'Soil carbon—is it marketable?'

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Introduction

There is considerable interest in the potential of agricultural soils to sequester carbon from the atmosphere, thus helping to mitigate greenhouse gas emissions. Worldwide, governments, researchers and the agriculture sector have focussed on building the scientific, technical, policy and institutional tools required to realise the potential for increasing soil organic carbon (SOC) stores. Australian landholders are hearing that they may be able to earn carbon credits by increasing the carbon on their land, thus producing an income stream if these credits can be sold in a carbon market.

There are still issues to be resolved before Australian landholders could participate in such a market. There is uncertainty about the biophysical relationships between land management practices and SOC levels for the varied soil types and climatic conditions across Australia. There is uncertainty about future policy settings and how SOC will be treated under international and Australian climate change mitigation policies. The institutions required for a functioning Australian carbon market either do not exist or are in their infancy. There are decisions to be made in terms of credibility, measurement and verification. There are many perspectives and ambitions have different perspectives and ambitions from trading in SOC (e.g. scientific, community, consumer, environmental). Here we focus on producers, policy makers and buyers of carbon credits and the institutions and policy settings required for SOC sinks to be marketable.

Services provided by SOC

For a long time, SOC was studied for its contribution to soil health and productivity, but only recently has its role in sequestration of atmospheric carbon dioxide become prominent. Other presenters at this conference will discuss the attributes of SOC in detail. Here we note that there are benefits for land managers in monitoring and managing SOC on their properties. Land managers influence SOC stores on their properties via land-use and management practices, through their effects on inputs of organic matter to the soil and losses of carbon from microbial respiration, erosion and leaching. The benefits, or services, that SOC provides include enhancements to the soil's water holding capacity, food and habitat for soil biodiversity, nutrient storage and supply, erosion control and buffering capacity.

A further service provided to the wider community is to sequester carbon from the atmosphere. If SOC stores can be increased substantially then atmospheric carbon levels will be reduced compared to normal, thus helping to mitigate against dangerous human-induced climate change. Evidence suggests that Australian soils can potentially store more SOC than present levels; however, realising this potential may involve changes in land uses that could impact on traditional productivity and incur opportunity costs associated with sequestration. Therefore, it may be considered reasonable to offer some financial incentive to provide this service—carbon sequestration in soils. In this sense, payment for SOC is one component of the emerging issue of payment for environmental services.

SOC as a commodity

It has been proposed that market mechanisms, such as a carbon trading market, should be used to obtain the service of carbon sequestration from land managers. Such a mechanism would issue carbon credits to land managers when they increase SOC levels on their properties. These credits would be sold, in a carbon market, to those wishing to purchase this carbon sequestration service. Prices for this service would be determined by the market, through the interaction of supply and demand.

In this system, SOC could become a commodity with standardised features recognised by buyers and sellers. However, unlike other traded commodities, the physical commodity itself—the SOC that produced the credit—remains perforce on the land in which it was sequestered, with the land manager who produced the SOC being the custodian of the resultant credit. It is the carbon credit, or offset, that is recognised and traded by larger markets.

Trading in SOC

Buyers and sellers want to have confidence in the market and the integrity of the products traded. To ensure integrity, credits must be technically credible, measurable and able to be verified by a third party. There is sufficient scientific knowledge available that credibility could be assessed through: the use of peer-reviewed measurement techniques; models; and customised calculators to provide accurate estimates of potential storage capacity and risks of loss associated with particular management techniques.

It is likely that the measurement of SOC will influence both credibility and verification. As with all commodities, there needs to be a standard method of measurement of the commodity with sufficient accuracy for tradeable purposes. This becomes more difficult when the commodity is largely hidden from sight, is variable across the landscape, occurs at low concentrations and accumulates slowly—all characteristics of SOC. To calculate SOC across variable soil-scapes requires both adequate sampling and measurement. There are new methods being developed to determine this rapidly and cheaply; however, they may still entail a substantial cost, particularly to set the initial baseline levels.

Policy perspectives on SOC

Policy makers are pursuing climate change mitigation policies with the objective of effectively reducing net emissions of greenhouse gases in the most economically efficient manner. Economic efficiency demands that emissions reductions come at least cost to society; a market mechanism, in theory, should deliver this efficiency. Although agricultural emissions will be excluded from the Carbon Pollution Reduction Scheme, there is opportunity for voluntary participation and contributions in offset markets. To fulfil the objective of achieving real net emissions reductions, policy makers want carbon credits to be issued only when emissions reductions, or sequestration activities, occur that are measurable, additional to business-as-usual and result in a permanent reduction in atmospheric greenhouse gases.

