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A regulatory analysis of Carbon Farming in the EU

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A regulatory analysis of carbon farming in the EU

Hideki Katagiri*

Abstract

Carbon farming, agricultural practices for sequestering carbon in the soil or biomass, has a significant but still uncertain potential to mitigate climate change globally as well as in the EU. To ensure its positive impact on climate change and at the same time avoid green washing and any other adverse effect, carbon farming needs to be controlled by clear regulatory frameworks that contain robust measurement, reporting and verification (MRV) system. Funding schemes incentivizing farmers to scale up carbon farming is also necessary to make substantial impact on climate change mitigation. Recently, as a global leader in the climate domain, the EU has initiated several policies supporting carbon farming as one of the key policy targets to mitigate climate change, including proposal on regulatory framework of carbon removal certification scheme. Although carbon farming is emerging scientifically, economically, and politically, the present and future regulation thereof has thus far received relatively little attention in the literature. To bridge this gap, with a specific focus on the EU context, this thesis intends to reveal how carbon farming is and will be defined and regulated, with specific focus on conducting MRV and incentivizing scaling up of carbon farming to mitigate climate change.

Key words: carbon farming, climate change, MRV (Measurement, Reporting and Verification), common agricultural policy, carbon removal certification

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1. Introduction

1.1 Background

According to the United Nation's Intergovernmental Panel on Climate Change ("IPCC"), anthropogenic climate change is "*causing dangerous and widespread disruption in nature and affecting the lives of billions of people around the world, despite efforts to reduce the risks.*"[1] In 2015, the Paris Agreement was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, and its overarching goal is to hold "*the increase in the global average temperature to well below 2°C above pre-industrial levels*" and pursue efforts "*to limit the temperature increase to 1.5°C above pre-industrial levels*".[2] However, in recent years, the IPCC indicated that "*if global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks, compared to remaining below 1.5°C*".[3] This rapid pace climate change has been mainly caused by anthropogenic greenhouse gas ("GHG") emissions that keep the sun's heat in and raise temperatures of the earth.[4] An IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels published in 2018 warned that "*global net human-caused emissions of carbon dioxide (CO_2) would need to fall by about 45 % from 2010 levels by 2030, reaching net zero around 2050 to limit global warming below 1.5°C level*".[5]

Agriculture is one of the main contributors of climate change because it causes emissions of GHGs including carbon dioxide (CO_2), methane ("NH_4") and nitrous oxide ("N_2O") in various ways, such as through deforestation, digestion by ruminants, the production and application of fertilizers and manure for growing crops, and the energy consumption for running farm equipment, usually generated by fossil fuels use.[6] However, unlike many other emissions-intensive sectors, agriculture also has the potential to contribute positively to reducing GHGs by removing carbon from the atmosphere, through efforts to sequester carbon in biomass and soils, and thus aiding in reaching the net zero goal by 2050 as stated above.[7] This can be achieved through practices, such as conservation agriculture and the restoration of degraded agricultural lands, both to mitigate direct emissions and prevent further indirect emissions from land use change.[8] Within this context, "carbon farming" is a particular practice that "*regenerates soil increasing the carbon stored in the soil in the form of organic matter, and often increases the carbon that is held in perennial biomass above and below*

[1] The Intergovernmental Panel on Climate Change, "Climate Change: A Threat to Human Wellbeing and Health of the Planet. Taking Action Now Can Secure Our Future" (*IPCC* February 28, 2022) https://www.ipcc.ch/2022/02/28/pr-wgii-ar6/ accessed May 8, 2023.

[2] UNFCCC, "What Is the Paris Agreement?" (*Unfccc.int*) https://unfccc.int/process-and-meetings/the-paris-agreement accessed April 14, 2023.

[3] United Nations, "Climate Change" https://www.un.org/en/global-issues/climate-change accessed April 13, 2023.

[4] United Nations, "What Is Climate Change?" https://www.un.org/en/climatechange/what-is-climate-change accessed April 13, 2023.

[5] United Nations, "Climate Change" https://www.un.org/en/global-issues/climate-change accessed April 13, 2023.

[6] United Nations, "Causes and Effects of Climate Change" https://www.un.org/en/climatechange/science/causes-effects-climate-change accessed April 13, 2023.

[7] OECD (2022), *Agricultural Policy Monitoring and Evaluation 2022: Reforming Agricultural Policies for Climate Change Mitigation*, OECD Publishing, Paris, https://doi.org/10.1787/7f4542bf-en., chapter 1.

[8] Ibid.

ground as well". [9] Moreover, carbon farming could potentially also provide environmental benefits, especially for soil health and biodiversity.[10]

Carbon farming has been emerging globally backed mainly by a voluntary carbon markets mechanism to generate additional income for farmers. For example, the Australian Emission Reduction Fund ("ERF") is a public scheme established under the Australian legislations in 2015.[11] This initiative aims at incentivizing projects that avoid the release of GHG emissions or remove and sequester carbon from the atmosphere by generating carbon credits,[12] which can be sold either to the Australian Government through a reverse auction system, or to companies and other private organizations in the secondary market.[13] Since it was launched on 31 December 2012, ERF has registered 1,500, projects and issued 124,951,625 credits.[14] As for private voluntary carbon markets, the Nori carbon removal marketplace, which was established in 2017 in the USA, managed by Nori Inc., exclusively focuses on removing CO_2 from the atmosphere by initiating agricultural projects storing CO_2 in soils.[15] Farmers can trade carbon credit backed by actual sequestered tonne of carbon in marketplace, generating additional income for farmers.[16] So far, through Nori carbon removal marketplace, around 123,000 tonnes of carbon has been removed and around 1.8 million USD has been rewarded to farmers.[17]

The EU presents itself as a global leader in the climate domain. As such, the EU has also initiated several proposals to promote carbon farming. Sustainable Carbon Cycles was adopted in 2021 to promote and upscale carbon farming as one of core policy targets to achieve sustainable carbon cycle in the EU, as backed by the Farm to Folk Strategy.[18] The European Commission (the "Commission") concluded that "*result-based carbon farming can contribute significantly in the EU's efforts to tackle climate change, bringing benefits in terms of carbon sequestration and storage and other co-benefits, such as increased bio-diversity and preservation of eco-systems*".[19] In order to encourage the agricultural sector to deliver on climate action and contribute to the European Green Deal, the Commission would promote carbon farming practices under the policy packages including the Common Agricultural Policy (the "CAP") and other funding schemes such as LIFE and Horizon Europe.[20] Nevertheless, the regulatory

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[9] Journal of International Affairs, "Carbon Farming: A Solution to Climate Change?" (*JIA SIPA* February 12, 2020) https://jia.sipa.columbia.edu/carbon-farming-solution-climate-change accessed April 14, 2023.

[10] Scheid A, McDonald H and Bognar J, "Carbon Farming Co-Benefits: Approaches to Enhance and Safeguard Biodiversity" (2023) Ecologic, section 2.

[11] Carbon Credits (Carbon farming Initiative) Act 2011 and the Carbon Credits (Carbon Farming Initiative) Rule 2015.

[12] Australian Government Clean Energy Regulator, "About-the-Emissions-Reduction-Fund "(*Clean Energy Regulator Crest*) https://www.cleanenergyregulator.gov.au/ERF/About-the-Emissions-Reduction-Fund accessed November 17, 2022.

[13] Ibid.

[14] This is based on the data available on 28 March 2023 (Australian Government Clean Energy Regulator, "Emissions-Reduction-Fund-Project-Register "(*Clean Energy Regulator Crest*) https://www.cleanenergyregulator.gov.au/ERF/project-and-contracts-registers/project-register accessed November 21, 2022).

[15] Nori, "About Nori: Carbon Removal Marketplace" https://nori.com/about accessed April 14, 2023.

[16] Nori, "$Nori- Your Digital Corn Bin" https://nori.com/growers-crypto-intro accessed April 14, 2023.

[17] Nori, "Carbon Removal Marketplace: Reverse Climate Change" https://nori.com/ accessed April 14, 2023.

[18] European Commission, "Carbon Farming" (*Climate Action*) https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-farming_en accessed April 14, 2023.

[19] European Commission, "Commission Sets the Carbon Farming Initiative in Motion" (*Climate Action* April 27, 2021) https://climate.ec.europa.eu/news-your-voice/news/commission-sets-carbon-farming-initiative-motion-2021-04-27_en accessed April 14, 2023.

[20] European Commission, "Carbon Farming" (*Climate Action*) https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-farming_en accessed April 14, 2023.

status of carbon farming is still vague in the EU. How carbon farming can be incentivized by the CAP is also unclear at this moment. The EU further does not yet have a regulatory framework governing carbon farming to adequately conduct measurement, reporting and verification ("MRV") of carbon farming.[21] Due to a lack of this regulatory framework, voluntary carbon markets mechanisms apply very different benchmarks and rules to the carbon credits placed on the voluntary carbon markets.[22] According to the Commission, due to lack of this standardization, carbon farming in the EU faces "*uncertainty or lack of public trust in the reliability of standards in voluntary carbon markets*" and also "*unavailability, complexity or high costs of robust*" MRV systems.[23] Without a high degree of transparency, environmental integrity, and methodological standardization, stakeholders of voluntary carbon market mechanisms would not be able to develop a successful business model. To ensure that carbon farming duly works as a key driver to mitigate climate change, regulatory frameworks are needed that set out the criteria to promote adequate (conversely, screen out inadequate) carbon farming projects.

Notably, in order to address the lack of standardisation for MRV applicable to carbon removals, on 30 November 2022, the Commission published a legislative proposal (the "CRC Proposal") to develop a regulatory framework for certifying carbon removals.[24] It aims for setting out criteria to define high-quality carbon removals, including carbon farming, and the process to conduct MRV for the authenticity of these removals.[25] Christian Holzleitner, the Commission's representative from its climate division, has already pointed out this proposal, if accepted, would only be a first stepping-stone towards comprehensive policy on carbon removals and the EU still needs to learn how much carbon can be stored.[26]

Despite the growing interest in carbon farming globally as well as in the EU, the present and future regulation thereof has thus far received relatively little attention in the literature.[27] To bridge this gap, with a specific focus on the EU context, this thesis intends to reveal how carbon farming is and will be defined and regulated, with specific focus on conducting MRV and incentivizing scaling up of carbon farming to mitigate climate change. This is because robust MRV system is necessary to ensure carbon

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[21] Measurement, Reporting, and Verification (MRV) refers to the multi-step process to *measure* the amount of GHG emissions reduced by a specific mitigation activity over a period of time and *report* these findings to an accredited third party. The third party then *verifies* the report so that the results can be certified and carbon credits can be issued (World Bank Group TWBG, 'What You Need to Know About the Measurement, Reporting, and Verification (MRV) of Carbon Credits' (*Climate Explainer: MRV*, 15 November 2022 https://www.worldbank.org/en/news/feature/2022/07/27/what-you-need-to-know-about-the-measurement-reporting-and-verification-mrv-of-carbon-credits accessed 3 May 2023).

[22] European Commission, "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles" (*COM/2021/800 final* December 15, 2021) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0800 accessed January 20, 2023, chapter 2.2.2.

[23] Ibid, chapter 2.2.

[24] European Commission, "Carbon Removal Certification" (*Climate Action*) https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-removal-certification_en accessed May 4, 2023.

[25] European Commission, "Carbon Farming" (*Climate Action*) https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-farming_en accessed April 14, 2023.

[26] Institute for Agriculture and trade Policy, "Greenwashing or New Potential for Farmers? IATP's Contribution to the EU Greens/EFA Conference on Carbon Farming" (February 20, 2023) https://www.iatp.org/eu-greens-efa-carbon-farming-conference accessed April 24, 2023.

[27] Exceptions include:
EU: Verschuuren J, "Towards an EU Regulatory Framework for Climate-Smart Agriculture: The Example of Soil Carbon Sequestration" (2018) 7 Transnational Environmental Law 301; and
USA: Alexia Brunet Marks, (Carbon) Farming Our Way Out of Climate Change, 97 DENV. L. REV. 497 (2020), available at https://scholar.law.colorado.edu/articles/1294.

farming is authentic and the risk of fraud and errors thereof is duly minimized.[28] Additionally, financial rewards towards carbon farming have shown to be critical to create direct incentives for the adoption of carbon farming.[29] Understanding the regulatory landscape is a cornerstone to realize true potential of carbon farming to mitigate climate change.

1.2 Research Question

Previous considerations resulted in the following main research question:

Whether and how is carbon farming regulated in the EU, with respect to conducting measurement, reporting and verification (MRV) and incentivizing scaling up of carbon farming to mitigate climate change?

To reveal what dimension of carbon farming should (not) be controlled by the regulatory frameworks, first what issues carbon farming is trying to solve and how it can be done shall be clarified. Then, the limitations and challenges carbon farming is facing also need to be taken into account. After these, the current and prospected regulatory framework of carbon farming will be investigated.

The following sub-questions have been formulated in order to be able to answer the overarching research question:

(1) What are the characteristics of the agricultural sector in the EU in terms of its impact on climate change?
(2) What is the potential of carbon farming to mitigate climate change as well as creating co-benefits of environmental and socio-economic values, and how has it developed in the EU?
(3) What are existing challenges to conduct MRV and incentivize scaling up of carbon farming?
(4) Whether/how is carbon farming regulated under the current legislations in the EU with respect to conducting MRV and incentivizing scaling up of carbon farming?
(5) Whether/how will the proposed carbon removal certification scheme regulation regulate carbon farming in the EU with respect to conducting MRV and incentivizing scaling up of carbon farming?

1.3 Methodology

In this thesis, mainly doctrinal research is conducted.[30] Namely, a systematic exposition of legislations and policies governing carbon farming as a mean of climate change mitigation in the agricultural area, analysis on the relationship between the relevant rules, explanation of areas of difficulty, and predictions of future developments are given through the thesis. During the research, academic literature review and research

[28] Appunn K, "Carbon Farming Explained: The Pros, the Cons and the EU's Plans" (*Clean Energy Wire* June 1, 2022) https://www.cleanenergywire.org/factsheets/carbon-farming-explained-pros-cons-and-eus-plans accessed April 14, 2023.
[29] European Commission, "Carbon Farming" (*Climate Action*) https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-farming_en accessed April 14, 2023.
[30] Bhat PI, "Doctrinal Legal Research as a Means of Synthesizing Facts, Thoughts, and Legal Principles" (2020) Idea and Methods of Legal Research 143.

on legislations/governmental documents are conducted.[31] The details of investigated sources are explained per sub-question because the approach differs per sub-question:

Sub-question (1), (2) and (3): Through sub-question (1) to (3), the impact of the agricultural sector on climate change and potential/challenges of carbon farming to mitigate climate change as well as generating co-benefits are investigated. Each topic needs to be investigated and evaluated based on scientific point of view. Therefore, academic literature and governmental documents on relevant topics are collected and reviewed. However, since carbon farming is still at an early stage from a research perspective, certain topics of carbon farming are still under debate. Especially, each point of view described in sub-question (2) and (3) is the result of literature review at this moment. It has been the intention of the author to provide a balanced perspective of this current state in light of the existing research in the field – which may indeed develop rapidly in the future. In addition, this thesis overall focuses on the EU. Hence, in terms of the sub-question (1), the impact of the agricultural sector on climate change is investigated on EU focus. Then, each topic described in sub-question (2) and (3) still focuses on EU perspective, but academic literature and governmental documents referred thereto may be beyond the EU perspective because the fundamental technical background can be discussed under universal, context irrespective of geographical differences. Therefore, the relevant literature and governmental documents available on the EU/global/other countries (regions) basis are investigated to conduct research for sub-question (2) and (3).

Through sub-question (4) and (5), the current and prospected regulatory framework of carbon farming in the EU is investigated. To reveal the legal status of carbon farming in the EU legislative framework, first how the agricultural sector is regulated in EU legislations from climate perspective is investigated by referring to the relevant EU legislations (sub-question (4)). Then, specifically, how and whether carbon farming is regulated in such an agriculture-climate related legal framework is investigated by referring to relevant policy materials published by the Commission and other EU bodies (sub-question (4)). Finally, the CRC Proposal published by the Commission on 30 November 2022 is investigated to reveal the prospected framework applicable to carbon farming in the EU (sub-question (5)). In terms of the accuracy of analysis on each legislation, some legislations relevant to each topic discussed in sub-question (4) and (5) would be currently under development or amendment. Especially, the CRC Proposal is pending on the future discussion among EU legislators.[32] Therefore, this thesis can only rely on the current status of each legislation. The relevant policy materials such as impact assessment and other working documents are investigated from time to time to understand the background of such legislations. This thesis does not guarantee the consistency and/or accuracy of each legislation in the future, and this needs to be noted as a limitation of the thesis.

1.4 Outline of the thesis

This thesis is structured into four substantive chapters, as well as chapter 1 (Introduction), chapter 6 (Discussion) and chapter 7 (Conclusion).

Chapter 2 explains the climate impact of the agricultural sector in the EU. Namely, what percentage the agricultural sector occupies to GHG emissions in the EU and

[31] All the documents reviewed for this thesis are English written materials only, which could be a limitation of the thesis when analysing the details of each Member State's initiative. This limitation is mitigated, however, by referring to the summary documents written in English.

[32] European Parliament, "Amending the Regulation on Greenhouse Gas Emissions and Removals from Land Use, Land Use Change and Forestry: Legislative Train Schedule" (*European Parliament*) https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-lulucf-revision accessed April 17, 2023.

how/which sources of GHG emissions the agricultural sector is generating are identified to understand the climate impact the agricultural sector is responsible for in the EU. Then, the unique characteristics of agriculture in terms of the possibility to mitigate climate change will be investigated to understand the opportunities of carbon removal the agricultural sector can focus on in the context of climate change mitigation.

Chapter 3 first investigates carbon farming as a potential source of climate change mitigation as well as co-benefits creation, and answers how it has developed in the EU. To show this, first, the scientific background of carbon farming to sequester carbon in soils and biomass and to generate co-benefits is explained. After that, funding scheme to incentivize scaling up of carbon farming is examined. Then, Chapter 3 also describes challenges of carbon farming to realize positive impact on climate change and co-benefits. Namely, technical difficulties to accurately conduct MRV of carbon farming practice and financial challenges for scaling up carbon farming practice are explained.

Chapter 4 explains whether/how EU legislations regulate and incentivize carbon farming to tackle with the challenges stated in the chapter 3. First, a specific EU-wide policy supporting carbon farming, namely "Sustainable Carbon Cycles" is explained with a specific focus on carbon farming. Then, the EU legislative framework regulating the agricultural sector from climate perspective, namely the Effort Sharing Regulation (the "ESR") and the Land Use, Land Use Change and Forestry Regulation (the "LULUCF Regulation") are investigated. Finally, the CAP is investigated to identify whether/how carbon farming has been incorporated in the EU-wide public funding scheme.

Chapter 5 explains the CRC Proposal to examine whether/how the proposed carbon removal certification scheme, if adopted, regulates carbon farming in the EU with respect to conducting MRV and incentivizing scaling up of carbon farming.

2. Climate impact of the agricultural sector in the EU

2.1 GHG emissions of the agricultural sector in the EU

Emissions associated with agriculture fall in two different categories of emissions under the United Nations Framework Convention on Climate Change (the "UNFCCC") reporting system: (i) agriculture and (ii) LULUCF, while the two categories are often merged into agriculture, forestry and other land use ("AFOLU") considering that the distinction between the two category is not always clear.[33]. Worldwide, the AFOLU sector is the second-largest emitter of GHGs after the energy sector, and for example in 2019, contributes 22% of GHG emissions.[34] In the EU, situation is different largely because deforestation rarely occurs associated with agriculture.[35] In the EU, the agricultural land sector is presently sources of carbon emissions due to land-use changes other than deforestation, such as intensive land use and drainage of peat soils, which increases emissions of CO_2 from carbon stored in the soil and biomass.[36] The overall LULUCF sector in the EU currently removes a net total of 249 Mt CO_2eq from the atmosphere every year, equivalent to 7% of its annual greenhouse gas emissions in the EU, due to carbon absorption by forests and carbon storage in harvested wood products.[37]. The agricultural sector, excluding net removal originating from the LULUCF sector, in the EU contributes around 10% of the EU's total GHG emissions in 2015.[38] Despite its relatively small share in the EU's total GHG emissions compared to sectors such as transport and energy,[39] CH_4 emissions from the agricultural sector constitutes about 54% of total CH_4 emissions in the EU, and N_2O emissions from the agricultural sector contributes nearly 79% of total N_2O emissions in the EU.[40] Large amount of CH_4 releases from livestock production and N_2O emissions mainly originates from manure and chemical fertilisers usage on fields.[41] Both CH_4 and N_2O are particularly potent greenhouse gases. For instance, the Global Warming Potential (GWP), which is the indicator of impact on warming the atmosphere, for 100-year time scale of CH_4 is estimated to have 27-30 times against CO_2, and that of N_2O is 273 times against CO_2.[42] Therefore, the agricultural sector has an important role to play in reducing greenhouse gas emissions and mitigating climate change.

