Abstract on carbon farming

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CO_2-emission is an important source of greenhouse gases and climate change. In order to reach targets set in the Paris Agreement and the European Green Deal on reduction of CO_2-emission, also farmers have to play a role. For that reason, the concept of 'carbon farming' is developed. This supports farmers to take actions that either enhance the carbon content of the soil or decrease carbon dioxide emissions, e.g. caused by oxidation of organic matter in soil or do both. This would be additional to standard soil management and lead to a more positive soil carbon balance. One could think of activities like application of manure and compost and not-ploughing grassland or enhancing the input of residues from crops to soils. In peatland regions, a higher groundwater level decreases the oxidation of peat, contributing to a lower CO_2-emission in those regions.

To stimulate and reward farmers to manage the soil in a way that carbon will be sequestered, public or private payment schemes can be used. In Road4Schemes, we first make an inventory of ongoing projects all over Europe to stimulate farmers such activities. Based on this inventory, we will make an analysis on pros and cons of each scheme to come to recommendations for a general scheme that rewards result-based activities, additionality, fairness and permanence.

Trade-off between cost and accuracy of soil carbon measurement: does the reduction of the frequency of monitoring campaigns encourage farmers to adopt carbon certification contracts?

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In order to achieve its goal of carbon neutrality by 2050, the European Union aims to develop "carbon farming". One of the goals is to maintain and increase carbon stocks in soils and biomass, thus allowing the compensation of residual GHG emissions. To encourage farmers to adopt practices that sequester carbon,the EU is relying on public and private funding and has the ambition to develop a European carbon credit certification framework.

However, the credits currently certified by frameworks from different European countries are expensive compared to the international market and limiting monitoring costs is a challenge for the development of carbon certification [Cevallos et al., 2019].

Indeed, while a low accuracy requirement can lead to undue payments and thus to a misallocation of the budget, the opposite can impact the incentive for farmers to participate in contracts. A trade-off is needed between accuracy and cost of monitoring to encourage adoption of contracts to meet mitigation goals.

While the variation in the number of samples [Mäkipää et al., 2008]and in the size of the area considered [Mooney et al., 2004] have already been studied in the context of the trade-off between monitoring costs and uncertainty, it is not, to our knowledge, the case for the temporal frequency of observations. The latter is currently about 5 years in most certification methods. Without information asymmetry, the regulator has no interest in requiring monitoring during the contract. But the risk-averse farmer may be reluctant to subscribe to a contract with a low frequency of observations. We propose here to determineunder what conditions, in terms of carbon price and uncertainty discount levels, a farmer decides to subscribe to the contract and at what frequencies he prefers to carry out observation and sampling campaigns.

To do this, we build a dynamic microeconomic model at the plot level, maximizing the expected utility of the income from the contract. There is an obligation to measure the carbon stock ex-ante and ex-post, the payments are made only after a monitoring campaign and there is a discount according to the uncertainty of the measurements. Thus, if the farmer decides to subscribe to the contract, he chooses each year the method of estimating the carbon stored. Either the farmer measures it and chooses the number of samples and pays the cost. Or he is content with a prediction based on the previous measurement campaign, which costs nothing. The number of samples taken as well as the time elapsed since the last monitoring campaign has an impact on the uncertainty of stored carbon predictions.

We apply this economic model to experimental data from Ultuna (Finland) and to simulations of a multi-model of carbon stock evolution [Bruni et al, In prep] calibrated on the Ultuna data. We run simulations with the economic model for several carbon price, discount, and risk aversion levels and several practices.

Our results are still in progress.

Keywords: carbon certification contract design, soil carbon sequestration, measurement cost, monitoring accuracy, monitoring frequency

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A Marginal Abatement Cost Curve for Greenhouse gases attenuation by additional carbon storage in French agricultural land

