LIFE Carbon Farming Scheme Project

LAYMAN'S REPORT

CARBON FARMING SCHEME

LIFE Preparatory Project

LIFE19 PRE FI001 – SI2.828588
The Life Carbon Farming project has received funding from the LIFE Programme of the European Union

Contents

Carbon sequestration is the uptake and storage of carbon.

Carbon sequestration can occur as a *biological* process through vegetation, soils, and oceans. It can also take place as a *geological* process, in which carbon is stored in underground geological formations; or as a *technological* one, where carbon is captured directly from the atmosphere using an advanced technological solution.

Carbon farming and carbon forestry are nature-based practices performed in agriculture or forestry with the aim of sequestering greenhouse gases from the atmosphere.

LIFE Carbon Farming Scheme – 2 years at glance

Introduction to the problem

In spring 2021, the European Union (EU) and its Member States agreed to a Union-wide climate neutrality target by 2050 through the European Climate Law. According to the law, by 2050, excess greenhouse gas emissions must be matched by an equivalent amount of carbon dioxide removals (CDR), in order to result in net zero emissions. Among the means defined for reducing emissions and removing carbon dioxide from the atmosphere are carbon farming practices.

The European Commission (EC) will propose a framework for certification requirements for CDRs, with the ambition of scaling up the carbon sequestration activities needed to increase carbon sinks in the land use sector (LULUCF) according to the 2030 target.

The proposed framework aims to accelerate carbon farming practices and set up rules for the following:

- quality of measurement
- monitoring, reporting, and verification
- promoting wider aspects of sustainability, such as
  - impacts on biodiversity
  - energy consumption
- promoting market mechanisms for supply and demand of CDRs

LULUCF sector net CO_2-e sink in EU
2019 ~250 $MtCO_2$-e
2030 target ~310 Mt CO_2-e

The primary purpose of the LIFE Carbon Farming project was to study and pilot carbon credit supply and demand to support the development of European climate policy and regulation. The objective of our project was to explore and suggest mechanisms for incentivising carbon farming and carbon forestry in order to increase carbon sinks by taking both public and private funding options into consideration.

The project sought attractive and realistic solutions that are verifiable and cost efficient as well. Our aim was to find tangible and practical means which respond to different stakeholders' needs.

Outlined below are the current obstacles to a functioning and realistic CDR market

- Lack of regulation and guidelines on the national and EU levels
- Lack of knowledge on producers, market users, and other actors
- No realistic and workable market model currently exists

Vital stakeholder needs relevant to the project

- Policy makers need to understand how incentives to carbon farming schemes can be implemented.
- Policy makers, farmers, and credit buyers are interested in the key factors behind efficient carbon credit markets.
- Policy makers require information relevant aspects for farmers as well as their motivations with regard to carbon farming.
- Farmers need more information on potential carbon farming practices.
- Policy makers, farmers, and credit buyers must gain an understanding and practical information through real-world pilot projects.

Our approach

Over the course of the project, the partners in the scheme piloted a market model for producing carbon credits with the help of farmers. Credit buyers were found through the voluntary carbon market. We conducted a survey and interviews to gather feedback and gauge perceptions of both the farmers and the buyers, along with pilot data from the market.

Additionally, we carried out a cost analysis on the investments needed for a prospective carbon credit market that could be taken into consideration in regulation. This included mapping, testing, and validating the criteria required in such a market. In cooperation with volunteer case farms, the project modeled soil carbon sequestration potential using computer simulation for the farming and forestry sectors.

Carbon Markets
Carbon markets can be divided into two categories: the voluntary market and the regulated compliance market. Carbon credits or offsets, as well as emission permits, are traded as commodities on these markets.

In a compliance market, companies buy emission permits or Carbon Removal Credits (CRCs) to reach their legally binding climate targets. In a voluntary market, buyers cannot fulfil any legal obligations, but pay compensation to mitigate climate change of their own accord.