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[33] Verschuuren J, "Achieving Agricultural Greenhouse Gas Emission Reductions in the EU Post-2030: What Options Do We Have?" (2022) 31 Review of European, Comparative & International Environmental Law 246.

[34] Ibid.

[35] Ibid.

[36] Hendriks C and others, "Lulucf : Land Use, Land-Use Change and Forestry : Interactive PDF" , Introduction.

[37] European Environment Agency, "Greenhouse Gas Emissions from Land Use, Land Use Change and Forestry" (*European Environment Agency* October 26, 2021) https://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emissions-from-land/assessment accessed December 27, 2022.

[38] Eurostat, "Archive: Agri-Environmental Indicator - Greenhouse Gas Emissions" (*Archive: Agri-environmental indicator - greenhouse gas emissions - Statistics Explained*) https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive%3AAgri-environmental_indicator_-_greenhouse_gas_emissions&oldid=374989 accessed December 23, 2022.

[39] For instance, energy supply sector in the EU accounts for nearly 26% and transportation sector comprises over 22% of the total GHG emissions in EU in 2020 (European Environment Agency, "EEA Greenhouse Gases - Data Viewer" (Data and maps May 31, 2022) https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer accessed January 17, 2023).

[40] Mielcarek-Bocheńska P and Rzeźnik W, "Greenhouse Gas Emissions from Agriculture in EU Countries—State and Perspectives" (2021) 12 Atmosphere 1396.

[41] Ibid.

[42] United States Environmental Protection Agency, "Understanding Global Warming Potentials" (May 5, 2022) https://www.epa.gov/ghgemissions/understanding-global-warming-potentials accessed March 30, 2023.

2.2 Unique challenges and opportunities of the agricultural sector to mitigate climate change

As stated in the chapter 2.1, the agricultural sector in the EU has an important role to play in the reduction of GHG emissions, particularly non-CO_2 emissions. According to statistical data available on Eurostat, GHG emissions from the agricultural sector in the EU declined by 20 % between 1990 and 2015.[43] The decline in GHG emissions was mainly due to a 17 % reduction in N_2O emissions from agricultural soils driven by the reduced fertilisers usage, and a 22 % decrease in CH_4 emissions caused by a reduction in livestock numbers.[44] However, reduction trend of GHG emissions originating from the agricultural sector has been slowing down. Eurostat data mentioned above clearly shows that declines were fastest in the period through until 2000, but continued at slower pace through until 2012.[45] From 2012 to 2015, however, GHG emission levels even rose.[46] Another recent research conducted by the European Environment Agency showed the decline trend of the EU's agricultural GHG emissions between 2005 and 2021.[47] An overall slight decreasing trend of agricultural GHG emissions in 2021 compared to 2005 is 2%, and it is estimated that such a decline will be still 2 % by 2030 compared with 2005 levels.[48] Therefore, more efficient management of carbon and nitrogen flows within agricultural systems is necessary to reduce GHG emissions.[49] For example, selecting high quality feed that will reduce CH_4 released from enteric fermentation is one option.[50] Additionally, manure management to reduce CH_4 and N_2O, such as covering manure storage facilities, optimizing manure use with nutrient management plan and capturing and combusting CH_4 from manure storage is also beneficial.[51]

However, even though further reduction of GHG emissions could take place, it is not plausible to eliminate all GHG emissions originating from agriculture. Edelenbosch et al., 2022 points out three reasons behind this. The first reason is that the sector's GHG emissions is directly related with food consumption.[52] Population growth is generally associated with higher demand for agricultural products, and GDP growth correlates with an increased consumption of animal products.[53] Second reason is that it is technically impossible to have agricultural emissions reaching to zero, even if all

[43] Eurostat, "Archive: Agri-Environmental Indicator - Greenhouse Gas Emissions" (*Archive: Agri-environmental indicator - greenhouse gas emissions - Statistics Explained*) https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive%3AAgri-environmental_indicator_-_greenhouse_gas_emissions&oldid=374989 accessed December 23, 2022.
[44] Ibid.
[45] Ibid.
[46] Ibid.
[47] European Environment Agency, "Greenhouse Gas Emissions from Agriculture in Europe" (*Site*) https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-agriculture accessed December 23, 2022.
[48] European Environment Agency, "Greenhouse Gas Emissions from Agriculture in Europe" (*Site*) https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-agriculture accessed December 23, 2022.
[49] Ministry of Agriculture and Food, "Reducing Agricultural Greenhouse Gases" (*Province of British Columbia* April 28, 2022) https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-land-and-environment/climate-action/reducing-agricultural-ghgs accessed April 18, 2023.
[50] Ibid.
[51] Ibid.
[52] Edelenbosch O and others (PBL Netherlands Environmental Assessment Agency 2022) rep.
[53] Ibid.

identified measures are applied.[54] The third reason is that the high investment costs for mitigation measures form barriers particularly for smallholder farms.[55].

According to Bergman et al., 2021, the remaining GHG emissions originating from agriculture is estimated to account for 0.8-1.9 Gt CO_2eq globally.[56] That is approximately 2.2 – 5.2 % of 2021 global CO_2 emission levels.[57] To mitigate remaining impact of GHG emissions originating from agriculture, large scale carbon dioxide removal ("CDR") measures to compensate the remaining emissions need to be taken into account.[58] The 6th IPCC Assessment report regarding the mitigation of climate change also stated that "*The deployment of carbon dioxide removal (CDR) to counterbalance hard-to-abate residual emissions is unavoidable if net zero CO_2 or GHG emissions are to be achieved*".[59]

In the context of CDR, the land sector, including agriculture, can be key for sequestering CO_2 from the atmosphere.[60] Improved agricultural practices can help lowering atmospheric concentrations of CO_2 by storing carbon in plant biomass and soils.[61] Realizing such a CDR capacity originating from agriculture aligns with the overall EU climate policy. The EU adopted the European Green deal in 2019 and enacted the European Climate Law in 2021, setting out the goal of climate neutrality (net zero GHG emissions) by 2050.[62] Enhancing CDR capacity of agriculture will increase the carbon removal capacity of the agricultural sector. However, specific policy target supporting the increase and protection of carbon sinks for land managers had rarely been developing until recently in the EU.[63] Although the CAP is recognized as the most powerful financing scheme to support specific type of farming that is beneficial for the protection of environment, the recent study conducted by the European Court of Auditors (the "ECA Study, 2021") revealed that the CAP measures had not led to an overall increase in carbon content of soils and plants, in the period of 2014-2020.[64] This lack of policy support to enhance CDR capacity in the agricultural sector had hindered CDR potential of the agricultural sector to mitigate climate change.[65]

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[54] Ibid.

[55] Ibid. In the EU, as of 2020, there were 9.1 million agricultural holdings in the EU, about two-thirds (63.8 %) of which were less than 5 ha in size (Eurostat, "Farms and Farmland in the European Union - Statistics" (*Statistics Explained*) https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Farms_and_farmland_in_the_European_Union_-_statistics#:~:text=There%20were%209.1%20million%20agricultural,than%205%20ha%20in%20size.&text=EU%20farms%20used%20157%20million,land%20area%20of%20the%20EU. accessed April 18, 2023.).

[56] A Bergman & A Rinberg (2021) "The Case for Carbon Dioxide Removal: From Science to Justice" CDR Primer, edited by J Wilcox, B Kolosz, J Freeman, Table 1.3.

[57] Friedlingstein P and others, "Global Carbon Budget 2022" (2022) 14 Earth System Science Data 4811.

[58] A Bergman & A Rinberg (2021) "The Case for Carbon Dioxide Removal: From Science to Justice" CDR Primer, edited by J Wilcox, B Kolosz, J Freeman, Table 1.3.

[59] IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)). Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.

[60] European Commission, "Carbon Farming" (*Climate Action*) https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-farming_en accessed April 14, 2023.

[61] Food and Agriculture Organization of the United Nations, "Soil Carbon Sequestration" (*FAO SOILS PORTAL*) https://www.fao.org/soils-portal/soil-management/soil-carbon-sequestration/en/ accessed April 18, 2023.

[62] European Commission, "European Climate Law" (*Climate Action*) https://climate.ec.europa.eu/eu-action/european-green-deal/european-climate-law_en accessed March 11, 2023.

[63] Ibid. The development of policy target is described in the chapter 4.2.

[64] European Court of Auditors, "Common Agricultural Policy and Climate half of EU Climate Spending but Farm Emissions Are Not Decreasing" (*Special report: Common Agricultural Policy (CAP) and climate* 2021) https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/ accessed November 7, 2022, page 36.

[65] The details of legislative and policy circumstances with respect to CDR in the agricultural sector, including the CAP, will be further described in the chapter 4.

2.3 Interim Conclusion

As explained in the chapter 2.1, agriculture is one of the main sources of GHG emissions in the EU, particularly non-CO_2 emissions and a further endeavour to reduce emissions originating from agriculture is crucial to mitigate climate change. As shown in the chapter 2.2, the agricultural sector also faces the challenges in further reduction of GHG emissions, and at the same time, has a potential to conduct large scale CDR to compensate hard-to-abate residual emissions. Therefore, although it is currently accelerating climate change, agriculture also has a potent capacity to achieve large scale CDR, and thus potentially contributing to climate change mitigation (sub-question (1)). However, due to the lack of clear policy support, the CDR capacity originating from agriculture has not been developed enough. In this regard, carbon farming has been noted in the scientific literature as a possible policy target to enlarge the capacity of CDR, which is explained further in the next chapter.

3. Carbon farming as a potential source of climate change mitigation

3.1 Introduction

As stated above, to realize the CDR capacity originating from agriculture, the clear policy target is necessary. In this context, carbon farming, by sequestering and storing carbon and/or reducing greenhouse gas emissions at farm level, offers significant potential in the EU to mitigate climate change, while there is also considerable scientific uncertainty around its true potential.[66] Additionally, nature conservation carbon farming practices can have co-benefits for biodiversity, water, soil health, and animal welfare, while some carbon farming practices can have negative impacts and lead to trade-offs.[67] Moreover, to make economic sense to farmers, financial incentives at least need to exceed set-up, ongoing, and other costs for implementing carbon farming.[68] To achieve this, different models and payment structures have developed to offer different opportunities in response to diverse carbon farming practice.[69] In this chapter 3, first, the potential of carbon farming with specific focus on the climate change impact as well as other environmental/socio-economic co-benefits is examined. After that, how carbon farming has been developed by financial supporting scheme in the EU is explained (Chapter 3.2: sub-question (2)). Then, exiting challenges of carbon farming in terms of conducting MRV and incentivizing scaling up of carbon farming is examined (Chapter 3.3: sub-question (3)).

3.2 Potential of carbon farming

(1) Introduction

The potential to sequester carbon in agricultural soils has spurred a precipitous increase in public and private interest, serving as a climate solution.[70] In addition, carbon farming can generate environmental and socio-economic co-benefits, which is also demonstrated as a main policy target of public authorities supporting carbon farming.[71] Moreover, carbon farming can create market opportunities that pay farmers to sequester carbon in their soils as a means for mitigating climate change.[72] This is the reason why the term carbon farming is used to refer to "*a business model where farmers*

[66] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, Executive Summary.

[67] Ibid.

[68] Ibid.

[69] Ibid.

[70] Thompson NM and others, "Opportunities and Challenges Associated with 'Carbon Farming' for U.S. Row-Crop Producers" (*Center for Commercial Agriculture* July 1, 2021) https://ag.purdue.edu/commercialag/home/resource/2021/06/opportunities-and-challenges-associated-with-carbon-farming-for-u-s-row-crop-producers/ accessed April 20, 2023.

[71] The government of Queensland in Australia sets co-benefits standard to verify co-benefits generated by carbon farming project and pay premium price for projects that deliver co-benefits (Ibid).

[72] Thompson NM and others, "Opportunities and Challenges Associated with 'Carbon Farming' for U.S. Row-Crop Producers" (*Center for Commercial Agriculture* July 1, 2021) https://ag.purdue.edu/commercialag/home/resource/2021/06/opportunities-and-challenges-associated-with-carbon-farming-for-u-s-row-crop-producers/ accessed April 20, 2023.

are paid to reduce emissions or sequester carbon".[73] In this chapter 3.2, therefore, potential of carbon farming as a mean of climate change mitigation and co-benefits is explained, followed by the explanation of financial incentive mechanism as a reward for carbon farming practices that has developed carbon farming in the EU.

(2) Climate change mitigation

Although there is no unified definition of carbon farming used world-wide at this moment, carbon farming is an aggregate of agricultural practices for sequestering carbon in the soil or biomass.[74] In general, there are two important aspects for increasing soil organic carbon ("SOC") and eventual SOC storage: (i) increase of carbon-rich inputs such as crop residues, compost and manure and (ii) reduction of the decomposition or decay rate of organic matter and soil carbon losses due to erosion achieved by reduced tillage, erosion management and crop diversity.[75] Carbon farming includes a range of agronomic practices covering land use changes to technological solutions such as cover crops, improved rotations, peatland restoration or expanding agroforestry systems.[76] Although the importance and relevance of each practice differs across farming systems, different agricultural practices and their carbon storage potential can be summarized as below.[77]

Type of action	Carbon storage potential		
	Low	Medium	High
Erosion management (incl. cover/catch crop)	No erosion management (topsoil erosion not prevented)	Some erosion management (topsoil erosion to some extent prevented)	Erosion management top priority (topsoil erosion prevented)
Tillage	Conventional	Reduced tillage/Tillage only for special purpose	No tillage
Irrigation	Water deficit during significant part of the year	Some water deficit (drip irrigation)	No water deficit year around (drip or sprinkler irrigation)
Fertilization & organic matter management	Only chemical fertilizer used (Plant residue removed)	Chemical fertilizer (with plant residue & untreated manure)	Combination of chemical fertilizer, plant organic matter & treated manure
Selection of plant types & diversity	Monocrop/No rotation/No buffer area	Crop rotation (annual crops)/Some cover crops (permanent crops)	Crop rotation with selected cover crops (annual crops)/proactive

[73] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, Executive Summary.

[74] Rabo Research and FMO, "How to Unlock the Green Potential of the Agricultural Sector" (*carbon Sequestration in Agricultural Soils* July 2021) https://www.fmo.nl/how-to-unlock-the-green-potential-of-the-agricultural-sector accessed April 19, 2023, page 4.

[75] Ibid.

[76] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 2.1.

[77] Rabo Research and FMO, "How to Unlock the Green Potential of the Agricultural Sector" (*carbon Sequestration in Agricultural Soils* July 2021) https://www.fmo.nl/how-to-unlock-the-green-potential-of-the-agricultural-sector accessed April 19, 2023, page 5.

			management of C:N ratio & cover crops (permanent & annual crops)
Livestock integration & management	No livestock	Some livestock (one specie, sub-optimal grazing system)	Full integration of livestock (multi-species, optimal grazing techniques and treated manure management)
Land use changes	Marginal areas under production	Marginal areas left fallow	Marginal areas managed to maximize above/below ground SOC

(Table 1: Agricultural Practices and carbon storage potential)[78]

In terms of climate mitigation potential carbon farming can perform globally, the Food and Agriculture Organization of the United Nations (FAO) estimates that soils can sequester around 20 Pg (=20Gt) C in 25 years, more than 10 % of the anthropogenic emissions.[79] Additionally, Rabo Research & FMO, 2021 stated that, based on the conservative IPCC estimate, soil can sequester 1.44 Gt CO_2eq/year and potentially account for more than 60% of the CO_2 sequestration targets outline in the 2018 IPCC scenario.[80] Moreover, the international "4 per 1000" Initiative, which was launched by France in 2015 during COP21, estimates that the world's soils contain 2 to 3 times more carbon than the atmosphere and if the level of carbon stored by soils in the top 30 to 40 cm of soil increased by 0.4% per year, the annual increase of CO_2 in the atmosphere would be significantly reduced.[81]

Furthermore, in the EU level, McDonald, H. et al., 2021 estimates a total carbon farming mitigation potential is 101-444 Mt CO_2eq/year, which is equivalent to approximately 3-12% of the EU's total annual GHG emissions.[82] However, as indicated by this wide range (101-444), there is considerable uncertainty about the true potential of carbon farming in the EU and the need to be cautious in interpreting study results.[83]

Hence, although estimated carbon sequestration potential available at this moment still varies and the true potential should not be overestimated, **theoretically**, significant volume of carbon can be absorbed and stored into soil by implementing high-carbon storage potential agricultural practices. However, to implement such farming practices and realize the potential of climate change mitigation, it is critical to choose and adapt relevant practices in the context of local community's needs.[84] For example, choosing the type of plants being suitable for the local climate is important, and the

[78] Ibid, Annex 1.

[79] Ibid.

[80] Rabo Research and FMO, "How to Unlock the Green Potential of the Agricultural Sector" (*carbon Sequestration in Agricultural Soils* July 2021) https://www.fmo.nl/how-to-unlock-the-green-potential-of-the-agricultural-sector accessed April 19, 2023, page 3.

[81] The international "4 per 1000" Initiative, "Discover the Initiative" (*4 per 1000*April 1, 2022) https://4p1000.org/discover/?lang=en accessed April 19, 2023.

[82] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022.

[83] Ibid.

[84] Food and Agriculture Organization of the United Nations and Rabobank, "Global System for Carbon Farming" (November 2022), section 4.1.

local community needs to have the knowledge of how to care for the carbon farming interventions.[85] Otherwise they will wither or require additional water, specific fertilizers, management practices farmers are not familiar with, which makes project difficult to succeed.[86] Therefore, each project to implement carbon farming practices needs to be realistic and practical in the context of local condition.

(3) Co-benefits

In addition to its capacity to mitigate climate change, carbon farming can also provide environmental benefits especially for soil health and biodiversity as well as other environmental values including water balance, air quality and climate adaptation.[87] Carbon farming has potential to restore soils, to regenerate degraded land, and even to reverse the process of desertification.[88]

In terms of soil health, for example, a high level of SOC is a key indicator for soil fertility and health, as soils with higher levels of SOC can store nutrients better and release them more slowly through mineralisation, and thus need fewer nitrogen or fertiliser inputs.[89] Certain practices of carbon farming such as cover crops, crop rotation and agroforestry can reduce soil erosion and nutrient leaching, thus achieving higher level of SOC.[90] Peatland re-wetting also contributes to the retention of nutrients that are mobilised in degraded peatland through decomposition and peat soil degradation.[91]

Then, in terms of biodiversity, peatland re-wetting and agroforestry can provide "*food, shelter, habitat and other resources for multiple species, such as pollinators, birds, invertebrates and in the case of peatlands the recovery of aquatic macro-invertebrate fauna*".[92] Moreover, improving soil fertility backed by increase of SOC as mentioned above also provides biodiversity both on farm and below ground level.[93] Especially, soil fertility and biodiversity are interlinked: soils with high organic matter are capable of supporting greater vegetation diversity, which in turn increases SOC and enhances below ground biodiversity.[94] Moreover, co-benefits created by carbon farming may cover socio-economic values, namely the resilience and strength of regional communities by supporting direct and indirect employment and skills and increasing economic opportunities.[95] The economic opportunities for farmers implementing carbon farming will be explained in detail in the next section.

(4) Financial incentives for farmers

From a practical point of view, carbon farming only makes sense for farmers if the

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[85] Ibid.

[86] Ibid.

[87] Scheid A, McDonald H and Bognar J, "Carbon Farming Co-Benefits: Approaches to Enhance and Safeguard Biodiversity" (2023) Ecologic, section 2.

[88] Food and Agriculture Organization of the United Nations and Rabobank, "Global System for Carbon Farming" (November 2022), section 4.2.

[89] Judith Reise, Anne Siemons, Hannes Böttcher, Anke Herold, Cristina Urrutia, Lambert Schneider, Ewa Iwaszuk, Hugh McDonald, Ana Frelih-Larsen, Laurens Duin, McKenna Davis 2022: Nature-Based Solutions and Global Climate Protection. Assessment of their global mitigation potential and recommendations for international climate policy. Climate Change 01/2022. German Environment Agency, Dessau-Roßlau.

[90] Scheid A, McDonald H and Bognar J, "Carbon Farming Co-Benefits: Approaches to Enhance and Safeguard Biodiversity" (2023) Ecologic, section 2.

[91] Ibid.

[92] Ibid.

[93] Ibid.

[94] Ibid.

