EIP-AGRI Focus Group – Grazing for carbon
Mini-paper – *Incentives*

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Introduction

Grasslands are a major biological resource of Europe that play an important role from the environmental, economic and social point of view. They cover 20 % of the EU surface and represent the main feed resource for livestock. Further, grasslands can support biological diversity and multiple ecosystem services, such as cultural heritage landscapes, natural cycling of water and nutrients. Particularly they have a large potential for carbon sequestration.
Carbon flows into terrestrial soil stocks by removing CO_2 from the atmosphere, which mitigates climate change, considering current day elevated atmospheric CO_2 concentrations at approximately 400ppm. **Carbon sequestration is of societal interest, but given the beneficial effects of organic carbon in soils, also of interest for farmers** (Lal, 2004). Carbon sequestration depends on many climatic and paedogenic factors, as well as the vegetation. This effect is also particularly relevant in pastures, which in many places in the world have a potential to store carbon levels almost as high as forests (Guo & Gifford, 2002).
Besides the advantages of grasslands to multiple stakeholders, there are multiple strategies for boosting carbon sequestration in pastures (Smith et al 2008, Conant et al. 2017). The decision maker of the farm (hereinafter as farmer) typically plays a pivotal role in most of those strategies. It is the producer that is in charge of managing land in ways conducive to increase the rate of carbon sequestration and oversee its long-term storage. Therefore, an analysis of incentives for farmers to sequester carbon must identify the motivations that may be involved in adopting such management practices.
The goal of this mini-paper is to outline and present examples of the main incentives, which can be, and are used to promote the adoption of grazing practices.

Types of incentives

Incentives are defined as immediate drivers of actions which foster C sequestration (Table 1). Actions are initiated by different actors (e.g. government, public authorities, private companies, consumers, civil society, Table1) or even by changes in natural production conditions (e.g. soil erosion, , drought). For example due to drought, farmers may be more susceptible to changes in management, e.g. to increase soil organic carbon and corresponding water holding capacity.

Motivations behind decision-making at farm level on management practices are influenced by many components. Note the sociological considerations are out of scope in this paper. We consider four types of motivations behind incentives in this paper (Table 1).

Table 1: Tools for incentives, , actors, motivations and relation to carbon sequestration

Incentives	Actors	Motivation	**Currently applied for** carbon sequestration
1, Command and control policies	**Gov**	Compliance with norms	…
2. Subsidies	**Gov Civ**	Economic reasoning	☑
3. Taxes	**Gov**	Economic reasoning	…
4. Carbon markets	**Gov**	Economic reasoning	☑
5. Innovation policy	**Gov**	Economic reasoning	…
6. Knowledge transfer	**Gov Priv Civ**	Intrinsic motivation Economic reasoning	☑
7. Labelling	**Gov Priv Civ**	Economic reasoning	
8. Insurance services	**Gov Priv**	Economic reasoning	…
9. Private production standards	**Priv**	Economic reasoning	☑
10. Social norms	**Gov Civ**	Intrinsic motivation Compliance with norms	…

[1] Gov: governments; Priv: Private market partners and consumers; Civ: Civil society

Tools for incentives

1) Command & control policies are created by governments and are mandatory for farmers. The policies can set thresholds on output indicators or define management standards. The main advantage is that all land users within reach of the policy can be expected to adapt their management according to the rules, subject to sufficient monitoring and enforcement. Disadvantages are the costs for enforcement, a risk of demotivating voluntary behaviour, economic inefficiencies, and the risk of wide application of counter-productive rules . These regulations could prevent soil from degradation or may foster soil C sequestration, although direct links between the legal requirements and C sequestration need to be investigated case by case.

Good example?!

2) Economic (policy) **tools** can be mandatory (only if created by governments) or voluntary for farmers. Most economic instruments are created by governments but there are examples for subsidies issued by NGOs as well. A major difference to command & control policies is that they take different marginal costs of companies in providing environmental services into account. Companies with low marginal costs are incentivised to provide more services than those with higher marginal costs. For example, in case of fixed subsidies paid for each unit of sequestered carbon, farmers with low marginal sequestration costs would more likely participate in this program than those with high marginal costs. As a result, the same level of an environmental service, such as sequestered carbon, can be achieved at lower total costs to a society compared to command & control policies. Economic policy instruments differ with respect to the welfare gains for individual societal actors, which is dependent on the distribution of property rights.

