European Commission

Technical Guidance Handbook

Setting up and implementing result-based carbon farming mechanisms in the EU

Executive summary

PDF	ISBN 978-92-76-46569-0	doi: 10.2834/12087	ML-02-21-162-EN-N

Luxembourg: Publications Office of the European Union, 2022

Introduction

In 2019 the European Green Deal established the ambitious objective of climate neutrality for the EU's economy, to be reached by 2050. This objective is included in the Commission's proposal for the first European Climate Law. In 2020 the new EU Climate Target Plan set a target of a 55% GHG reduction by 2030 compared to 1990. Agriculture is responsible for about 10% of total EU GHG emissions and needs to contribute to the EU reduction goals. In addition, the contribution of the agriculture and forest sectors will be essential to reach the climate target because of their unique role as sinks, and therefore their capacity to compensate for the unavoidable GHG emissions of agriculture and other sectors. For these reasons, carbon farming will play a key role in achieving EU's climate targets.

The Farm to Fork Strategy establishes that a new EU Carbon Farming Initiative will be launched in 2021, in order to reward climate-friendly farming practices, via the Common Agricultural Policy (CAP) or through other public or private initiatives linked to carbon markets. The Strategy also establishes that the Commission will develop a regulatory framework for carbon credits.

Carbon farming refers to the management of carbon pools, flows and GHG fluxes at farm level, with the purpose of mitigating climate change. This involves the management of both land and livestock, all pools of carbon in soils, materials and vegetation plus fluxes of CO_2 and CH_4, as well as N_2O. It includes carbon removal from the atmosphere, avoided GHG emissions and emission reductions from ongoing agricultural practices.

Farm-level payments for carbon farming can be action-based or result-based. Action- based schemes reward land managers for putting in place climate-friendly agricultural practices. In result-based schemes the payment to land managers is directly linked to measurable indicators of the climate benefits they provide. The advantage of this approach is that the use of public or private funds is more directly linked to the intended climate objective. In addition, farmers enjoy a greater degree of flexibility, as they are free to choose their management strategies to achieve the desired results, rather than following a set of rules. Hybrid schemes combine elements of action- and result-based schemes, typically offering a payment to carry out a set of management actions, which is 4opped up' if farmers can demonstrate that they have delivered additional climate benefits.

This study explores how a widespread adoption of carbon farming in the EU can be triggered, with a particular focus on result-based carbon farming payments. The project reviewed existing international and EU payment schemes that reward carbon sequestration, reduced or avoided emissions in agriculture. On the basis of this review, five key thematic areas were selected for analysis: peatland restoration and rewetting; agroforestry; maintaining and enhancing soil organic carbon (SOC) on mineral soils; grasslands; and livestock farm carbon audits. The analysis in these five areas informed the development of a guidance handbook for practitioners that are considering setting up a result-based carbon farming scheme, such as public authorities, non-governmental organisations and private investors. The research was discussed with policy and scientific experts during two Roundtables held in October 2019 and September 2020.

Analysis of key thematic areas

Peatland restoration and rewetting

Peatlands have a key function in the carbon cycle due to their role as a permanent carbon stock and ongoing sink. However, years of unsustainable land management practices have resulted in the degradation of peatlands in the EU, making them a net GHG emitter. Currently, degraded peatlands emit 2 $GtCO_2$ per year, and are responsible for almost 5% of global total anthropogenic CO2 emission. Peatland restoration and rewetting can provide an important contribution to climate mitigation, by stopping emissions from oxidation of organic carbon and protecting the remaining carbon.

Result-based carbon farming in peatlands is a promising option because of the high level of potential climate benefits per hectare. It is also the type of land use where result- based carbon farming is more advanced at the moment. There have been exploratory projects in Finland and the UK and there is at least one scheme (MoorFutures) that has been in place in the EU since 2010, gaining considerable operational experience.

Peatland restoration and rewetting can be financed through carbon credits that may be exchanged in the markets, or bought directly from project developers (land managers, NGOs, trust funds or public bodies) or from intermediaries. The choice among these options will depend on the specific characteristics of the peatland, including the institutional setting.

GHG fluxes from peatlands and emission factors in peatlands are well correlated to water table levels, land use and vegetation type. In many peatlands, the water level and thus land use are determined by drainage, either in below ground piping or open ditches, sometimes with active pumping. Reducing or ending drainage will be a pre-requisite for rewetting and restoration. Therefore, payments can rely on monitoring of proxy indicators such as vegetation for GHG fluxes rather than on direct measuring. This feature makes monitoring, reporting and verification (MRV) simpler and more cost efficient.