The recent National Carbon Offset Standard sets out the following criteria for eligible domestic offsets:

- Additional—Credit to be given only for the additional amount of carbon that is stored above that which would occur in the absence of carbon trading i.e. 'business-as-usual'.
- Permanent—Emissions must be sequestered and not released into the atmosphere in the future.
- Measurable—Methodologies must be robust and based on a defensible scientific method.
- Transparent—Stakeholders must be able to examine information on the project.
- Audited—Eligibility of the project, methodologies and the greenhouse gas reductions must be independently audited by a third party.
- Registered—Reduction units generated must be registered in a publicly transparent registry.

In addition, projects aiming to increase SOC may need to ensure that there is no leakage—whereby savings in one area are not nullified by losses in another area. For example, crop land converted to pasture for inclusion in soil carbon trading may lead to pasture land elsewhere being converted to cropping with a corresponding emission of greenhouse gases such as nitrous oxides.

Internationally, there are reservations about providing offsets using SOC. The European Union has allowed 13% of overall reductions to come from offsets, but with very little take-up to date. Canada will allow some agricultural offsets to meet reductions required by covered sectors (e.g. heavy industry and power) but again with little take-up to date. The United States of America has indicated a preference for offsets to be included in trading to reduce the burden of emissions reduction on industry. Recently, there has been severe criticism of international offset projects because of poor adherence to standards for permanence and additionality.

Buyer perspectives on SOC

Buyers include individuals, non-government organisations, and businesses seeking to offset particular products and meet corporate commitments to social responsibility. Buyers may have different objectives for buying carbon credits, which will affect their willingness to pay for carbon credits, their need for reliable, trustworthy agents and market knowledge.

Economic analyses suggest credits from biosequestration activities should be heavily discounted due to the problems of permanence, leakage and additionality. However, discounting will only compensate the buyer for buying a risky product. The supply of cheap, heavily discounted and risky offset credits onto carbon markets will divert investment away from more reliable but more expensive reductions in fossil fuel use. As a result, the stated goal of trading systems—to reduce emissions and offer a path to a low emissions future—will be compromised.

Producer perspectives on SOC

Farmers are likely to be interested in trading carbon if the price per tonne of carbon is greater than the opportunity costs of capturing and storing the carbon. Producers often decide between competing uses for agricultural land for different products (e.g food and fibre, forestry or biofuels), each of which will have different impacts on SOC. Payment for SOC will likely alter traditional competitive advantages between land uses. Carbon farming—incorporating SOC and other means such as through tree plantations and biochar—could incur costs such as transitional loss in revenue from changed agricultural production, possible

increased fixed costs (e.g. new machinery) and additional transaction costs (e.g. contract and brokerage fees).

To participate in the market, producers will require some understanding of the processes and risks. A greater understanding of the effects of different farming systems and land-use practices on stores of SOC is required. The risks include: the impact of climate change, fire and drought on SOC stores; potential changes to the policy and economic environment; and problems with permanence, leakage and additionality. It is likely that a producer would enter the carbon market with a contract for delivery at a fixed time. They will consider the price, payment schedule, costs and restrictions on their management options and the risks mentioned above. It could well have many of the attributes of futures trading.
Alternatively, some producers interested in SOC may elect to defer participation in offset markets. They could consider registering their interest in possible trading and measure baseline soil carbon levels before they undertake changes in land management practices. This would incur up front expenses and obtain more detailed information than they would require for normal management purposes.

Broker perspectives on SOC
Buyers and sellers of carbon credits will be linked via investment vehicles that find sources of financial capital and distribute that capital to projects. Brokers will often be required to establish contracts, pool carbon into tradeable quantities and sell the tradeable parcels on the market. In foreign markets, carbon trades are made as contracts where one tradeable parcel varies between 100 tonnes of carbon dioxide equivalents in the Chicago Climate Exchange to 1000 tonnes in the European Carbon Market. As individual farmers are unlikely to be able to deliver this quantity, it is likely that carbon sequestered by a number of farmers will be aggregated to fulfil contracts. There are potential deterrents to brokers participating in SOC markets, namely the costs associated with aggregating tradeable quantities of carbon and verifying compliance are likely to be high.

Conclusions
Increasing SOC has the potential to reduce atmospheric carbon, improve productivity and provide other beneficial ecosystem services such as erosion control. It has been proposed that market mechanisms, such as a carbon trading market, should be used in order to encourage land managers to increase the service of carbon sequestration in soils. Despite its broad appeal, there are many challenges to making this a reality.

To fulfil the objective of achieving real net emissions reductions, policy makers want carbon credits to be issued only when sequestration activities occur that are measurable, additional to business-as-usual and result in a permanent reduction in atmospheric greenhouse gases. The National Carbon Offset Standard specifies criteria for eligible domestic offsets.

There are still uncertainties that will impact on the ability to trade SOC in a carbon market: the lack of consistent methods for measurement; the risks of climate variability and climate change on SOC stores; the effects of different farming systems and land-use practices on SOC levels; and the costs associated with aggregating tradeable quantities of carbon and verifying compliance.

Further reading

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