

Soil carbon management for climate change mitigation and adaptation: framing and integrating the issue in the evolving policy environment

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Abstract: Soil carbon management plays an important role in the maintenance of agricultural productivity under changing climatic conditions and is an element of the mitigation response in the land use sector. Recently, soil carbon management has become an increasingly visible part of the policy agenda in the EU. In this paper, we examine how soil carbon management is integrated in the evolving policy environment for soil protection in the EU. Although the EU Soil Thematic Strategy provides an overall strategic framework for soil management in Europe, there is no overarching legal or policy framework for soil protection. Instead, soil protection and management are addressed in many different policy areas as secondary objectives (such as agricultural, resource efficiency and climate policy). We examine the most relevant policy instruments for soil carbon management, as well as highlight the challenges for promoting soil carbon management. We point to some of the ways in which the current regulatory framework could be improved to better support soil carbon management.

Keywords: soil carbon management, mitigation, adaptation, Common Agricultural Policy, rural development

Introduction

Soil carbon plays an important role in the maintenance of agricultural productivity under changing climatic conditions and is an element of the mitigation and adaptation response in the land use sector (Smith, 2012). In particular, the maintenance of existing carbon stocks as well as soil carbon sequestration can contribute to improving and/or sustaining agricultural productivity, reducing greenhouse gas emissions, and increasing the resistance and resilience of agricultural ecosystems against climate change impacts, such as rising temperatures, increased frequency of flooding and other extreme weather events. Soil carbon management relates most directly to the maintenance of soil organic matter, a critical component in maintaining soil functionality, including nutrient cycling, water regulation and water holding capacity, biodiversity, and plant support (Jones et al., 2012). Although a degree of scientific uncertainty around soil carbon management remains, the overall benefits of improved soil carbon management for multiple policy objectives are of significant importance and sufficiently clear that the issue has gained salience on the EU policy agenda over the last decade (EC, 2012; Smith, 2012).

In this paper, we examine how the current regulatory framework for soil protection addresses soil carbon management, pointing to the multiple relevant policy objectives and instruments. We discuss some of the challenges in framing this issue in policy terms, as well as some ways in which it could be better and more coherently integrated in the evolving policy environment in the EU. The article is based on the research conducted under the SmartSOIL project (www.smartsoil.eu), as well as direct involvement in relevant EU policy processes.

Soil carbon management in the current regulatory framework

The main EU soil-focused instrument is the Soil Thematic Strategy, which was adopted in 2006 and remains a strategic document without regulatory powers, such as compulsory targets or mechanisms. It identifies the main soil threats in Europe, of which the decline of soil organic matter is a key one. The Strategy also included a proposal for a Soil Framework Directive, which was aimed at integrating and raising the level of soil protection in the EU. Nonetheless, negotiations have stalled for eight years and, most recently, DG Environment indicated that it would re-examine whether it should withdraw the proposal, opening the way for an alternative initiative (EC, 2013a). The final decision whether or not to withdraw will be judged on the feasibility of adopting the Directive before the European Parliament elections in May 2014. Whether there would be an alternative initiative and how it would be designed differently than the current proposal are open questions. The “Communication on land as a resource” is expected in 2014 and would be another relevant strategic document for soil protection.

In the absence of a Soil Framework Directive, there is no overarching legal / policy framework for soil protection. Instead, soil protection and land degradation are addressed in different policy areas as secondary objectives and most often indirectly. Different policy mechanisms and processes are on-going, but action is fragmented and incomplete and there is little systematic overview of how soil protection is addressed in EU Member States (Louwagie et al., 2011).

A number of different policies in the EU address soil protection indirectly, such as the Water Framework Directive (WFD), the EU Biodiversity Strategy to 2020, Resource Efficiency Roadmap, Nitrates Directive, the Adaptation Strategy, and the Common Agricultural Policy.