Subsidy schemes, such as agri-environmental programs, are voluntary in general. Land users can decide whether or not to participate depending on the level of the subsidy and their costs to provide the requested service. Many agri-environmental measures support more than one environmental objective. Examples to foster carbon sequestration are payments for no-till agriculture in the Portuguese or Austrian agri-environmental program. These examples support a specific management (i.e. action-oriented scheme), which is in

contrast to the support of environmental outcomes (outcome-oriented scheme) such as the change in sequestered carbon over time. It utilizes local knowledge but transfers the risk of goal achievement from the authority to the land user. Disadvantages of subsidies include the costs for public budgets, the risk of windfall profits, the risk of crowding out previously voluntary and unpaid (eventually intrinsically motivated) activities of farmers. Lacking permanence can lead to changing behaviour of land users once the subsidy scheme ceases. If subsidy levels are too low, there may not be any change in the level of environmental services.

Good practices
Common Agricultural Policy:
The Common Agricultural Policy (CAP) is the main public instrument regarding agriculture in the European Union. The trend in the last reforms of the CAP has been towards a greener policy and the tendency is expected to continue. The first pillar of the CAP adopted in the 2013 reform, the so-called "greening" policy, includes specific grants for farmers that apply certain managing practices. It has an indirect positive effect on the sequestration of carbon, via the preservation of permanent grasslands and the Ecological Focus Areas. In the second pillar of the CAP, the Rural Development Policy, there are a set of measures proper to trigger the adoption of grazing practices by farmers to favour carbon sequestration. The Regulation[1] on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) describes the measures that Rural Development Programs (RDP) in the EU shall include in their strategy, several among which have the potential to contribute to soil carbon sequestration. Among them, the following measures can promote the adoption of Optimal Grazing Management Practices (OGMP):

Measure (M) Advisory services, farm management and farm relief services (art. 15)[2]:
OGMP topic could be in the contents of every RDP for advisory services as *agricultural practices beneficial for the climate and the environment.*
M. Quality schemes for agricultural products, and foodstuffs (art.16):
This measure can support the adoption of a quality label with sequestration carbon value.
M. Establishment of agroforestry systems (art. 23):
annual premium per hectare in those agroforestry systems with permanent pastures can be included.
M. Prevention and restoration of damage to forests from forest fires and natural disasters and catastrophic events (art. 24):
permanent pastures could be included as investment in fire walls to control fire forests and as first measure to recover soils after fires.
M. Agri-environment-climate (art. 28):
This measure supposes the backbone for the application of OGMP, emphasis on grazing practices that increase the carbon sequestration.
M. Organic farming (art. 29):
Organic farming: this measure fits for those organic livestock producers.
M. Payments to areas facing natural or other specific constraints (art.31):
Grants to less favoured areas (LFA) such as mountains: permanent pastures are the ideal production in many of these areas.. The increase of support on this measure to foster the agriculture activity in these areas should bring an increase in permanent pastures. For example, high mountain pastures in many EU territories are in risk of abandonment, incentives for mountain farming plays an important role for their permanence and as a key resource to support the viability of mountain farms and families.

M. Cooperation, EIP and the sub measure targeted to joint approaches to environmental projects (Art 35)

[1] REGULATION (EU) No 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013: **http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0487:0548:en:PDF**

This measure aims at foster the cooperation among different actors from agriculture, forestry, food chain and other actors to achieve the objectives and priorities of rural development policy. Its sub-Measures offer potential support for the establishment of cooperation projects to encourage the adoption of adequate and innovative grazing practices for carbon sequestration.

National and regional instruments in the EU

The competence on environmental policies is distributed among the different public administrations, including National and Regional governments. In this sense there are diverse policy instruments already applied that can be examples of appropriate promotion of optimal grazing practices. As an example, Germany introduced cultural landscape programs (Kulturlandschaftsprogramme, short KULAP) which reward individual measures regarding dimensions like climate change or biodiversity.

3) Environmental taxes are mandatory governmental measures. One may think about a tax on releasing carbon from the soil based on regular monitoring. Compared to command & control policies, land users have the choice to either change their management or to pay the tax. However, both subsidies and taxes require robust monitoring, which can be expensive in the case of a high number of service providers with heterogeneous environmental effects. A common moral argument against environmental taxes is the perceived "right" of companies to pollute the environment once they paid the tax – instead of changing their management.