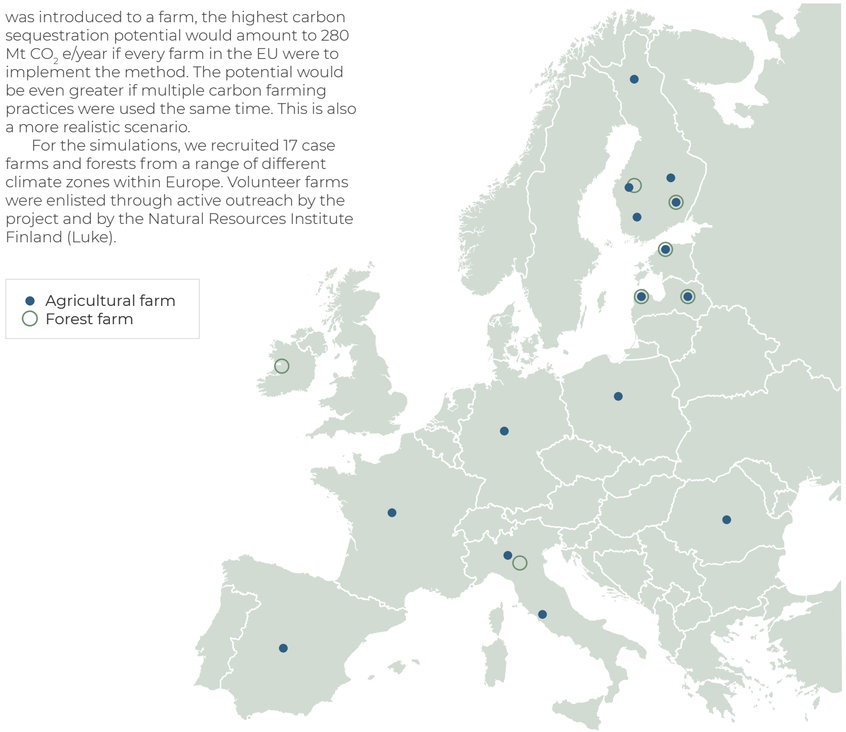
Link to video here

Our findings

Potential in soil-based carbon sequestration and the challenge of verification
We initiated the project by analysing various quantitative methods for measuring, monitoring, and modelling stored carbon in forests and agricultural lands. We learned that aboveground carbon sinks and stocks can be estimated effectively, but that measuring soil organic carbon is challenging. Due to the short timeframe of our project as well as the suitability of the Yasso07 computer model for both forest and agricultural soil simulations, we opted to utilise the model for our simulations.

The simulations showed a yearly increase in carbon sequestration by the agricultural carbon sinks of up to 1.6 t CO_2e ha during the first 10-year simulation period. According to the simulation, in which one carbon farming method was introduced to a farm, the highest carbon sequestration potential would amount to 280 Mt CO_2 e/year if every farm in the EU were to implement the method. The potential would be even greater if multiple carbon farming practices were used the same time. This is also a more realistic scenario.

For the simulations, we recruited 17 case farms and forests from a range of different climate zones within Europe. Volunteer farms were enlisted through active outreach by the project and by the Natural Resources Institute Finland (Luke).



Every farm committed to the project by providing detailed information and historical data on their agricultural practices. In addition, the farmers were interviewed to gain a wider understanding of each farm and its operating environment. The method for the simulation was chosen according to factors such as each farm's agricultural practices, crops, history, and soil data.

In our simulations, all carbon farming practices achieved the highest carbon accumulation in the first 10 years after their introduction. Beyond this initial period, as the new equilibrium point approached for the specific practice in use, carbon sequestration slowly evened out.

This natural equilibrium phenomenon shows that the potential for carbon sequestration is higher for farms which have not yet implemented carbon farming, in comparison to those farms that have already adopted the practices. This crucial difference between farms should be considered when defining the baseline for them.