Soil Carbon Management: linking practices with policy objectives and instruments

In order to situate soil carbon management within the framework for soil protection, and examine how it is already addressed by the current policies and mechanisms, it is important to first identify the most relevant technical practices or measures that contribute to good soil carbon management. In broad terms, soil carbon management can be divided in two categories: 1) protection of existing carbon stocks in soils; and 2) additional soil carbon sequestration.

The list of agricultural management practices that can maintain or enhance soil organic carbon and thereby benefit overall soil quality is very long (Lal, 2004; Hart et al., 2012). Many best practices for soil carbon management are also no-regret measures for adaptation, providing multiple environmental benefits for water, soil and biodiversity protection even in absence of climate change, and thus warrant further policy support (Hjerp, et.al. 2012). The overview here is focused on those practices which have been identified by the SmartSOIL project as the most relevant options for soil carbon management in croplands; as well as a selected number of other best practice options (Smith, 2012).

The table below presents an overview of the best practices for soil carbon management and links them to objectives under existing policies and the policy instruments through which they can be implemented and funded.³¹⁰ This is followed by a brief discussion of the most important policy instruments.

³¹⁰ For a further discussion and detailed lists of agricultural management practices contributing to climate change mitigation and adaptation in the agricultural sector, see, for example, Underwood et al. (2013).

Table 1. An overview of key management practices for soil carbon management and their relevance under existing policies

Management practices	Relevance to objectives of existing policies	Policy instrument
Organic manure input	Nitrates Directive	Nitrate vulnerable zones Nutrient budget plans CAP cross-compliance
Cover crops, perennial crops, legumes	WFD, Nitrates Directive, Resource Efficiency Roadmap, Adaptation Strategy, Floods Directive	CAP rural development plans River Basin Management Plans (RBMPs) CAP Pillar 1 greening payments
Incorporation of crop residues	WFD, Nitrates Directive, Resource Efficiency Roadmap, Adaptation Strategy	CAP cross-compliance (ban on arable stubble burning)
No-tillage practices	WFD, Nitrates Directive, Resource Efficiency, Adaptation Strategy, Floods Directive	CAP rural development plans RBMPs
Organic farming	Birds and Habitats Directives, WFD, Nitrates Directive, Floods Directive, Adaptation Strategy	Primarily CAP rural development LIFE+ Pillar 1 greening payments for grassland protection RBMPs
Maintenance of permanent grassland		
Maintenance and restoration of peatlands and wetlands (including rewetting of organic soils)		
Conversion of arable land to grassland in risk areas		
Afforestation of cropland / woodland creation in risk areas		

Water Framework Directive and the Nitrates Directive

The WFD and Nitrates Directive have been particularly relevant to soil management due to the role that soil protection has for reaching their objectives. Appropriate soil management increases soil water filtering and water holding capacities, reducing runoff and associated sediment transport and thus reducing pressures on water quality and WFD objectives. Moreover, as part of on-farm nutrient management, soil management contributes to improved, more efficient nutrient use at farm level, reducing pressures on nitrate pollution of surface and groundwater. The compulsory nature and established policy mechanisms mean that the Directives provide harder incentives and accountability rules. The two directives set clear mandatory targets, planning instruments (River Basin Management Plans), and monitoring and reporting requirements for EU Member States.

The Common Agricultural Policy

The Common Agricultural Policy is currently the most relevant funding mechanism for soil protection and soil carbon management in the EU.

CAP Pillar 1

The CAP reform for the 2014-2020 programming period was completed in December 2013. The greening of Pillar 1 is aimed at increasing the environmental performance of farms throughout Europe by making payments for certain actions – 30% of the Pillar 1 budget is dedicated to those

payments (EU, 2013a: Rec. 37). The mandatory agricultural practices include crop diversification, maintenance of existing permanent grassland, and inclusion of ecologic focus area (EU, 2013a: Art 43).

