

- Farming is a risky and costly business due to its dependence on weather and climate.
- High up-front and ongoing costs associated with implementing agroforestry systems;
- Lack of adequate advisory services for agroforestry compared to mono-crop agriculture;
- Policy and regulation: There are many regulatory inconsistencies and a lack of political support between agriculture and forestry in European policies, including in the CAP.

Challenges related to the practical implementation of carbon farming schemes for agroforestry

There are also several challenges related to the practical implementation of carbon farming schemes for agroforestry. These include the duration of carbon removals, the integration of co-benefits, ensuring the permanence of ecosystem services, measurement uncertainty, identifying potential impacts on biodiversity, and the accuracy, complexity and high cost of monitoring, reporting and verification (MRV) systems.[112] These main challenges are discussed in more detail below.

Permanence

Permanence in carbon farming refers to the process of ensuring that the carbon captured through practices remains stored over the long term, thereby preventing its release back into the atmosphere.[113] Ensuring permanence is essential for carbon farming practices to effectively mitigate climate change by maintaining long-term reductions in greenhouse gas levels. Permanence is a major challenge for carbon storage in agroforestry systems because of the potential risk of intentional or unintentional release of the stored carbon, for example, through changes in land use or unforeseen events such as drought or fire affecting the farmland. Achieving permanence of carbon sequestration and other ecosystem services is critical to ensure the environmental benefits of carbon farming practices.

Additionality

Additionality refers to ensuring that the carbon farming scheme produces results that would not have occurred otherwise. It includes environmental, financial and regulatory components:[114]

- **Environmental additionality:** Increased carbon sequestration and provision of measurable ecosystem services in the long term that would not have occurred without the scheme;
- **Financial additionality:** Without the financial rewards of the scheme for the provision of ecosystem services, the costs of adopting agroforestry practices would exceed the benefits;
- **Regulatory additionality**: Carbon farming practices must go beyond the regulatory baseline to ensure that they contribute to enhancing and protecting ecosystems.

These components ensure that farmers adopt agroforestry practices that have real, measurable and positive impacts on the climate and environment without compromising other societal priorities (e.g., food production, water quality, biodiversity conservation). The scheme's objective must be clear to ensure that farmers, policymakers, and stakeholders understand the intended outcomes.

[112] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122
[113] Ibid.
[114] Ibid.

Co-benefits and risks of carbon farming

Carbon farming practices such as agroforestry can provide benefits beyond climate change mitigation, including environmental and socio-economic benefits. Co-benefits, including increased land productivity, biodiversity conservation and enhancement, improved water quality, and soil protection, make carbon farming attractive and justify increased public funding for this approach in Europe.[115] In addition, carbon farming can help support the transition to agroforestry by financing the high up-front and ongoing costs associated with establishing and managing agroforestry systems. However, there are also risks associated with carbon farming practices, such as the potentially negative impacts on soil health of certain SOC mitigation measures (e.g., biochar), or the negative impacts on biodiversity of agroforestry practices that are not locally appropriate.[116] Poorly implemented carbon farming can potentially have a negative impact on other environmental and societal objectives.

To align carbon farming with the climate and environmental objectives of the European Green Deal, it is important to maximise co-benefits and reduce risks in designing and implementing carbon farming schemes. Carbon farming policies need to develop sufficient safeguards (e.g., negative lists that exclude harmful carbon farming actions) to protect against negative impacts, monitor the impacts of carbon farming on climate and other environmental objectives, and provide sufficient financial incentives to encourage carbon farming practices that maximise multiple benefits to society.[117]

Monitoring, reporting and verification (MRV)

MRV refers to how participants' climate and environmental actions are reliably measured, how they are required to report them to authorities, and how authorities verify their accuracy. However, MRV is costly and time-consuming, and is therefore often seen as a major barrier by funders and farmers.

Table 5 provides definitions of monitoring, reporting and verification.

Monitoring	Refers to the quantification of greenhouse gas emissions or removals, and includes data collection and calculation methods.
Reporting	Establishes how participants are required to record and communicate monitoring data to relevant authorities and/or government entities.
Verification	Refers to the process of establishing the truthfulness and accuracy of reporting.

Table 5: Definitions of monitoring, reporting and verification. Source: COWI, Ecologic Institute and IEEP (2021).

MRV must ensure the environmental integrity of the scheme and incentivise carbon removals that are real, positive, additional, measurable and permanent while avoiding carbon leakage and double counting. However, there are several key challenges to monitoring.[118] First, the diverse nature of emissions/removals from carbon farming makes accurate measurement complex. Second, there is great variability between different geographical areas. The same carbon farming practice can have different effects on different tree and animal species, depending on specific climate and soil conditions. Therefore, even small differences between similar farms must be taken into account to ensure accurate monitoring. Thirdly, the potential interaction effects between different greenhouse

[115] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf
[116] Ibid.
[117] Ibid.
[118] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122

gas emissions should be carefully considered (e.g., peat rewetting increases carbon sequestration, but also methane emissions). Finally, accurately measuring and validating the impact of carbon farming on greenhouse gas emissions can be very costly. This may lead to a trade-off between the accuracy of MRV and cost. The significant costs associated with MRV, whether financial or in terms of time, can reduce the benefits of carbon farming. These costs are often a barrier to farmers' voluntary adoption of carbon farming or to effective policy implementation by scheme administrators.[119]

Monitoring can be done by direct measurement, modelling or a combination of both approaches:[120]

- **Direct measurement** calculates changes in carbon stocks (e.g., in soil or trees), which can then be translated into greenhouse gas removals or emissions. This involves site visits and sampling or measurement to calculate changes in carbon. Direct measurement is a common approach for agroforestry and soil carbon. Although this approach is more accurate, it can be very costly to implement due to the need for site visits and laboratory testing.
- **Modelling** involves estimating greenhouse gas emissions and carbon removals based on measurable proxies and already-known scientific relationships. Modelling involves greater uncertainty than direct measurement but has the advantage of being less costly.
- **The combination of direct measurement and modelling** can improve accuracy through ground truthing. Limited direct measurement can be used to test and adjust modelling estimates. Most direct measurement approaches require modelling to scale up measurement results to larger scales (e.g., from a specific field location to a whole farm).

Developing an appropriate monitoring approach

No single monitoring approach is optimal for all carbon farming schemes. Even schemes with the same objectives will have different ideal monitoring approaches when implemented in different locations, depending on the farm, ecological conditions and other local conditions.[121] Scientific robustness is, therefore the most important criterion when selecting a monitoring approach.

Designing robust MRV systems that measure the impact of farmers' actions with sufficient accuracy and at a reasonable cost to the farmers and the scheme's administrator is a major challenge for all result-based schemes. Highly rigorous MRV can provide accuracy but comes at a high cost (financial and time), which can reduce voluntary uptake by farmers and the overall impact of the scheme. In addition to scientific robustness, scheme designers need to consider the practicality of monitoring approaches.[122] They should be relatively easy to implement to reduce transaction costs for farmers and scheme administrators. There is always a degree of uncertainty in monitoring changes in carbon stocks. Even with robust MRV systems, these assessments are only approximations and cannot anticipate unknown stressors and shocks.[123] In addition, monitoring carbon sequestration and other biodiversity co-benefits further complicates the process for farmers and scheme administrators.
Technology and data availability will likely improve accuracy and reduce monitoring costs in the future.[124] Significant progress is being made in developing new, more accurate and affordable methods

[119] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf
[120] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122
[121] Ibid.
[122] Ibid.
[123] Wells, G., Pascual, U., Stephenson, C. and Ryan, C. M. (2023). Confronting deep uncertainty in the forest carbon industry. *Science*, *382*(6666), 41-43. DOI: 10.1126/science.adh8117
[124] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122

for monitoring emissions and removals in carbon farming. MRV requirements and standards should reflect a practical balance between the available science and technology, and the expected time and cost burden of meeting these requirements. By reducing costs for farmers and scheme administrators, the availability of technology and data can facilitate the uptake of carbon farming.

Carbon farming costs

Adopting agroforestry as a carbon farming practice is economically attractive to farmers when the combined benefits of payments and co-benefits outweigh the costs they incur.[125] Farmers assess the economic attractiveness based on their net benefits after considering the costs of learning new practices, establishing baseline data, and estimating set-up and ongoing implementation costs. From a societal perspective, decision-makers need to ensure that the benefits of carbon farming practices exceed the total costs, including the costs to farmers and scheme administrators.[126] This assessment goes beyond direct financial considerations and includes wider societal benefits such as carbon sequestration and biodiversity enhancement. It involves weighing the positive impacts against the economic investment required to implement and maintain carbon farming practices.

The costs associated with carbon farming vary depending on the specific farming practices adopted and the local context. High costs, particularly those associated with MRV processes, may make certain practices economically unviable for farmers, thereby hindering the uptake of carbon farming. For farmers, costs typically include set-up costs for acquiring knowledge and skills, setting a baseline, and implementing carbon farming actions.[127] Ongoing costs include implementation, opportunity costs associated with income foregone due to the implementation of the practice, and other transaction costs (e.g., MRV and administrative costs). For example, in the case of agroforestry, farmers face high up-front and ongoing costs associated with implementing and maintaining agroforestry systems. Scheme administrators face set-up costs related to mechanism design, scientific research, data collection, baseline establishment, outreach, and training activities. Ongoing costs include monitoring and verifying the implemented practices, the mechanism's administration, and securing funding.[128]

Non-financial barriers also pose challenges to the uptake of carbon farming[129]. Farmers encounter learning costs as they need to develop new knowledge and skills, requiring training, support, and practical examples. They also face risks associated with result-based payment mechanisms and price uncertainty in voluntary carbon markets. For administrators, the challenges include the high costs and uncertainties of MRV for carbon farming, and the complexity of the scheme design in terms of permanence, additionality, and interactions with existing agricultural and environmental regulations. Carbon farming also requires specific knowledge, skills, baseline data, and scientific understanding.