[95] Queensland Government, "Co-Benefits Overview" https://www.qld.gov.au/environment/climate/climate-change/land-restoration-fund/co-benefits/overview accessed April 20, 2023.

benefits outweigh the costs incurred by farmers.[96] Especially, farmers implementing carbon farming faces material timing difference among the process of (i) practice change, (ii) carbon stock change and (iii) the timing of generating profit for farmers.[97] This requires financial support to compensate financial barriers for farmers to start carbon farming practices. Indeed, according to the final report of the EU LIFE Carbon Farming Scheme, which is an EU wide initiative funded by the EU to demonstrate the value of carbon farming by conducting field studies across the Europe, the total costs of different carbon farming practices across the value chain range from 10,000 EUR to 19,600 EUR annually per farm.[98] This is relatively high comparing to the average farm income in the EU between 2007 and 2018 that accounts for 35,300 EUR per farm and 22,500 EUR per annual working unit in 2018.[99]. Therefore, financial incentives that reward farmers are necessary to economically make sense of carbon farming. Furthermore, through carbon farming practices, farmers can generate additional income sources by selling carbon credits on markets and food industry can decarbonize its supply chain by buying those credits.[100] Growing demand of the carbon market has led public and private sectors to establish new agricultural initiatives resulting in opportunities for farmers.[101] In this section, therefore, financial incentive mechanisms for realizing and upscaling carbon farming is explained.

a. Carbon farming payment types

First, before explaining the details of financial incentive mechanism, carbon farming payment type, which is the basic concept to describe financial incentive mechanism, is explained. Namely, there is "action-based" and "result-based" payment type. The category of "action-based" and "result-based" represents the difference regarding for which consequence reward is paid.[102] The summary of each concept is as follows:

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[96] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 4.1.1.

[97] Rabo Research and FMO, "How to Unlock the Green Potential of the Agricultural Sector" (*carbon Sequestration in Agricultural Soils* July 2021) https://www.fmo.nl/how-to-unlock-the-green-potential-of-the-agricultural-sector accessed April 19, 2023, page 11.

[98] Kirsi Tiusanen, Anniina Lampinen, Ville Hulkkonen, Noora Harjama, Karoliina Rimhanen, Hannu Ilvesniemi, Luke Juuso Joona, Kaj Granholm, Veera Naukkarinen and Marianne Tikkanen, 'LIFE Carbon Farming Scheme final report: Guidance for future carbon farming schemes' (2022) < https://content.st1.fi/sites/default/files/2022-06/LIFE%20Carbon%20Farming%20Scheme%20final%20report%2001062022.pdf?_gl=1*1upkv8z*_ga*NTk2MDQ1MTA4LjE2NzI4MjM5OTQ.*_ga_76166H0SHQ*MTY3Mjk5NTc2NC4yLjEuMTY3Mjk5NTc5NC4wLjAuMA..> accessed 6 January 2023, Annex 2, section 2.1.

[99] European Commission, "Farm Income Increased over Last Decade, with Important Differences between EU Countries" (*Agriculture and rural development* July 9, 2021) https://agriculture.ec.europa.eu/news/farm-income-increased-over-last-decade-important-differences-between-eu-countries-2021-07-09_en#:~:text=and%20Rural%20Development-,Farm%20income%20increased%20over%20last%20decade%2C%20with%20important%20differences%20between,annual%20working%20unit%20in%202018. accessed April 3, 2023.

[100] Olick D, "Farmers Are Making Thousands of Dollars from Carbon Credits through This Climate Start-Up" (*CNBC* July 14, 2022) https://www.cnbc.com/2022/07/11/farmers-are-making-thousands-of-dollars-from-carbon-credits.html accessed April 24, 2023.

[101] S&P Global, "Carbon Farming: Opportunities for Agriculture and Farmers to Gain from Decarbonization" (*ESG INVESTMENT RESEARCH* July 28, 2022) https://www.spglobal.com/esg/insights/topics/carbon-farming-opportunities-for-agriculture-and-farmers-to-gain-from-decarbonization accessed April 24, 2023.

[102] However, action-based payment and result-based payment is not necessarily incompatible. Indeed, there can be hybrid payments, combining low-risk, up-front or guaranteed payment for farmers for implementing specific farm management actions, with additional payments based on actual measured mitigation results (McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at:

Action-based: Farmers receive a set payment for taking a particular action, e.g., complying with a defined farming practice or implementing specific technologies.[103] *Action-based payments are relatively simple, with low MRV requirements for farmers and administrators.*[104] *However, the actual mitigation impact of action-based payments is uncertain, as payment depends only on the action, not the result.*[105]

Result-based: Farmers receive a payment that depends on the actual mitigation outcome, regardless of the specific actions taken.[106] *Result-based payments require that the mitigation outcome can be quantified and verified, which requires costly and complex MRV, and thus environmental certainty and credibility are high due to the explicit link between the mitigation contribution and payment.*[107]

b. Financial incentive mechanisms to reward carbon farming

In practice, there are mainly two types of financial incentive mechanisms to incentivize carbon farming.[108] Namely, a land-management practice payments mechanism and a carbon markets mechanism.[109]

First, at a land-management practice payments mechanism, a reward is paid for farmers by the central funders in exchange for implementing climate carbon farming management actions.[110] While land-management practice payments can be result-based, generally they are action-based.[111] This mechanism has the advantage of being simple and generally with low MRV requirements, therefore low-cost to administer.[112] Thus however, the mitigation impact is commonly uncertain.[113] Currently, this type of mechanism is adopted by public funding scheme including the CAP.[114]

Second, at a carbon markets mechanism, farmers implement mitigation measures in accordance with approved methodologies to produce offset credits that represent actual sequestered carbon (i.e., it is a result-based payment mechanism).[115] Farmers can trade those credits directly with buyers to generate income sources.[116] A carbon markets mechanism is divided into two categories, namely compliance carbon markets and voluntary carbon markets. Compliance carbon markets are regulated by carbon reduction frameworks that are mandatory internationally, nationally or regionally, while voluntary carbon markets are established and operated outside of

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https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 3.1.1).

[103] Ibid.

[104] Ibid.

[105] Ibid.

[106] Ibid.

[107] Ibid.

[108] McDonald, H. et al., 2021 also states that there is another category of funding mechanism, where agri-food companies are motivated either by price premiums or for marketing reasons within their own supply chain, but this mechanism is out of scope of this thesis. This is because many of such mechanisms are opaque and significantly differs depending on projects, which makes difficult in analysing this mechanism, and this mechanism tends to combine each practice of (i) and (ii) above, thus not giving independent value to the thesis at this moment. (Ibid, section 3.2).

[109] Ibid.

[110] Ibid, section 3.1.2

[111] Ibid.

[112] Ibid.

[113] Ibid.

[114] Ibid. The CAP funding for carbon farming is explained in the chapter 4.4.

[115] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 3.2.

[116] Ibid.

compliance markets rules.[117] Companies and individuals participate voluntary carbon markets to purchase carbon offsets on a voluntary basis.[118] A compliant carbon markets mechanism is organized by governments, but a voluntary carbon markets mechanism can be organized by governments, NGOs, and private companies.[119] At this moment, the agricultural sector is not covered by compliance carbon markets in the EU, namely EU ETS under the Directive 2003/87.[120] Therefore, at this moment, only voluntary carbon markets mechanisms are applicable to carbon farming in the EU.

c. Overview of current financial incentive mechanisms in the EU

Thus far, according to the Commission, "*it is possible to conclude that currently the largest certification schemes in voluntary carbon markets have virtually no role in certifying carbon removals happening in the EU*". [121] Namely, the two biggest certification schemes in voluntary carbon markets, the Voluntary Carbon Standard and Gold Standard, have respectively registered very few carbon removal projects in the EU.[122] On the other hand, "*a few national or local voluntary markets mechanisms have emerged in the EU that are solely or mainly dedicated to certifying various types of CO_2 removals*" including carbon farming.[123]

For example, the Label Bas Carbone in France has covered farming and forestry activities to both reduce emissions and increase removals and.[124] In the context of agriculture, it has developed methodologies in focus of agriculture, namely "CARBON AGRI", which includes the methodology of carbon storage.[125] Through the application of standardised methodologies, environmental co-benefits are also taken into account.[126] These methodologies set guidelines for establishing eligibility criteria, quantification standard (incl. calculation of emission reductions, baseline scenario, requirements on additionality and management of non-permanence risks), MRV requirements and demonstration of environmental co-benefits.[127] Companies, public organisations or even individuals wishing to compensate their emissions can voluntarily acquire the reduced emissions/increased removals determined by these methodologies to offset their emissions.[128] As of 4 July 2022, the Label Bas Carbone had certified 233 projects covering farming and forestry activities to both reduce emissions and increase

[117] Stockholm Environment Institute and GHG Management Institute, "Mandatory & Voluntary Offset Markets" (*Carbon Offset Guide* December 29, 2020) https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/mandatory-voluntary-offset-markets/ accessed January 19, 2023.

[118] Ibid.

[119] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 3.2.

[120] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

[121] European Commission, "COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the Document Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL Establishing a Union Certification Framework for Carbon Removals" (*SWD/2022/377 final* November 30, 2022) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52022SC0377 accessed January 24, 2023, section 5.1.2.

[122] Ibid.

[123] Ibid.

[124] United Nations Development Program, "Report on International Voluntary and Compulsory Carbon Markets with Special Emphasis to Mechanisms Applied in Case of Carbon Farming and Potential Opportunities for Ukrainian Developers", section 15.5.

[125] Ibid.

[126] Ibid.

[127] Ibid.

[128] Ibid.

removals.[129]

In terms of economic potential, carbon markets specialised on carbon removal projects with robust MRV requirements like Label Bas Carbon show price range of a ton of CO_2 removal between 20 and 70 EUR or more, while the global average price on voluntary markets was approximately 8 EUR in the period 2020 – 2021.[130]

In addition, in terms of land-management practice payments mechanism, the most significant source would be the wide range of CAP funding opportunities applicable to support carbon farming.[131] The EU-wide public funding may significantly relieve the financial burden and reduce risks for farmers to participate into carbon farming, which also would lower the bar of private investment activities by complementing the risk of private investors. The details of the relation between the CAP and carbon farming are explained in the chapter 4.4 below.[132]

3.3 Challenges of carbon farming

(1) Introduction

Although carbon farming has its potential to mitigate climate change as well as providing environmental and socio-economic co-benefits as mentioned above, there is still uncertainty about actual potential of carbon farming. McDonald, H. et al., 2021 states that carbon farming faces concerns, at a fundamental level, about whether it will really deliver the promised robust mitigation outcome, environmental co-benefits, and socio-economic benefits to farmers.[133] This is due to "*scientific uncertainties regarding the feasible mitigation potential and the measurement of mitigation outcomes, concerns around permanence of these impacts, barriers to farmer uptake, and risks of negative impacts on other environmental objectives*.".[134] If such uncertainty of carbon farming on climate change mitigation and co-benefits is ignored or insufficiently cared, carbon farming would be the source of green washing.[135] Such uncertainty would cast doubt on feasibility of carbon farming as a potent way of climate change mitigation. This would also hinder the economic value of carbon farming as it becomes less attractive for both

[129] European Commission, "COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the Document Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL Establishing a Union Certification Framework for Carbon Removals" (*SWD/2022/377 final* November 30, 2022) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52022SC0377 accessed January 24, 2023, section 5.1.2.

[130] Ibid, annex 3.

[131] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 4.2.2.

[132] Besides the CAP, the Commission provides funding opportunities to kick-start the development of carbon removal practices or technologies trough: the Innovation Fund, the LIFE programme and Horizon Europe (Soil Deal for Europe) (Holzleitner C and Gawlik T, "Carbon Farming in the EU" (2022) 36 Food Science and Technology 36). These are important funding opportunities, but they are mainly focusing on building fundamental technologies and/or developing pilot scale projects. In this regard, this thesis only focuses on the CAP and voluntary carbon markets mechanisms as funding support schemes. Other funding sources are out of the scope for this thesis.

[133] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, Executive Summary.

[134] Ibid.

[135] For instance, the rainforest carbon offset programs initiated by Verra, the world's leading carbon standard, are criticized by the Guardian, the German weekly Die Zeit and Source Material collectively that most of them do not represent genuine carbon reductions, though Verra counter-argued such findings (Greenfield P, "Revealed: More than 90% of Rainforest Carbon Offsets by Biggest Certifier Are Worthless, Analysis Shows" (*The Guardian* January 18, 2023) https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe accessed March 21, 2023).

public and private parties to integrate carbon farming into carbon credit markets and other funding schemes.[136]

In this chapter 3.3, therefore, uncertainty around carbon farming potential on climate change mitigation and co-benefits (in chapter 3.3(2)) as well as limitations of a voluntary carbon markets mechanism as a financial incentive scheme for carbon farming (in chapter 3.3(3)) is explained.

(2) Uncertainty of carbon farming potential

Current understanding of carbon farming mitigation potential is still uncertain. According to the survey of 31 soil carbon scientists working in academia, non-profit organizations and government agencies, coordinated by Institute for Carbon Removal Law and Policy of American University, 75% of scientists answered there is not comprehensive enough scientific understanding — across farm management practices and biophysical conditions — to accurately predict the quantity, pace and durability of soil carbon accumulation and storage in croplands.[137] Furthermore, respondents of this survey were concerned about the potential for trade-offs between climate pollutants: for example, some interventions could boost soil carbon but also increase emissions of N_2O.[138] According to 85% of scientists, a singular focus on soil carbon risks causing unintended consequences for climate change and ecosystem health.[139] Additionally, in the context of the EU, Thünen Institut (German Federal Research Institute for Rural Areas, Forests and Fisheries) and INRAe (French National Research Institute for Agriculture, Food and the Environment) revealed great variance and uncertainty around measuring soil carbon within the EU by demonstrating significantly different potentials for carbon sequestration from the agriculture sector in the two countries, ranging from a 3-6 million tonnes CO2eq soil carbon sequestration potential in Germany compared to 28 million tonnes CO2eq annually in France.[140]

In this section, particularly significant challenges to create policies and/or incentive schemes that will realize true mitigation potential of carbon farming for farms in the EU, namely **the permanence and the additionality of the impact, the affordability of robust MRV, and the co-benefits/risks of carbon farming**, are explained.[141]

a. Permanence

In order for carbon farming to have a positive impact on the climate change, GHG levels must be lower than they otherwise would have been in the long-term.[142] It does not have substantial effect of climate change mitigation if carbon is stored for short periods of time and it is likely to be released again, thus making it essential that carbon farming mitigation is **permanent**.[143] Permanence is a challenge through the process of carbon capture from the atmosphere to carbon storage in above/below ground biomass and

[136] European Environmental Bureau, "Carbon Farming for Climate, Nature, and Farmers Report" (2021) EEB Report, page 19.

[137] Brown J, Buckley K and Funk J, "Assessing Views on Soil Carbon in Croplands: Final Report" (2022) Institute for Carbon Removal Law and Policy of American University.

[138] Ibid.

[139] Ibid.

[140] Institute for Agriculture and trade Policy, "Greenwashing or New Potential for Farmers? IATP's Contribution to the EU Greens/EFA Conference on Carbon Farming" (February 20, 2023) https://www.iatp.org/eu-greens-efa-carbon-farming-conference accessed April 24, 2023.

[141] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 1.

[142] Ibid, section 2.3.2

[143] Ibid.

soils.[144] This sequestered carbon is unstable and can be released easily through intentional actions, such as changing cropping patterns or reintroducing tillage and/or natural disturbance such as drought or fire resulting in the loss of agroforestry trees.[145]

Although it is an issue for many type of CDR projects, permanence could be especially a problem for carbon farming. This is because farmers might need to seek for incorporating new technology and/or new crops in response to changing market or climate trend, while these new practices might have adverse effect on keeping carbon sequestered in long term.[146] Therefore, practically, the usual duration of carbon farming project is set for 5-30 years, which however makes it difficult to guarantee land and farm management practices for longer period time.[147] To tackle with this (im)permanence issue, existing carbon programs provide mitigation measures by using a buffer pool/reserve account, which usually represents about 20-30% of the total number of credits estimated at the beginning of project.[148] It can be drawn upon to compensate for reversals, thus functioning as an insurance mechanism.[149] However, this mechanism also faces some issues: calculating proper buffer rate in response to the real risk of impermanence is challenging, and the size of the buffer pool relative to the number of carbon credits may not be sufficient to protect against catastrophic losses (such as unpredictable large fires and floods).[150]

b. Additionality

Carbon farming practices are not **additional** if observed mitigation would have occurred in the absence of a carbon farming incentive scheme.[151] The concept of additionality is key when designing mechanisms to incentivize and reward carbon farming practices that have real impact on climate change mitigation.[152] To be considered additional, emission reductions or removals must happen due to activities other than those already legally required or commonly practiced in the project area.[153] Demonstrating and verifying additionality is not simple because it is hard to show exactly how finance, technology, laws, or practices would have caused additional result compared to a counterfactual baseline scenario.[154] In the EU perspective, according to McDonald, H. et al., 2021, additionality can be a particular challenge to ascertain within EU because it is "*challenging to set realistic baselines or ascertain additionality at the farm scale,*

[144] Ibid.

[145] European Commission, Directorate-General for Climate Action, "Setting up and implementing result-based carbon farming mechanisms in the EU : technical guidance handbook : annexes : case-studies" (Publications Office of the European Union, 2021) https://data.europa.eu/doi/10.2834/934916 accessed January 5, 2023.

[146] Rabo Research and FMO, "How to Unlock the Green Potential of the Agricultural Sector" (*carbon Sequestration in Agricultural Soils* July 2021) https://www.fmo.nl/how-to-unlock-the-green-potential-of-the-agricultural-sector accessed April 19, 2023, page 11.

[147] Ibid.

[148] Ibid.

[149] Ibid.

[150] MacDonald A, "Guide to Carbon Credit Buffer Pools" (December 15, 2022) https://www.sylvera.com/blog/carbon-credit-buffer-pools accessed April 25, 2023.

[151] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 2.3.3.

[152] Ibid.

[153] Streck C, Dyck M and Trouwloon D, "Chapter 6: What Makes a High-Quality Carbon Credit?" (*The Voluntary Carbon Market Explained* January 26, 2022) https://vcmprimer.org/chapter-6-what-makes-a-high-quality-carbon-credit/ accessed April 25, 2023.

[154] Ibid.

with the potential that farmers are paid multiple times for the same mitigation (e.g., through CAP and through carbon farming mechanisms)."[155]

Additionality is also relevant with double counting issue,[156] which must be protected by having strict guidance and transparent registries in place to track carbon credit ownership.[157] Furthermore, additionality is also affected by carbon leakage.[158] Carbon leakage is the concept: the implementation of stringent environmental policies targeting the reduction of domestic (regional or farm level) carbon emissions results in an increase of emissions generated by countries (regions or farm) that do not implement similar policies.[159] In short, carbon leakage could happen where the carbon farming project, for example, focusing on conversion of cropland to grassland does not cover the entire farm or across regions, and then new cropland is created elsewhere.[160] To avoid carbon leakage, managing, quantifying and accounting for entire farm GHG balance and compensating displacements are necessary.[161] Alternatively, discounting emission reductions or removals with the assumption that some leakage will occur based on possible leakage modelling is also another option to diminish leakage effect.[162]

c. Affordability of robust MRV

To ensure that GHG mitigation and carbon removals are real, the consequence needs to be measured objectively through measuring, reporting, and verification.[163] While robust MRV is essential, measuring and validating accurately the GHG impact of carbon farming is expensive, resulting in a trade-off between MRV accuracy and cost.[164] High MRV costs decrease the net-benefit of carbon farming and would make carbon farming less attractive for farmers implementing carbon farming actions.[165] According to Rabo Research & FMO, 2021, high MRV cost represents the most important short-term obstacle of scaling up carbon farming.[166] In the case of carbon storage in aboveground biomass (i.e., forestry), new remote sensing and drone technologies have reduced these costs and have become more widely accepted by carbon credit protocols.[167] For measurement of belowground carbon storage, however, remote sensing/satellite

[155] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 2.3.3. In this regard, whether/how the CAP can enhance carbon farming is described in the chapter 4.3 below.

[156] Double counting issue: carbon farming mitigation is only additional if each unit of mitigation is counted no more than once (Ibid.).

[157] Ibid.

[158] Ibid.

[159] Arvanitopoulos T, Garsous G and Agnolucci P, "Carbon Leakage and Agriculture: A Literature Review on Emissions Mitigation Policies" (2021) 169 OECD Food, Agriculture and Fisheries Papers.

[160] European Environmental Bureau, "Carbon Farming for Climate, Nature, and Farmers Report" (2021) EEB Report, page 20.

[161] Streck C, Dyck M and Trouwloon D, "Chapter 6: What Makes a High-Quality Carbon Credit?" (*The Voluntary Carbon Market Explained* January 26, 2022) https://vcmprimer.org/chapter-6-what-makes-a-high-quality-carbon-credit/ accessed April 25, 2023.

[162] Ibid.