The CAP cross-compliance is the framework of rules which are compulsory for farmers and which can be used to encourage soil carbon management. The cross-compliance rules also set the baseline for the agri-environment measures under Pillar 2 so that incentives are only given to those farmers which go above and beyond the minimum requirements for environmental impacts of production. The cross-compliance baseline includes standards for keeping land in good agricultural and environmental condition (GAEC), including soil management issues and most importantly the requirement to maintain soil organic matter. The protection of carbon rich soils, however, was removed from the list of GAEC standards during the latest CAP reform negotiation process.

CAP Pillar 2

Under rural development funding, a number of opportunities are available which can directly contribute to soil carbon management by funding targeted actions and practices. Climate mitigation and adaptation feature much more strongly as an objective for rural development: all measures must contribute to these objectives.

A range of different rural development measures are available to Member States to support soil management, the most important measure being the agri-environment-climate measure. At least 30% of the rural development programmes' (RDP) budgets must be allocated to agri-environmental measures, including support for organic farming and projects associated with environmentally friendly investment or innovation measures (EU, 2013b: Article 59). Agri-environment-climate measures must exceed the requirement set for greening practices under Pillar 1. As a result, the RDPs will have to set and meet higher environmental protection targets to exceed the baseline (as well as guarantee practices are not receiving double funding).

Farmers can also receive support from farm advisory services, which are specified in the regulation as providing assistance for farmers to improve the climate-friendliness of their operations or address mitigation and adaptation to climate change in agriculture (EU, 2013b: Article 15).

Rural development programmes are a significant opportunity for supporting soil carbon management. However, they are limited in effectiveness by insufficient funding – there is flexibility between the pillars for 2014 -2020, which allows Member States to transfer money from rural development to direct payments (EU, 2013a: Article 14). Many Member States may choose to allocate payments to their farmers under Pillar 1 rather than require compliance with environmental standards, which effectively reduces the total amount of funding available for encouraging soil carbon management. Additional challenges include the effective design of measures so that the measures are ambitious enough, ensuring sufficient level of incentives, as well as appropriate control for implementation.

Challenges in developing policies for soil carbon management

Soil carbon and its benefits are difficult to demonstrate and convey

The loss of soil carbon and its immediate effects are more invisible than a number of other environmental problems which are more noticeable, their impact is more immediate and more directly linked to human well-being, for example the water pollution with nitrates and pesticides, soil erosion or landslide, or loss of natural landscape elements. The long-term effects of carbon in the atmosphere are harder to demonstrate. While there is some political pressure from the climate change perspective to address soil carbon, there is otherwise low awareness and a lack of public

drive behind soil protection more generally. This is in contrast to, for example, water pollution, the effects of which are more tangible to the general public (e.g., reduced pollution of water or reduced water scarcity).

In addition, the topic of soil carbon is a relatively new entity for the policy communities in many EU Member States. However, since soil carbon has always been an important element in soil organic matter which contributes to soil health, soil carbon management is somewhat a repackaging of an old idea – soil fertility. Farmers understand the value of fertile soils, so presenting soil carbon management as a part of good soil management for soil fertility purposes makes it more relevant to them.

Lower political urgency at the local level

Soil carbon management has less political urgency at the local level than internationally or nationally, reflecting in part also the resistance to regulatory controls over agricultural production. Thus, when obligations are being negotiated and set for the local areas regarding a matter which might not be immediately apparent, relevance to the farmer, and interest and willingness to adopt may be quite low. Soil management tends to have more political urgency at the local level if it is closely tied to issues which local people are affected by and push to change, such as water (quality, scarcity, flooding, drought, etc.).

Scientific uncertainty and complexity of advice

Messages about soil carbon management need to be clearly presented to avoid miscommunication and misinterpretation. Some view the science on carbon to be uncertain and therefore think no action should be taken. Additionally, issues exist with certification schemes and carbon calculators aimed at estimating and communicating carbon levels to producers, companies, and consumers. Frequent errors, problems with functionality, over-burdening administrative obligations, as well as poor presentation of results and next steps can diminish target users' confidence and eliminate the inclusion of these options in policies (Frelth-Larsen et.al., 2013; Naumann et.al. 2013).