Overall, promoting the uptake of carbon farming practices in Europe will require overcoming financial and non-financial barriers through enhanced knowledge and practical experience, supportive policies and innovative approaches to implementing and monitoring carbon farming. To be effective and successful, carbon farming practices should be economically viable for farmers in the long term.

[125] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf
[126] Ibid.
[127] Ibid.
[128] Ibid.
[129] Ibid.

4.2 Carbon farming: Financing mechanisms and sources for agroforestry

This subsection emphasises the role of carbon farming as a business model for agroforestry and describes potential financing mechanisms and sources for agroforestry carbon farming initiatives.

4.2.1 Carbon farming as a business model

Carbon farming can be seen as a business model that aims to promote climate change mitigation actions by paying farmers to implement climate-friendly land management practices.[130]

Carbon farming can be funded through incentives from public or private sources:[131]

- The EU offers funding for carbon farming through the CAP, and other EU programmes (e.g., LIFE, Horizon Europe, INTERREG).
- The revised and simplified State aid rules can support the introduction of sustainable land management practices.
- Private initiatives linked to carbon markets or a combination of different financing options can complement and further promote the large-scale uptake of carbon farming.

Types of carbon farming payments

There are currently three types of carbon farming payments:[132]

- **Action-based:** These payments reward farmers for adopting environmentally friendly agricultural practices. Farmers receive a guaranteed payment for specific actions, such as adhering to a particular farming practice or utilising certain technologies. Action-based payments are commonly applied under the CAP (e.g., eco-schemes under Pillar I and AECMs under Pillar II). Although action-based payments are usually relatively simple and require little monitoring by project developers, their impact on the climate and the environment is uncertain because the payment is based on the action rather than the result.
- **Result-based**: Farmers receive a payment directly linked to the actual environmental results. they achieve (e.g., carbon sequestration, biodiversity enhancement), regardless of the specific actions taken. Result-based payments require that environmental benefits be quantified and verified through complex and costly MRV systems. The main advantage of this carbon farming payment is that it provides environmental certainty and credibility by explicitly linking the environmental results achieved to the payment.
- **Hybrid scheme:** It combines elements of both action- and result-based schemes. Farmers receive a guaranteed, action-based payment for adopting sustainable land management practices, in recognition of the presumed environmental benefits. Farmers can also receive an additional result-based payment if these benefits can be demonstrated. This scheme can provide farmers with the flexibility to innovate and implement optimal land management practices on their farms, thereby achieving environmental benefits.

[130] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf
[131] European Commission (n.d.). Climate Action Land use sector. Available at: https://climate.ec.europa.eu/eu-action/land-use-sector_en
[132] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf

4.2.2 Carbon farming mechanisms

Payments to farmers can be made through four main carbon farming mechanisms. These mechanisms differ in terms of who ultimately pays the farmer, the form of payment the farmer receives (e.g., cash or tradable offset credits), and the level of MRV required.

The four carbon farming mechanisms are described below.[133]

Payments for land management practices

- **Payments for land management practices:** A central funder (public or NGO) rewards farmers for adopting environmentally friendly land management practices. These practices should relate to crops, soil, land use or livestock. Payments are usually made in cash, either action- or hybrid/result-based. The MRV requirements are low to medium.

Benefits and drawbacks

Payments for land management practices are the main source of funding for carbon farming. In recent years, the CAP has utilised this financing mechanism to support farmers who adopt sustainable practices, such as agroforestry, for their potential climate and environmental benefits. These payments usually have low MRV requirements. However, they heavily depend on public funding, which is a relatively limited source of funding. As the funding for payments for land management practices is primarily action-based with limited MRV, the climate and environmental impacts are generally uncertain. In comparison, result-based payments for land management practices have higher MRV requirements and costs but provide more certainty on environmental benefits.

CAP (2023-2027): Eco-schemes (Pillar I) and AECMs (Pillar II)
The CAP, with its Pillar I eco-schemes and Pillar II AECMs, provides action-based payments to farmers who adopt sustainable practices that deliver climate and environmental benefits. Receiving support from pillars I and II is conditional on compliance with conditionality rules. These standards aim to prevent soil erosion, define minimum soil cover and land management practices, and maintain soil organic matter and structure, and permanent grassland.[134] Eco-schemes under Pillar I provide financial support to farmers who adopt practices such as organic farming, agroecological practices, precision farming, agroforestry and carbon farming.[135] Pillar II rural development measures (e.g., AECMs) can also play an important role in providing financial support, technical assistance, and knowledge transfer to farmers interested in adopting carbon farming practices.

Table 6: CAP: Eco-schemes (Pillar I) and AECMs (Pillar II). Source: European Commission (n.d.).

[133] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf

[134] European Commission (n.d.). Agricultural and rural development Conditionality. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/conditionality_en

[135] European Commission (n.d.). Agricultural and rural development Eco-schemes. Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/eco-schemes_en

Corporate supply chain

The concept of "carbon footprinting" is gaining popularity in the corporate supply chain. It is used to assess the amount of greenhouse gases released at each stage of the production process, and this assessment can also include the distribution and usage phases.[136] Agri-food companies aim to reduce the carbon footprint of their products. For example, enhancing agroforestry practices by optimising the management of trees on agricultural land allows farmers to increase their income. At the same time, agri-food companies can comprehensively monitor and manage their carbon footprint. The importance of land-use systems, such as agroforestry, in mitigating climate change has grown significantly in recent decades. These systems are now recognised for their high capacity to sequester atmospheric carbon dioxide and store carbon in plant and soil components.

- **Corporate supply chain:** Agri-food companies with sustainability objectives can recognise and reward farmers for achieving climate change mitigation and other co-benefits through their sustainable practices. They can reward farmers for higher carbon removal through increased carbon storage in soils and vegetation through climate-friendly practices such as agroforestry. This allows farmers to benefit from additional income and agri-food companies to document their carbon footprint. MRV requirements can be low, medium or high, depending on the type of carbon farming payment (e.g., action-based, result-based, hybrid).

Benefits and drawbacks

Agri-food companies in the corporate supply chain can provide private funding sources for carbon farming. Some agri-food companies, motivated either by price premiums or marketing reasons, commit to corporate climate pledges or market products as climate-friendly to gain price premiums or access to new markets. To be credible and avoid greenwashing, these mechanisms must be transparent, which requires the use of proven and published methodologies to quantify and verify the results of carbon farming, along with the associated high MRV requirements, costs, and complexity.

These are significant challenges, particularly for commodities with long, complex and often opaque supply chains, such as soy and corn.[137] For this reason, several standards have been developed to support transparency, such as Science-Based Targets[138], Green House Gas Protocol[139], and ISO Standard 14064.[140] There is a need to regulate the claims that companies can make to consumers.

Swiss Coop support programme for agroforestry

The Coop support programme for agroforestry was established by the Swiss food retailer Coop to encourage agricultural businesses in its supply chain to plant and maintain trees on their arable and pastureland. The focus is on timber and wild fruit trees, such as walnut, oak, wild pear, and sweet chestnut, which can be planted alongside standard fruit trees. Participating farmers receive free advice on tree selection, location and regular maintenance. They also receive a payment of CHF 75 per tree (for a minimum of 20 trees per farm) and any other form of agricultural support. The programme aims to reduce emissions by 4,500 tonnes of carbon dioxide per year over 50 years,

[136] Eldesouky, A., Mesias, F.J., Elghannam, A. and Escribano, M. (2018). Can extensification compensate livestock greenhouse gas emissions? A study of the carbon footprint in Spanish agroforestry systems. *Journal of Cleaner Production*, *200*, 28-38. https://doi.org/10.1016/j.jclepro.2018.07.279

[137] Freidberg, S. (2017). Big food and little data: The slow harvest of corporate food supply chain sustainability initiatives. *Annals of the American Association of Geographers, 107*(6), 1389-1406. https://doi.org/10.1080/24694452.2017.1309967

[138] See: https://sciencebasedtargets.org/

[139] See: https://ghgprotocol.org/

[140] See: https://www.iso.org/standard/66453.html

which will be accounted for by the Coop climate protection project. The independent foundation Myclimate validates and monitors the commitments made.

Table 7: Swiss Coop support programme for agroforestry. Source: COWI, Ecologic Institute and IEEP (2021).

Voluntary carbon markets

Voluntary carbon markets can facilitate private financing of carbon farming. These markets involve companies, public bodies, and individuals who can purchase credits generated from projects by matching buyers with individuals willing to undertake actions aimed at climate change mitigation in exchange for payment. Payments to farmers could be generated from the sale of carbon credits resulting from carbon sequestration through agroforestry practices in the voluntary carbon markets. These markets enable entities to purchase credits or offsets to compensate for their environmental impacts, while providing farmers with an additional income directly linked to measurable on-farm results. Voluntary carbon markets can operate in different ways, with or without intermediaries.

Verified Carbon Standard
The Verified Carbon Standard (VCS)[141] is the largest voluntary greenhouse gas crediting programme, reducing or removing more than one billion tonnes of carbon and other greenhouse gas emissions from the atmosphere. It drives finance into projects and activities that deliver environmental benefits, such as reducing and removing emissions and protecting nature.

Table 8: Verified Carbon Standard. Source: VERRA (n.d.).

There are two types of voluntary carbon markets, each with its benefits and challenges.