[163] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 2.3.1.

[164] Ibid.

[165] Ibid.

[166] Rabo Research and FMO, "How to Unlock the Green Potential of the Agricultural Sector" (*carbon Sequestration in Agricultural Soils* July 2021) https://www.fmo.nl/how-to-unlock-the-green-potential-of-the-agricultural-sector accessed April 19, 2023, page 11.

[167] Ibid.

technology does not yet provide sufficiently accurate estimates and thus direct soil sampling in addition to soil carbon modelling is necessary, which needs higher cost.[168]

d. Co-benefits and risks of carbon farming

Some carbon farming practice may deliver mitigation of climate change, but negatively affect other environmental or societal objectives.[169] For example, to generate soil health benefits, nutrient and manure application must be carefully managed because soil health is dependent on the timing of the application and the amount that is applied.[170] Moreover, ill-managed and poorly timed applications will have negative impacts on biodiversity because it leads higher nutrient inputs or increased pollution. [171] Furthermore, in terms of biodiversity, establishing new agroforestry systems on land that already has a high biodiversity value and/or intensive agroforestry systems, in particular monocultures such as poplar plantations, will diminish the habitats quality, thus leading to an overall loss of ecosystem services compared to mixed farmland.[172]

(3) Uncertainty of a voluntary carbon markets mechanism

According to Gumbau A, 2022, a carbon credit markets mechanism has long been criticized for potentially allowing the demand side (buyers of credit) to keep on emitting GHGs or even increasing them, instead of actually reducing and eliminating them.[173] This becomes especially critical when carbon farming mitigation is not additional as mentioned in chapter 3.3 (2) (b) (i.e., there are no real reductions or sequestration relative to business-as-usual) because GHG emissions can be offset by nothing, which will make climate change worse.[174] As shown by Christiana Figueres, a key architect of the Paris Agreement, trust is an essential resource to hold collective effort to climate change.[175] This observation is particularly apt when it comes to a voluntary carbon markets mechanism. [176] A voluntary carbon markets mechanism has struggled to establish a credible reputation due to scepticism that offsets will simply help companies to greenwash their public image.[177] Therefore, solving uncertainty of carbon farming is also critical to build trust of a voluntary carbon markets mechanism.

Furthermore, another challenge a voluntary carbon markets mechanism faces on is a lack of stability. In terms of economic potential of a carbon markets mechanism, carbon credit price is key. The price of carbon credits (not only backed by carbon farming, but in general) is influenced by many factors, such as the project type, volume of credits traded at a time (the higher the volume the lower the price, usually), the

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[168] Ibid.

[169]Ibid, section 2.3.4.

[170] Scheid A, McDonald H and Bognar J, "Carbon Farming Co-Benefits: Approaches to Enhance and Safeguard Biodiversity" (2023) Ecologic, section 2.

[171] Ibid.

[172] Ibid.

[173] Gumbau A, "Carbon Farming: Climate Fix or Greenwashing?" (September 12, 2022) https://www.dw.com/en/carbon-farming-climate-change-solution-or-greenwashing/a-61532175 accessed April 24, 2023.

[174] Ibid.

[175] Figueres C, "Solving Climate Change Requires a New Social Contract" (January 20, 2022) https://time.com/6140430/climate-change-trust/ accessed April 26, 2023.

[176] Macquarie R, "Searching for Trust in the Voluntary Carbon Markets" (*Grantham Research Institute on climate change and the environment* February 15, 2022) https://www.lse.ac.uk/granthaminstitute/news/searching-for-trust-in-the-voluntary-carbon-markets/ accessed April 26, 2023.

[177] Ibid.

geography of the project and the duration of program.[178] Moreover, specifically for carbon farming, environmental and socio-economic co-benefits mentioned above in chapter 3.2 (3) are a major focus in carbon markets and, where demonstrated, can increase the value of the carbon credit to which they are attached.[179] However, carbon credit price relevant with carbon farming, so far, is unstable and widely varies depending on the projects and regions. According to S&P Global 2022, for example, breakeven prices for applying carbon farming practices (e.g., no tillage from conventional tillage) can vary sharply on region and crop, for example, varying from 21 USD/tCO_2eq to as high as 104 USD/ tCO_2eq in the USA.[180] Additionally, the same report also estimates that, in the USA, carbon prices would range from \$3.30 to \$200/tCO_2eq depending on region and whether markets are voluntary or compliance markets, while Europe would have prices as high as \$35/tCO_2eq. [181] Such price variety and heterogeneous characters among carbon credits means that it is time-consuming and inefficient to match an individual buyer with a corresponding supplier.[182] Particularly, in the context of the EU, the final report of the EU LIFE Carbon Farming Scheme revealed that 52 EUR/tCO_2, a price of certain type of credits under this pilot scale project is still expensive for buyers, while farmers expected to be paid even four times higher than such a real price.[183] Therefore, there is a significant disparity regarding the expectation of price for carbon removal credit between credit sellers and buyers in voluntary carbon markets.

3.4 Interim Conclusion

As explained in the chapter 3.2 (2) and (3), scientific literature has shown the potential of carbon farming to mitigate climate change and generate environmental and socio-economic co-benefits. As explained in the chapter 3.2 (4), carbon farming has been supported by financial incentive mechanisms, especially a voluntary carbon markets mechanism that would generate additional income source for farmers. Thus, carbon farming possibly creates win-win solution by achieving climate change mitigation, generating co-benefits and increasing farmers' income (sub-question (2)). Nonetheless, as explained in the chapter 3.3 (2), science also has revealed that there is still uncertainty of carbon farming about the permanence and additionality of sequestered carbon and creation of co-benefits. The chapter 3.3 (2) also shows affordable, robust MRV to secure the reality of carbon farming solution is still unavailable. As a response to these challenges, as explained in the chapter 3.3 (3), a voluntary carbon markets

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[178] Favasuli S and Sebastian V, "Voluntary Carbon Markets: How They Work, How They're Priced and Who's Involved" (*S&P Global Commodity Insights* June 10, 2021) https://www.spglobal.com/commodityinsights/en/market-insights/blogs/energy-transition/061021-voluntary-carbon-markets-pricing-participants-trading-corsia-credits accessed April 24, 2023.

[179] Ibid. Details of carbon market mechanism will be explained in the chapter 3.2 (3).

[180] S&P Global, "Carbon Farming: Opportunities for Agriculture and Farmers to Gain from Decarbonization" (*ESG INVESTMENT RESEARCH* July 28, 2022) https://www.spglobal.com/esg/insights/topics/carbon-farming-opportunities-for-agriculture-and-farmers-to-gain-from-decarbonization accessed April 24, 2023.

[181] Ibid.

[182] Blaufelder C and others, "A Blueprint for Scaling Voluntary Carbon Markets to Meet the Climate Challenge" (January 29, 2021) https://www.mckinsey.com/capabilities/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge accessed April 26, 2023.

[183] Kirsi Tiusanen, Anniina Lampinen, Ville Hulkkonen, Noora Harjama, Karoliina Rimhanen, Hannu Ilvesniemi, Luke Juuso Joona, Kaj Granholm, Veera Naukkarinen and Marianne Tikkanen, 'LIFE Carbon Farming Scheme final report: Guidance for future carbon farming schemes' (2022) < https://content.st1.fi/sites/default/files/2022-06/LIFE%20Carbon%20Farming%20Scheme%20final%20report%2001062022.pdf?_gl=1*1upkv8z*_ga*NTk2MDQ1MTA4LjE2NzI4MjM5OTQ.*_ga_76166H0SHQ*MTY3Mjk5NTc2NC4yLjEuMTY3Mjk5NTc5NC4wLjAuMA..> accessed 6 January 2023, Section 2.1.

mechanism also faces lack of credibility and market stability (sub-question (3)). To maximize its potential of creating real positive impact on climate change together with co-benefits, carbon farming needs to be controlled and properly incentivized by clear regulatory and policy frameworks to screen out green washing and adverse effect it would cause. In the next chapter, therefore, whether/how is carbon farming regulated under the current legislations in the EU with respect to conducting MRV and incentivizing scaling up of carbon farming will be investigated.

4. The current legal status of carbon farming in the EU

4.1 Introduction

As stated in the chapter 3.2 (2) and 3.3 (2), the potential of carbon farming in terms of mitigating climate change is promising, but uncertain. To ensure that carbon farming duly works as a key driver to mitigate climate change, regulatory frameworks are needed that set out the criteria to screen out inadequate carbon farming projects, and pinpoint adequate carbon farming projects to which financial incentive should be provided.

In this chapter, sub-question (4) is answered. First, the EU policy relevant to carbon farming, namely Sustainable Carbon Cycles is explained whether/how carbon farming is/will be defined and supported by the EU policy (chapter 4.2). Next, the relevant regulatory framework governing carbon farming is examined. To do so, it is examined how GHG emissions and removals of agriculture are regulated in the EU by the ESR and the LULUCF Regulation, which are the major regulatory framework governing GHG emissions and removals in diverse area including agriculture (chapter 4.3(1)). After that, whether carbon farming is integrated in such legislations with respect to conducting MRV and incentivizing scaling up of carbon farming is investigated (chapter 4.3(2)). Finally, the CAP, which is the most influential public funding scheme of the agricultural sector in the EU, is investigated to understand whether/how the CAP can adequately incentivize farmers to implement carbon farming practices (chapter 4.4).

4.2 Policy development of carbon farming in the EU

As mentioned in the chapter 2.2, a specific policy package supporting and enhancing carbon farming had not been existed in the EU until just recently even though potential of soil carbon stock from soil and climate perspective had been researched by scientists broadly for a long time.[184] In this chapter, the recent policy development regarding carbon farming is explained.

In 15 December 2021, the Commission adopted a communication document regarding Sustainable Carbon Cycles (the "SCC Communication").[185] On the same date, commission staff working document Sustainable carbon cycles - Carbon farming was also published by the Commission as a supplement document for the SCC Communication with specific focus on carbon farming.[186] The SCC Communication highlights the necessity of establishing sustainable and climate-resilient carbon cycles, and features carbon farming as one of the special focuses to achieve the net removal target of 310 Mt CO_2eq in the land sector by 2030.[187] In addition, the SCC Communication sets out actions plans aiming to address current challenges to upscale

[184] Manlay RJ, Feller C and Swift MJ, "Historical Evolution of Soil Organic Matter Concepts and Their Relationships with the Fertility and Sustainability of Cropping Systems" (2007) 119 Agriculture, Ecosystems & Environment 217.

[185] European Commission, "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles" (*COM/2021/800 final* December 15, 2021) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0800 accessed January 20, 2023.

[186] European Commission, "COMMISSION STAFF WORKING DOCUMENT Sustainable Carbon Cycles - Carbon Farming Accompanying the Communication from the Commission to the European Parliament and the Council Sustainable Carbon Cycles" (*SWD/2021/450 final* December 15, 2021) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021SC0450 accessed April 30, 2023.

[187] European Commission, "Delivering the European Green Deal" (European Commission - European Commission August 16, 2022) https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en#working-with-nature-to-protect-our-planet-and-health accessed October 14, 2022.

carbon farming.[188] These mainly consist of: (i) promoting carbon farming practices under the EU-wide funding schemes such as the CAP, (ii) standardizing MRV methodologies to provide a clear and reliable framework for carbon farming and (iii) providing adequate knowledge, data management and tailored advisory services to land managers.[189] In terms of (i) and (ii) respectively, whether/how CAP has been developed to incentivize carbon farming will be explained in the chapter 4.4, and framework for carbon farming including the MRV standardization will be explained in the chapter 5. In the perspective of (iii), research work on technical aspects of carbon farming has been initiated by the Commission.[190] Especially, on 27 April 2021, the Commission published a technical handbook on how to set up and implement carbon farming in the EU and concluded that result-based carbon farming can contribute significantly to tackle climate change.[191]

In the SCC Communication, both practices and definition of carbon farming are listed.[192] The following improved land management is listed as effective examples of carbon farming.[193]

Land Management Practice	Outline
Afforestation & Reforestation	Respecting ecological principles favorable to biodiversity and enhanced sustainable forest managemen.
Agroforestry	Combining woody vegetation (trees or shrubs) with crop and/or animal production systems on the same land.
Soil management	Protecting soils, reducing soil loss and enhancing SOC on degraded arable land by use of catch crops, cover crops and conservation tillage.
Land conversion	Targeted conversion of cropland to fallow or permanent grassland.
Restoration of organic soil	Restoration of peatlands and wetlands to reduce carbon release and to increase the potential for carbon sequestration.

Table 2: Examples of carbon farming practice as detailed by the European Commission[194]

These practices focus on increasing carbon sequestration in soils and above/below ground biomass, as well as achieving harmonization with other nature conservation perspectives including biodiversity.[195] They align with generally accepted carbon farming practices as mentioned in the chapter 3.2 (2). Based on these practices, carbon farming is defined in the SCC Communication as:

"*a green business model that rewards land managers for taking up improved land management practices, resulting in the increase of carbon sequestration in living biomass, dead organic matter and soils by enhancing carbon capture and/or reducing the release of carbon to the atmosphere*".[196]

[188] European Commission, "Carbon Farming" (*Climate Action*) https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-farming_en accessed April 30, 2023.
[189] Ibid.
[190] Ibid.
[191] Ibid.
[192] SCC Communication, chapter 2.1.
[193] Ibid.
[194] Ibid.
[195] Ibid
[196] Ibid.

This definition covers both technical and economic aspects of carbon farming. This economic perspective of carbon farming has been emphasized by the Commission. For example, a farm to fork strategy, which was adopted on 20 May 2020, announced in its communication document that a new EU carbon farming initiative will promote carbon farming as new business model that enables both income increase for farmers and decarbonization of the food chain.[197] To enhance both technical and economic perspectives, the adequate legal framework for regulating and incentivizing carbon farming is necessary. Therefore, whether/how this policy target can be realized is examined in the following chapters (chapter 4.3, 4.4 and 5).

4.3 Mechanism of the ESR and LULUCF Regulation as regulatory framework governing agricultural GHG emissions and removals, and legal status of carbon farming within these frameworks

(1) Mechanism of the ESR and the LULUCF Regulation in the agricultural sector

In the EU, GHG emissions and removals originating from the agricultural sector are governed by two different legal frameworks. Namely, ESR under the Regulation (EU) 2018/842,[198] and the LULUCF Regulation under the Regulation (EU) 2018/841.[199] In short, the ESR governs agriculture (i.e., except for the LULUCF sector) and the LULUCF Regulation governs the LULUCF sector in a different way. However, these two frameworks are also interconnected to achieve mitigating climate change impact originating from the agricultural activities flexibly.[200] Here, the brief outline of the ESR and the LULUCF Regulation and how both is interlinked is explained.[201]

First, the ESR aims for **reducing GHG emissions** of most sectors that are **not** covered under the Emissions Trading System (the "EU ETS") Directives (Directive 2003/87/EC) by setting annual emission reduction targets for each of EU member states ("Member States") for set periods.[202] These sectors include **agriculture**, transport, building and waste.[203] The LULUCF sector is clearly **removed** from the scope of the ESR regulation.[204] The ESR sets national GHG reduction target for 2030 expressed as percentage changes from 2005 levels by reflecting differences of economic power (i.e.,

[197] European Commission, "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A Farm to Fork Strategy for a Fair, Healthy and Environmentally-Friendly Food System" (*COM/2020/381 final* May 20, 2020) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0381 accessed April 30, 2023, section 2.1.

[198] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013.

[199] 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.

[200] European Commission, "Land Use and Forestry Regulation for 2021-2030" (*Climate Action*) https://climate.ec.europa.eu/eu-action/forests-and-agriculture/land-use-and-forestry-regulation-2021-2030_en accessed April 28, 2023.

[201] Both the ESR and the LULUCF Regulation were just amended recently: The ESR was amended by the Regulation (EU) 2023/857 on 16 May 2023, and the LULUCF Regulation was amended by the Regulation (EU) 2023/839 on 11 May 2023 respectively. There are several important updates for each regulation, but such updates do not substantially affect or change the mechanisms mentioned in this chapter 4.2(1). Therefore, in this thesis, the relevant rules based on the previous legislations (namely, the Regulation (EU) 2018/841 and the Regulation (EU) 2018/842) are referred to.

[202] Art 1 and 2(1) of the ESR.

[203] Art 2 (1) of the ESR.

[204] Art 2(2) of the ESR.

GDP per capita) among each Member State.[205] For example, the reduction target of the Netherlands in 2030 compared to in 2005 is 36%, while that of Bulgaria is 0%.[206] To be clear, this national reduction target needs to be achieved by reducing the GHG emissions of target sectors collectively (i.e., the specific reduction target for individual sector, such as agriculture, is not set.). To achieve this national target, the Commission Implementing Decision (EU) 2020/2126 provides the corresponding number of emission allocations to each of Member States each year from 2021 to 2030.[207]

Second, the LULUCF Regulation applies to emissions and removals of the GHGs that occur in certain land sectors such as cropland, forest land, grassland and wetland.[208] Member State shall ensure that **emissions do not exceed removals, calculated as the sum of total emissions and total removals on its territory in all of these land accounting categories** in the period 2021 to 2030.[209] In essence, if a Member State converts forests to other land uses (i.e., deforestation), which leads GHG emissions increase, it must compensate the resulting emissions by planting new forest (i.e., afforestation) or by improving the sustainable management of their existing forest, croplands, grasslands or wetlands.[210] In this way, the LULUCF Regulation incentivises Member States to take actions that increase the absorption of CO_2 in agricultural soils and forests.[211]

As shown above, each of the ESR and the LULUCF Regulation regulates different scope in different manner. However, the ESR and the LULUCF Regulation is inter-connected in the following way: If the GHGs emissions of a Member State exceeded its annual emission allocations determined by the ESR for a given year, and at the same time, that Member State has achieved net removal in the LULUCF sector, such a net removal quantity may be taken into account for that Member State's compliance with the ESR Regulation under the certain conditions.[212] For example, if a Member State generates net removals by increasing forest area (i.e. afforestation) or through improved practice in agriculture (i.e. managed grassland, cropland or wetlands), a limited number of these net removals can be used to comply with national targets in the ESR.[213] This integration mechanisms also applies vice versa. Namely, where total emissions exceed total removals under the LULUCF sector in a Member State and such a Member State requests to delete annual emission allocations under the ESR, the

[205] European Commission, "Questions and Answers - The Effort Sharing Regulation and Land, Forestry and Agriculture Regulation" (July 14, 2021) https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3543 accessed April 27, 2023.

[206] Art 4 (1) and Annex 1 of the ESR.

[207] European Commission, "Effort Sharing 2021-2030: Targets and Flexibilities" (*Climate Action*) https://climate.ec.europa.eu/eu-action/effort-sharing-member-states-emission-targets/effort-sharing-2021-2030-targets-and-flexibilities_en#:~:text=The%20Effort%20Sharing%20Regulation%20establishes,agriculture%2C%20small%20industry%20and%20waste. accessed April 28, 2023.

[208] Art 2(1) of the LULUCF Regulation.

[209] Art 4 of the LULUCF Regulation.

[210] European Commission, "Land Use and Forestry Regulation for 2021-2030" (*Climate Action*) https://climate.ec.europa.eu/eu-action/forests-and-agriculture/land-use-and-forestry-regulation-2021-2030_en accessed April 28, 2023.

[211] Ibid.

[212] Art 7 of the ESR.

[213] This amount is strictly limited to ensure the environmental integrity of the national targets under the ESR, and is dependent on the share of the agricultural sector emissions in each Member State. Moreover, only domestic action can be used for compliance under the ESR (European Commission, "Land Use and Forestry Regulation for 2021-2030" (*Climate Action*) https://climate.ec.europa.eu/eu-action/forests-and-agriculture/land-use-and-forestry-regulation-2021-2030_en accessed April 28, 2023).

quantity of deleted emission allocations shall be taken into account for that Member State's compliance with the LULUCF Regulation.[214]

The interaction between the ESR and the LULUCF Regulation may complement each other for GHG emissions/removals between the agricultural and LULUCF sector. Potential of decreasing emissions or increasing removals of GHGs within the agricultural/LULUCF sector for each Member State would be different. Perhaps increasing carbon removal in the LULUCF sector might be easier than decreasing emissions from agricultural activities in some Member States (and maybe it is opposite in another Member State). Hence, under the EU regulatory framework, the agricultural GHG emissions can be compensated to some extent by the carbon removal capacities of the LULUCF sector. This idea aligns with the concept that hard-to-abate emissions originating from agriculture can be offset by carbon removals as stated in the chapter 2.2.

(2) Legal status of carbon farming in the ESR and the LULUCF Regulation

As shown above, the ESR sets the reduction target of GHG emissions driven by certain industries covering agriculture, and the LULUCF regulation sets the target of net carbon removal in the LULUCF sector. In this chapter, whether/how carbon farming is regulated or incentivized by the ESR and the LULUCF Regulation is examined.