Institutional and financial capacities

Institutional challenges derive from lack of communication and cooperation, and perhaps even conflict, between different government departments regarding competence to make policies regarding soil management. Lack of adequate knowledge or training of personnel to address soil carbon management issues is another institutional barrier.

Political barriers may stem from low political commitment, which may be due to lack of awareness of the importance of soil carbon management and perception of scientific uncertainty regarding management practices' effect on soil carbon.

Financial barriers may result from lack of financial resources or low allocation of funds to address soil carbon management. Integrated planning and delivery barriers can arise due to lack of coordination between government departments in terms of strategic planning and frameworks for implementation, potentially leading to fragmented and conflicting approaches. Informational and data-related barriers may be caused by a lack of available data, including risk assessments and maps of vulnerable areas for loss of soil carbon, in order to target policy approaches most strategically. Finally, knowledge transfer/exchange barriers can prevent effective uptake of soil carbon management.

Conclusion: Integrating soil carbon management in the evolving EU policy framework

In conclusion, what are some of the ways forward in which soil carbon management could be better integrated in the EU policy framework?

Promoting soil carbon management as part of sustainable soil management rather than introducing it as a new and separate issue can reduce the novelty of it and emphasize the benefits for soil productivity, water and biodiversity management. Further improving the integration of soil carbon management into existing policies also avoids adding an administrative burden for farmers if an entirely new framework is created for a single issue. Soil carbon management objectives should be clear and explicit, however, within existing policies and some type of horizontal mechanism that enables monitoring and targeting of policy action according to risk/hotspots is needed. A horizontal mechanism is also needed in order to increase the coherence and effectiveness of policy measures on soil carbon as well as soil protection more broadly. Such a mechanism would link and integrate the different ongoing activities and measures. Whether this is the Soil Framework Directive or an alternative remains to be seen, but regardless, an overarching soil policy setting targets for different soil threats, including soil carbon and soil organic matter loss would significantly improve policy coherence and effectiveness.

Some progress towards a horizontal mechanism for soil protection and soil carbon management can be made through the new obligation for Member States to account for and monitor land use, land use change and forestry (LULUCF)-related emissions, as well as develop voluntary LULUCF action plans. Beyond this, improved and harmonised soil monitoring and identification of risk areas would enable the EU to clearly target and establish ambitions for risk reduction. Improved usability of information on hotspots for soil carbon (in particular, areas of very low soil organic matter and areas with rich organic soils) would allow regulatory and voluntary measures to be targeted.

Given the limited public funding available and competing needs, regulatory and voluntary measures must be targeted and balanced according to risk and the potential to deliver, not only on the soil carbon objective, but also other relevant environmental and productivity benefits. Public funding needs be prioritised for the most cost-effective soil protection measures. Those measures with high adoption potential should be prioritised in critically affected areas across Europe. Additionally, measures which address multiple policy objectives rather than having a limited impact should be prioritised.

Mandatory standards for rich organic soils that would apply broadly across the EU would ensure that existing carbon stocks are better protected. The development of management options for peatlands (paludiculture) also holds promise for a more carbon-friendly cultivation of these important reservoirs of soil carbon³¹¹.

Flexibility or thresholds can be included to increase the adoption potential, e.g., mandatory requirements above a certain size threshold and voluntary incentives for smaller landholdings. Such measures were not implemented in the current round of the CAP reform, but need to remain high on the priority list of actions. In Rural Development Programmes, clear definitions of the individual measures are needed and the role of results-oriented measures needs be examined, including the role of low carbon farming certification.

Finally, emphasizing the benefits of soil carbon management for agricultural productivity and resource efficiency (i.e., cost savings and the economic bottom line for farmers' business operations) would increase farmers' buy-in. There are many longer-term essential contributions which more climate- and environmental-friendly agricultural production systems can make to maintain-

³¹¹ <http://www.paludiculture.uni-greifswald.de/en/index.php>

ing and enhancing agricultural productivity. However, this connection is often not communicated convincingly enough. Farm advisory support plays an important role in this context.

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