4) Carbon markets and funds

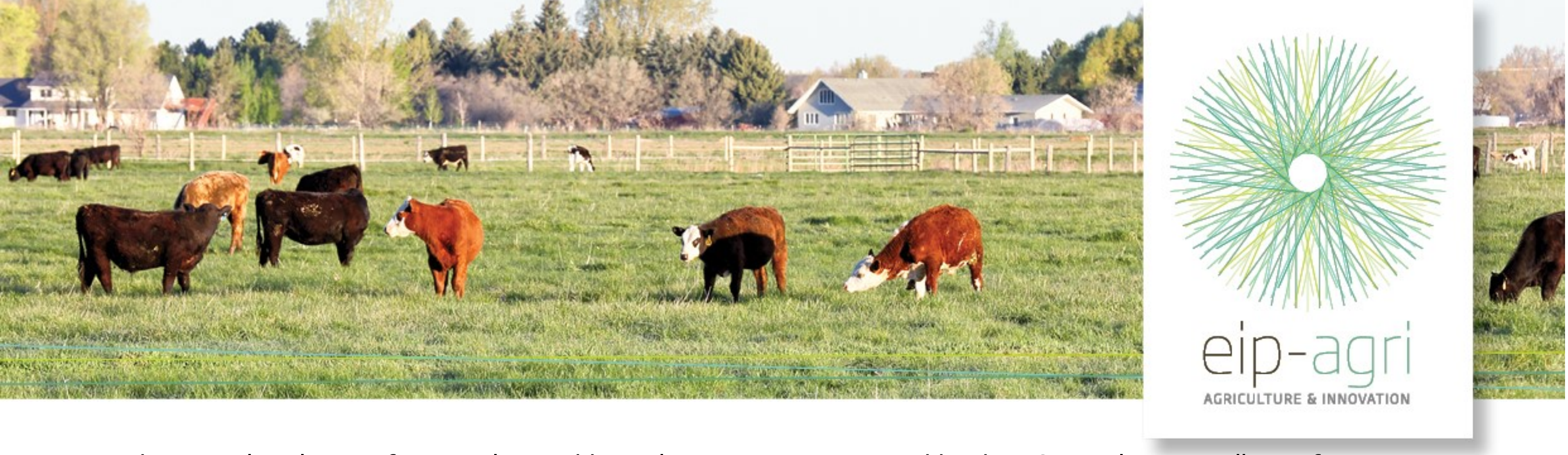
A further stimulus to increase soil carbon in grazed grasslands is to bring the carbon to the market. Carbon markets are mostly designed to reduce greenhouse gas emission and developed for large industries. However, agricultural projects which are proved to act as carbon sinks could also join the market by selling emission allowances. The inclusion of agriculture in the carbon market through allowing regulated industries to buy carbon offsets from the agricultural sector is set by California, Alberta, Australia, and more recently also China.

There are voluntary and mandated carbon markets where carbon offsets can be purchased by anyone trying to reduce their emissions (Raymond 2013). The aim is to control the emission of greenhouse gases (GHG) via a market-based approach by providing economic incentives for achieving reductions in the emissions of pollutants (Stavins 2001). A carbon offset is generated when an action is undertaken that reduces, avoids or removes GHG emissions. Polluters that want to increase their emissions above target must buy permits from others willing to sell them. These industries/sectors can purchase carbon offsets from non-mandated industries/sectors (e.g. agricultural sector) to help them meet their emissions targets (Raymond 2013). See examples for carbon markets below.

Good practices

Portuguese Carbon Fund

One example of a widespread, large-scale incentive for carbon sequestration in pastures took place in Portugal. Between 2008 and 2014, The Portuguese Carbon Fund (PCF), a financial instrument created by the Portuguese Government to help the country comply with Kyoto targets, financed three projects for carbon sequestration in pastures. In two of these projects, the PCF supported the installation and maintenance of sown biodiverse permanent pastures rich in legumes through a system of payments for carbon sequestration. This sown pasture system consists of sowing a mix and twenty different species or varieties of mostly legumes and grasses tailor-made for particular soil, climate and use conditions, and selected for high dry matter productivity (Teixeira et al., 2015). These pastures have also been shown to sequester approximately 5 t CO_2 per year per ha (Teixeira et al., 2011). The PCF supported these pastures on a per-ton basis, but also provided accompanying farmer advisory systems that ensured that the best management practices were used, maximizing the yield for feed and the carbon sequestration for reporting. With these projects, the area of this pasture system increased 48,491 hectares (spread between 1095 farmers), and now occupies 4% of