In this regard, carbon farming is neither defined under the ESR nor the LULUCF Regulation. Both regulations may indirectly help farmers to develop climate-smart agriculture practices.[215] However, both the ESR and the LULUCF regulation do not regulate anything about specific farming practices to achieve each of objectives. Therefore, at this moment, neither the ESR nor the LULUCF Regulation sets any rule in terms of conducting MRV and incentivizing scaling up of carbon farming.

4.4 Common Agriculture Policy

(1) Outline of the CAP

As shown above, the regulatory framework governing GHG emissions and removals covering the agricultural sector has not provided any definition or criteria of carbon farming. The CAP, composing of farmers' income aid, market measures and rural development measures, is, on paper, one of the EU's main tools supporting farmers' transition towards more carbon friendly farming practice. Historically, the CAP was established in 1962 under the Art 38 of Treaty on the Functioning of the European Union ("TFEU") and has been reformed several times.[216] The current CAP just came into force from January 2023, and sets the rule applicable from 2023 to 2027 (therefore, the current CAP is called as the "CAP 2023-2027".). Before this, the CAP set the rule applicable from 2014 to 2020 (therefore, the previous CAP is called as the "CAP 2014-2020".).[217] In 2021 and 2022 respectively, the transitional regulation under the Regulation (EU) 2020/2220 was applied to enable smooth transition (most of the CAP

[214] Art 12 of the LULUCF Regulation.

[215] European Commission, "Land Use and Forestry Regulation for 2021-2030" (*Climate Action*) https://climate.ec.europa.eu/eu-action/forests-and-agriculture/land-use-and-forestry-regulation-2021-2030_en accessed April 28, 2023.

[216] The European Council and Council of the EU, "Timeline - History of the Cap" (*Consilium* February 3, 2022) https://www.consilium.europa.eu/en/policies/cap-introduction/timeline-history/ accessed January 19, 2023.

[217] European Commission, "CAP at a Glance" (*Agriculture and rural development*) https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en accessed April 28, 2023.

rules that were in place during the 2014-2020 period were extended during this period).[218]

With respect to the environment and climate aspects of the CAP, until the CAP 2014-2020 ended, the CAP had not explicitly integrated environment protection in its objectives.[219] The objectives of the CAP are originally stipulated in the TFEU: (i) to increase agricultural productivity, (ii) to ensure a fair standard of living for the agricultural community, (iii) to stabilize markets, (iv) to assure the availability of supplies and (v) to ensure that supplies reach consumers at reasonable prices.[220] Although the CAP has adopted several incentive schemes that are beneficial for the environment and climate in its mechanism, the above objectives stipulated in the TFEU have remained unchanged since the CAP launched in 1962 and the protection of environment and climate aspects was explicitly stipulated as its objectives under the CAP for the first time in the CAP 2023-2030.[221]

In this chapter, whether/how the CAP has set the rule to adequately incentivize carbon farming practices is examined. To do so, first, whether/how carbon farming had been supported under the CAP 2014-2020 is explained with special focus on its limitations as a supporting tool for farmers to enhance carbon farming. After that, whether/how CAP 2023-2030 has been developed to work as an effective carbon farming incentive mechanism especially as a response to the limitations under the CAP 2014-2020 is examined.

(2) CAP 2014-2020- limitation as a supporting tool to enhance carbon farming-

a. Mechanism to enhance carbon farming under the CAP 2014-2020

The CAP plays a critical role in incentivizing specific farming practices by providing EU farmers with direct financial incentives. Regarding carbon farming, the CAP 2014-2020 had **greening measures** and **cross compliance rule** within income support system, which was the potent financial mechanism to incentivize farmers' adoption of carbon farming.

-Greening measures:

Considering greening measures, these measures embody additional payments for farmers who adopt or maintain farming practices that contribute to environmental and climate protection in the EU.[222] More specifically, farmers receive greening direct payment if they comply with one or several of the three practices or the equivalent practices that benefit the environment (soil and biodiversity in particular) under Art 43 (1) and (2) of the Regulation (EU) No 1307/2013.[223] These are (i) maintaining permanent grassland, (ii) crop diversification, and (iii) dedicating 5% of arable land as ecological focus area (such as land lying fallow, catch crops, nitrogen-fixing crops and

[218] European Commission, "Transitional Regulation" (*Agriculture and rural development*) https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/transitional-regulation_en accessed April 28, 2023.

[219] Heyl K and others, "The Common Agricultural Policy beyond 2020: A Critical Review in Light of Global Environmental Goals" (2020) Review of European, Comparative & International Environmental Law.

[220] Art 39(1) of the TFEU.

[221] Heyl K and others, "The Common Agricultural Policy beyond 2020: A Critical Review in Light of Global Environmental Goals" (2020) Review of European, Comparative & International Environmental Law.

[222] European Commission, "Greening" (*Agriculture and rural development*) https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/greening_en accessed April 28, 2023.

[223] Regulation (EU) No 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009.

landscape features).[224] In terms of (i) maintaining permanent grassland, it has a significant potential to increase carbon sequestration into the soil because the grass roots take up more carbon and the soil is less disturbed.[225] Additionally, as already shown in the chapter 3.2 (2), (ii) crop diversification and (iii) maintaining ecological focus area (such as catch crops) also increases carbon sequestration, thus considered as carbon farming practices. Therefore, greening measures can work as an incentive for farmers implementing carbon farming.

-Cross Compliance Rule:

Second, cross compliance rule requires farmers to respect a set of basic rules in order to receive EU income support under Art 91(1) and 93(1) of the Regulation (EU) No 1306/2013.[226] Farmers are expected to comply with rules on (i) statutory management requirements and (ii) good agricultural and environmental conditions (it is called "GAECs"), both related to the area of environmental, public and animal health, animal welfare or land management.[227] Farmers shall follow the (i) statutory management requirements regardless of whether they receive support under the CAP (since these are legislations), while farmers only receiving CAP support shall follow the (ii) GAECs. Where a farmer receiving the CAP support such as direct payments and rural development payments does not comply with the rules on cross-compliance as laid down above, an administrative penalty is imposed on that farmer.[228] GAECs are specifically relevant for carbon farming, since they include carbon farming practices such as prevention of soil erosion, maintaining soil organic matter and maintaining permanent grassland, as well as protection of biodiversity, which is a part of co-benefits generated by carbon farming practices, as shown in the chapter 3.2 (3).[229]

b. Limitation of the CAP 2014-2020

As shown in the previous section, the CAP 2014-2020, at least theoretically, set the financial incentive schemes to enhance carbon farming. However, ECA Study, 2021, which was designed for examining whether the 2014-2020 CAP measures supported a reduction in emissions from land use or an increase in the carbon sequestration on grassland and cropland, concluded that **the CAP measures, although over 100 billion EUR had been spent for mitigating and adapting to climate change, had not led to an overall increase in carbon content stored in soils and plants, in the period of 2014-2020**.[230] Through the study, the assessment was conducted regarding whether the CAP supported mitigation practices having the potential to

[224] Art 46(2) of the Regulation (EU) No 1307/2013.

[225] European Court of Auditors, "Common Agricultural Policy and Climatehalf of EU Climate Spending but Farm Emissions Are Not Decreasing" (*Special report: Common Agricultural Policy (CAP) and climate*2021) https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/ accessed November 7, 2022, page 42, Item 61.

[226] Regulation (EU) No 1306/2013 of the European Parliament and of the Council of 17 December 2013 on the financing, management and monitoring of the common agricultural policy and repealing Council Regulations (EEC) No 352/78, (EC) No 165/94, (EC) No 2799/98, (EC) No 814/2000, (EC) No 1290/2005 and (EC) No 485/2008.

[227] The details are specified under the ANNEX II of the Regulation (EU) No 1306/2013.

[228] Art 91(1) and 92 of the Regulation (EU) No 1306/2013.

[229] European Commission, "Cross-Compliance" (*Agriculture and rural development*) https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/cross-compliance_en accessed November 7, 2022.

[230] European Court of Auditors, "Common Agricultural Policy and Climate half of EU Climate Spending but Farm Emissions Are Not Decreasing" (*Special report: Common Agricultural Policy (CAP) and climate* 2021) https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/ accessed November 7, 2022, page 36.

materially contribute to climate mitigation, and whether it increased their uptake.[231] However, the study showed the CAP 2014-2020 had failed to support those promising practices.[232] The summary of the ECA Study, 2021, is given as follows with specific focus on carbon farming by the land use category, namely, peatland, grassland and arable land.

-Peatland:

Peatlands are particularly rich in organic matter.[233] In the EU, they cover around 24 million hectares and store about 20-25 % of the total carbon in EU soils, and of which over 4 million hectares of drained organic soils, including peatland, are managed as cropland or grassland in the EU.[234] This represents about 2 % of the total cropland and grassland area in the EU, but it accounts for 20 % of EU agriculture emissions.[235] Although peatlands, if untouched, can contain rich carbon, the CAP 2014-2020 did not have an EU-wide measure, including GAECs under the cross compliance rule, to prevent untouched peatlands from conversion to agricultural land.[236] As a result, the CAP 2014-2020 allowed farmers that cultivate drained organic soils to receive direct payments, despite their negative impact on climate.[237]

-Grassland:

According to the EU GHG inventories for 2018, grassland on mineral soils removed 35 million tonnes CO2eq from the atmosphere.[238] Therefore, Preventing the conversion of grassland into cropland and frequent ploughing can avoid GHG emissions.[239] Under "greening measures", Member States were (i) obliged to monitor the share of permanent grassland in the total agricultural area covered by CAP direct payments to ensure that it does not fall more than 5% below a reference level, and (ii) prohibited to convert and plough environmentally sensitive permanent grassland. [240] This environmentally sensitive permanent grassland consists of Natura 2000 areas and other grassland designated by Member States.[241] This mechanism (ii) contributed to maintain permanent grassland, but the grassland protected as "environmentally sensitive permanent grassland" covered 8.2 million hectares of permanent grassland, which represents 52 % of Natura 2000 grassland area and 16 % of EU permanent grassland only.[242] Other grassland areas were not protected from conversion or ploughing, which significantly reduced the effectiveness of this mechanism to protect carbon stored in grasslands. [243] Indeed, despite of mechanisms (i), the permanent grassland ratio actually decreased in 21 countries and regions, of which the decrease exceeded permitted 5 % margin in two cases.[244]

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[231] Ibid.
[232] Ibid.
[233] Ibid, page 39.
[234] Ibid.
[235] Ibid.
[236] Ibid, page 41.
[237] Ibid.
[238] Ibid, page 42.
[239] Ibid.
[240] Art 45 of the Regulation (EU) No 1307/2013.
[241] Ibid.
[242] European Court of Auditors, "Common Agricultural Policy and Climate half of EU Climate Spending but Farm Emissions Are Not Decreasing" (*Special report: Common Agricultural Policy (CAP) and climate* 2021) https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/ accessed November 7, 2022, page 43.
[243] Ibid.
[244] Ibid, page 42.

-Arable Land:

The amount of carbon stored in cropland depends on various factors: such as crop type, management practices, and soil and climate variables.[245] In terms of carbon farming, whether identified measures for arable land that can help to remove GHG emissions (namely: the use of catch/cover crops and afforestation/agroforestry) were supported by the CAP 2014-2020 was examined as follows.

Cultivation of catch/cover crops is encouraged by the requirement of "ecological focus area" under greening measures.[246] Although cultivating catch crops is listed as the second most common option used by farmers to meet their ecological focus area obligations, in most Member States farmers had already grown most of catch crops before the greening measures were introduced by the CAP in 2015.[247] This indicates that the greening measures did not incentivize farmers to increase catch crops cultivation.[248] In addition, cross compliance rule sets the requirement of "minimum soil cover" as GAEC 4,[249] but the Commission does not have uptake data for GAEC 4 at EU level, thus the impact of cross compliance rule that would allow comparison of the possible impact of this rule before and after 2015 is unclear.[250]

Then, although afforestation/agroforestry had been supported with rural development funds, the uptake of afforestation/agroforestry during 2014-2020 was very low compared to the original targets (afforestation: -84% / agroforestry: -97%), and even lower than that during 2007-2013 (afforestation: -68% / agroforestry: -33%), thus the estimated overall impact of the CAP 2014-2020 on afforestation/agroforestry is negligible.[251]

(3) The new CAP-the potential to support carbon farming-

As shown in the previous section, although it had the supporting system that could enhance carbon farming practices, the CAP 2014-2020 failed to make a real impact on increasing carbon sequestration in soils and biomass. In this section, whether/how the CAP 2023-2030 has been developed to contribute more to supporting carbon farming practices is examined.

a. The outline of the CAP 2023-2030

After lengthy negotiations among the Member States, an agreement on reform of the CAP 2014-2020 was formally adopted on 2 December 2021.[252] This new CAP has entered into force from January 2023.[253] The reformed CAP aims to ensure a sustainable future for European farmers in line with the European Green Deal.[254] To align with this perspective, supporting and strengthening environmental protection (including

[245] Ibid, page 45.

[246] Art 46(2)(i) of the Regulation (EU) No 1307/2013.

[247] European Court of Auditors, "Common Agricultural Policy and Climate half of EU Climate Spending but Farm Emissions Are Not Decreasing" (*Special report: Common Agricultural Policy (CAP) and climate*2021) https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/ accessed November 7, 2022, page 46.

[248] Ibid.

[249] Annex II of the Regulation (EU) No 1306/2013.

[250] European Court of Auditors, "Common Agricultural Policy and Climate half of EU Climate Spending but Farm Emissions Are Not Decreasing" (*Special report: Common Agricultural Policy (CAP) and climate*2021) https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/ accessed November 7, 2022, page 45.

[251] Ibid, page 46.

[252] European Commission, "Cap 2023-27" (*Agriculture and rural development*) https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27_en accessed April 29, 2023.

[253] Ibid.

[254] Ibid.

biodiversity, and climate action) to achieve the environmental and climate-related objectives of the Union (including its commitments under the Paris Agreement) is added as a new objective of the CAP under Art 5 of the Regulation (EU) 2021/2115 (the "Strategic Plans Regulation").[255] This perspective is further identified by the several specific objectives, such as addressing climate change mitigation/adaptation, management of natural resources including water, soil and air, and halting and recovering biodiversity loss.[256]

In addition, the CAP 2023-2030 introduced a new strategic approach. The CAP 2023-2030 gives Member States the autonomy to put together their CAP strategic plans ("Strategic Plans") based on their needs and at the same time guarantees the conformity in line with EU-wide goals by authorizing the Commission to check and approve the submitted Strategic Plans.[257] This means that measures at member state's level can be directly targeted to local needs without undermining the overall common nature of the policy.[258]

b. Funding Scheme update

In the context of financial incentive scheme supporting protection of environment and climate, the CAP 2023-2030 introduced eco-schemes and conditionality system as new financial supporting mechanisms.

-Eco-Schemes:

Eco-schemes are a specific payments scheme established to incentivize climate-sensitive and nature-friendly practices.[259] According to the Commission document of "List of potential agricultural practices that eco-schemes could support", carbon farming is one of the target areas to be supported by the eco-schemes.[260] The non-exhaustive examples of carbon farming practices are listed there: conservation agriculture, rewetting wetlands/peatlands, minimum water table level during winter, appropriate management of residues, and establishment/maintenance/extensive use of permanent grassland.[261] Hence, eco-schemes can directly incentivize carbon farming practices.

Eco-schemes are area-based payments and can be paid per hectare annually either on a cost incurred or income forgone basis or, in some cases, a top up income payment.[262] This would lower adoption barriers for farmers as they can try out eco-schemes without committing them for multiple years.[263] On the other hand, annual

[255] 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.

[256] Art 6 of the Strategic Plans Regulation.

[257] Art 118 and 119 of the Strategic Plans Regulation.

[258] The European Council and Council of the EU, "Timeline - History of the Cap" (*Consilium* February 3, 2022) https://www.consilium.europa.eu/en/policies/cap-introduction/timeline-history/ accessed January 19, 2023.

[259] Art 31(1) of the Strategic Plans Regulation.

[260] European Commission, "Commission Publishes List of Potential Eco-Schemes" (*Agriculture and rural development* January 14, 2021) https://agriculture.ec.europa.eu/news/commission-publishes-list-potential-eco-schemes-2021-01-14_en#moreinfo accessed November 7, 2022.

[261] Ibid.

[262] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 4.2.2.

[263] European Commission, Directorate-General for Climate Action, Radley, G., Keenleyside, C., Frelih-Larsen, A., et al., *Setting up and implementing result-based carbon farming mechanisms in the EU : technical guidance handbook*, Publications Office of the European Union, 2021,https://data.europa.eu/doi/10.2834/056153, table 5.

commitment linked to annual budgets may be ineffective to take environment and climate measures that usually needs a long-term commitment to achieve impacts, as farmers can drop the measure after one year.[264]

-Conditionality:

A payment system linked to a set of mandatory rules, called as cross compliance rule under the CAP 2014-2020, was reformulated as "conditionality" rule.[265] Where a farmer receiving the CAP support such as direct payments (including eco-schemes) and rural development payments does not comply with the statutory management requirements or the GAECs, an administrative penalty is imposed on that farmer.[266] Although the basic concept and protection targets are quite similar with cross compliance rule under the CAP 2014-2020, conditionality rules added more effective aspects into GAECs. Here is the summary of updated GAECs, in specific regards to carbon farming:

Protection of peatland and wetland (GAEC 2): Peatland and wetland had not been protected before this GAEC 2 is implemented, which is one of the significant limitations of the CAP 2014-2020, as pointed out in the ECA Study, 2021.[267]

Soil protection and quality (GAEC 7): Crop rotation is required on all farms of at least 10 hectares.[268] Grassland, and organic farms are exempted since these have significant capacity to sequester carbon, and thus need to be protected.[269]

Biodiversity and landscape (GAEC 8): 4% of arable land needs to be devoted to non-productive elements and areas, including fallow land, on all farms of at least 10 hectares.[270] This is more stringent than ecological focus area backed by greening measures under the CAP 2014-2020.[271] In addition, the scope of target farmers expanded from the CAP 2014-2020 to the CAP 2023-2030 (farmers of at least 15 hectares were eligible under the CAP 2014-2020.).[272] This minimum obligatory ratio for such non-productive features can be decreased to 3% where farmers devote significant additional land to catch crops or nitrogen-fixing crops (if cultivated without plant protection products in each case).[273]

c. Observation of Strategic Plans

As mentioned in (a) above, Member States need to implement Strategic Plans at national level. Each Plan combines a wide range of targeted interventions addressing the specific needs of that EU country and deliver tangible results in relation to EU-level objectives, while contributing to the ambitions of the European Green Deal.[274]

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[264] Ibid.

[265] Department of Agriculture, Food and the Marine of Ireland, "Cap Explained" (February 20, 2023) https://www.gov.ie/en/publication/8ea74-cap-explained/ accessed April 30, 2023.

[266] Art 12(1) of the Strategic Plans Regulation.

[267] Annex III of the Strategic Plans Regulation.

[268] Ibid.

[269] Annex III of the Strategic Plans Regulation.

[270] Ibid.

[271] Department of Agriculture, Food and the Marine of Ireland, "Cap Explained" (February 20, 2023) https://www.gov.ie/en/publication/8ea74-cap-explained/ accessed April 30, 2023.

[272] Art 46 of the Regulation 1307/2013 and Annex III of the Strategic Plans Regulation.

[273] Department of Agriculture, Food and the Marine of Ireland, "Cap Explained" (February 20, 2023) https://www.gov.ie/en/publication/8ea74-cap-explained/ accessed April 30, 2023.

[274] European Commission, "Cap Strategic Plans" (*Agriculture and rural development*) https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en accessed April 29, 2023

Strategies related to environment and climate protection, including eco-schemes, are also specified in Strategic Plans by each Member States.[275] Each Strategic Plan is made public on the Commission and each government's website.[276] Thus theoretically, whether/how carbon farming is supported by the CAP 2023-2030 can be found by reviewing Strategic Plans. Due to the language limitation, however, individual Strategic Plan is not reviewed on this thesis. Instead, summary documents of all 28 Strategic Plans (one for each EU country and two for Belgium) published by the Commission in English on December 2022 and April 2023 (collectively, "Strategic Plans Summaries") are reviewed to examine whether/how carbon farming will be supported by the CAP 2023-2030.[277] Here is the highlight of the Strategic Plans Summaries with a special focus on carbon farming.

In terms of overall financing scale, around **98 billion EUR**, corresponding to 32% of the total CAP funding sources, will be devoted to delivering benefits for climate and other environmental conservation issues.[278] Within this, more than 45% financing sources are dedicated specifically to eco-schemes, and thus around **15%** of total CAP funding is directed to eco-schemes.[279] Therefore, significant amount of funding will be delivered to protect climate and environment.