- **Voluntary carbon market with an intermediary:** A central intermediary (e.g., a private/public mechanism or a project developer) pays farmers to implement specific climate mitigation actions. It monitors and verifies the impacts of mitigation and sells offset credits to private buyers. Payments are made in the form of non-fungible offset certificates. They can be action/result-based or hybrid. MRV requirements are medium to high. Projects must be approved according to various standards, including validation and periodic certification by third-party organisations (e.g., Sustainability Carbon Services, Bureau Veritas Certification). After generating voluntary carbon credits, project developers typically sell them to companies that want to voluntarily offset their carbon dioxide emissions.

<u>Benefits and drawbacks</u>

These markets require close cooperation between farmers and intermediaries. The intermediary effectively reduces the risk and complexity of farmer participation. The credits generated in these markets are usually limited to a single type of mitigation measure or carbon farming, and the offset credits can be sold once before being retired. As a result, the MVR does not need to be as stringent in convincing buyers as in the exchange-based voluntary carbon market. This can reduce complexity and costs for farmers without increasing environmental uncertainty. However, the important role of the intermediary and the cost of its services make these markets more difficult to develop.

[141] See: https://verra.org/programs/verified-carbon-standard/

MoorFutures
The MoorFutures standard[142] is a voluntary carbon market that incentivises the rewetting of peatlands to reduce greenhouse gas emissions in Germany. It is primarily aimed at companies, organisations, and private individuals who wish to voluntarily offset at least part of their unavoidable greenhouse gas emissions. MoorFutures works with farmers and landowners to establish a baseline scenario and estimate the expected avoided emissions from rewetting peatlands. Farmers sign 50-year contracts and receive result-based payments (of € 40-80/t).

Table 9: MoorFutures. Source: MoorFutures. (n.d.).

- **Exchange-based voluntary carbon market:** Farmers implement carbon farming practices according to approved methodologies to generate offset credits, which they trade directly with buyers. The certification mechanism ensures that offset credits represent high-quality carbon sequestration. Offset credits are freely tradable and must be equivalent to removals and reductions in other sectors. They are result-based and have high MRV requirements.

Benefits and drawbacks

Exchange-based voluntary carbon can provide large-scale private funding for carbon farming. Carbon offsets are considered to be equivalent and tradable to those generated by other methods (e.g., afforestation). However, there are several drawbacks. First, the high cost of MRV and the complex structure of the voluntary carbon market increase costs for participating farmers and often exclude small farms that cannot benefit from economies of scale. In addition, the price is set by the market, which further increases uncertainty and risk for market participants. Finally, if low-quality carbon credits enter the market and are used to offset emissions reductions in other sectors, this could undermine the confidence of participants and the achievement of climate objectives.

Carbon by Indigo
Carbon by Indigo[143] helps farmers transition to more sustainable farming practices by generating registered agricultural carbon credits. It has developed a Verra Voluntary Carbon Standard methodology to quantify the increase in soil carbon on agricultural land.

Table 10: Carbon by Indigo. Source: Indigo Ag. (n.d.).

4.2.3 Potential sources of funding for carbon farming and agroforestry

Carbon farming initiatives, such as agroforestry, can be funded through the CAP (e.g., eco-schemes, AECMs), other public financing instruments (such as State aid), private initiatives linked to voluntary carbon markets and the corporate supply chain, or through a combination of these options.

Public financing sources

The CAP (2023-2027)

The CAP (2023-2027) has the same structure as previous CAPs, with two support pillars for EU farmers. However, it has a new policy approach that prioritises results and performance over rules and compliance and gives EU countries greater flexibility to adapt measures to local conditions. It delivers tangible results in relation to EU-level objectives while contributing to the ambitions of the European

[142] See: https://www.moorfutures.de/
[143] See: https://www.indigoag.com/carbon

Green Deal, the Biodiversity Strategy, and the Farm to Fork Strategy. EU countries have the flexibility to allocate CAP funds and can use this opportunity to support effective carbon farming practices, which will be monitored by the European Commission. The effectiveness of the CAP will also depend on how Member States choose to meet their climate and other environmental objectives (which are broader than carbon farming) in their CAP strategic plans and how they implement their interventions.

The CAP is the main source of public funding and offers several opportunities to support carbon farming. Payments for land management practices allow farmers to receive funding for implementing carbon farming practices such as agroforestry. These can be direct payments under the CAP Pillar I eco-schemes and other CAP Pillar II options such as AECMs and investment measures.[144] EU research funding can also support carbon farming through research, networking, and training.

The current CAP can support carbon farming in several ways:[145]

- By setting baseline standards for land management through GAECs;
- With up-front investment support for land-use changes at the farm level to enable carbon farming;
- Through a series of practice-based land management contracts for specific carbon farming actions (e.g., AECMs), which could finance the ongoing costs of carbon farming;
- With advisory and capacity-building support for farmers;
- The EAFRD could contribute to research and development costs for farmers and scheme administrators implementing new local, national and EU carbon farming mechanisms.

Eco schemes under Pillar I and AECMs under Pillar II are recognised as policy instruments for carbon farming payment mechanisms for agroforestry, particularly for action-based payments.

Pillar I (Direct payments)

- **Eco-schemes** consist of payments per hectare granted to farmers who carry out practices that specifically contribute to climate and environmental objectives.[146] The payment may either compensate for the additional costs and income foregone associated with a given practice or serve as an incentive payment in addition to the basic income support. Payments under eco-schemes are, in principle, granted annually and are only made on agricultural land that is eligible for direct payments. As CAP direct payments are made in advance, eco-schemes are generally considered action-based. This policy instrument can contribute to financing the ongoing costs of agroforestry projects by providing guaranteed action-based payments to farmers who implement and maintain agroforestry systems for their presumed environmental benefits.

The European Commission has published a list of potential agricultural practices, including agroforestry, that can be financed through eco-schemes under the current CAP.

[144] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf
[145] Ibid.
[146] European Commission (n.d.). Agriculture and rural development Eco-schemes.
Available at: https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/eco-schemes_en

Pillar II (Rural Development)

- **AECMs** offer payments to farmers who adopt environmentally friendly practices with commitments that contribute to achieving specific objectives that go beyond the SMRs and GAEC standards.[147] They can offer multiannual action-based payments to farmers for implementing practices, such as agroforestry, for their presumed environmental benefits. Payments are calculated based on the additional costs incurred or income foregone.

Table 11 provides a description of eco-schemes and AECMs with their features and applicability.

	Eco-schemes	**AECMs**
Type	Public	Public
Climate action	Climate and environment	Climate and environment
Mandatory/voluntary	Mandatory for Member States, optional for farmers	Mandatory for Member States, optional for farmers
Funding	Pillar I (EU budget)	Pillar II (EU and Member States budgets)
Payment basis	Per eligible hectare	Per eligible hectare
Support calculation	Compensation for induced costs or income foregone or fixed top-up payment to decoupled payments	Compensation for induced costs or income foregone
Commitment period	Annual or multiannual	Multiannual (usually 5 years)
Minimum spending requirement	At least 25% of Pillar I budget	At least 35% of Rural Development funds to be allocated to measures to support climate, biodiversity, environment and animal welfare
Financial cover	Up-front and ongoing costs, potential for result-based payment	Up-front and ongoing costs, potential for result-based payment
Payment	Cash	Cash
MRV requirements	Low-medium	Low-medium

Table 11: Features and applicability of eco-schemes and AECMs. Source: Author's own elaboration based on Guyomard et al. (2023) and European Commission (n.d.).

State aid

State aid is another public financing option for agroforestry, as it can complement or reinforce the CAP measures. The agricultural state aid guidelines assist countries in applying EU rules on state subsidies to agriculture, forestry, and rural areas. State aid can finance carbon farming initiatives for agroforestry.

Most categories of agricultural State aid target key features related to agroforestry, although only a few explicitly mention agroforestry. Research and development in the agricultural and forestry sectors includes a state subsidy for establishing agroforestry system projects: "Agroforestry systems (limited

[147] EUR-Lex (2021). Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013. Available at: https://data.europa.eu/eli/reg/2021/2115/oj

to € 7.5 million per agroforestry system establishment project)".[148] State aid can finance research projects or pilot programmes to promote agroforestry practices.

State aid is also intended to cover the costs of establishing, regenerating or renovating such systems.[149] The annual premium per hectare granted under the aid covers the maintenance costs of the agroforestry system for a maximum period of 12 years from the date the aid is granted.

Carbon markets and private actors

Carbon markets are mandatory or voluntary schemes in which entities whose activities result in net carbon sequestration can receive payments from entities whose activities result in net carbon emissions. An entity can compensate for its emissions by purchasing carbon credits to finance emissions reductions or removals elsewhere (offsetting). A carbon credit (or offset) is an instrument that represents the reduction of one metric tonne of carbon dioxide or greenhouse gas emissions. The majority of carbon credits traded today come from emissions reductions. Voluntary carbon markets operate outside compliance markets, allowing entities seeking to offset their emissions to voluntarily purchase carbon credits that are not intended for compliance purposes. They support various environmental projects that reduce or remove greenhouse gas emissions from the atmosphere.

Table 12 describes the features of the voluntary carbon markets.

	Voluntary carbon market
Type	Private
Climate action	Climate change mitigation
Mandatory/voluntary	Voluntary for farmers
Funding	Predominantly private funding (e.g., private companies, individuals)
Payment basis	Carbon/offset credits
Support calculation	Farmers sell carbon credits for carbon emission reductions/removals achieved (credits equivalent to one metric tonne of carbon dioxide equivalent). Prices may be determined by markets, set through negotiation or fixed in advance
Commitment period	Not specified
Minimum spending requirement	None
Financial cover	Result-based payments
Payment	Freely tradeable offset credits
MRV requirements	High

Table 12: Features of the voluntary carbon markets. Source: Author's own elaboration based on COWI, the Ecologic Institute and IEEP (2021) and McDonald et al. (2021).