the agricultural area of Portugal. An additional project was supported by the PCF involving no-tillage of agri-forestry montado/dehesa areas (commonly grazed).
Another example is "Energias de Portugal" (EDP), the main Portuguese electrical company that decided in 2006 to sponsor a project aimed at demonstrating how land use activities could help Portugal comply with its Kyoto Protocol target, thus paving the way for the FPC project previously mentioned (Teixeira et al., 2010). The project financed the sequestration of 7 kt CO_2 per year in more than 1,500 ha. Land uses included in this project were afforestation, forest management, the agricultural practice of no-tillage, and as the centrepiece of the project the installation and management of sown biodiverse pastures. The project helped to establish accounting methods for sequestration factors, including detailed monitoring through collection of soil samples to obtain a data set for soil carbon from 2006 to 2012. For EDP this project was a strategic move. It contributed to foster innovation in society and position the company itself as a precursor of the widespread incentives provided by the PCF later on.

USA - California's Global Warming Solutions Act,Chicago Climate Exchange
Various state and regional GHG reduction measures have been implemented or are being developed across the United States, some that include terrestrial sequestration offset options (Follet and Reed 2010). For example, California's legislature passed the Global Warming Solutions Act of 2006, the first mandatory state GHG emissions reduction plan enacted and that saw its first certified GHG emissions trade in February 2008, when New Yorkbased Natsource Asset Management LLC bought 60 000 tons of forest sequestration emission reductions from a private California landowner (Follet and Reed 2010). This could provide a framework However, no federal or state mandatory policy currently recognizes soil C sequestration by grazing lands as a certifiable offset (Follet and Reed 2010)
The US-based Chicago Climate Exchange (CCX), a voluntary GHG emissions reduction program, issues offset contracts for soil C sequestration due to improved rangeland management practices, such as the use of sustainable stocking rates, rotational grazing, and seasonal use in eligible locations (Follet and Reed 2010). US Senate and the US House of Representatives may recognize C sequestration on grazing lands as valid offsets, as long as they will be systematically and accurately measured, monitored, and verified (Follet and Reed 2010). Opportunities to reward emissions reductions achieved explicitly through USDA conservation programs are also being considered. Also, being developed is an Environmental Credit Trading Information Series of fact sheets, with the first one addressing carbon credit trading on rangelands (Follet and Reed 2010). There are a growing numbers of these kind of proposals worldwide, from an EU point of view these are examples, from which lessons could be learned and, it can be of interest of future policy in carbon markets.

Australia - C sequestration of grazed land in the Emissions Reduction Fund
The Emissions Reduction Fund in Australia is a voluntary scheme that provides incentives for farmers and land holders to adopt new practises and technologies to reduce Australia's greenhouse gas emissions (Emissions Reduction Fund 2017). The carbon market fostered by government policy was launched in 2012.The federal government's Carbon Farming Initiative (Carbon Credits Act 2011) is the only compliance initiative of its kind in the world that "allows farmers and land managers to earn and sell carbon credits by storing carbon or reducing greenhouse gas emissions on the land" (Future Earth 2016). The Emissions Reduction Fund provides a methodology for the determination of carbon sequestration in the soils of grazed grasslands (Emissions Reduction Fund 2017). Farmers should prove via collected soil samples taken by qualified technicians and analysed by an accredited laboratory that soil C sequestration is actually achieved with a new management action (e.g. rejuvenating pastures, changing grazing pattern, changing stocking rates, applying organic or synthetic fertiliser to pastures, changing pasture irrigation). Soil carbon stored must be maintained until the end of the permanence period (25 or 100 years) (Emissions Reduction Fund 2017).