Then, in specific regards to carbon farming, the Strategic Plans Summaries highlight that land managers collectively owing **35 %** of the agricultural area in the EU will be incentivized to store carbon in soil and biomass and reduce emissions through appropriate management practices (such as extensive grassland management, growing of leguminous and catch-crops, organic fertilisation or agroforestry),[280] while such percentage significantly varies depending on the Member States.[281] Moreover, the Strategic Plans Summaries indicate that **30 %** of all eco-schemes at the EU level set soil conservation as a thematic objective of eco-schemes.[282] Furthermore, according to Strategic Plans summaries, designated environmentally sensitive grasslands in Natura 2000 sites, which are prohibited to be converted or ploughed under the GAEC 9 of the conditionality rule, are 9.98 million hectares.[283] This is 9% higher than those declared under greening measures of the CAP 2014-2020, which is explained in the chapter 4.4 (2)(b).[284]

To how much extent overall these practices are effective to sequester more carbon is still unclear at this moment. As mentioned in the chapter 4.4(2)(b), over 100 billion EUR had been spent for adoption/mitigation of climate change under the CAP 2014-2020, and thus just securing significant budget is not enough to effectively incentive environment and climate friendly farming. As indicated by the ECA Study, 2021, only 1.5 % of farmland in the EU was affected by the requirement of permanent grassland, and 2.4 % of that was affected by the requirement of ecological focus areas

[275] Art 31 (1), 70 and 71 of the Strategic Plans Regulation.

[276] European Commission, "Approved CSP" (*Agriculture and rural development*) https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans/approved-csp-0_en?page=1 accessed January 16, 2023.

[277] Ibid.

[278] European Commission, "Press Corner" (New Common Agricultural Policy: set for 1 January 2023) https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7639 accessed January 16, 2023.

[279] Ibid.

[280] European Commission, "COMMON AGRICULTURAL POLICY FOR 2023-2027" (28 CAP STRATEGIC PLANS AT A GLANCE) https://agriculture.ec.europa.eu/document/download/a435881e-d02b-4b98-b718-104b5a30d1cf_en?filename=csp-at-a-glance-eu-countries_en.pdf accessed January 16, 2023.

[281] European Commission, 'Summary Overview for 27 Member States Facts and Figures' (2023) Approved 28 CAP Strategic Plans (2023-2027), Figure 50.

[282] Soil conservation includes but not limits to carbon farming. Specific practices supported by eco-schemes are not clearly mentioned in the Strategic Plans Summaries (Ibid, section 5.4).

[283] Ibid, section 5.1.

[284] Ibid.

under greening measures of the CAP 2014-2020.[285] However, if it is duly implemented, a mechanism backed by the CAP 2023-2030 as mentioned in the last paragraph above can affect much larger agricultural area in the EU, which has significant potential to make impact on increase of carbon sequestration during the period of 2023-2030 compared to the period of 2014-2020.

4.5 Interim Conclusion

As explained in the chapter 4.2, a specific policy package called Sustainable Carbon Cycles was adopted in December 2021 as a response to lack of policy target for scaling up carbon farming in the EU. In this policy, as explained in the chapter 4.2, economic perspective of carbon farming is emphasized in addition to its potential of climate change mitigation and co-benefits. Then, a specific regulatory framework to realize this policy direction is necessary. In this regard, as explained in the chapter 4.3 (1), the ESR and the LULUCF Regulation governs GHG emissions and removals originating from agriculture. Although these regulations aim at mitigating climate change originating from agriculture, they do neither regulate nor incentivize specific farming practices, as explained in the chapter 4.3 (2). Therefore, at this moment, these regulations do not set any rule for conducting MRV and incentivizing scaling up of carbon farming. Then, in terms of the CAP, the largest EU-wide funding scheme in the agricultural sector, as explained in the chapter 4.4 (2), the previous CAP 2014-2020 had rarely achieved the increase of carbon sequestration in soil and biomass in the EU mainly due to inadequate rule setting. As a response to this limitation, the current CAP has set the new funding mechanisms, if they are duly implemented, that have potential to make impact on increase of carbon sequestration during the period of 2023-2030, as explained in the chapter 4.4 (3). However, the regulatory framework setting robust and accurate criteria to properly conduct MRV and incentivize scaling up of carbon farming is still lacking. (sub-question (4)). This framework is especially important to control the quality of carbon farming in voluntary carbon markets and to prevent green washing and adverse effect it would cause. Therefore, in the next chapter, the carbon removal certification scheme just recently proposed by the Commission will be examined to understand whether/how this limitation for conducting MRV and incentivizing scaling up of carbon farming can be solved by the proposed regulatory framework.

[285] European Court of Auditors, "Common Agricultural Policy and Climate half of EU Climate Spending but Farm Emissions Are Not Decreasing" (*Special report: Common Agricultural Policy (CAP) and climate* 2021) https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/ accessed November 7, 2022, page 51.

5. The proposed carbon removal certification scheme

5.1 Introduction

In this chapter, the CRC Proposal is investigated to understand whether/how the proposed carbon removal certification scheme regulation (the "Proposed CRC Regulation"), if adopted, regulates carbon farming in the EU with respect to conducting MRV and incentivizing scaling up of carbon farming. To do so, first, the background and outline of the Proposed CRC Regulation Proposal is summarized (chapter 5.2). Then, the mechanisms of the Proposed CRC Regulation are investigated in detail with specific focus on: what/who is regulated by, what is the benefit of and how it is regulated by the Proposed CRC Regulation. Namely, scope of the Proposed CRC Regulation (chapter 5.3), the potential usage of carbon removal certification (chapter 5.4) and certification mechanism (chapter 5.5) are examined. The CRC Proposal is the initiative covering not only carbon farming but carbon removal activities in varied areas. In this thesis, however, focus is mainly placed on carbon farming perspective only.

5.2 The background and outline of the Proposed CRC Regulation Proposal

As shown in the chapter 3.2 (4), carbon farming in the EU has grown backed mainly by voluntary carbon markets mechanisms. Due to lack of regulatory framework standardizing and guaranteeing quality of carbon credits, however, carbon farming in voluntary carbon markets has faced uncertainty or lack of public trust in the reliability of standards and high costs of robust MRV systems.[286] To overcome these challenges, a certification mechanism that sets the measurement standard and manages the risk of carbon reversal or leakage to secure high quality sequestered carbon is necessary.[287] Robust monitoring, reporting and verification of carbon removals is a necessary prerequisite to ensure their authenticity, as well as to minimize the risk of fraud and errors.[288] Moreover, this framework should ensure environmental integrity and prevent negative impacts on biodiversity and ecosystems.[289]

As a response to these objectives, a carbon removal certification scheme was proposed by the Commission on 30 November of 2022.[290] The main objectives of the CRC Proposal are to accelerate the deployment of high-quality carbon removals and build trust with stakeholders by screening out greenwashing.[291] The CRC Proposal lays down requirements for certification of carbon removals, the management of certification schemes, the third-party verification and the functioning of registries.[292] Carbon removals are eligible for certification when they meet the quality criteria and verified in accordance with the Proposed CRC Regulation.[293]

The European Parliament ("EP") and the Council of EU ("Council") will review the CRC Proposal and either approve or amend the proposal in accordance with the ordinary

[286] European Commission, "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles" (*COM/2021/800 final* December 15, 2021) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0800 accessed January 20, 2023, chapter 2.2.2.

[287] Ibid, chapter 4.

[288] Ibid.

[289] Ibid.

[290] European Commission, "Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL Establishing a Union Certification Framework for Carbon Removals" (*COM/2022/672 final* November 30, 2022) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022PC0672 accessed January 23, 2023.

[291] The Proposed CRC Regulation Proposal, section 1.

[292] Art 1(1) of the Proposed CRC Regulation.

[293] Art 3 of the Proposed CRC Regulation.

legislative process.[294] In this regard, EP has already started 1st reading from 1 February, 2023.[295] If adopted by the European Parliament and Council, this would be the first EU-wide voluntary certification framework for carbon removals. According to the Impact Assessment Report on the CRC Proposal (the "CRC Impact Assessment"), *Voluntary* here means anyone who intends to develop a certification scheme (e.g., voluntary carbon market developers) or be certified by such a scheme (e.g., farmers) under the Proposed CRC Regulation, he/she must follow the applicable rules under the Proposed CRC Regulation.[296] No one in the EU is prohibited to develop different certification mechanisms and be certified by such a scheme to which the Proposed CRC Regulation is not applicable. In this regard, the Proposed CRC Regulation does not necessarily regulate existing voluntary carbon markets mechanisms, unless they apply for the proposed certification scheme under the Proposed CRC Regulation. However, existing voluntary carbon markets mechanisms will be inevitably affected by the Proposed CRC Regulation, if adopted, since they need to consider whether to participate into this proposed scheme for keeping or improving their credibility.

5.3 Scope of the Proposed CRC Regulation

In short, the Proposed CRC Regulation applies to carbon removal activities, and carbon farming is listed as one of such activities.[297] A (legal/physical) person implements carbon removal activity to get a certificate (as for carbon farming, a farmer implements carbon farming to get a certificate).[298] That certificate is issued where a person conducting carbon removal activity complies with specific rules set by certification scheme, and that compliance is verified by a certification body.[299]

In this section, the important concept to understand what/who is regulated by the Proposed CRC Regulation with specific focus on carbon farming is explained. Namely, the concept of "carbon removal" and "carbon farming" is explained to understand what is regulated by the Proposed CRC Regulation, and the concept of "operator", "certification scheme" and "certification body" is explained to understand who is regulated by the Proposed CRC Regulation.

(1) What is regulated?

-Carbon removal:

According to the proposal, ***Carbon removal*** means either "*the storage of atmospheric or biogenic carbon within geological carbon pools*,[300] *biogenic carbon pools*,[301] *long-*

[294] The Council of the EU, "The Ordinary Legislative Procedure" https://www.consilium.europa.eu/en/council-eu/decision-making/ordinary-legislative-procedure/ accessed May 1, 2023.

[295] European parliament, "Procedure File: 2022/0394(COD): Legislative Observatory" https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2022%2F0394%28COD%29&l=en accessed May 1, 2023.

[296] The CRC Impact Assessment, section 5.3.

[297] The Proposed CRC Regulation does not apply to emissions falling within the scope of EU ETS Directives, except for the storage of carbon dioxide emissions from sustainable biomass according to the EU ETS Directives (Art 1(2) of the Proposed CRC Regulation).

[298] The CRC Impact Assessment, section 5.1.1.

[299] Ibid.

[300] Although geological carbon pools are not defined in the Proposed CRC Regulation, the term of geological storage (of CO_2) is used in the recital (14) of the Proposed CRC Regulation, in which the meaning of this term is referred to the Directive 2003/87/EC and the Directive 2009/31/EC of the European. There, the term of geological storage of CO_2 is defined as "*injection accompanied by storage of CO_2 streams in underground geological formations*".

[301] Biogenic carbon pools mean "*above-ground biomass, below-ground biomass, litter, dead wood and soil organic carbon"*, each defined under the LULUCF Regulation (Art 2(1)(c) of the Proposed CRC Regulation).

lasting products and materials, and the marine environment", or "*the reduction of carbon release from a biogenic carbon pool to the atmosphere*."[302] In terms of the scope of carbon removal, "*reduction of carbon release*" is not always included as the scope of carbon removal. For example, the IPCC defines carbon dioxide removals as "*the withdrawal of greenhouse gases from the atmosphere as a result of deliberate human activities*".[303] The background why carbon release is included in carbon removal is not clearly mentioned in the CRC Proposal. However, considering that carbon release from a biogenic carbon pool (especially soil organic carbon) can be protected by organic soil management such as rewetting or restoring drained peatlands,[304] it seems that the Proposed CRC Regulation intends to incorporate the organic soil management into the scope of the Proposed CRC Regulation.[305] This is important especially in terms of carbon farming since organic soil management is one of the carbon farming practices as stated in the chapter 3.2 (2).

-Carbon farming:
The second important concept to set the scope of the Proposed CRC Regulation is ***Carbon farming***. Carbon farming is categorized as one of the carbon removal activities under the Proposed CRC Regulation.[306] Carbon removal activities is defined as "*one or more practices or processes carried out by an operator resulting in permanent carbon storage, enhancing carbon capture in a biogenic carbon pool, reducing the release of carbon from a biogenic carbon pool to the atmosphere, or storing atmospheric or biogenic carbon in long-lasting products or materials*".[307] Then, carbon farming is referred to as "*a carbon removal activity related to land management that results in the increase of carbon storage in living biomass, dead organic matter and soils by enhancing carbon capture and/or reducing the release of carbon to the atmosphere*".[308] This definition of carbon farming aligns with the definition under the SCC Communication as stated in chapter 4.2. Yet, in this Proposed CRC Regulation, the perspective of green business model that rewards land managers for taking up land management is not included in the definition. This is likely because the aspect of financial reward in exchange for land management by farmers would not be always prerequisite when certification is used (e.g., food industry may use certification for substantiating the amount of removed carbon within its supply chain).[309]

(2) Who is regulated (Overview of certification actors and role)?

In the Commission's proposed certification mechanism, mainly three categories of actors are involved and regulated by the Proposed CRC Regulation.

Operator:
First, the project operators who implement carbon removal solutions are the applicants of this mechanism to seek certification for their activities. Under the Proposed CRC Regulation, such an ***Operator*** is defined as "*any legal or physical person who operates*

[302] Art 2(1)(a) of the Proposed CRC Regulation.
[303] Meyer-Ohlendorf, Nils et al. 2023: Certification of Carbon Dioxide Removals – Evaluation of the Commission Proposal. Interim Report. Climate Change 13/2023. German Environment Agency: Dessau-Roßlau, section 2.2.1.1
[304] Darusman T and others, "Effect of Rewetting Degraded Peatlands on Carbon Fluxes: A Meta-Analysis" (2023) 28 Mitigation and Adaptation Strategies for Global Change, page 2.
[305] The recital 9 of the Proposed CRC Regulation indicates "the carbon kept in the ground by a peatland re-wetting activity" as one of the carbon removal activities.
[306] Art 2(1)(h) of the Proposed CRC Regulation.
[307] Art 2(1)(b) of the Proposed CRC Regulation.
[308] Art 2(1)(h) of the Proposed CRC Regulation.
[309] Details are discussed in the chapter 5.4.

or controls a carbon removal activity, or to whom decisive economic power over the technical functioning of the activity has been delegated".[310] Therefore, it can be a company implementing industrial removal solutions or an individual farmer implementing carbon farming solutions.[311] Moreover, a project operator can be a group of operators.[312] This means a legal entity that represents more than one operator can also work as a project operator. By allowing a group of operators, larger consortiums or alliances other than individual farmers can work as an operator in the proposed scheme. It would lower the administrative burden by efficiently distributing relevant costs among a group of farmers.[313]

Certification Scheme:
Second, ***Certification Scheme*** that provides a set of rules and procedures to certify carbon removal operators is the responder of this mechanism. It (i) establishes certification criteria and develops the related certification methodologies, (ii) validates projects and verifies climate benefits and (iii) issues removal certificates corresponding to the verified carbon removals and records them in a registry system.[314] Each of certification schemes shall be recognized by the Commission to secure its harmonization in the EU level.[315] Certification schemes can be developed by either a private or public organization.[316] According to the Proposed CRC Regulation, the existing (both national and private) voluntary carbon markets will also need to apply to the Commission for recognition of their market mechanisms if they want to be integrated into the carbon removal certification scheme under the Proposed CRC Regulation.[317]

Certification Body:
Third, ***Certification Body*** is a third-party auditor to evaluate documentation at certification procedures and to issue certificates on behalf of the certification scheme.[318] Third-party verification system has been broadly implemented under the current European voluntary carbon markets mechanisms.[319] Certification bodies perform an assessment of carbon removal projects at the stage of project registration to evaluate whether the proposed outcome driven by future activities is reasonable, and they audit the projects at the issuance of credits to confirm the quantified climate impact and ensure such a performance is aligned with the scheme's criteria.[320]

5.4 The potential usage of carbon removal certification

Besides what is and who is regulated by the Proposed CRC Regulation, what is the

[310] Art 2(1)(d) of the Proposed CRC Regulation.
[311] The CRC Impact Assessment, section 5.1.1.
[312] Art2(1)(e) of the Proposed CRC Regulation.
[313] Kirsi Tiusanen, Anniina Lampinen, Ville Hulkkonen, Noora Harjama, Karoliina Rimhanen, Hannu Ilvesniemi, Luke Juuso Joona, Kaj Granholm, Veera Naukkarinen and Marianne Tikkanen, 'LIFE Carbon Farming Scheme final report: Guidance for future carbon farming schemes' (2022) < https://content.st1.fi/sites/default/files/2022-06/LIFE%20Carbon%20Farming%20Scheme%20final%20report%2001062022.pdf?_gl=1*1upkv8z*_ga*NTk2MDQ1MTA4LjE2NzI4MjM5OTQ.*_ga_76166H0SHQ*MTY3Mjk5NTc2NC4yLjEuMTY3Mjk5NTc5NC4wLjAuMA..> accessed 6 January 2023, section 1.5.
[314] The CRC Impact Assessment, section 5.1.1.
[315] Art 13(1) of the Proposed CRC Regulation.
[316] Art 2(1)(k) of the Proposed CRC Regulation.
[317] Art 13 (2) of the Proposed CRC Regulation.
[318] The CRC Impact Assessment, section 5.1.1.
[319]McDonald, H et al., "Certification of Carbon Removals. Part 2: A review of carbon removal certification mechanisms and methodologies." (2021) Vienna: Environment Agency Austria., Annex I.
[320] Ibid.

consequences of this regulation (i.e., what operators will become able to do by the Proposed CRC Regulation) is also a key aspect to analyse the CRC Regulation Proposal. In this regard, operators, in exchange for carbon farming, can obtain the "certificate", which is defined as "*a conformity statement issued by the certification body certifying that the carbon removal activity complies with this Regulation*".[321] However, how to use this certificate is not clearly stipulated in the specific articles of the Proposed CRC Regulation. The Questions and Answers on EU Certification of Carbon Removals published by the Commission ("Carbon Removal Certification Q&A") summarize the potential usage of this certificate.[322] According to the document, certificates are mainly assumed to be used for result-based rewards: for example, farmers who achieve higher carbon removals are rewarded by public authorities, food industry and/or investors based on the amount of the certified removals.[323] Another usage described by the Carbon Removal Certification Q&A is that when farmers are rewarded in return for achieving higher carbon removals, food industry especially can use certificates to credibly document its carbon footprint, which will allow food industry's consumers and investors to compare the real climate impacts of food industry's supply chain and be beneficial to prevent green washing.[324] Moreover, Carbon Removal Certification Q&A mentions that the carbon removal certificates can be used for result-based financing under EU programs, such as the CAP.[325] However, the CAP seems to work as a reward to specific farming practices instead of reward to actual unit of sequestered carbon under the current CAP system, as mentioned in the chapter 3.2 (4)(b).[326]

5.5 Certification Mechanism

(1) Introduction

It is critical to guarantee the quality of all carbon removals certified in the EU and enable the assessment and comparison of diverse carbon removal activities to develop and scale up carbon removals activities in the future. Especially, according to the CRC Regulation Proposal, the certification of carbon removals is much less common than that of emission reductions in existing voluntary carbon markets mechanisms, and therefore, the standardization of certification methodologies has been less developed yet.[327] In addition, carbon removal activities cover diverse activities, such as permanent removal, carbon storage products and carbon farming, which are very heterogeneous in terms of their maturity and cost-effectiveness.[328] To address these issues, the CRC Regulation Proposal sets the EU-wide certification framework for carbon removals based on four criteria, indicating how to ensure QUantification, Additionality and baselines, Long-term storage and sustainabilITY (so called "QU.A.L.ITY Criteria").[329] This QU.A.L.ITY Criteria, if adopted, potentially works as a management tool to tackle with the limitation of carbon farming as mentioned in the chapter 3.3.

Furthermore, transparent and robust rules and procedures need to be placed in

[321] Art 2(1)(n) of the Proposed CRC Regulation.

[322] European Commission, "Questions and Answers on EU Certification of Carbon Removals" (*Questions and answers* November 30, 2022) https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_7159 accessed January 24, 2023.

[323] Ibid, chapter 4.

[324] Ibid.

[325] Ibid.

[326] Details of whether/how carbon removal certificate system based on result-based payment fits the CAP-based financing mechanism are discussed in the chapter 6.2.

[327] The Proposed CRC Regulation Proposal, chapter 3.

[328] Ibid.