At the moment, a simulation of soil carbon stock change is the most practicable approach for quantification. However, it is good to recognise that simulations do not reveal the exact amount of carbon dioxide removed. It is for this reason that the developing carbon market needs a cost-efficient, replicable, and transparent approach where model simulation is treated as part of the system. Because the exact quantities of removed carbon remain uncertain, the methods for monitoring and measurement must still be improved further.

Moreover, maintaining soil carbon stocks also requires the continuous use of carbon farming practices. Commitment to long-term changes in farming practices is a key to success.

Information received from the case farms

- Location
- Size in ha
- Main production type, form and methods
- Cultivation history
- Field age
- Cultivated crops
- Fertilizers (ammo nitrate, phosphorous, potash, other nitrogen, manure, slurry)
- Animal husbandry

Carbon farming practices chosen for the simulation

- Soil improvement fibre (gave the highest carbon sequestration potential)
- Increasing the grass cutting height
- Cover crops
- Green fallow of grassland addition to the cultivation cycle
- Theoretically increasing the soil productivity, resulting in increases in yields by 10% or 15%
- Forest management
- Forest fertilization

Piloting carbon credit supply and demand with a novel soil amendment methodology
For the pilot, we developed a novel soil amendment methodology which was verified by Puro.Earth. It was the only method suitable for piloting in the voluntary market and the sole option for producing measurable and verifiable carbon credits within our two-year project timeframe.

Advantages of the chosen soil amendment methodology
- New solution
- In the development phase and readily available
- Links with circular economy
- Measurable and verifiable carbon removal within a short timeframe
- Viability of market simulation

Within the duration of the project, we identified and selected three soil amendment projects for verification according to the requirements of the soil amendment methodology. One was the Finnish Soilfood project, where soil improvement fibres are produced from pulp and paper mill side streams which would otherwise be bound for incineration.

Only the stabile carbon share of the soil improvement is contracted to buyers as credits after the lifetime emissions based on the Life-cycle assessment (LCA) of the stored carbon are deducted, thus arriving at the net sequestered tons of carbon dioxide. The average application of soil improvement is 40 tons per hectare,

which amounts to approximately 5 tons of CO_2 per hectare removed from the atmosphere.

The pilot achieved 20-year permanence, which requires one application of soil improvement fibre. The Yasso07 computer modelling result and a lab result indicate how much of the carbon remains in the soil after 20 years.

The revenue from sold credits is divided equally between the industrial supplier of the side stream material, the processing company Soilfood, and the farmers who apply the soil improvement fibre in their fields. This kind of profit distribution is needed to incentivise all actors in the value chain. In addition, the credit buyers saw this type of credit as an interesting alternative to forest origin credits.

Farmers' perspectives

It is essential for carbon farming to enable the longevity of the practices and the maintenance of the soil carbon stocks after the initial push to produce carbon credits. Joining the scheme should be easy and without extra bureaucracy for farmers. There is also a vast need for more shared knowledge around carbon farming.

Our simulations concluded that all carbon farming practices sequester the highest volume of carbon within the first 10 years of introduction. However, the farmers' survey and interviews found out that the optimal contract length for farmers is between five and 10 years. In other words, farmers are not keen to make commitments longer than five years.

Vis-à-vis this anticipated permanence, farmers are obliged to react rapidly to changes in their operating environment, the cultivated species, the weather, and the crop market. As a result, for a farmer, a ten-year commitment is an exceedingly long one.

Within the pilot, over 80% of participant farmers preferred to be involved and represented jointly through a central body. This preference indicates that the administrative burden of monitoring, verification, and third-party validation may be a barrier for individual small or medium-scale farming and forestry businesses.

The primary concern of farmers is the viability of their agricultural business. For arable farming soil to be productive, resilience to extreme weather and reduced costs of external inputs are vital to profitability. The benefits of climate and soil health were more important to farmers than earnings from potential carbon trading. Nevertheless, farmers aspire for regular yearly incomes.