Private sources of finance predominate in carbon farming mechanisms linked to voluntary carbon markets. Payments from private sector actors can increase the funding available for carbon farming, usually through result-based payments in intermediary or exchange-based carbon markets.

[148] EUR-Lex (2022). Commission Regulation (EU) 2022/2472 of 14 December 2022 declaring certain categories of aid in the agricultural and forestry sectors and in rural areas compatible with the internal market in application of Articles 107 and 108 of the Treaty on the Functioning of the European Union. Available at: http://data.europa.eu/eli/reg/2022/2472/oj

[149] EUR-Lex (2022). Communication from the Commission Guidelines for State aid in the agricultural and forestry sectors and in rural areas 2022/C 485/01.
Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52022XC1221%2801%29

While voluntary carbon markets are suitable for result-based payments, their effectiveness and long-term price stability depend on support from public and private sources. Many carbon standards are linked to voluntary carbon markets, with different levels and types of support. Voluntary carbon markets incentivise farmers to improve their land management practices, reducing greenhouse gas emissions and increasing carbon sequestration. However, the high MRV costs of these markets are a significant barrier to their widespread adoption, requiring careful risk and effectiveness assessment, a robust certification system, and thorough evaluation before they can be scaled up.

In addition, while voluntary carbon markets are a potential payment mechanism for climate results, they are insufficient to promote payments for a wider range of ecosystem services. The development of the EU certificate framework for carbon removals and the potential future integration of agriculture and forestry into the EU Emissions Trading System (EU ETS) would be a significant step forward in the development of result-based payments for carbon removals from the agricultural and forestry sectors. This will require strong support and acceptance from the institutions involved in the system, as well as sufficiently robust MRV systems for carbon removals.

Corporate supply chain financing

Agri-food companies (e.g., food processors or retailers) interested in sustainability issues use supply chain financing when they want to reduce the carbon footprint of their products. Payments made as part of an agri-food company's supply chain can finance carbon farming practices. For example, they can reward farmers for higher carbon removals through increased soil carbon storage and for adopting sustainable practices such as agroforestry. This would allow farmers to benefit from additional income and agri-food companies to credibly document their carbon footprint.

Table 13 describes the features and applicability of the corporate supply chain.

	Corporate supply chain
Type	Private
Climate action	General
Mandatory/voluntary	Voluntary for agri-food companies and farmers
Funding	Determined by the agri-food company
Payment basis	Determined by the agri-food company
Support calculation	Generally long-term contracts or agreements with guaranteed payments
Commitment period	Annual or multiannual
Minimum spending requirement	Determined by the agri-food company
Financial cover	Up-front and ongoing costs, potential for result-based payments
Payment	Cash
MRV requirements	Low-medium

Table 13: Features and applicability of the corporate supply chain. Source: Author's own elaboration based on COWI, the Ecologic Institute and IEEP (2021) and McDonald et al. (2021).

Agri-food companies in the supply chain can establish long-term agreements or contracts with farmers to support agroforestry initiatives and projects. This can include financial support, technical assistance, and long-term commitments to purchase products from agroforestry systems. Agri-food companies can collaborate with farmers to develop financing mechanisms that support sustainable practices, including funding for agroforestry projects aligned with the company's sustainability objectives.

Generally, farmers must be suppliers to the funding company to be eligible for supply chain financing. To mitigate the risk of greenwashing, it is crucial to maintain high transparency, employ proven methodologies, and regulate the company's claims.

A combination of public and private funding

To effectively cover all the costs associated with implementing carbon farming practices, it is often necessary to consider multiple sources of funding.[150] The significant up-front and ongoing costs for farmers implementing carbon farming practices may exceed what private funding can fully support. This is typically the case with agroforestry projects, which require initial investment and maintenance. Public sector support is therefore essential to help farmers adopt and maintain these practices. Combining funding sources can ensure a diverse and resilient financing and policy landscape, reduce financial risks and support the economic viability of carbon farming practices such as agroforestry.

Contribution of EU research funding to carbon farming

Several funding mechanisms are available in the EU to support innovation, research and development in carbon farming and agroforestry. The European Commission provides financial support for carbon farming pilot initiatives through Horizon Europe, the LIFE programme and INTERREG.

- **Horizon Europe**[151] is the EU's research and innovation programme that provides funding for research on sustainable agricultural and forestry practices and the development of innovative agroforestry technologies. The recently completed H2020 project CIRCASA[152] is an interesting example of a project that aims to develop international synergies for research and knowledge exchange on carbon sequestration in agricultural soils at both the EU and global levels, with the active involvement of all relevant stakeholders. Although agroforestry has a high potential for climate change mitigation and other positive environmental outcomes, relatively few Horizon Europe projects have focused on this practice.
- **LIFE Programme**[153] is the EU's funding instrument for climate and environmental action. It supports many carbon farming projects and the implementation of agroforestry practices that promote biodiversity conservation. For example, the ongoing LIFE Carbon Farming project[154] aims to develop and implement a result-based funding mechanism for carbon farming mixed crop-livestock systems in the EU.
- **INTERREG**[155] is a key EU instrument that strengthens cooperation between regions and countries within the EU. For the period 2021-2027, INTERREG focuses on addressing current challenges, including climate change, digital transformation, and social inclusion. The INTERREG Carbon Farming project[156] aims to mitigate climate change and improve agricultural soils by implementing carbon sequestration techniques on farms. It also facilitates cooperation between farmers and stakeholders within and outside the food supply chain. Another project is Carbon Farming CE[157], which aims to enhance the potential of carbon farming to increase the amount of carbon stored in the soil and to reduce greenhouse gas emissions from livestock.

[150] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CCLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122

[151] See: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

[152] See https://www.circasa-project.eu/

[153] See: https://cinea.ec.europa.eu/programmes/life_en

[154] See: https://www.life-carbon-farming.eu/

[155] See: https://interreg.eu/about-interreg/

[156] See: https://northsearegion.eu/carbon-farming/

[157] See: https://www.interreg-central.eu/projects/carbon-farming-ce/

EU co-funded projects have a fixed short-term duration and are not suitable for funding agroforestry carbon farming schemes. However, they are a potentially valuable source of funding for developing innovative methodologies for future carbon farming schemes.

4.3 How can carbon farming safeguard and enhance biodiversity?

This subsection examines how carbon farming and agroforestry can safeguard and enhance biodiversity, emphasising carbon farming approaches to climate change mitigation and the provision of biodiversity co-benefits. It outlines the risks and opportunities associated with agroforestry systems and their potential to enhance biodiversity. This subsection also discusses the challenges of integrating these co-benefits into carbon farming standards (e.g., result-based or hybrid schemes) and possible approaches to safeguarding and enhancing biodiversity through carbon farming initiatives.

4.3.1 Carbon farming and agroforestry: Opportunities and risks for biodiversity

Carbon farming and biodiversity: Opportunities and risks

Promoting carbon farming practices that can mitigate climate change and provide other environmental benefits is essential. Carbon farming includes a range of agronomic practices that can present both opportunities and risks for biodiversity and the environment.

Carbon farming offers significant opportunities for biodiversity conservation by promoting habitat restoration, enhancing soil health and reducing the environmental impact of conventional agricultural practices.[158] However, context-specific impacts on biodiversity must be carefully considered to avoid any potential negative effects. The literature review by Kletty et al. (2023) on biodiversity in temperate silvoarable systems reveals that the majority of studies have found a positive effect of agroforestry systems on biodiversity, while only a few studies have found no positive effect or even a negative effect under certain conditions. This finding reveals that the same carbon farming practice may be beneficial in one area and detrimental in another. On the other hand, several carbon farming measures, such as planting hedges, incorporating short rotation coppice, intercropping or incorporating plant residues into the soil (including cover cropping), may result in reduced food production (e.g., by reducing the area used for food production, or where plant residues could be used as feed).[159] This can contribute to leakage effects and indirect land use changes that cause greenhouse gas emissions and negative impacts on biodiversity conservation.[160] Most practices are unlikely to have negative impacts on biodiversity, but some practices carry risks (e.g., agroforestry on species-rich grasslands).[161]

In light of these considerations, carbon farming actions must be carefully designed and implemented to minimise negative impacts and ensure that they deliver biodiversity co-benefits in addition to carbon sequestration. This requires careful monitoring of biodiversity impacts and consideration of the local context. It is also crucial to exclude climate change mitigation measures that may have a negative

[158] Scheid, A., McDonald, H., Bognar, J. and Tremblay, L. (2023). Carbon farming co-benefits: Approaches to enhance and safeguard biodiversity. Ecologic Institute, Institute for European Environmental Policy. Available at: https://www.ecologic.eu/19040

[159] Paul. C, Bartkowski, B., Dönmez, C., Don, A., Mayer, S., Steffens, M., Weigl, S., Wiesmeier, M., Wolf, A. and Helming, K. (2023). Carbon farming: Are soil carbon certificates a suitable tool for climate change mitigation?. *Journal of Environmental Management, 330*, 117142. https://doi.org/10.1016/j.jenvman.2022.117142

[160] Ibid.