[329] Ibid.

certification schemes to guarantee diverse stakeholders' trust towards certification schemes and to lower the risks that the certification process accepts low-quality removals. As mentioned in the chapter 5.2, this lack of transparency and trust of carbon removals framework would hinder the investment activities by potential public and private investors, which will prevent the future growth of carbon removal activities including carbon farming. To solve these problems, certification schemes should comply with harmonised certification requirements to ensure transparency and build trust by securing the mechanism of clear governance, third party verification and public registry.[330]

In the section below, details of the certification mechanisms proposed by the Proposed CRC Regulation Proposal are described. First, each aspect of QU.A.L.ITY Criteria is described in (2), (3) and (4). After that, the transparent and trustworthy aspects of certification mechanisms are described in (5). Finally, how methodologies will be developed under the Proposed CRC Regulation is described in (6).

(2) Quantification and Additionality

As mentioned in the chapter 3.3 (2)(b) above, the quantification method to accurately measure increase of sequestered carbon and the concept of additionality is crucial to make a real impact of mitigating climate change by carbon removals.[331] In this section, how quantification method and additionality requirement is set by the Proposed CRC Regulation is examined.

Quantification:

The outcome of carbon removal (called "carbon benefit" under Art 4(1) of the Proposed CRC Regulation) originating from carbon removal activities is calculated by deducting (i) the carbon removals under the baseline from (ii) total carbon removals of the carbon removal activity.[332] In case of carbon farming, each of (i) and (ii) above is set as net GHG removals or emissions in accordance with the accounting rules laid down in the LULUCF Regulation.[333] Therefore, for example, if 20 tonnes of carbon is removed by carbon removal activity (e.g., carbon farming) while 10 tonnes of carbon has been removed under the baseline, the carbon removal benefit is described as 10 tonnes of carbon (i.e., 20-10). [334] The baseline here is defined as "*the standard carbon removal performance of comparable activities in similar social, economic, environmental and technological circumstances and take into account the geographical context*". [335] However, the individual carbon removal performance of that activity can be used for calculating the baseline.[336] This is only allowed where duly justified because setting

[330] Ibid.

[331] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 2.3.3.

[332] It should be noted that uncertainties need to be managed in accordance with recognized statistical approaches when carbon removal is quantified in both scenarios (Art 4(8) of the Proposed CRC Regulation).

[333] Carbon removal activity operators are expected to gather data on carbon removals and greenhouse gas emissions to support the quantification of carbon removals generated by carbon farming. This data shall be collected in a manner compatible with national greenhouse gas inventories under the LULUCF Regulation and Part 3 of Annex V to Regulation (EU) 2018/1999 (Art 4(9) of the Proposed CRC Regulation).

[334] If the increase in direct and indirect greenhouse gas emissions occur during carbon removal activity, such emissions must be deducted from carbon benefit. However, in the context of carbon farming, this does not need to be taken into account because this rule does not apply to GHG emissions from biogenic carbon pools in the case of carbon farming (Art 4(1)(c) of the Proposed CRC Regulation).

[335] Art 4.5 of the Proposed CRC Regulation.

[336] Art 4(6) of the Proposed CRC Regulation.

standard based on individual performance has adverse effect particularly on first movers (for example, farmers who already have implemented carbon farming before they apply for the proposed certification scheme).[337] This is because such individuals already perform well in terms of carbon removal capacity when they apply for carbon removal certificate scheme.[338] It is likely that their baseline is set higher than other applicants and they have less room to improve their carbon removal capacity, which hinders their opportunities to receive fair reward.[339] The baseline represents the standard practices in comparable land parcels based on integrated datasets and remote sensing.[340] If these data are not available, baselines should be higher ambition than business-as-usual and can be based on available best practices and historical averages of national, regional or project-specific data that should be corrected for data uncertainties.[341] As a response to uncertainty of quantification, the Proposed CRC Regulation points out the necessity to consider recognised statistical approaches during quantification process, though how it affects the actual carbon removal benefit (i.e., number listed on certificates as removed carbon) is not clear.[342]

Additionality:

Under the Proposed CRC Regulation, additionality embodies regulatory and financial additionality requirements.

First, regulatory additionality is intended to ensure that carbon removal activity is not eligible under this certification scheme if such activity is already required by law.[343] In this context, as mentioned in the chapter 4.4(3), the CAP provides statutory management requirements and GAECs that farmers must comply with in order to be eligible for income support under conditionality rule. The CRC Impact Assessment describes that those requirements "*can be of inspiration when establishing that carbon farming projects are additional from a regulatory point of view (for example that they exceed legal obligations and/or conditionality requirements)*".[344] However, the CRC Proposal does not clearly mention whether/how the CAP requirement could work as the baseline for regulatory additionality. The CRC Impact Assessment does not provide further explanation. The details between the CAP and the proposed certification scheme in this regard will be discussed in the chapter 6.2 (2).

Second, financial additionality is satisfied if the incentive effect of the certification motivates a carbon removal activity.[345] It is not obvious how to prove the presence of incentive effect, but the basic idea is that the presence of the incentive effect is assumed if any practice on the relevant project or activity has not started before the application.[346] Therefore, practically, the Proposed CRC Regulation stipulates that additionality is satisfied where the baseline is established pursuant to Art 4(5) of the Proposed CRC Regulation.[347] In case the baseline is set based on the individual

[337] The CRC Impact Assessment, section 5.1.3.

[338] Ibid.

[339] On the other hand, there is risk that first movers could be rewarded just because they originally performed better than the baseline rather than improving their performance after they apply for the certification scheme. This could be problematic specially to guarantee additionality (McDonald, H.; Siemons, A.; Bodle, R.; Hobeika, M.; Scheid, A.; Schneider, L., "QU.A.L.ITY soil carbon removals? Assessing the EU Framework for Carbon Removal Certification's from a climate-friendly soil management perspective." (2023) Ecologic Institute, Berlin., section 4.3).

[340] The CRC Impact Assessment, section 5.2.1.

[341] Ibid.

[342] Art 4(8) of the Proposed CRC Regulation.

[343] Art 5(1) of the Proposed CRC Regulation.

[344] The CRC Impact Assessment, section 5.1.4.

[345] Art 5(2) of the Proposed CRC Regulation.

[346] The CRC Impact Assessment, Annex 7.

[347] Art 5(2) of the Proposed CRC Regulation.

performance under Art 4(6), both regulatory and financial additionality is to be demonstrated through specific test.[348]

(3) Long-term storage (Permanence)

As mentioned in chapter 3.3 (2)(a), keeping carbon sequestered in the long-term (permanence) is crucial, especially from a carbon farming perspective, in order to make sure carbon removal duly contributes to mitigating climate change. In this section, how long-term storage requirement is set by the Proposed CRC Regulation is examined.

Under the Proposed CRC Regulation, operators "*shall demonstrate that a carbon removal activity aims at ensuring the long-term storage of carbon*".[349] There are two points to be mentioned here. First, operators need to demonstrate **aim** for ensuring the long-term storage, instead of actually keeping carbon storage in the long-term. Second, the terminology of **long-term** is not defined in the Proposed CRC Regulation. In this regard, "permanent carbon storage" is defined as "*the storage of atmospheric or biogenic carbon for several centuries*" specifically.[350] "Long-term" would be shorter than permanent, but specific time frame is not set for "long-term".[351] In these regards, perators are required to demonstrate the aim of long-term carbon storage by complying with monitoring and mitigating any risk of release of the stored carbon occurring during the monitoring period,[352] and taking responsibility when any release of the stored carbon occurs during the monitoring period.[353] However, it is unclear what operators should do to monitor and mitigate risk of carbon release in practice, and what kind of mechanisms will be implemented to make sure they take responsibility when carbon is released during the monitoring period.[354] In this context, the carbon stored by carbon farming is considered released to the atmosphere at the end of the monitoring period.[355] This is because carbon farming is more exposed to the risk of carbon release into the atmosphere compared to permanent storage solutions (such as technology-based geological carbon storage),[356] and to account for this risk, the validity of the certified carbon removals generated by carbon farming is subject to an expiry date matching with the end of the relevant monitoring period.[357] A renewal of the certificate to maintain the carbon sequestration for a longer period than the initial validity period is not prohibited by the Proposed CRC regulation. According to the CRC Impact Assessment, such arrangements can secure a continuous income stream for farmers and at the same time limit their risk exposure because farmers do not need to commit this scheme for a very long period.[358]

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[348] Art 5(2) of the Proposed CRC Regulation. Although the contents of this specific test are not clearly defined in the Proposed CRC Regulation, this will be specified in the methodologies under the delegated acts (Annex I (g) of the Proposed CRC Regulation).

[349] Art 6(1) of the Proposed CRC Regulation.

[350] Art.2(1)(g) of the Proposed CRC Regulation.

[351] Ibid.

[352] Monitoring period means "a period, the duration of which is determined in accordance to the type of carbon removal activity, over which the storage of carbon is monitored by the operator" (Art 2(1)(f) of the Proposed CRC Regulation).

[353] Art 6(2) of the Proposed CRC Regulation.

[354] Although the recital 14 of the Proposed CRC Regulation introduces some liability mechanisms, such as "discounting of carbon removal units, collective buffers or accounts of carbon removal units, and up-front insurance mechanisms.", the recital does not have binding power.

[355] Art 6(3) of the Proposed CRC Regulation.

[356] Art 2(1)(g) of the Proposed CRC Regulation.

[357] The Proposed CRC Regulation, recital (13).

[358] On the other hand, removed carbon would not equally balance out the emissions that is offset by such removals unless the emissions are removed for the same period through renewal of removal units. However, an obligation of uninterrupted renewal for the same period, e.g., 1000 years, seems an implausible regulatory approach. (Ibid, Annex 8).

(4) Sustainability

As mentioned in the chapter 3.3 (2)(d), generating co-benefits is a particularly beneficial aspect of carbon farming as a mean of CDR. In this regard, the Proposed CRC Regulation set the requirement of sustainability, which aims for creating co-benefits. In this section, how sustainability requirement is set by the Proposed CRC Regulation is examined.

A carbon removal activity is required to have a neutral impact on, or generate co-benefits for, all the sustainability objectives specified in the Proposed CRC Regulation. They are: (i) climate change mitigation beyond the net carbon removal benefit, (ii) climate change adaptation, (iii) sustainable use and protection of water and marine resources, (iv) transition to a circular economy, (v) pollution prevention and (vi) control and protection and restoration of biodiversity and ecosystems are set as such sustainability objectives.[359] These objectives come from the so called EU taxonomy regulation.[360] The Proposed CRC Regulation prepares two steps to achieve these goals. First, a carbon removal activity shall comply with minimum sustainability requirements to make sure it does not harm sustainability objectives.[361] These requirements serve to exclude activities with a negative impact on sustainability.[362] This aligns with the idea of Do Not Significant Harm concept, which is referred to under the recital 15 of the Proposed CRC Regulation.[363] The details of these requirements will be laid down in the certification methodologies to be set out in delegated acts.[364] The specific contents of minimum sustainability requirements are still unclear at this moment. However, according to the Proposed CRC Regulation, these requirements should build both on the technical screening criteria concerning forestry activities and underground permanent geological storage of CO_2, laid down in the Regulation (EU) 2021/2139, and on the sustainability criteria for forest and agriculture biomass raw material laid down in Article 29 of the Directive (EU) 2018/2001.[365] For example, the recital 15 of the Proposed CRC Regulation raises a requirement of minimum sustainability requirement as "*practices, such as forest monocultures, that produce harmful effects for biodiversity should not be eligible for certification.*".[366]

Then, where operators report co-benefits that contribute to the sustainability objectives beyond the minimum sustainability requirements, they need to comply with further requirements on certification methodologies to be set out in delegated acts.[367] Although these requirements are not clear at this moment, the Proposed CRC Regulation encourages the certification methodologies to include mechanisms that incentivize generating co-benefits in particular for the objective of (vi) above (i.e., control and protection and restoration of biodiversity and ecosystems).[368] As indicated in the

[359] Art 7(1) of the Proposed CRC Regulation.

[360] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088.

[361] Art 7(2) of the Proposed CRC Regulation.

[362] The CRC Impact Assessment, section 5.1.4.

[363] For any activity pursuing one or more of the six objectives to qualify as sustainable, it cannot cause significant harm to any of the other objectives (Doyle DH, "A Short Guide to the EU's Taxonomy Regulation" (*S&P Global Homepage* May 12, 2021) https://www.spglobal.com/esg/insights/a-short-guide-to-the-eu-s-taxonomy-regulation#:~:text='Do%20No%20Significant%20Harm'(,with%20do%20no%20significant%20harm. Accessed March 3, 2023).

[364] Art 7(2) of the Proposed CRC Regulation.

[365] Recital 15 of the Proposed CRC Regulation.

[366] Ibid.

[367] Art7(3) of the Proposed CRC Regulation.

[368] Ibid.

chapter 3.3 (3), these additional co-benefits are also expected to give more economic value to the certified carbon removals and will result in higher revenues for operators.[369] In light of these considerations, the Commission is encouraged to prioritise the development of tailored certification methodologies on carbon farming activities that has potential to provide significant co-benefits for biodiversity,[370] to improve the soil fertility and land resilience to climate change, and thus to contribute to better food security and sustainability.[371]

(5) Reporting and Verification

Setting robust reporting and verification system is critical to accurately communicate measured results to administrators or other external parties and to ensure the truthfulness and accuracy of those results.[372] In this section, how reporting and verification requirement is set by the Proposed CRC Regulation is examined.

To guarantee the quality of carbon removal activity, a certification body shall conduct a certification audit to verify the application information submitted by operators and to confirm compliance of the carbon removal activity with QU.A.L.ITY Criteria.[373] A certification body makes an agreement with a certification scheme to carry out certification audits and issue certificates.[374] To guarantee its capability, a certification body shall be accredited by a national accreditation authority pursuant to Regulation (EC) No 765/2008.[375] In addition, to secure its independency, a certification body shall not (i) be operators, the owner of them or be owned by them, or (ii) have relations with operators that could affect their independence and impartiality.[376]

After an audit, a certification body shall issue a certification audit report containing the details of carbon removal activity, applied certification scheme and technical methodologies, carbon removal benefit, and co-benefits.[377] Then, the certification body shall carry out periodic re-certification audits to reconfirm compliance of the carbon removal activity and verify the generated carbon benefit, and issue a re-certification audit report.[378] These (re-) certification audit reports need to be made publicly available through the digital registry system established by a certification scheme.[379]

In addition to these verification and reporting mechanisms applied to individual carbon removal activities, certification schemes are required to set the governance system, in particular with regard to: internal management and monitoring, handling of complaints and appeals, stakeholder consultation, transparency and publication of information, appointment and training of certification bodies, addressing non-conformity issues, development and management of registries.[380] Moreover, each certification scheme shall submit to the Commission a report about its operations,

[369] Recital 17 of the Proposed CRC Regulation.
[370] Ibid.
[371] The CRC Impact Assessment, Annex 8.
[372] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 2.3.1.
[373] Art 9(2) of the Proposed CRC Regulation.
[374] Art 2(1)(j) of the Proposed CRC Regulation.
[375] Art 10(1) of the Proposed CRC Regulation.
[376] Art 10(3) of the Proposed CRC Regulation.
[377] Annex II of the Proposed CRC Regulation.
[378] Art 9(3) of the Proposed CRC Regulation.
[379] Art 12 of the Proposed CRC Regulation.
[380] Art 11(2) of the Proposed CRC Regulation.

including a description of any cases of fraud and related remediation measures annually by 30 April.[381] The Commission makes this annual report available in public.[382]

(6) Methodologies development

Technical certification methodologies shall comply with the QU.A.L.ITY Criteria, and to do so, these certification methodologies shall include at least the elements set out in Annex I of the Proposed CRC Regulation, which identifies each element of QU.A.L.ITY Criteria as elaborated in the section (2)(3)(4) of this chapter 5.5 above. Details of technical certification methodologies are to be established by delegated acts.[383] Delegated acts are non-legislative acts adopted by the Commission that serve to amend or supplement the non-essential elements of the legislation.[384] To adopt these highly technical delegated acts, the Commission shall consult with experts designated by the Member States.[385] The proposed schedule for implementing delegated acts is as follows: The Proposed CRC Regulation is assumed to enter into force in 2024 subject to the successful ordinary legislative procedure as mentioned in the chapter 5.2 above.[386] After that (around 2024-2025), the Commission will prepare at least three delegated acts setting out the certification methodologies for carbon removal activities in the area of (i) permanent storage, (ii) carbon storage products and (iii)carbon farming.[387]

Specific methodological rules shall be tailored to the characteristics of the different types of carbon removal activities. To take carbon farming as an example, it is hard to guarantee long term storage of sequestered carbon due to vulnerability to natural/anthropologic disturbances, such as forest fire and changes in management practices.[388] It is also challenging to secure robust but cost-effective monitoring solution as explained in the chapter 3.3 (2)(c).[389] In addition, methodologies applicable to carbon farming should generate co-benefits as carbon farming has high potential to give positive impact on sustainability as mentioned in the section (4) of this chapter. Moreover, carbon farming practice is quite heterogeneous and carbon farming is highly dependent on local climate and soil characteristics.[390] Therefore, even within carbon farming, applicable methodologies could be very diverse. For instance, according to the CRC Impact Assessment, it is relatively simple to set the baseline in the case of afforestation or agroforestry, while this can be more difficult in the case of increase in

[381] Art 14(1) of the Proposed CRC Regulation.

[382] It is allowed to be published in an aggregated form where necessary to preserve the confidentiality of commercially sensitive information (Art 14(2) of the Proposed CRC Regulation).

[383] Art 8(2) of the Proposed CRC Regulation.

[384] In other words, essential elements of a legislative act may not be delegated to the Commission according to the Art 290 of the TFEU. If the technical details of certification methodology are essentially important, and Annex 1 of the Proposed CRC Regulation fails to limit the delegation power of the Commission, the proposed delegation of power would be incompatible with Art 290 of the TFEU. (European Union, "Delegated Acts" (*EUR-Lex*) https://eur-lex.europa.eu/EN/legal-content/glossary/delegated-acts.html#:~:text=Delegated%20acts%20are%20non%2Dlegislative,essential%20elements%20of%20the%20legislation. accessed May 1, 2023).

[385] Art 16(4) of the Proposed CRC Regulation. The expert group will include approximately 70 members and could involve a number of sub-groups, including additional expertise (The CRC Regulation proposal, section 4).

[386] The CRC Regulation Proposal, LEGISLATIVE FINANCIAL STATEMENT, section 1.5.1.

[387] The Commission will also prepare two implementing acts setting out the rules for the operation of certification schemes and their assessment and recognition by the Commission, and for the set up and operation of public registries of carbon removals (Ibid.).

[388] The CRC Impact Assessment, Annex 2, section 5.1.

[389] For example, soil sampling is very expensive. Although an alternative method based on innovative technologies combining remote sensing and artificial intelligence are less accurate, it will often be cheaper and simpler than soil sampling , thus reducing the barriers of high monitoring costs (Ibid).

[390] The CRC Impact Assessment, section 2.2.2.

soil organic carbon.[391]

In addition, Art 8(3) of the Proposed CRC Regulation states that the Commission shall consider minimizing administrative burden for operators (particularly small-scale farmers in case of carbon farming) when the Commission develops technical methodologies.[392]. As mentioned in the chapter 3.3(2)(c), affordability of MRV is a particular challenge to provide real solution to major mitigation impact. In this regard, the CRC Impact Assessment raises several examples to reduce administrative burden of operators: such as using remote sensing technologies to decrease the burden of monitoring and reporting for individual operators and introducing simpler verification procedures.[393]

5.6 Interim conclusion

As explained in the chapter 5.2, the CRC Regulation Proposal sets the criteria of conducting MRV of carbon removal activities to ensure the accuracy of removed carbon and prevent carbon release during the project period. In terms of robustness of certification scheme, first, as explained in the chapter 5.5 (2) and (3), additionality and permanence requirement that aims at guaranteeing the reality and longevity of sequestered carbon is proposed under the certification scheme. In this regard, however, as shown in the chapter 5.5 (2), how regulatory additionality will be set is unclear especially because the CRC Proposal does not directly state the relation with the CAP, which sets the mandatory rule for farmers that is strongly relevant with carbon farming. Then, in terms of co-benefits, as mentioned in the chapter 5.5 (4), only avoidance of adverse effect caused by carbon removal activities is guaranteed by sustainability requirement, while the co-benefits beyond neutrality is not mandatory. In this regard, as indicated in the chapter 5.5 (4), incorporating co-benefits especially from biodiversity, soil fertility and climate adaptation perspective into carbon farming methodologies will be a priority when methodologies are developed.[394] However, as stated in the chapter 5.5 (6), methodologies will be established by the delegated acts to be adopted by the Commission around the period of 2024-2025. Therefore, to how much extent robustness of certification criteria is guaranteed depends on the future development of methodologies. Moreover, in terms of the scalability of carbon farming, as explained in the chapter 5.4, the potential usage for such certificates are not clearly described by the Proposed CRC Regulation. Therefore, to how much extent carbon removal certificate scheme contributes to generating additional income sources, and thus motivating farmers to implement carbon farming is unclear (sub-question (5)).