The initiatives reviewed for this study base the payment on avoided emissions, but buyers are generally willing to pay a higher price to secure co-benefits. In fact, the carbon credit prices of the ongoing carbon farming initiatives are generally higher than those traded in the international voluntary carbon markets. Design options to measure and reward co-benefits beyond climate change mitigation, in particular related to water quality and biodiversity, should be considered in future schemes. The possibility of linking credits and payments to the slower process of sequestration of carbon in peatlands, rather than only to avoided emissions, should also be explored.

In the 2014-2020 CAP programming period peatland managers face a trade-off between CAP payments and carbon farming. In fact, although Member States may offer support for peatland restoration and rewetting under their Rural Development Programmes (RDPs), the resulting rewetted peatlands may no longer be eligible for CAP Pillar 1 direct payments. This barrier to uptake could be overcome if rewetted peatlands were made eligible for both Pillar 1 direct payments and rural development interventions in the 2021-27 programming period.

Agroforestry

Agroforestry is the practice of combining woody vegetation (trees or shrubs) with crop and/or animal production systems on the same plot of land. Long-established agroforestry systems, found mainly in the Mediterranean, are already providing both climate mitigation and adaptation benefits but many are under threat, and not all are eligible for CAP Pillar 1 direct payments. Recent research estimates that introducing agroforestry on selected EU arable land and grassland where there are already multiple environmental pressures could lead to sequestration of 2.1 to 63.9 MtC per year, i.e. between 7.78 and 234.85 MtCO2eq per year.
Result-based schemes for maintaining or establishing agroforestry systems are in their infancy in the EU and mostly at an experimental stage. However, agroforestry is a promising option for result-based carbon farming because it has the potential to be deployed on all types of farmland in the EU (except drained peatlands) using locally appropriate trees, woody perennial crops and hedges.

Two approaches can be adopted for result-based carbon farming schemes focussing on agroforestry: through the supply chain, when a company interested in offsetting their emissions (e.g. a supermarket) supports sustainable agroforestry; or through certification of carbon credits that the farmer can sell to purchasers wishing to offset their emissions or can trade in a local market.

Methodologies to calculate carbon sequestration in above-ground woody biomass using indirect methods look promising, but techniques to measure changes in soil organic carbon under agroforestry are not yet fully validated and need further research.

Upscaling agroforestry at EU level will require both action-based and result-based payment schemes, significant advisory services and upfront investment support to overcome farmers' resistance to adopting a new land use. Incentives must take account of the time required to realise the full benefits of the woody element and develop design features to ensure permanence over time. Economic risks to millions of hectares of existing agroforestry could be reduced and the creation of new agroforestry encouraged if the 2021-27 CAP made all agroforestry land (including the trees/ and other woody elements) eligible for both Pillar 1 direct payments and rural development interventions.

Future projects should prioritise the restoration and maintenance of long-established, extensively-managed agroforestry systems of high natural and cultural value that are currently under threat. New agroforestry within existing conventional farming systems offers climate mitigation and adaptation benefits, and a range of other ecosystem and biodiversity co-benefits. However, achieving these cost-effectively requires careful selection of locally-appropriate schemes, and rewarding provision of co-benefits.

The maintenance and enhancement of soil organic carbon in mineral soils

The maintenance and sequestration of soil organic carbon (SOC) on mineral soils is an important mitigation option with significant co-benefits for productivity and ecosystem health. Farmers can apply a range of management practices to improve SOC levels, including cover cropping, improved crop rotations, agroforestry, and converting from cropland to grassland. The sequestration potential of soil organic carbon on mineral soils in the EU has been estimated to be between 9 and 58 MtCO2eq per year. Furthermore, maintenance of existing soil organic carbon is crucial, given that many mineral soils continue to lose SOC under current management. The estimated EU annual emissions from mineral soils under cropland are 27 MtCO2eq.

Different result-oriented carbon farming initiatives are already in place that reward farmers for improvements in SOC levels. Some are funded by public or private sources as action-based or hybrid schemes (for example, the Solothurn project and Ebenrain project in Switzerland), while others sell non-tradeable offset credits (e.g. Kaindorf Certificates in Austria or CarboCert in Germany). Several result-based schemes are also under development, such as the Indigo AG Carbon Pilot project, Climate KIC funded project in France, or the LIFE Carbon Farming project in Finland. Some of these aim for nontradable emission reduction certificates while others aim to set up schemes producing offsets credits that are exchangeable in the market.