[161] Scheid, A., McDonald, H., Bognar, J. and Tremblay, L. (2023). Carbon farming co-benefits: Approaches to enhance and safeguard biodiversity. Ecologic Institute, Institute for European Environmental Policy. Available at: https://www.ecologic.eu/19040

impact on biodiversity.[162] While identifying potentially negative actions is usually straightforward, there is no single approach, and flexibility is essential to tailor carbon farming actions to local contexts. Carbon farming initiatives can help achieve multiple environmental and sustainability objectives.[163]

The potential of agroforestry to deliver biodiversity co-benefits

Agroforestry systems can provide a wide range of environmental benefits and play a key role in conserving biodiversity through five main mechanisms:[164]

- Providing vital habitats for species that can adapt to some level of environmental disturbance;
- Preserving the germplasm of sensitive species;
- Reducing the rate of conversion of natural habitats by providing a more sustainable alternative to traditional agricultural systems that can lead to the deforestation of natural habitats;
- Establishing habitat corridors between the ecosystems, strengthening the coherence of these areas and supporting the conservation of the region's vulnerable flora and fauna species;
- Providing ecosystem services such as erosion control and water recharge, thus preventing habitat degradation and loss.

In a very relevant study, Torralba et al. (2016) conducted a meta-analysis of the effects of agroforestry on ecosystem service provision and biodiversity levels. The study shows that agroforestry systems can enhance biodiversity and ecosystem services compared to conventional agriculture and forestry in Europe. However, the results are heterogeneous, with differences between the types of agroforestry practices and ecosystem services assessed. The study provides evidence that agroforestry systems enhance erosion control, biodiversity, and soil fertility. Comparisons between different types of agroforestry and reference land use indicate that silvopastoral and silvoarable systems increase the provision of ecosystem services, especially when compared to forestry land.[165]

Agroforestry has great potential for promoting and maintaining biodiversity, as it can provide habitats and resources for a wide range of plant and animal species. However, although species richness is high in agroforestry systems, species diversity and the presence of rare or endemic species are often low compared to undisturbed natural habitats.[166] This is because agroforestry systems are managed landscapes designed by humans and may not replicate all the complex ecological processes in undisturbed natural habitats. Agroforestry should be understood as an intermediary between the marginal habitat provided by conventional agriculture and the optimal functioning of undisturbed natural habitats. While agroforestry can enhance biodiversity compared to conventional agriculture, it cannot fully replace the unique ecological functions and biodiversity of undisturbed natural systems, which are essential for biodiversity conservation.[167]

[162] Ibid.
[163] Ibid.
[164] Jose, S. (2012). Agroforestry for conserving and enhancing biodiversity. *Agroforestry Systems*, *85*, 1-8. https://doi.org/10.1007/s10457-012-9517-5
[165] Torralba, M., Fagerholm, N., Burgess, P. J., Moreno, G. and Plieninger, T. (2016). Do European agroforestry systems enhance biodiversity and ecosystem services? A meta-analysis. *Agriculture, Ecosystems & Environment*, *230*, 150-161. https://doi.org/10.1016/j.agee.2016.06.002
[166] Nair, P. K. R., Kumar, B. M. and Nair, V. D. (2021). Agroforestry for Biodiversity Conservation. In An Introduction to Agroforestry. Springer, Cham. https://doi.org/10.1007/978-3-030-75358-0_21
[167] Ibid.

4.3.2 Integration of biodiversity co-benefits into carbon farming standards

Integrating biodiversity co-benefits into carbon farming: A way to achieve biodiversity benefits.

Carbon farming explicitly aims to mitigate climate change. However, the same carbon farming action often provides other environmental and socio-economic co-benefits. Although biodiversity conservation and climate change mitigation are closely linked, different policy areas often address them in practice.[168] As a result, integrating biodiversity co-benefits into carbon farming schemes could help address the synergies between climate and biodiversity actions while offering farmers the opportunity to receive higher payments for adopting practices that benefit both the climate and biodiversity.[169] Co-benefits, such as enhanced biodiversity and water quality, are public environmental goods and can justify increased public and private funding for carbon farming. In addition, farmers can benefit from diversified production and income sources, reduced costs and increased land productivity, making carbon farming more attractive.[170] Recognising the co-benefits of carbon farming practices and rewarding farmers for delivering them will be very important in scaling up carbon farming.

Challenges for integrating biodiversity measures into carbon farming schemes

There are several challenges to integrating biodiversity measures into carbon farming schemes:[171]

- **Monitoring and assessment:** Carbon farming practices must be carefully monitored and assessed to ensure that they deliver biodiversity co-benefits beyond carbon sequestration and do not negatively impact biodiversity. Qualitative approaches to measuring co-benefits can have low accuracy, while quantitative approaches have high MRV costs.
- **Data collection and baseline establishment:** Ensuring biodiversity outcomes is often difficult because monitoring biodiversity requires reliable data collection over large temporal and spatial scales. It is necessary to establish a baseline for biodiversity, to have sufficient available data to measure changes in biodiversity over time, to set clear objectives for biodiversity conservation, and to assess progress in conserving biodiversity.
- **Development of indicators for biodiversity co-benefits:** Biodiversity indicators should be developed to measure the status of species, habitats, and the functional diversity of ecosystems in space and time (e.g., the number and relative abundance of species). Including co-benefits poses challenges for MRV regarding data collection, baseline definition, indicator selection and financing. The cumulative complexity of measuring parameters for multiple objectives can make the cost and burden of MRV too high.
- **Trade-offs between different ecosystem services:** There may be trade-offs between different ecosystem services. For example, certain carbon farming practices such as agroforestry on species-rich grasslands, increase carbon sequestration but can reduce the availability of open habitats needed by certain grassland species, thereby reducing biodiversity.
- **Payment structure and financial compensation:** Incorporating biodiversity co-benefits into the payment structures of carbon farming schemes presents significant challenges, including

[168] Scheid, A., McDonald, H., Bognar, J. and Tremblay, L. (2023). Carbon farming co-benefits: Approaches to enhance and safeguard biodiversity. Ecologic Institute, Institute for European Environmental Policy. Available at: https://www.ecologic.eu/19040

[169] Scheid, A., McDonald, H., Bognar, J. and Tremblay, L. (2023). Carbon farming co-benefits: Approaches to enhance and safeguard biodiversity. Ecologic Institute, Institute for European Environmental Policy. Available at: https://www.ecologic.eu/19040

[170] McDonald, H., Frelih-Larsen, A., Lorant, A., Duin, L., Pyndt Andersen, S., Costa, G. and Bradley, H. (2021). Carbon farming: Making agriculture fit for 2030. In Study for the committee on environment, public health and food safety (ENVI). Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf

[171] The challenges described are mainly based on McDonald et al. (2021) and Scheid et. al (2023).

added complexity, increased costs, difficulties in monitoring and developing appropriate indicators for each co-benefit, and providing adequate financial compensation.

- **Policy and regulatory frameworks:** There may be potential conflicts between different policy objectives and interactions with existing agricultural and environmental regulations, which can make the integration of biodiversity co-benefits into carbon farming schemes very challenging.

Further scientific research is needed to develop accurate indicators, integrate co-benefits and improve data collection and monitoring systems on the performance of agroforestry systems in terms of provision of biodiversity co-benefits. Overcoming these challenges is crucial for successfully integrating biodiversity measures into carbon farming, ensuring environmental sustainability.

4.3.3 Enhancing biodiversity through carbon farming: Approach by Scheid et al. (2023)

The growth of carbon farming standards represents both a risk and an opportunity for biodiversity. The study by Scheid et al. (2023) shows that carbon farming actions often fail to encompass all the necessary approaches and requirements to mitigate negative impacts on biodiversity and achieve positive impacts. Based on an evaluation of ten existing carbon farming standard approaches to biodiversity protection and enhancement, their study proposes an approach to enhance biodiversity through carbon farming financing. The approach considers two key factors:

- **Uncertainty of biodiversity impacts:** Carbon farming actions can have expected positive impacts (e.g., practices that enhance SOC) or uncertain impacts (e.g., manure management) on biodiversity. Carbon farming practices with uncertain impacts on biodiversity require more cautious management. However, even standards that promote practices with expected positive impacts must have some basic minimum requirements.
- **Scale of the project:** Small scale (e.g., small individual participants) or large scale (e.g., large projects, groups of farms, large individual farms). Large-scale carbon farming projects will have greater impacts (positive or negative) on biodiversity than small-scale carbon farming projects with fewer participants. Large-scale projects should be subject to stricter requirements.

Scheid et al. (2023) identify three levels of requirements for carbon farming actions:

- **Basic requirements** are needed for carbon farming actions that are expected to have a positive impact on biodiversity. These requirements should include monitoring ongoing practices and any unexpected negative impacts on biodiversity, as well as identifying best practices to maximise biodiversity co-benefits. In addition, they should be accompanied by transparency requirements (e.g., project documentation, information on biodiversity impacts that should be publicly available) and an adaptive approach to monitoring results.
- **Medium requirements** apply to carbon farming actions where the biodiversity impacts are uncertain, and the scale of the project is small. Establishing positive/negative lists, as well as quantitative monitoring, complements the basic requirements. For example, positive lists could limit funding to actions using native species, while negative lists could exclude actions near nature reserves.
- **High requirements** apply to large-scale carbon farming actions where the impact on biodiversity is uncertain. Large-scale projects can present greater risks to biodiversity, but also offer opportunities to enhance it. They should be subject to more stringent requirements. Stringent requirements should include robust biodiversity monitoring for each funding beneficiary. The developed biodiversity indicators could include, for example, soil biodiversity, biotope value or species-level indicators. Biodiversity management requires tailored approaches that consider each beneficiary's specific context and needs.

Based on these standards, multiple payments with financial incentives for climate and biodiversity outcomes will be essential to secure the benefits of carbon farming.[172] Multiple payments should reward any additional biodiversity co-benefits of carbon farming practices. This may require more robust individual monitoring beyond the basic requirements. With the advent of carbon credits and their promotion by EU policies, the protection and enhancement of biodiversity should become a fundamental part of the regulatory framework for carbon removals and carbon farming activities in general. This requires a holistic approach to land management, taking into account both climate change mitigation and biodiversity, while also achieving other sustainability objectives in synergy.