[391] Ibid.

[392] Art 8(3)(b) of the Proposed CRC Regulation.

[393] The CRC Impact Assessment, section 6.2.

[394] The CRC Impact Assessment, Annex 8.

6. Discussion

6.1 Short summary of findings

This thesis started its research with the question:

Whether and how is carbon farming regulated in the EU, with respect to conducting measurement, reporting and verification (MRV) and incentivizing scaling up of carbon farming to mitigate climate change?

To answer this question, the following sub questions have been answered throughout chapter 2, 3, 4 and 5.

(1) Chapter 2

In chapter 2, sub-question (1) was answered as follows:

sub-question (1): *What are the characteristics of the agricultural sector in the EU in terms of the impact on climate change?*

As explained in the chapter 2.1, agriculture is one of the main sources of GHG emissions in the EU, particularly non-CO_2 emissions. To mitigate climate change, a further endeavour to reduce emissions originating from agriculture is crucial.[395] Moreover, as shown in the chapter 2.2, the agricultural sector has a potential to conduct large scale CDR to compensate hard-to-abate residual emissions of and even beyond agriculture. Hence, although the agricultural sector in the EU is currently accelerating climate change, it also has a potent capacity to achieve large scale CDR, and thus contributing to climate change mitigation.

(2) Chapter 3

In chapter 3, sub-question (2) and (3) were answered as follows:

sub-question (2): *What is the potential of carbon farming to mitigate climate change as well as creating co-benefits of environmental and socio-economic values, and how has it developed in the EU?*

As explained in the chapter 3.2 (2) and (3), scientific literature has supported carbon farming has a potential to mitigate climate change and generate environmental and socio-economic co-benefits. Backed by this potential, as shown in the chapter 3.2 (4), carbon farming has attracted public and private investors and especially developed in a voluntary carbon markets mechanism. This mechanism enables farmers to sell carbon credits in exchange for carbon farming practices, potentially generating income sources for farmers.[396] Thus, carbon farming possibly creates win-win solution for both nature and farmers by achieving climate change mitigation as well as generating other environmental co-benefits and increasing farmers' income.

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[395] Ministry of Agriculture and Food, "Reducing Agricultural Greenhouse Gases" (*Province of British Columbia* April 28, 2022) https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-land-and-environment/climate-action/reducing-agricultural-ghgs accessed April 18, 2023.

[396] McDonald, H. et al., "Carbon farming: Making agriculture fit for 2030" (November 2021) Ieep.eu. Available at: https://ieep.eu/publications/carbon-farming-making-agriculture-fit-for-2030 accessed 16, September 2022, section 3.2.

sub-question (3): *What are existing challenges to conduct MRV and incentivize scaling up of carbon farming?*

As explained in the section (a) and (b) of the chapter 3.3 (2), scientific literature also has revealed that the permanence and additionality of sequestered carbon is still uncertain, leading the uncertainty of carbon farming's real impact on climate change mitigation. Moreover, as shown in the section (c) of the chapter 3.3 (2), robust MRV system is still expensive, which creates a significant challenge in practice to guarantee truthful impact of carbon farming on climate change mitigation. Furthermore, as indicated in the section (d) of the chapter 3.3 (2), some carbon farming practice may deliver mitigation of climate change, but negatively affect other environmental or societal objectives. In addition, as stated in the chapter 3.3 (3), a voluntary carbon markets mechanism faces lack of credibility and market stability as a response to these challenges.

(3) Chapter 4

In chapter 4, sub-question (4) was answered as follows:

sub-question (4): *Whether/how is carbon farming regulated under the current legislations in the EU with respect to conducting MRV and incentivizing scaling up of carbon farming?*

As a response to a lack of policy target for scaling up carbon farming in the EU, a specific policy package called Sustainable Carbon Cycles was adopted in December 2021.[397] As explained in the chapter 4.2, the economic perspective of carbon farming is emphasized in this policy in addition to its potential of climate change mitigation and co-benefits creation. A specific regulatory framework to realize this policy direction is necessary. In this regard, as shown in the chapter 4.3, the ESR and the LULUCF Regulation aiming at mitigating climate change originating from agriculture shows some relevance with carbon farming with respect to governing GHG emissions and removals originating from agriculture. However, they neither regulate nor incentivize specific farming practices, and therefore, at this moment, these regulations do not set any rule for conducting MRV and incentivizing scaling up of carbon farming. Then, in terms of the CAP, the largest EU-wide funding scheme in the agricultural sector, as stated in the chapter 4.4 (2), the previous CAP 2014-2020 had rarely achieved the increase of carbon sequestration in soil and biomass in the EU mainly due to inadequate rule setting. As a response to this, as mentioned in the chapter 4.4 (3), the current CAP has set the new funding mechanisms, if they are duly implemented, that have potential to make impact on increase of carbon sequestration during the period of 2023-2030. However, the regulatory framework setting robust and accurate criteria to properly conduct MRV and incentivize scaling up of carbon farming is still lacking.

(4) Chapter 5

In chapter 5, sub-question (5) was answered as follows:

Whether/how will the proposed carbon removal certification scheme regulation regulate carbon farming in the EU with respect to conducting MRV and incentivizing scaling up of carbon farming?

[397] European Commission, "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles" (*COM/2021/800 final* December 15, 2021) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0800 accessed January 20, 2023.

As explained in the chapter 5.2, the CRC Regulation Proposal sets the criteria of conducting MRV of carbon removal activities to ensure the accuracy of removed carbon and prevent carbon release during the project period. In terms of robustness of certification scheme, as shown in the chapter 5.5 (2) and (3), additionality and permanence requirement that aims at guaranteeing the reality and longevity of sequestered carbon is proposed under the certification scheme. In specific regard of additionality, however, as stated in the chapter 5.5 (2), how to ensure regulatory additionality is still unclear, especially because the CRC Proposal does not directly state the relation with the CAP. As explained in the section (b) of the chapter 4.4 (3), the CAP sets the mandatory rules for farmers that are strongly relevant with carbon farming. Then, in terms of co-benefits, as mentioned in the chapter 5.5 (4), only avoidance of adverse effect caused by carbon removal activities is guaranteed, while the co-benefits beyond neutrality are not mandatory. In this regard, the Commission states, in the CRC Impact Assessment, that incorporating co-benefits especially from biodiversity, soil fertility and climate adaptation perspective into carbon farming methodologies is a priority when methodologies are developed.[398] However, as indicated in the chapter 5.5 (6), methodologies will be established by the delegated acts to be adopted by the Commission around the period of 2024-2025. Therefore, to how much extent robustness of certification criteria is guaranteed depends on the future development of methodologies. Moreover, in terms of the scalability of carbon farming, as explained in the chapter 5.4, the potential usage of proposed certificates is not clearly described by the CRC Regulation Proposal. Therefore, to how much extent this carbon removal certificate scheme contributes to generating additional income sources, and thus motivating farmers to implement carbon farming is unclear.

6.2 Discussion and policy recommendations

As summarized in the previous chapter, there is no EU-wide regulation that sets the criteria for conducting MRV of carbon farming. The Proposed CRC Regulation, if adopted, would provide EU-wide MRV rules for carbon farming. In addition, the CAP is an EU-wide regulation that incentivizes scaling up carbon farming. In this sense, if the Proposed CRC Regulation is adopted, carbon farming is regulated in the EU with respect to conducting MRV and incentivizing scaleup of carbon farming. However, to answer the question of *how* carbon farming is regulated under these regulations, further detailed analysis is needed. In this part, therefore, further analysis of how carbon farming is regulated is provided. Following this, policy recommendations for each discussion point are also given. Finally, the conclusion of the research question is provided.

(1) Policy recommendation 1: Clarify MRV frameworks and liability mechanisms under the Proposed CRC Regulation

As mentioned in the chapter 3.4, the reason why regulatory framework of carbon farming is necessary is to prevent green washing and motivate adequate carbon farming practices that have real positive impact on climate change mitigation. In this regard, robust MRV of carbon farming is necessary to ensure the authenticity of carbon farming and minimise the risk of fraud and errors.[399] However, to how much extent MRV is stringent under the Proposed CRC Regulation is still not clear thus far. In addition, even though stringent methodologies are implemented to screen out non-permanent/no-

[398] Ibid.

[399] Appunn K, "Carbon Farming Explained: The Pros, the Cons and the EU's Plans" (*Clean Energy Wire*June 1, 2022) https://www.cleanenergywire.org/factsheets/carbon-farming-explained-pros-cons-and-eus-plans accessed April 14, 2023.

additional credits as much as possible, it is possible that unpredictable natural disturbance such as wildfires or storms cause carbon release.[400] As mentioned in the chapter 5.5 (3), the carbon stored by carbon farming is considered released to the atmosphere at the end of the monitoring period.[401] However, this mechanism is not applied to carbon release occurred during the monitoring period. Therefore, it is also important to establish appropriate mechanisms to allocate liability in case such a carbon release occurs during the lifespan of a carbon removal activity.[402] However, what liability allocation mechanisms are established under the Proposed CRC Regulation is not clear thus far. In this chapter, therefore, the detailed analysis on these aspects under the CRC Proposal is provided.

To determine how stringent MRV standards are necessary, the potential usage of certificates is a key element.[403] For example, allowing certificates to be used for carbon offsetting in voluntary carbon markets would require higher level of robustness. This is because such offset could increase overall GHG emissions unless carbon removals used for carbon offsetting are compatible with carbon emissions, in terms of quantification, additionality and permanence.[404] Considering that it still faces uncertainty of additionality and permanence, as explained in the section (a) and (b) of the chapter 3.3 (2), carbon farming especially needs to secure stringent MRV standards if certificates are allowed to be used for carbon offsetting. In this regard, the potential usage of certificates is not directly stipulated under the articles of the Proposed CRC Regulation. However, the recital 21 of the Proposed CRC Regulation raises several examples of different end-uses such as, "*the compilation of national and corporate greenhouse gas inventories, the proof of climate-related and other environmental corporate claims (including on biodiversity), and the exchange of verified carbon removal units through voluntary carbon offsetting markets*".[405] Given this, certificates under the Proposed CRC Regulation are likely to be allowed for offset use in the voluntary carbon markets, and thus **strict MRV would be especially necessary for carbon farming certificates**.

In case carbon release occurs after carbon farming credit is used for offsetting during the monitoring period, according to the rule of the Proposed CRC Regulation, operators (i.e., farmers) shall be liable for this release.[406] However, there would be the case that such a farmer is not able to fulfil its duty due to financial difficulties especially when such a farmer is a small-scale farmer. This risk could be managed in theory **IF** there is a mechanism that enforces financial intermediaries (i.e., certification scheme) or purchasers of carbon removal certificates (such as food industry) to be responsible for carbon release. To distribute a liability to the financial intermediaries, for example, discount factors to the quantity of net carbon removals certified could be applied, and if it is applied, the discounted part of carbon removal would be withheld and allocated to a buffer account in a registry that is operated by the certification scheme.[407] This

[400] McDonald, H.; Siemons, A.; Bodle, R.; Hobeika, M.; Scheid, A.; Schneider, L., "QU.A.L.ITY soil carbon removals? Assessing the EU Framework for Carbon Removal Certification's from a climate-friendly soil management perspective." (2023) Ecologic Institute, Berlin., section 5.1.

[401] Art 6(3) of the Proposed CRC Regulation.

[402] The CRC Impact Assessment, annex 8, section 2.

[403] McDonald, H.; Siemons, A.; Bodle, R.; Hobeika, M.; Scheid, A.; Schneider, L., "QU.A.L.ITY soil carbon removals? Assessing the EU Framework for Carbon Removal Certification's from a climate-friendly soil management perspective." (2023) Ecologic Institute, Berlin., section 7.

[404] Gumbau A, "Carbon Farming: Climate Fix or Greenwashing?" (September 12, 2022) https://www.dw.com/en/carbon-farming-climate-change-solution-or-greenwashing/a-61532175 accessed April 24, 2023.

[405] Recital 21 of the Proposed CRC Regulation.

[406] Art 6 (2)(b) of the Proposed CRC Regulation.

[407] The CRC Impact Assessment, annex 8, section 3.2.2.

buffer reserve could be drawn down once carbon release occurs.[408] Then, to distribute a liability to purchasers of carbon removal certificates, for example, the liability for carbon reversal risk could be attached to the certificate and therefore transferred to its purchaser.[409] In case of a reversal, the certificate would lose its validity, and the purchaser would need to acquire a new certificate to preserve the benefit of the associated carbon removals.[410] However, **such mechanisms have not been incorporated thus far in the Proposed CRC Regulation**.[411]

Given these points, a first policy recommendation in terms of MRV framework and liability mechanisms is that:

Robustness of MRV should align with the risk profile of carbon removal activities and potential usage of certificates. In addition, liability mechanisms in case for carbon release during the monitoring period should be clearly described in the Proposed CRC Regulation.

These points are especially relevant with carbon farming because carbon farming is relatively vulnerable to risk of carbon release into the atmosphere (as shown in the chapter 5.5 (3)).

(2) Policy recommendation 2: Strengthen the link of the CAP and the proposed certification scheme

In terms of the link between the certification scheme and the CAP, only the recital of the Proposed CRC Regulation states something about this. Namely, "*Farming practices that remove CO_2 from the atmosphere contribute to the climate neutrality objective and should be rewarded, either via the Common Agricultural Policy (CAP) or other public or private initiatives.*".[412] Indeed, the Commission considers certificates backed by carbon farming could be funded by the CAP, although the details of how the CAP is linked with the proposed certification scheme are not well explained under the CRC Proposal.

When considering how the certificates under the proposed certification scheme could be used for receiving CAP-based funding, the payment mechanism of both the CAP-based funding and proposed certification scheme needs to be taken into account. On one hand, certificates are mainly assumed to be used for result-based rewards, as stated in the chapter 5.4. On the other hand, the CAP incentives have been commonly action-based payments for compliance with very specific farming practices or technologies for the assumed environmental benefits, while few schemes or projects have offered result-based payments where the incentive payment is linked to measured outcomes on the farm.[413] As for carbon farming, for example, payments under the echo-schemes are granted as a reward for specific actions for the climate, the environment, animal welfare and combatting antimicrobial resistance.[414] Therefore, the CAP would

[408] Ibid.

[409] Ibid, section 3.3.3.

[410] Ibid.

[411] Especially, as stated in the chapter 5.3 (2), the Proposed CRC Regulation only regulates parties who conduct and control carbon removal activities such as operators, certification scheme and certification bodies. Thus, potential users of carbon removal certificates such as credit purchasers and food industry who claims net carbon removal within supply chain are out of scope.

[412] Recital 16 of the Proposed CRC Regulation.

[413] European Commission, Directorate-General for Climate Action, Radley, G., Keenleyside, C., Frelih-Larsen, A., et al., *Setting up and implementing result-based carbon farming mechanisms in the EU : technical guidance handbook*, Publications Office of the European Union, 2021,https://data.europa.eu/doi/10.2834/056153, section 2.3.

[414] Art 31(4) of the Strategic Plans Regulation.

need to introduce result-based payment mechanism if it intends to be adapted to the proposed certification scheme, which would require the amendment of the CAP regulations.[415]

Given these points, the linkage between the CAP and the proposed certification scheme under the Proposed CRC Regulation needs to be clarified under the CRC Proposal. Especially, which specific funding scheme under the CAP will be used for this purpose needs to be clearly shown. In case the result-based payment under the CAP is not the right choice to link the CAP and the proposed certification scheme, action-based CAP funding may support farmers for compensating upfront expenditures. Combining this with market result-based payments would well incentivize farmers for implementing carbon farming, though care would need to be taken to avoid double funding between the proposed certification scheme and the CAP (or other funding scheme such as other EU-funding schemes and/or state aid).[416]

From another perspective of the linkage between the CAP and the proposed certification scheme, as mentioned in the chapter 5.5 (2), the CAP conditionality requirement could work as the baseline for regulatory additionality under the proposed certification scheme. If the CAP requirement is set as criteria, a carbon removal activity shall be rewarded under the certification scheme as long as operators implement practices beyond those required by the CAP.[417] This is not contradictory to the possibility that the carbon removal certification can be used for CAP based funding. However, it would be challenging to set GAECs as the regulatory criteria. This is because GAECs vary between Member States,[418] and it would not be easy to compare the farming practices specified by the GAECs with those specified by methodologies to be set out under the delegated acts of the Proposed CRC Regulation.[419] This lack of clear link between the CAP and proposed certification scheme is a potential limitation for incentivizing scaling up of carbon farming.

Given these points, the policy recommendation in terms of the linkage between the CAP and the proposed certification scheme is that:

(i) Whether/how carbon farming certificates under the proposed certification scheme can be used for receiving the CAP-based funding and (ii) whether/which requirements of the CAP (including but not limited to statutory management requirements and GAECs under conditionality rule) would work as the baseline of regulatory additionality for carbon farming under the proposed certification scheme need to be clearly mentioned under the Proposed CRC Regulation.

[415] Namely, Regulation (EU) 2021/2115, establishing rules on support for national CAP strategic plans, and repealing Regulations (EU) 1305/2013 and 1307/2013; Regulation (EU) 2021/2116, repealing Regulation (EU) 1306/2013 on the financing, management and monitoring of the CAP; and Regulation (EU) 2021/2117, amending Regulation (EU) 1308/2013 on the common organisation of the agricultural markets; Regulation (EU) No 1151/2012 on quality schemes for agricultural products; Regulation (EU) No 251/2014 on geographical indications for aromatised wine products; and Regulation (EU) No 228/2013 laying down measures for agriculture in the outermost regions of the EU.

[416] European Commission, Directorate-General for Climate Action, Radley, G., Keenleyside, C., Frelih-Larsen, A., et al., *Setting up and implementing result-based carbon farming mechanisms in the EU : technical guidance handbook*, Publications Office of the European Union, 2021,https://data.europa.eu/doi/10.2834/056153, section 5.5.2.

[417] The details of the relation between the CAP and the Proposed CRC Regulation is discussed in the chapter 5.

[418] European Commission, Directorate-General for Climate Action, Radley, G., Keenleyside, C., Frelih-Larsen, A., et al., *Setting up and implementing result-based carbon farming mechanisms in the EU : technical guidance handbook*, Publications Office of the European Union, 2021,https://data.europa.eu/doi/10.2834/056153, section 5.2.1 (a).

[419] Details of the delegated acts under the Proposed CRC Regulation are summarized in the chapter 5.5 (6).

7. Conclusion

The answer to the following research question is provided in this chapter.

Research Question: *Whether and how is carbon farming regulated in the EU, with respect to conducting measurement, reporting and verification (MRV) and incentivizing scaling up of carbon farming to mitigate climate change?*

First, carbon farming in the EU is regulated, if the Proposed CRC Regulation is adopted, in terms of conducting MRV and incentivizing scaling up of carbon farming to mitigate climate change. More specifically, carbon farming is (to be) regulated by the Proposed CRC Regulation in terms of conducting MRV as explained in the chapter 5 and by the CAP in terms of incentivizing scaling up of carbon farming as explained in the chapter 4.4.

Second, with respect to how MRV aspect of carbon farming is regulated in the EU, the framework of conducting MRV contains the basic ruling for measurement (such as quantification, additionality and long-term storage), reporting and verification of sequestered carbon initiated by carbon farming practices as explained in the chapter 5.5 (2), (3) and (5). Besides the climate mitigation perspective, avoiding adverse effect caused by carbon farming is also guaranteed by sustainability requirement under the Proposed CRC Regulation by as explained in the chapter 5.5 (4). The details of to how much extent MRV rules would be stringent are still unclear at this moment as explained in the chapter 6.2 (1). In addition, co-benefits of environmental and socio-economic values are also taken into account when specific methodologies are developed, but not guaranteed by the Proposed CRC Regulation as explained in the chapter 5.5 (4).

Third, with respect to how incentive aspect of carbon farming is regulated in the EU, the CAP 2023-2030 has direct incentive mechanisms towards carbon farming as explained in the section (b) of the chapter 4.4 (3). As the Strategic Plans highlights, land managers collectively owing 35 % of the agricultural area in the EU will be incentivized to store carbon in soil and biomass and reduce emissions through appropriate carbon farming practices, while which and how carbon farming practices will be implemented is not clear at this moment as explained in the section (c) of the chapter 4.4 (3).

For the future research, detailed information about methodologies and potential usage of the certifications is necessary to examine to how much extent carbon farming is regulated under the Proposed CRC Regulation. Moreover, the linkage between the CAP and the Proposed CRC Regulation needs to be clarified and strengthened to scale up result-based funding backed by the proposed certification scheme.

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Regulation (EU) No 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009.

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