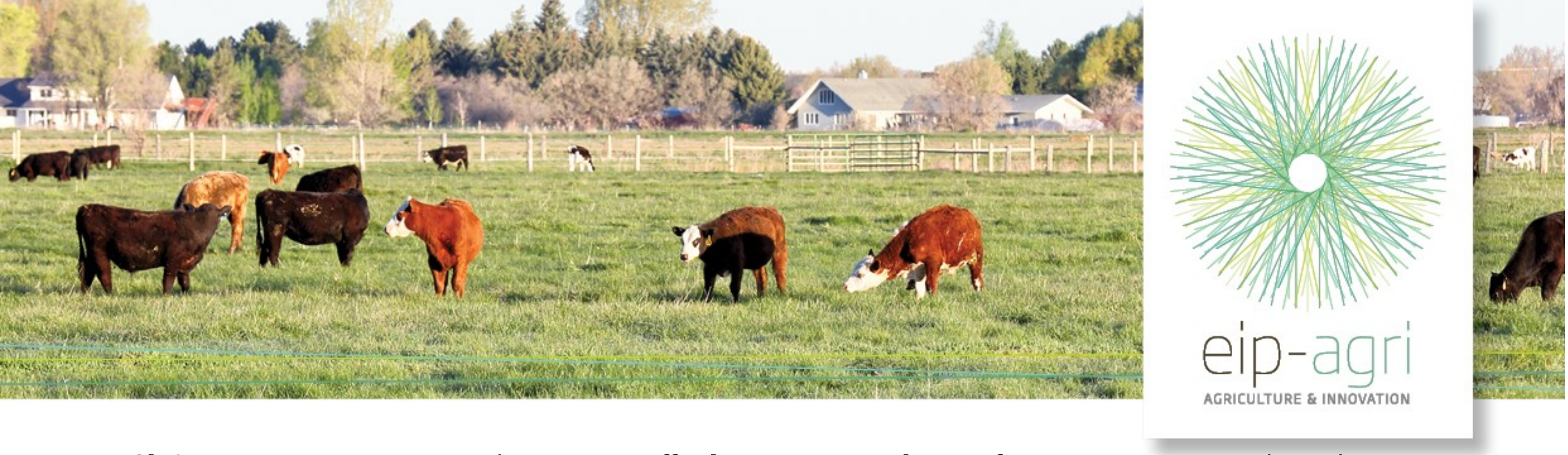
Canadian offsets projects

British Columbia is currently soliciting for offsets projects through the voluntary Pacific Carbon Trust (PCT) (Raymond 2013). Beef producer, must prepare a Project Plan, which provides details about the offset project, including what the project entails, how it will be conducted and how the GHG reductions, avoidance or removals will be calculated (Raymond 2013). In order to create high quality offsets, science based protocols (ISO 14064-2) must be developed to properly identify GHG emission reductions that result from the use of different management practices. It also requires a review of the scientific literature to form a "Science Discussion Document", peer review of the document, several rounds of stakeholder reviews, and then if a "go", development of the actual quantification protocol" (Basarab et al. 2009). It is estimated these changes have the potential to reduce GHG emissions from cattle by 0.025 to 1.1 t CO_2 eq per animal, with an estimated value of $0.25 - $11 per animal in the Alberta carbon market (Basarab et al., 2009).
Sccording to the Alberta Climate Change Emissions Management Act it was obligatory for large companies (with annual emissions of more than 100,000 tonnes CO_2 eq.) to reduce their emissions by purchasing offsets from others (Raymond 2013). Non-compliant companies are faced with stiff penalties of up to $200 per tonne CO_2 eq. The financial implications of inaction have created a market for "Gold Standard" credits consistently valued at $12-15 per tonne CO_2 eq. This has created a significant opportunity for developing carbon offset projects in Alberta and the demand side of the marketplace has looked favourably towards the agricultural industry as a supplier of offset credits (Alberta Environment, 2008).

5-6) Governments, private market partners, and the civil society can stimulate **innovation** and technological change with investments in research, technology diffusion, and **knowledge transfer**. The latter includes support of extension services to foster win-win or low-cost management measures that provide benefits to farmers and the society. Knowledge transfer services can be a cheap solution leading to permanent changes in management. However, it will be successful only if lacking information constrains management changes or if it impacts the intrinsic motivation of a farmer. It will be less successful for adverse private cost-benefit ratios of farmers.

7) Product labelling

An important market-driven incentive is product labelling. Environmental labelling may help environmentally aware consumers select products with lower impacts (Leach, 2016), hopefully improving consumption of low-impact products or incentivizing adaptation of best practices by highly impactful producers. There are many private labels in Europe, although their use is still relatively low (Fischer & Lyon, 2014). None are specific about carbon sequestration, but for most of them good SOC management is a key factor. One particularly important example that may grow in importance in the future is the European Commission's (EC) Communication "Building the single market for green products – Facilitating better information on the environmental performance of products and organisations" (EU 2013a). The EC proposed a Product Environmental Footprint (PEF) and an Organisation Environmental Footprint (OEF) method (EU 2013b) to recommend and stabilize methods for measuring environmental impacts. These guides are based on Life Cycle Assessment (LCA), a consistent and multi-criteria framework used to assess the environmental impacts of a good or a service throughout its life cycle, from extraction of raw material through to disposal (Hellweg and Milà i Canals 2014). The PEF/OEF were tested and piloted to draft product and sector-specific rules, including the meat and dairy sectors, and understand potential new policies one of which may be product labelling. The recommended indicator to assess land use impacts of products is SOC depletion (EC-JRC, 2011). In the near future, it is highly likely that producers either as direct sellers to consumers, or as suppliers for the processing industry, will need to report emissions of their products and SOC will likely be involved as one of the indicators. This will provide an extra incentive for farmers to adopt best practices for carbon sequestration.