4.3.4 Result-based payments for ecosystem services: Insights from Guimarães et al. (2023)

Developing a result-based (or hybrid) scheme for agroforestry requires consideration of the wide range of ecosystem services provided by agroforestry systems, which vary according to factors such as type of farming system, geographical location, climatic conditions and management techniques. Biodiversity is recognised as the cornerstone of ecosystem functions and services (e.g., Harisson, 2014). Applying ecosystem services in result-based schemes can promote the integration of biodiversity considerations into agricultural policies and practices, ensuring that farmers are rewarded for delivering specific environmental results linked to biodiversity conservation. It thus plays an important role in promoting sustainable land management practices and ensuring sustainable financing for agroforestry, which is essential for maintaining and enhancing biodiversity in agricultural landscapes.

Enhancing ecosystem services through targeted agricultural policies: A result-based approach

An interesting study on the application of ecosystem services, with a focus on biodiversity in a results-based scheme, was carried out for the Montado by Guimarães et al. (2023). The Montado is a silvopastoral system characterised by a tree cover primarily consisting of Quercus suber and Quercus rotundifolia, with cattle or sheep grazing in the understory. The Montado spans over one million hectares in southern Portugal, while the Dehesa covers approximately three million hectares in Spain.[173] These agroforestry systems can benefit the environment and socio-economic activities by providing a range of ecosystem services. However, the continuing decline in tree density and area under cover threatens the provision of ecosystem services.

In this context, targeted policies are needed to motivate farmers to ensure the provision of ecosystem services.[174] Guimarães et al. (2023) explore the possibility of developing a result-based scheme for agri-environmental schemes (AES) implemented under the CAP. In a result-based scheme, farmers are rewarded for achieving specific environmental results linked to the provision of ecosystem services. The CAP payments for AES, which link agriculture to the protection of natural resources, are based on the principle of compensation for both income foregone and additional costs incurred, compared to conventional farming practices.[175] To this end, public authorities must ensure that payments cover operating and investment costs, production foregone, profits and private transaction costs.[176]

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[172] Scheid, A., McDonald, H., Bognar, J. and Tremblay, L. (2023). Carbon farming co-benefits: Approaches to enhance and safeguard biodiversity. Ecologic Institute, Institute for European Environmental Policy. Available at: https://www.ecologic.eu/19040

[173] Guimarães, M.H., Pinto-Correia, T., de Belém Costa Freitas, M., Ferraz-de-Oliveira, I., Sales-Baptista, E., da Veiga, J.F.F., Tiago Marques, J., Pinto-Cruz, C., Godinho, C. and Belo, A.D.F (2023). Farming for nature in the Montado: The application of ecosystem services in a results-based model. *Ecosystem services*, *61*, 1-11. https://doi.org/10.1016/j.ecoser.2023.101524

[174] Ibid.

[175] Sainte Marie, C. (2014). Rethinking agri-environmental schemes. A result-oriented approach to the management of species-rich grasslands in France. *Journal of Environmental Planning and Management, 57*(5), 704-719. https://doi.org/10.1080/09640568.2013.763772

[176] Hejnowicz, A.P., Rudd, M.A. and White, P.C.L. (2016). A survey exploring private farm advisor perspectives of agri-environment schemes: The case of England's Environmental Stewardship Programme. *Land Use Policy*, *55*, 240-256. https://doi.org/10.1016/j.landusepol.2016.04.005

Policy and scientific discussions on the ecological performance and cost-effectiveness of the AES highlight the need to integrate ecosystem services into AES (e.g., Cullen et al., 2018; O'Rourke and Finn, 2020; Pe'er et al., 2020). This requires an assessment of the value of the ecosystem services, which is very challenging for complex agroforestry systems that provide a wide range of ecosystem services.[177] Additionally, the intangible nature of many of these services makes it challenging to assign a value to them.[178] As agricultural systems produce both marketable and non-marketable goods and services, the value of an ecosystem service may be underestimated or neglected by the marketplace.[179] To implement a result-based scheme, it is necessary to identify existing farm management practices that can improve the provision of ecosystem services and calculate the costs incurred to determine the payment level.[180] In the current AES, payments for costs incurred are based on the incremental costs associated with each specific measure, combined with an estimate of income foregone, typically in terms of lost production. Similarly, in a result-based scheme, the payment rate can be derived by quantifying the opportunity cost of the management option considered most likely to deliver the ecosystem service rather than by assessing the results per se.[181]

One of the main challenges in setting an appropriate payment level for a result-based scheme is to ensure that the payment is cost-effective and reflects the full cost of providing the ecosystem service, including the time spent by farmers and any possible reduction in production-related income.[182]

Application of ecosystem services in a result-based scheme for the Montado

Securing the sustainable financing of agroforestry requires innovative methodological approaches to ensure the achievement of environmental, social and economic objectives. In the recent literature, Guimarães et al. (2023) propose a methodological approach for applying ecosystem services in a result-based scheme for the Montado. It includes three key sequential actions:

- **Defining environmental results:** Identifying and linking potential environmental results to the provision of ecosystem services.
- **Mapping land management practices:** Understanding and detailing the specific land management practices required to achieve these environmental results.
- **Calculation of costs:** Estimating the costs associated with implementing these practices.

Guimarães et al. (2023) identified twelve potential management practices and their estimated costs to achieve environmental results. To ensure that farmers are willing to improve environmental results, it is essential that the costs incurred are calculated and that result-based payments cover them all.

The methodological approach proposed by Guimarães et al. (2023) offers a compelling framework for developing result-based schemes in agroforestry. Their model compensates farmers for delivering

[177] Bennett, D. E. and Gosnell, H. (2015). Integrating multiple perspectives on payments for ecosystem services through a social-ecological systems framework. *Ecological Economics, 116*, 172-181. https://doi.org/10.1016/j.ecolecon.2015.04.019
[178] Ibid.
[179] Blackstock, K.L., Novo, P., Byg, A., Creaney, R., Juarez Bourke, A., Maxwell, J.L., Tindale, S.J. and Waylen, K.A. (2021). Policy instruments for environmental public goods: Interdependencies and hybridity. *Land Use Policy*, *107*, 104709. https://doi.org/10.1016/j.landusepol.2020.104709
[180] Guimarães, M.H., Pinto-Correia, T., de Belém Costa Freitas, M., Ferraz-de-Oliveira, I., Sales-Baptista, E., da Veiga, J.F.F., Tiago Marques, J., Pinto-Cruz, C., Godinho, C. and Belo, A.D.F. (2023). Farming for nature in the Montado: The application of ecosystem services in a results-based model. *Ecosystem services*, *61*, 1-11. https://doi.org/10.1016/j.ecoser.2023.101524
[181] Herzon, I., Birge, T., Allen, B., Povellato, A., Vanni, F., Hart, K., Radley, G., Tucker, G., Keenleyside, C., Oppermann, R., Underwood, E., Poux, X., Beaufoy, G. and Prazan, J. (2018). Time to look for evidence: Results-based approach to biodiversity conservation on farmland in Europe. *Land Use Policy,* 71, 347-354. https://doi.org/10.1016/j.landusepol.2017.12.011
[182] Cooper, T., Hart, K. and Baldock, D. (2009). Provision of Public Goods through Agriculture in the European Union. Institute for European Environmental Policy, London, United Kingdom. https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cmef/rural-areas/provision-public-goods-through-agriculture-european-union_en

specific environmental results linked to the provision of ecosystem services, such as a healthy soil ecosystem, a biodiverse pasture, and preserved or enhanced habitats and landscape elements.

The study was developed using a transdisciplinary dialogue approach between researchers, farmers and public authorities. It highlights the importance of defining environmental outcomes, mapping specific land management practices, and considering multiple factors to effectively identify and compensate farmers for their costs. The study highlights the need for result-based schemes for ecosystem services that provide flexibility to farmers, allowing them to use any management practice, as the focus is on achieving results.

4.3.5 A voluntary market for biodiversity credits: An opportunity for agroforestry?

The development of a voluntary market for biodiversity credits

Developing a voluntary market for biodiversity credits is an opportunity to protect biodiversity and ecosystems. A biodiversity credit is an economic instrument used to finance activities that have a positive impact on biodiversity. Unlike carbon or biodiversity offsets, which are payments made by a company to compensate for its negative impact on specific ecosystems, biodiversity credits allow companies to support actions that have a measurable positive impact on biodiversity.[183] Voluntary biodiversity markets can enable companies and investors to channel finance to areas and habitats that directly impact their business operations. Biodiversity credits can help the public and private sectors build a nature-friendly economic system. Several issues must be addressed to ensure the successful operation of biodiversity credits, including ensuring additionality and permanence, developing robust MRV systems, and preventing unintended spillovers to nearby geographical areas.[184]

To facilitate the development of voluntary biodiversity credit markets, various actors and stakeholders will play a role in helping these markets scale up.[185] First, farmers and local communities should implement biodiversity projects that deliver co-benefits for biodiversity. Second, investors and companies can provide up-front funding to biodiversity project proponents in exchange for purchasing biodiversity credits. Companies can purchase biodiversity credits to demonstrate their commitment to mitigating nature-related risks. Business innovators can also provide technological solutions to overcome barriers to market expansion. Third, governments and regulators can enable this market to scale up effectively by establishing policy frameworks that provide certainty and transparency for voluntary biodiversity credit markets. Ultimately, civil society can preserve the integrity of these markets and ensure that biodiversity projects deliver tangible and lasting benefits for both people and nature.

How can a voluntary market for biodiversity credits support the uptake of agroforestry?