Two main approaches for setting the baseline and monitoring of SOC changes are currently available, i.e. a measurement approach via sampling and an estimation approach via combined sampling and modelling. In both cases, high MRV costs and uncertainty associated with sequestration potential and impact pose a barrier to result- based schemes. When result-based schemes are funded externally (i.e. through sale of emission reduction certificates used for offsetting or tradeable offset credits), credit or certificate buyers demand high certainty of climate benefits. The need for higher certainty must be met by stringent MRV and/or external verification, thereby reducing the uptake potential due to higher costs and administrative complexity. It is essential that schemes clearly acknowledge and address uncertainties in their design.

Technological developments are anticipated that will reduce MRV costs. Remote sensing data obtained via the Copernicus Sentinel programme may provide opportunities for modelling approaches. Schemes can also draw on low-cost opportunities from crowdsourcing of soil sampling data from farms.

Learning from existing action-based and hybrid schemes may further facilitate the development of pure result-based schemes in the future. To reduce the risk for farmers and increase uptake, a hybrid model may be necessary in specific contexts, whereby an action-based payment is topped up with a payment related to the amount of sequestered carbon. Assessments of the existing SOC levels and expected potential at national/regional scale, as well as improved granular understanding of the impact of specific management practices on SOC sequestration in regional contexts, will enable targeting of SOC activities to areas with the highest potential for SOC increase (e.g. degraded soils).

Currently, the reviewed projects mostly focus on the changes in SOC levels as the key result indicator. However, in the future, schemes should move towards accounting for the whole GHG balance associated with increasing SOC levels to ensure that the full climate impact is captured (including CO2, CH4 and N2O emissions associated with soil management). Monitoring and demonstration of co-benefits (in particular yield, water holding capacity and economic efficiency) can facilitate farmer recruitment.

Managing soil organic carbon on grasslands

Grasslands cover more than a third of the total agricultural area in Europe, and can play an important role in climate mitigation, besides delivering considerable co-benefits, including biodiversity conservation and improved soil productivity and pasture yields. Maintenance of and conversion to grasslands is a promising management option to increase SOC in EU farmland soils. According to the 2016 data reported to the UNFCCC for the EU, 41 MtCO2eq are sequestered on mineral soils under grasslands. Preventing the loss of grassland can therefore contribute significantly to the EU climate targets. The recent IPCC Climate Change and Land report identified that soil carbon sequestration on grasslands and agricultural lands through improved grazing land management offers a global potential GHG mitigation opportunity of 0.045 GtC per year. The range for the potential increase in SOC for the broader category of land management of soils, which covers the other grassland mitigation pathways, is 4-8.6 GtCO2eq per year.

There are only a few ongoing projects in the EU that include result-based elements in action-based carbon farming schemes in grasslands, even though there is a long tradition of result-based schemes on grasslands for biodiversity enhancement.

In general, estimating the sequestered SOC on grasslands is complex because climate benefits differ depending on the soil type, climate, previous land use and subsequent management practices (e.g. fertiliser inputs, soil disturbance and grazing intensity). Furthermore, to ensure permanence grasslands need to be maintained for a long period of time, typically for decades, with minimum disturbance (cultivation and re-seeding will release some of the carbon that has been sequestered).
Despite the above-mentioned challenges, the large extent of grassland in the EU and the overall potential contribution to maintain and increase SOC storage suggests that options could be explored over the coming years to design result-based schemes for carbon farming on grasslands. One way to do so may be to include payments related to climate benefits to existing biodiversity result-based schemes.

Result-based carbon farming schemes could cover the ongoing management of existing grassland; conversion of 'fallow' areas to grassland; replacement of annual cropland with grassland, including arable land that is economically marginal such as sloping land or shallow soils, which are especially suitable for grassland; and avoided emissions from avoided conversion of grassland to arable land.

A reasonable MRV approach for measurement of SOC sequestration on grasslands should be based on the principles that the administration and costs to the farmers should be minimised, and usability and transparency optimised, while accepting that some level of uncertainty is unavoidable.