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Following the Paris agreement at COP21, the European Union (EU) set a carbon neutrality objective by 2050, and so did France. The French agricultural sector can contribute as a carbon sink through carbon storage in biomass and soil, in addition to reducing GHG emissions. The objective of this study is to quantitatively assess the additional storage potential and cost of a set of eight carbon-storing practices. The impacts of these practices on soil organic carbon storage and crop production are assessed at a very fine spatial scale, using crop and grassland models. The associated area base, GHG budget, and implementation costs are assessed and aggregated at the region level. The economic model BANCO

uses this information to derive the marginal abatement cost curve for France and identify the combination of carbon storing practices that minimizes the total cost of achieving a given national net GHG mitigation target. We find that a substantial amount of carbon, 36 to 53,5 $MtCO_2e\ yr^{-1}$, can be stored in soil and biomass for reasonable carbon prices of 55 and 250 € tCO_2e^{-1}, respectively (corresponding to current and 2030 French carbon value for climate action), mainly by developing agroforestry and hedges, generalising cover crops, and introducing or extending temporary grasslands in crop sequences. This finding questions the 3-5 times lower target retained for the agricultural carbon sink by the French climate neutrality strategy. Overall, this would decrease French GHG emissions by 8 to 11,7% respectively.

Keywords: soil organic carbon sequestration, greenhouse gas, abatement cost, agriculture, France

What role for the agri-environment in the era of carbon farming schemes?

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Today farmers make valiant efforts to work on the balance of market and society as they negotiate the drivers of technology, climate change, diet and population alongside pressures to natural resources. Market and society are not in conflict, according to Ostrom (2009) when they come to the significant challenge as to developing 'common kinds of heterogeneity that have independent effects and operate through different causal mechanisms'.

This paper sets out to pose a few questions underpinning the role of the agri-environment in the era of carbon farming schemes. The agri-environment (AE) is a strategy that operates precisely on the balance between market and society. AE takes into account the transactional perspective (Falconer 2000). This means that AE applies causal mechanism so as to incentivize farmers. The AE incentive is toward achieving the implementation of climate-friendly measures such as the safeguarding of soil carbon assets.

Carbon farming scheme is a term that prompts us to question the nature and the definition of a "scheme". In other words, what is the role for the AE scheme in the era of carbon funding schemes? The investigation is about the definition of a "scheme" to qualify as a causal mechanism worthy of the denomination "scheme". In this paper we set out three complementary definitions of the term "scheme": a) AE scheme associated to the carbon sequestration b) a scheme defined according to the usage of "quality schemes" in the area of food quality; and c) a scheme defined by the Commission report with regard to carbon farming.

Inasmuch as farmers increasingly align around private standards with regard to monitoring and verification associated to carbon farming, the agri-environment is a public measure representing the distribution of stakeholders' immense shared knowledge (Barnes et al. 2011; Nowicki et al. 2009), as shown in Fig. 1. The AE results emerge via farmers' complex interactions at different dimensions in tandem with supporting rural development policy organisations (Poláková et al. 2011 and 2013).

The conference paper outlines advantages and disadvantages with regard to AE schemes, in particular with regard to monitoring and verification, in comparison with carbon farming.

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Keywords: agri-environment; scheme; carbon farming; private standards; policy tools

Note to panel coordinators:

If you are unable to travel to Palermo but can attend online, and you still want to submit an abstract for a breakout session, you may do so, but please let us know in the form that you will only be attending online. – May you kindly be informed I apply for the online presentation.

Danish Farmers' perceptions of carbon farming practices – opportunities and barriers

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Carbon farming practices play a key role for soil fertility and climate adaptation, while also having potential to contribute towards climate mitigation. However, successful implementation depends on understanding farmers' perceptions of management practices and aligning policies with these behavioural insights. Here we analyse Danish farmers' views of carbon farming practices using a representative national survey. The results show that Danish farmers have limited knowledge of SOC content and limited awareness of SOC management practices. The SOC practices perceived to be most effective were grass in rotation, manure application, use of cover crops, residue management and to some degree, permanent grassland. Rewetting of organic soils, biochar and agroforestry are the management practices with least knowledge of effectiveness. We demonstrate that age and farm size constitute barriers and opportunities in developing effective polices for SOC management. We show that younger farmers (with larger farms) are more critical about the current SOC content than older farmers (smaller farms). However, younger farmers are more interested in and optimistic towards the potential effectiveness of SOC management practices. Our findings indicate that age and farm size demographics are important to include in the design of policies for upscaling the adoption of SOC management practices. The study also shows the importance of demonstrating myriad benefits to implementing SOC management practices as part of knowledge dissemination. There is a need for tailoring knowledge of practices and implementation strategies tailored to the farm context.

Keywords: Climate change; carbon farming; knowledge management; policy implementation; farmer demographics