Biodiversity credits can encourage farmers to adopt agroforestry practices that safeguard biodiversity and ecosystems by attributing a value to nature. Developing a voluntary market would enable farmers to receive certificates in exchange for their participation in agroforestry projects. In other words, farmers can be rewarded for their agroforestry practices that benefit biodiversity, while companies can contribute to biodiversity conservation and enhancement by purchasing credits. This certification

[183] Khatri, A., Kemp, N. and Valentini, A. (2022). Biodiversity Credits: Unlocking financial markets for nature-positive outcomes. Briefing Paper. World Economic Forum. Available at: https://www3.weforum.org/docs/WEF_Biodiversity_Credit_Market_2022.pdf

[184] Gray, C. and Khatri, A. (2022). How biodiversity credits can deliver benefits for business, nature and local communities. World Economic Forum and Swiss Re. https://www.weforum.org/agenda/2022/12/biodiversity-credits-nature-cop15/

[185] Khatri, A., Kemp, N. and Valentini, A. (2022). Biodiversity Credits: Unlocking financial markets for nature-positive outcomes. Briefing Paper. World Economic Forum.
Available at: https://www3.weforum.org/docs/WEF_Biodiversity_Credit_Market_2022.pdf

process can provide knowledge and funding opportunities for all interested parties to further engage in agroforestry projects and develop sustainable practices that safeguard biodiversity.

4.4 Future prospects for carbon farming and agroforestry in Europe

Carbon farming in Europe presents both new opportunities and challenges. The European Commission recognises the potential of carbon farming, highlighting its ability to advance the European Green Deal's climate and environmental objectives, as well as create new opportunities for farmers.[186] The Communication on Sustainable Carbon Cycles promotes the adoption of carbon farming as a green business model. It aims to encourage farmers to adopt practices that increase the absorption of carbon dioxide in the soil and biomass, thereby mitigating climate change. Carbon farming can provide knowledge and funding opportunities for farmers and other interested stakeholders who want to engage in carbon farming projects. For example, agribusinesses are increasingly interested in carbon sequestration in the land sector to offset emissions that cannot be reduced. Carbon farming represents an emerging opportunity to promote agroforestry as it embodies a holistic approach to sustainability by creating an economic reward for environmental actions that benefit society. [187]

In this context, results-oriented carbon farming initiatives can make a significant contribution to the EU's climate and environmental objectives. Together with the CAP, the European Commission's legislative proposal for a regulatory framework for the EU carbon removal certification scheme and the Communication promote carbon farming practices, including agroforestry. Upscaling agroforestry at the EU level will require action-based and results-based payment schemes, extensive advisory services, and upfront investment support to overcome the financial and knowledge barriers.[188] Hybrid carbon farming schemes offer a promising option for providing sustainable financing for agroforestry, allowing farmers to innovate and implement optimal land management practices that benefit multiple ecosystem services. In these schemes, farmers receive an action-based payment for adopting agroforestry practices for their presumed environmental benefits, with an additional result-based payment if these benefits can be demonstrated through MRV systems.

However, the practical implementation of carbon farming schemes for agroforestry faces several technical challenges, including the duration of carbon removals, ensuring the permanence of ecosystem services, measurement uncertainty, identifying potential impacts on biodiversity, and the complexity, uncertainty and high cost of MRV systems.[189] The significant costs and resources required to develop result-based mechanisms for carbon farming, as well as the reluctance of farmers to adopt new land management practices due to the high initial investment costs and longer payback periods, are also significant barriers. To overcome these barriers and realise the potential of carbon farming to support the uptake of agroforestry in Europe, a policy framework that integrates food systems, agriculture, forestry, and rural development is needed for a holistic approach to environmental, economic, and social sustainability.[190] To this end, the socio-economic value of the ecosystem services provided by agroforestry systems must be identified and integrated into the financial focus. In addition, increasing support to farmers through the CAP and leveraging public and private funds to cover the high up-front and ongoing costs can reduce risks for farmers and facilitate the uptake of

[186] European Commission (2022). EU Perspectives on Carbon farming, speech delivered at conference on Sustainable Carbon Cycles. Speech by the European Commission, 31 January 2022, Brussels.
Available at: https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_22_696
[187] Ibid.
[188] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122
[189] Ibid.
[190] Hajdukovic, I. (2023). Mapping report on agroforestry sector finance and policy 1. Deliverable D5.1 of ReForest (grant agreement 101060635). Available at: http://dx.doi.org/10.2139/ssrn.4562798

agroforestry as a carbon farming practice.[191] Finally, the development of a network of qualified advisors is a high priority to ensure sufficient advisory services, which requires technical expertise, local knowledge, community involvement, and policy support.

Developing a hybrid carbon farming scheme for agroforestry requires careful consideration of several key elements, including the development of result indicators, methodologies, necessary skills and expertise, farmer and stakeholder engagement, allocation of necessary funding and resources, definition of project scales, and the establishment of robust MRV systems.[192] Recognising the co-benefits of agroforestry systems and rewarding farmers for delivering them will also be an important step in scaling up agroforestry. In particular, integrating biodiversity considerations into carbon farming initiatives is crucial for achieving climate and environmental objectives, as it provides opportunities to enhance biodiversity while mitigating climate change.[193] To encourage the uptake of carbon farming schemes for agroforestry, farmers, policymakers, and agroforestry stakeholders should be involved in the design of schemes from the outset to build confidence and ensure continuous improvement.[194]

The European Commission aims to support the development of results-oriented carbon farming pilot schemes and to promote the wider uptake of action-based and hybrid schemes.[195] Pilot initiatives should be developed at the local or regional level to gain experience for scaling up carbon farming. Lessons learned from carbon farming pilot schemes will help improve their design and increase farmers' knowledge and understanding of their potential benefits.[196] Carbon farming has the potential to pave the way for agriculture, forestry, and agroforestry to make a significant contribution to achieving the EU's climate and environmental objectives. The way in which carbon farming schemes are designed and implemented will be crucial to upscaling sustainable practices, such as agroforestry, and realising their potential to deliver environmental, economic, and social benefits.

In summary, carbon farming presents promising opportunities to advance the EU’s climate and environmental objectives while generating new income streams for farmers and promoting the wider adoption of agroforestry systems across Europe. Due to its multiple environmental and societal benefits, agroforestry can play a key role in the EU's transition to a sustainable agricultural landscape. To this end, policy development, institutional support, sufficient resources, stakeholders’ collaboration and innovative carbon farming schemes are needed to enhance the uptake of agroforestry systems across Europe, recognising the pivotal role of farmers in driving these efforts forward.

5. CONCLUSIONS

This report examines the recent developments in the finance and policies currently applicable to agroforestry in Europe. With the growing ambition of the European Green Deal to address current challenges related to climate change, environmental degradation and food security, policy initiatives

[191] Scheid, A., McDonald, H., Bognar, J. and Tremblay, L. (2023). Carbon farming co-benefits: Approaches to enhance and safeguard biodiversity. Ecologic Institute, Institute for European Environmental Policy. Available at: https://www.ecologic.eu/19040

[192] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122

[193] Scheid, A., McDonald, H., Bognar, J. and Tremblay, L. (2023). Carbon farming co-benefits: Approaches to enhance and safeguard biodiversity. Ecologic Institute, Institute for European Environmental Policy. Available at: https://www.ecologic.eu/19040

[194] COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby. Available at: https://www.ecologic.eu/18122

[195] Ibid.

[196] Ibid.

and sustainable practices are needed to transform the EU into a more integrated and resource-efficient economy. As a multifunctional land use, agroforestry systems could be at the centre of this transition due to their environmental, economic and social benefits. This report provides an overview of the policy landscape for agroforestry, with a particular focus on the CAP (2023-2027) and State aid. It also provides insights into how the EU Sustainable Finance can help support the uptake of agroforestry systems and how agricultural, forestry and parametric insurance can protect farmers against unforeseen events in the European agroforestry sector. Ultimately, this study examines the potential of carbon farming as a promising avenue for promoting the adoption of agroforestry systems.

Section 3 provides an overview of the recent financial and policy developments in the European agroforestry sector. The policy landscape for agroforestry is evolving, with support embedded in the CAP and key EU legislation, including the European Green Deal, the Biodiversity and Farm to Fork strategies, and the EU Forestry Strategy for 2030. The CAP (2023-2027) focuses on promoting sustainable agriculture and forestry, improving farm incomes and resilience, enhancing climate and environmental sustainability, supporting social sustainability in rural areas, and promoting knowledge, innovation, and digitalisation in agriculture. It also introduces strict conditionality measures to ensure compliance with EU standards for public, plant, and animal health and welfare, as well as to maintain good agricultural and environmental conditions. Income support under Pillar I of the CAP includes both compulsory and voluntary payments designed to support farmers' incomes, encourage young farmers, promote sustainable farming practices, and ensure fair income distribution. These payments include schemes such as BISS, CISYF and eco-schemes, while voluntary payments include CIS, CRISS, and PSF. Pillar II “Rural development” focuses on enhancing the social, environmental and economic sustainability of rural areas. It now allocates 35% of funding towards climate and environmental interventions and introduces eight broad policy measures. Member States can tailor income support schemes and rural development measures to their needs and local conditions. Agroforestry is recognised as an important practice for the green architecture of the CAP and is supported under both pillars, particularly under eco-schemes and rural development interventions.