8) Governments or private market partners offer **insurance services** to farmers. Management dependent insurance costs could be used as instrument to incentivise carbon sequestration assuming that increasing carbon levels in the soil reduce production risks and increase farm resilience. For example, it can stabilize yields during drought events. Monitoring costs and long time frames until effects are measurable can be arguments against such instrument.

9) Private market partners, often driven by consumer demand, may incentivise land users by voluntary instruments in ways that are similar or complementary to policies. **Private production standards** may foster environmentally friendly behaviour beyond legal standards. They can include management measures to sequester carbon. For example, land users may receive price premiums if they follow sets of rules. However, in situations of large market power of individual companies, e.g. retailers, private standards may become factually mandatory and price premiums may decline over time.

10) Farmers may adopt practices to increase SOC stocks in their farms simply due to their personal belief in environmentally friendly behaviour and in the need for healthy soils. Such beliefs can be impacted by changes in societal norms, knowledge transfer, or the development of a farming community with farm to farm learning environments. Knowledge transfer as an instrument may reveal the importance of environmentally friendly land use to the society or the beauty of nature. Information may raise the awareness about the impacts of land use decisions, such as climate change impacts due to loss of carbon from soils. We consider this as intrinsic motivation defined as the reason for activities, here the choice of a certain management, for its own sake or enjoyment instead of its instrumental value (Ryan and Deci, 2000; Bénabou and Tirole, 2003). Governments and civil society organizations can influence **social norms** by means of knowledge transfer and public discourses. The civil society becomes a powerful actor in modern democracies. Professional institutions like NGOs channel the demand of individual citizens with similar interests. By its nature, climate change mitigation is a global public good where larger international organizations may be more relevant than local community efforts in raising awareness for environmental issues. Besides creation of labels or offering private payments for ecosystem services (see discussion above), they can create social pressure and lobby for changes in cultural norms. For example, NGOs use publicity instruments to blame or reward the observable behaviour of companies.

Good practices

Grazing practices that favour soil carbon storage have multiple advantages for farmers apart from carbon sequestration, including increasing in soil quality, reduction of production costs and valorisation of final products. For instance, soils with high carbon content are generally characterized with better soil structure, greater water-holding capacity and can provide more nutrients to plants.

Carbon sequestrating practices are closely connected to varied grazing methods and with organic farming as well. This may result in reducing costs for farmers on daily basis. Some of those costs are directly dependent on grazing methods, some are multifactorial. For example, costs for fertilisation of grasslands and costs for veterinary care can be significantly reduced this way. If farms successfully adapt good and suitable grazing practises, there should be also expected reduction of costs on human labour and costs on seasonal workers. It's uneasy to determine exact value of cost reducing, because there are many effects, that can influence result on every different farm, but in general farmers can save up to 20% of their cost dependent on grazing and grasslands maintaining. Another positive effect, except cost reducing may occur, such as better health condition of cattle and increasing yield of grass mass for hay and haylage, better soil life activity and wider representation of herb species on grasslands, and the biodiversity linked to them.

Bottlenecks and limitations

Do monetary incentives work?

The two examples for public and market-driven incentives in Portugal, were successful in terms of their implementation reach and achievement of goals. However, there is at the moment no data to assess whether or not they were successful in terms of advancing awareness of sown biodiverse pastures and demonstrating their advantages to other farmers, or whether the technical advisory component managed to transfer knowledge to farmers involved. Future similar incentives projects should include a follow-up that assesses their own impact post-project, to start a self-correcting mechanism that continuously informs additional incentive programs.

One important aspect of these incentives schemes is how they are monitored throughout the project. There is a perceived and often real prohibitive cost of monitoring of large-scale projects. While in the market-driven project in Portugal soil samples were collected each year and the payment was dependent on the results, in the PCF project the cost of monitoring would have been sufficiently high to de-incentivize farmers from joining, as it would have taken a large share of the per-ton payment. Consequently, in the PCF project a sequestration factor was pre-determined on the basis of management practices of sown pastures, and then only the correct implementation of those practices was audited.

While actual measurement would be more accurate, there is an additional issue that prevents it, which is that farmers have to internalize risk. If SOC decreased between two measurement periods, due not to poor practice but an unfortunate climatic year or another event (e.g. forest fire in multifunctional forest-grassland areas), that could potentially mean that farmers would not receive any payment, or even that they would have to compensate the buyer of carbon credits. This fact could detract producers from accepting to join these incentive schemes. Therefore, important questions to ask in incentive schemes are (1) who should pay for monitoring and (2) what cost is acceptable.