To scale up carbon removals, economic incentives are necessary

Among the tasks of the project was to evaluate the cost of establishing a new carbon farming scheme. Our analysis calculated the costs of implementing the carbon farming practices, the transaction costs to support the scheme, and the program-based costs. Relatively high estimates were quoted for the total costs of different carbon sequestration practices across the value chain.

The resulting cost analysis shows that economic incentives are needed to enhance investments. Investment support and grants ought to be targeted at setting up supply chains, especially outside the farm gate – for instance, for the required machinery, which is not utilised in routine farm operations, as well as for the adaptation of the required technology for verification and monitoring.

Our cost analysis also estimated break-even prices for the different carbon removal practices. However, due to the immaturity of the market, the numbers are not definitive. The break-even price for afforestation and reforestation is approximately 20 € / t CO_2. In the soil amendment category, we analysed two different fibres that are side streams from pulp industry. Their break-even prices were about 70 € / t CO_2 for zerofibre and about 40 € / t CO_2 for nutrient fibre.

Carbon Contracts for Difference (CCfD)

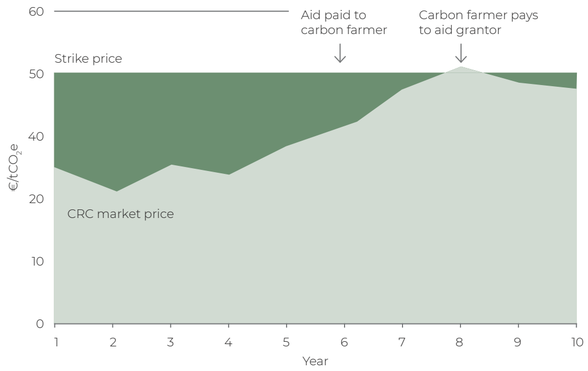
As a next step, we mapped different funding solutions for the carbon farming scheme. In order to attract investment, funding options need be cost-effective. Different funding sources could be combined to create a system that lowers demand and supply risks while easing the level of commitment for participants.

Possible funding sources	
Public	**Private**
Common Agricultural Policy (CAP)	Companies
Innovation funds	Private organisations
Other type of EU / state funding	Consumers

Carbon Contracts for Difference (CCfD) is a good example of a combination of public and private funding that responds to two problems related to scaling up supply and demand in an immature market.

1. Uncertain price level of the final product, e.g., the price of CRCs
2. The price level of the final product is too low to repay the investment.

The principle of Carbon Contracts for Difference in CRC markets



CCfD lowers the costs of investment, thereby also lowering investment risks. For example, when a low CRC price fails to incentivise a farmer to implement more carbon farming practices, the CCfD can provide an incentive to invest. The difference between the CRC price and the pre-agreed strike price is then paid out to the farmer. This means the producer can secure a pre-set price for the product and is better able to evaluate the level of investment risk beforehand, while the buyer pays the market price.

Carbon farming schemes require robust definitions for criteria

The work of the project focused heavily on permanence and additionality. Since the CO_2 emissions remain in the atmosphere for a long time, the goal for permanence is typically set at one hundred years. This prolonged goal for permanence is challenging, as farming can only guarantee shorter permanence on the scale of five to 20 years. This disparity needs to be addressed in regulation.

Key findings on permanence

- Since the limitations come from natural soil carbon accumulation and the dynamics of decomposition, simply maintaining soil carbon stocks continuously can lead to the fulfilment of longer permanence.
- In our pilot case, 20-year permanence was not challenging for farmers because the one-time application of external carbon input means that for the next two decades, monitoring or changing practices will not be necessary.
- Farmers are not keen to make commitments lasting longer than five years.
- Buyers of pilot credits were uncertain about the 20-year duration and what it entails.

With regard to additionality, guidelines for a reliable baseline are vital for ensuring that future projects create actual carbon sinks.