Livestock farm carbon audits

The European livestock sector is responsible for 81% of Europe's agricultural emissions. On-farm climate actions that can cost-effectively reduce livestock GHG emissions include herd management and feeding, animal waste management, crop management, and reduced use of fertilisers and energy, among other actions. Research and pilot projects suggest that European livestock farms applying these actions could potentially reduce their emissions by at least 12-30% by 2030. Whole-farm carbon audit tools can calculate the combined climate impact of multiple climate actions and thus offer a promising basis for result-based schemes that encourage farmers to reduce GHG emissions related to livestock. These tools are computer models/programmes that calculate a farm's GHG emissions (and other indicators such as nitrogen balance) based on input data that summarise the farm's management (e.g. animal number and type, feed type, etc.).

Existing farm carbon audit tools, such as CAP2'ER, Solagro, Cool Farm Tool, estimate GHG emissions (the baseline) and emission reductions (the results) with moderate levels of robustness for many EU farm types and on-farm climate mitigation actions. Many new audit tools can be parameterised or extended to different local contexts or different types of farms. The CARBON AGRI scheme, which covers French dairy and beef farms, already uses a farm carbon audit tool as the basis of a result-based carbon farming scheme, funded by emission reduction certificates sold to private and institutional buyers looking to offset their own emissions.

Scheme designers face one overarching design decision: they must decide the degree of acceptable environmental uncertainty. This uncertainty arises due to farm audit tool calculation methods (e.g. reliance on average emissions factors), data monitoring and inputting, and other design elements. Up to a point, uncertainty can be reduced through more stringent requirements (e.g. strict verification, conservative audit tool calculation assumptions, etc.); however, these come with increased costs, which can reduce farmer uptake. This decision also affects how the GHG reductions can be funded: for example, if they are sold as offsets in private markets, the buyers will demand a high level of certainty of climate benefits.

Monitoring, reporting, and verification should depend exclusively on the farm carbon audit tool (not on on-site testing), with random audits and high penalties for cheating. To reduce MRV costs, data inputs should be aligned with CAP reporting and existing data, as far as possible. The Farming Sustainability Tool (FaST), which is under development, could be a source of data or have a whole farm carbon audit module. Overall, farm carbon audit tools are relatively robust, with reductions (i.e. avoided emissions) more reliably estimated than carbon storage or sequestration due to higher scientific certainty (and no permanence issues).

Due to the importance of the local context (local objectives, data availability, farmer/farm consultant/policy maker's expertise and interest), there is no one-size-fits- all design. In general, it is important that transaction costs are kept low to increase farmer uptake. This can be done by accepting greater environmental uncertainty, simplifying design or by investing upfront to reduce ongoing transaction costs to farmers. High farmer engagement will be key to improve the design and increase farmers' uptake.

Conclusions

Result-based carbon farming can potentially offer a significant contribution to climate change mitigation in the EU. Result-based carbon farming remains in its infancy, with some implementation issues still to be addressed before it reaches its full potential. In particular, it will be necessary to promote new technological and methodological developments to progressively reduce the uncertainties and costs of MRV, both through public research programmes and private investments.

Developing a result-based scheme requires significant up-front investments and resources for the scheme's designers and for farmers. Increased support to farmers from the CAP and other public and private funds could facilitate farmers' uptake and upscaling by covering at least part of the costs.

Reducing risks for farmers will also be important to increase uptake. This could be done through different strategies, e.g. considering the use of hybrid schemes, where farmers receive a basic action-based payment for employing climate-friendly management practices and an additional result-based payment if climate benefits can be demonstrated.

Engaging farmers in the scheme design will also be essential to progressively improve it and to increase farmers' uptake. Another key element to build trust, and thereby promote farmers' uptake, is the support of advisors, who can assist farmers in identifying the most appropriate solutions for their farm, including through the use of whole farm carbon audit tools.

Finally, it will be necessary to recognise and reward farmers for the co-benefits of well-designed carbon farming initiatives, as an effective means of helping the EU to achieve other important environmental objectives for farmland and helping farmers to adapt their businesses to withstand the effect of climate change.

The EU Carbon Farming Initiative should encourage the development of a range of locally or regionally tailored result-based pilot schemes for carbon farming, and meanwhile promote the more widespread adoption of well-designed, action-based or hybrid schemes, to make the initial step towards a real shift in the agriculture sector's contribution to EU climate targets. The experience gathered through pilot schemes will be essential to upscale result-based carbon farming, by improving design elements and expanding farmers' knowledge and understanding of the potential benefits to them.

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