Can product-labelling work?

Regarding product labelling, there are many questions regarding the efficacy of such schemes. Besides the fact that they are still rarely used (Fischer & Lyon, 2014), there are questions regarding measurement of indicators – namely that there is a proliferation of measurement guides that built up confusion and not even the PEF/OEF of the EC solved (Finkbeiner, 2014). More importantly, there is evidence that consumers so far are unaware or uninterested of product-level sustainability (Hornibrook et al., 2015), particularly for food (Hartikainen et al., 2014). This may change in the future, particularly as the role of animal products becomes more widely known, making it plausible that informed consumers will be more predisposed to accepting a premium on sustainable food products. For the moment, product labelling does not seem to be a crucial short-term solution for promoting carbon sequestration in pastures.

Carbon markets and the shadow of speculation

Carbon markets present multiple opportunities to foster sequestration of carbon through the economic support of farmers for applying certain managing practices. This support can be an important source of income for those that practice agriculture, but also for those that does not have any agriculture activity, making room to facilitate the transverse of agricultural land into "carbon sequestration land" with no agricultural activity linked to it, and even to relocate the property of this land to non-rural individual and corporative landowners, with the consequent threaten of market bubble, land abandonment and rural depopulation. To cope with one of these aspects the Common Agricultural Policy introduced the term "active farmer", ensuring that at least the 25% of the granter income comes from agricultural activity. The example could be taken into consideration in the design of carbon markets, together with a close follow up of other collateral damages generated through the establishment of new income sources linked to a sensible activity for rural areas and their inhabitants.

The potential short-sightedness of incentives

Incentives must be devised to encompass the entire influence exerted by carbon sequestration projects on the environment. While many projects may not influence more than the farm where they are executed, others may have unforeseen consequences throughout the value chain and in the wider regions where they take place (both positive and negative). This means that (1) incentives must be assessed and monitored to ensure that there are no unforeseen negative consequences (including in other environmental criteria), and also that (2) farmers should be credited for the wider societal advantages of adopting best practices. Without careful consideration of both effects, incentives programs risk being short sighted.

First, it is possible for sequestration projects to have influences up or downstream in the value chain. A whole-system perspective must be considered, using an analytical framework such as LCA, to assess the actual effects of incentives. This means looking not only at carbon sequestration in soils, but at whole carbon balances of production systems, preventing "carbon leakage". For example, if a measure to improve SOC stocks would also mean a dramatic decrease in yield, and assuming that demand for the ensuing food product would remain the same, then when carbon emissions are factored in it might not be worthwhile incentivizing that measure as it is not the most efficient, despite sequestering carbon.

Second, some carbon sequestration measures in grasslands have larger implications and the farmers are often uncredited for them. One example is the role of managed grasslands in indirectly preventing forest fires. The tragic events that took place in Portugal in 2017, with fires that not only generated massive amounts of carbon emissions but also took an enormous toll on forestry landscapes, the built environment and even human lives, can be traced back to a longer trend that was identified in the Millenium Ecosystem Assessment report (Pereira et al., 2009). The ecosystem services provided by Mediterranean ecosystems show signs of degradation (Bugalho et al., 2011): these ecosystems occupy soils that have become increasingly shallow, stony, and low in SOC and nutrients. Lower pasture productivity and less farm activity jump start ecological succession cycles leading to the abundance of shrub cover and woody encroachment (Teixeira et al., 2015), highly susceptible to fire. Reversing the degradation of grassland areas through SOC recovery with grazing can keep (and historically has kept) these encroachments under control and regulate fire occurrence and propagation. This role of grasslands in forest fires is rarely acknowledged but is an important side effect in Mediterranean countries that producers should be given credit for.