Key findings on additionality

- The results show that all simulated carbon farming practices have the highest carbon additionality in the first 10 years upon their introduction.
- Our pilot demonstrates eligible additional activity as transforming biomass residues into products that are utilised in agriculture. Without the activity, the biomass residue would be incinerated, thus releasing carbon into the atmosphere.

Scaling up carbon farming credit market with a transport sector pilot

In the EU Member States, the transport sector must reach its target of 14% renewable energy by 2030. Significant research and development is needed in the field in order to scale up low and zero-carbon solutions and make them affordable for the market. To reach the current targets, more cost-efficient and climate-friendly solutions could supplement the use of costly biofuels. Currently the cost difference between CO_2 reduction measures in transport and carbon farming is multiple.

Over the short-term, the carbon farming and transport sectors could create a synergy through a well-planned pilot project to scale up cost-efficient CO_2 reductions, and in doing so, bring climate benefits and more business to farmers. The transport sector would thus create a significant boost in demand for carbon farming in the near term.

It is understood that CO_2 emissions from transport remain in the atmosphere for a long time, and that nature-based solutions for CO_2 removal may be impermanent. Nevertheless, creating a synergy between the transport and agricultural sectors is a step forward for scaling up carbon farming practices and can be implemented in the spirit of learning through experience.

The project brought to light a number of key aspects concerning soil carbon measurement and monitoring, criteria that require policy recommendations, farmers interests, as well as buyers' motivations. The different methodological approaches examined by the pilot provide knowledge and real-world evidence that will be worthwhile to consider when building larger-scale practical 'step-wise' pilots in the future.

Layman's Report - LIFE Carbon Farming Scheme Project

Points to consider when initiating carbon farming and creating a market around it

- To create an efficient certification framework for carbon removals through carbon farming, it is essential to address the knowledge gap, especially for farmers.
- In order to establish high-quality carbon farming practices, the carbon removal certification scheme should encompass the entire EU area and acknowledge the same minimum standards and rules for all.
- The EC should develop common EU-wide rules for Measurement, Reporting, and Verification (MRV) practices.
- Those EU-wide certification rules also need to account for social impacts in addition to other environmental and sustainability impacts.
- The administrative burden on individual farmers should be mitigated by forming larger alliances of farmers or intermediaries acting on farmers' behalf.
- Economic incentives are necessary to stimulate supply and demand and scale up carbon removals.

Closing words

We were delighted at the keen interest in our topic from the public and the wisdom and time various stakeholders offered in support of our project. In addition to imparting holistic and insightful perspectives, they enabled us to gain a clearer understanding that carbon sequestration is only one part of the solution. It has been extremely rewarding to engage in interesting discussions with people from all over Europe, implement our pilot, and gather its results.

Collaboration with Tyynelän Tila, Puro.Earth, the Baltic Sea Action Group (BSAG), North European Oil Trade Oy (NEOT), Natural Resources Institute Finland (Luke) and St1 across borders has been exceedingly fruitful. Despite challenges at times, it opened up new perspectives for all involved. All of the project partners brought valuable expertise, and thanks to our good cooperation, our undertaking has been a success. We believe it is crucial to act and maintain a dialogue with different stakeholders and find solutions to climate change, the single most complex and urgent crisis of our time.

We warmly thank all stakeholders, including the farmers, our business partners, and other parties who have given their time, contributed to the project, and promoted this important topic.

Glossary

CDR	Carbon Dioxide Removal
CRC	Carbon Removal Credit
CCfD	Carbon Contract for Difference

LIFE Carbon Farming Scheme Project

The Beneficiary
- St1 Oy
- Baltic Sea Action Group (BSAG)
- Natural Resources Institute Finland (Luke)
- North European Oil Trade Oy
- Puro.Earth Oy
- Tyynelä Farm

Project duration: 12.5.2020–30.9.2022
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Contact: www.st1.com/st1-life

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