State aid is another public financing option for agroforestry, as it can complement or reinforce the CAP measures. The EU guidelines for State aid in the agriculture and forestry sectors, as well as in rural areas, permit aid to be granted for the establishment, regeneration, or renewal of agroforestry systems. From a different perspective, the EU Sustainable Finance can provide an emerging opportunity to channel private investment into agriculture, forestry and agroforestry projects and initiatives in line with the climate and environmental objectives of the European Green Deal. This will require the recognition and further integration of agriculture, forestry, and agroforestry practices into the technical screening criteria of the Climate Delegation Act and the EU Taxonomy, thereby fully harnessing the untapped potential of sustainable finance and promoting these practices. Furthermore, this report highlights the crucial role of agricultural, forestry, and parametric insurance in protecting farmers against various risks and unforeseen events. Parametric insurance offers a complementary and promising non-traditional solution by providing timely payouts based on pre-determined parameters, helping to fill protection gaps and encouraging farmers to adopt sustainable agroforestry practices.

The study carried out in Section 4 reveals that carbon farming plays a key role in mitigating climate change and achieving the EU’s broader sustainability objectives by promoting sustainable practices. Agroforestry is listed as a carbon farming practice in the European Commission’s legislative proposal for a regulatory framework for an EU carbon removal certification scheme and in the Communication on Sustainable Carbon Cycles. Although European policies promote agroforestry as a carbon farming practice, there are key barriers to the adoption of agroforestry systems in the European region. These include the potentially permanent nature of the change of land classification with legal and economic implications, income uncertainty, the complexity and high costs of agroforestry, the lack of advisory services, regulatory inconsistencies, the lack of political support between agriculture and forestry in

European policies, and the complexity and high costs of MRV systems. Overcoming these existing barriers and promoting the uptake of agroforestry requires the development of innovative financial instruments and policies based on payments for ecosystem services provided by agroforestry systems. This requires a holistic approach to land management that considers both climate change mitigation and biodiversity in synergy with the achievement of other sustainability objectives. Recognising the co-benefits of agroforestry practices and rewarding farmers for delivering them will be very important in scaling up agroforestry. Carbon farming schemes can employ various payment structures, including action-based, result-based, and hybrid payments, as well as different mechanisms, such as payments for land management practices, corporate supply chains, and voluntary carbon markets.

Hybrid carbon farming schemes offer a promising option for the sustainable financing of agroforestry, enabling farmers to innovate and implement optimal land management practices that yield environmental benefits. Developing such schemes requires consideration of several elements, including the development of results indicators, methodologies, necessary skills and expertise, farmer and stakeholder engagement, resource allocation, project scale definition, and robust MRV systems. Agroforestry can be funded through the CAP (e.g., eco-schemes, AECMs), other public financing instruments such as State aid, private initiatives linked to voluntary carbon markets and the corporate supply chain, or through a combination of these options. The practical implementation of carbon farming schemes faces several technical challenges, including the duration of carbon removals, ensuring the permanence of ecosystem services, measurement uncertainty, identifying potential impacts on biodiversity, and the complexity and high cost of MRV systems. While there are clear opportunities to scale up carbon farming schemes for agroforestry in Europe, these barriers must be overcome to ensure the successful design and implementation of these schemes.

Carbon farming practices, including agroforestry, present risks and opportunities for biodiversity conservation. The positive impacts of carbon farming on biodiversity include habitat restoration, increased landscape connectivity, and improved soil health. However, certain carbon farming practices, such as agroforestry on species-rich grasslands, may pose risks to biodiversity that require careful consideration and monitoring. Integrating biodiversity co-benefits into carbon farming schemes presents several challenges, including monitoring results, data collection, and financing. Nevertheless, it offers opportunities to enhance biodiversity while mitigating climate change. By attributing a value to nature, the development of a voluntary market for biodiversity credits could also provide an additional source of funding for farmers adopting agroforestry practices that safeguard biodiversity. In light of these considerations, integrating biodiversity elements into carbon farming initiatives is crucial for achieving the EU’s climate and environmental objectives. These initiatives offer promising opportunities to advance these objectives, create new income opportunities for farmers and promote sustainable practices such as agroforestry. Overcoming the main challenges associated with the design of carbon farming schemes is essential to realise the full potential of carbon farming to support the adoption of agroforestry systems and the provision of their ecosystem services.

In conclusion, agroforestry systems can play a pivotal role in the EU's transition to a sustainable agricultural landscape and in supporting the achievement of its climate and environmental objectives, due to their numerous environmental and societal benefits. To this end, further policy development, institutional support, sufficient resources, collaboration with stakeholders, and the design of innovative carbon farming schemes are needed to enhance the uptake of agroforestry systems across Europe. This study can serve as a useful starting point for the future development of sustainable financing schemes for agroforestry, with an emphasis on payments for ecosystem services.

APPENDIX 1: REFERENCES AND RELATED DOCUMENTS

ID	Reference or Related Document	Source or Link/Location
1	Bennett, D. E., and Gosnell, H. (2015). Integrating multiple perspectives on payments for ecosystem services through a social-ecological systems framework. *Ecological Economics, 116*, 172-181.	https://doi.org/10.1016/j.ecolecon.2015.04.019
2	Blackstock, K.L., Novo, P., Byg, A., Creaney, R., Juarez Bourke, A., Maxwell, J.L., Tindale, S.J. and Waylen, K.A. (2021). Policy instruments for environmental public goods: Interdependencies and hybridity. *Land Use Policy*, *107*, 104709.	https://doi.org/10.1016/j.landusepol.2020.104709
3	CIRCASA (2017-2021). *Coordination of International Research Cooperation on soil CArbon Sequestration in Agriculture*. Project funded under H2020-EU.3.2.1.1. - Increasing production efficiency and coping with climate change, while ensuring sustainability and resilience (Grant agreement: 774378).	https://www.circasa-project.eu/
4	Cooper, T., Hart, K. and Baldock, D. (2009). Provision of Public Goods through Agriculture in the European Union. Institute for European Environmental Policy, London, United Kingdom.	https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cmef/rural-areas/provision-public-goods-through-agriculture-european-union_en
5	COWI, Ecologic Institute and IEEP (2021). Technical Guidance Handbook: Setting up and implementing result-based carbon farming mechanisms in the EU. Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby.	https://www.ecologic.eu/18122
6	Cullen, P., Dupraz, P., Moran, J., Murphy, P., O'Flaherty, R., O'Donoghue, C., O'Shea, R. and Ryan, M. (2018). Agri-environment scheme design: past lessons and future suggestions. *EuroChoices*, *17*(3), 26-30.	https://doi.org/10.1111/1746-692X.12187
7	den Herder, M., Moreno, G., Mosquera-Losada, R. M., Palma, J. H. N., Sidiropoulou, A., Santiago Freijanes,	https://doi.org/10.1016/j.agee.2017.03.005

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8	Donham, J., Venn, R., Schmutz, U. and Migliorini, P. (2022). Global inventory of current policy contexts, instruments and operational means for the support of mixed farming and agroforestry systems. Deliverable D6.1 for AGROMIX (862993).	https://agromixproject.eu/project/
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10	EUR-Lex (2013). 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) and repealing Council Regulation (EC) No 1698/2005.	http://data.europa.eu/eli/reg/2013/1305/oj
11	EUR-Lex (2018). Consolidated text: Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (Text with EEA relevance).	http://data.europa.eu/eli/reg/2018/841/2023-05-11
12	EUR-Lex (2021). Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing	http://data.europa.eu/eli/reg_del/2021/2139/oj

	substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives (Text with EEA relevance).	
13	EUR-Lex (2021). COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles.	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0800
14	EUR-Lex (2021). Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013.	https://data.europa.eu/eli/reg/2021/2115/oj
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	control, or to the protection and restoration of biodiversity and ecosystems and for determining whether that economic activity causes no significant harm to any of the other environmental objectives and amending Commission Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities.	
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20	European Commission (2022). Common Agricultural Policy for 2023-2027. 28 CAP strategic plans at a glance.	https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en?prefLang=en
21	European Commission (2022). EU Perspectives on Carbon farming, speech delivered at conference on Sustainable Carbon Cycles. Speech by the European Commission, 31 January 2022, Brussels.	https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_22_696
22	European Commission (2022). EU taxonomy: Complementary Climate Delegated Act to accelerate decarbonisation.	https://finance.ec.europa.eu/publications/eu-taxonomy-complementary-climate-delegated-act-accelerate-decarbonisation_en
23	European Commission (2022). Press corner Questions and Answers on EU Certification of Carbon Removals.	https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_7159
24	European Commission (2023). Approved 28 CAP Strategic Plans (2023-2027) Summary overview for 27 Member States Facts and figures.	https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en?prefLang=en
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26	European Commission (n.d.). Agricultural and rural development Conditionality.	https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/conditionality_en
27	European Commission (n.d.). Agriculture and rural development Coupled income support.	https://agriculture.ec.europa.eu/common-agricultural-policy/income-

		support/additional-schemes/coupled-income-support_en
28	European Commission (n.d.). Agriculture and rural development Eco-schemes.	https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/eco-schemes_en
29	European Commission (n.d.). Agriculture and rural development Forestry explained.	https://agriculture.ec.europa.eu/sustainability/forestry/forestry-explained_en
30	European Commission (n.d.). Agriculture and rural development Income support explained.	https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/income-support-explained_en
31	European Commission (n.d.). Agricultural and rural development Key policy objectives of the CAP 2023-27.	https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27/key-policy-objectives-cap-2023-27_en
32	European Commission (n.d.). Agriculture and rural development Key reforms in the CAP.	https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27/key-reforms-new-cap_en
33	European Commission (n.d.). Agriculture and rural development Natural or other area-specific constraints.	https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/additional-schemes/anc-payment_en
34	European Commission (n.d.). Agriculture and rural development Payments for small farmers.	https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/additional-schemes/payments-small-farmers_en
35	European Commission (n.d.). Agriculture and rural development Rural development.	https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_en
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37	European Commission (n.d.). Agriculture and rural development The basic income support for sustainability (BISS).	https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/biss_en
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