Proposal for potential operational groups

- An operational group can be established to find ways of bringing C sequestration labels to market. This group, which should involve grassland farmers who practices conducive to C sequestration, researchers who can help determine customer acceptance of animal products and the best ways to communicate sequestration to consumers, and retailers who could give an initial boost to the label.
- An operational group could be established by joining the efforts of research institutions, governmental organizations, and stakeholders from the forestry and agricultural sector, including farmers, to explore ways of organizing and cooperating in agri-forestry landscapes that will the multifunctional benefits of these systems. For example, the group could establish ways for incentivizing the creation of cooperatives and other institutions to jointly manage these landscapes so that the understory grazing can maximize carbon sequestration while at the same improving the conditions of forest areas, for example by mitigating the occurrence and effects of fires.
- Another operational group could be established on permanent pastures in mountains: to collect and to implement best practices of communal land use to foster permanent grasslands in large mountain areas ideal for pastures. The agricultural use of these areas serves to sequester carbon, as well as to prevent forest fires and the consequent liberation of carbon. The operational group would seek to promote the use of these areas applying contrasted practices for grazing purposes while decreasing land abandonment, depopulation, forest fights, natural hazards and soil degradation.

Proposals for (research) needs from practice

- Verifiable measuring and monitoring methodologies should be developed for C sequestration of grazed land before sequestered C could enter to the carbon market.
- Interdisciplinary research is needed to develop a holistic management system because C sequestration should not be an only and single goal in grassland and livestock management. Financial support of C sequestration may be the focus of new mechanisms (financial, labelling) or embedded in previously marketed brands or products from quality production systems, as well as in financing instruments for sustainability and rural development.
- Different farmers are motivated by different types of incentives, and may respond to them in different ways. Data and an assessment on the effectiveness of different incentives is missing. Post-project analysis of the effectiveness of incentives is crucial to understand their success and long-lasting effects. The role of intrinsic motivations in selecting management practices should be studied (survey on the motivation of farmers).
- Tests of different grazing management systems in a long-term project to assess grassland sustainability, the need for mineral nitrogen, the C sequestration evolution, and the profitability of those grazing systems. The economic performance is vital for good practices to be implemented.
- Assess the link between C sequestration and profitability.
- Carbon funds and markets have the potential to be important incentives for C sequestration and as such the extension of their regional scope and universe of actors involved should be expanded. There are some good examples of successful schemes for incentivizing C sequestration such as the Portugal Carbon Fund or the Canadian offset projects. It should be studied how these can be extended in their respective countries and how they can be tailored for local conditions.

Recommendations for further development

Collect more information about carbon markets and funds, to see how the examples (carbon markets, funds) are developing. It is necessary to study the effectiveness of incentives; to measure how effective the incentives are, to perform a continues evaluation on how incentives on carbon sequestration are working worldwide. Funds and markers similar to the Portugal Carbon fund, Australian Emission Reduction Fund should be designed. It is necessary to assess if the greening policy of CAP contributes to C sequestration. Effectiveness of products labelling on influencing C sequestration

Conclusions

Carbon sequestration is important for farmers both in the short-term, but also on the long-term as improved fertility for soils (reduction costs on fertilization) and as insurance and insulation against natural variability (e.g. droughts) and major climatic changes. Despite the fact that many farmers recognize and prioritize the importance of C stocked in grassland soils, there is often a mismatch of priorities that leads to the adoption of C-depleting practices. Accumulating C in soils, therefore, may not happen spontaneously of perceived self-interest by farmers, but require some level of incentive – monetary or otherwise (e.g. technical advisory, transferring knowledge).

This mini-paper assessed the most common types of incentives that are applicable for improving C sequestration in grasslands. We surveyed policy instruments, market procedures and other types of incentives. We saw that incentives may serve as compensation for short-time losses in productivity, as payments for ecosystem services (C-sequestration), or as more indirect valorisation by consumers, industries and distributor companies.

We found that the best examples of C sequestration incentives available combine monetary and non-monetary compensations. For example, the Portuguese Carbon Fund project in Portugal paid farmers for C sequestration but also provided technical advisory on how to manage pastures and ensure maximum yield (win-win management). That project, however, ended in 2014. It would be important to devise long-lasting programmes to create stability for farmers. Carbon markets are plentiful and often alluded to when discussing incentives, but the role of C sequestration in many of such markets is either minimal or indirect. New and better instruments will have to be created. Carbon markets could be one of the solutions to increase C sequestration via grazing if there is proper monitoring (see monitoring mini-paper of the Focus Group), reporting, verification and/or certification. Market failures should also be strictly surveyed and duly dealt with to avoid perverse incentives. Low prices of the carbon credits could cause a decline in the carbon market. As an alternative, C sequestration can also be added as a criteria/indicator in public policy (e.g. subsidies) or integrate well established brands (e.g. quality-assured private brands), which brings in extra revenue for farmers if they select best practices for C accumulation in soils. This can also be done through specific labels for C-sequestering products, but much research and stakeholder engagement is needed (e.g. through operational groups) before such a solution can be sustainable in the marketplace.

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