The potential and limitations of carbon farming

Agriculture has long been known for being a very large producer of greenhouse gases (GHG). The 2019 IPCC report estimated that 8.5% of worldwide GHG emissions originated from agriculture, while an additional 14.5% resulted from land use change linked to food production and agriculture[i]. In recent years, European and international policies have been put in place to reduce land use change, notably by reducing or removing financial incentives and market attractiveness for products resulting from this practice[ii,iii]. To reduce direct GHG emissions from agricultural practices themselves, "carbon farming" was introduced as a new set of practices which could not only reduce emissions from cropping and livestock farming, but which could also lead to large quantities of carbon (C) and other GHG to be locked within soils and living organisms (such as trees).

The core principles of carbon farming

Simply put, carbon farming describes a set of practices designed to optimise the immobilisation of atmospheric CO_2 inside plant material and soils[iv,v]. The scale on which carbon farming is performed can vary, from changes in the type of fertilisers used, to crop rotation systems and agroforestry. Some farms managed under the carbon farming framework also integrate livestock within the carbon cycling and carbon capture management practices. Carbon farming looks at agricultural systems as circular systems, and aims to promote natural processes by reducing man-made interference.

Under the carbon farming framework, soil disturbance is drastically reduced, if not banned altogether. Tilling, which breaks down soil aggregates and destroys the integrity of soils[vi], is no longer practiced. Chemical inputs, such as pesticides, herbicides and fungicides are avoided, as they wipe out microbial communities essential to soil health[vii]. This goes on step further than organic farming which can allow for the use of specified chemicals. Synthetic fertilisers are no longer used, as they often lead to nutrient unbalance in soils, which undermines the natural cycles and overloads ecosystems[viii] (often leading to serious ecological issues down the line). Carbon farming also makes use of more diverse and less common agroecological practices. Monocultures are fully replaced by crop rotations and cover cropping, which provide a protective cover for soils, maintain carbon stores intact and allow for the regeneration of nutrient stocks[ix]. Trees become an integral part of pastures and grazing fields, offering cattle a more varied diet, promoting biodiversity, maintaining soil structure (which can be damaged by livestock) and further carbon capture[x]. Some, carbon farming systems also integrate crops and cattle together in the same space. Crop-livestock systems have proven benefits for soil structure and resilience to climatic conditions, as well as for nutrient cycling, organic carbon content and microbial communities[xi]. Rewilding land, with native wild flowers and trees, also falls under the "carbon farming umbrella".

As well as promoting carbon immobilisation, healthy soils promote life, retain nutrients and are seldom prone to weather damage. Therefore, carbon farming appears to have the potential of becoming a real asset for the development and maintenance of a sustainable agricultural production.

Carbon credits

The most widespread mechanism to incentivise regenerative farming and agroforestry is known as "carbon credits", and can be provided by public funding schemes (or compliance schemes) or through private funding (via supply chains or voluntary carbon markets)[xii]. In essence, this provides a revenue stream for carbon farmers who implement sustainable agricultural practices, or who restore woodlands and peatlands, by providing them with carbon credits on the basis of the amount of carbon they have "stored" or "locked" within their soils and/or plant biomass.

Carbon credits are calculated in tonnes of CO_2-equivalent and their price is highly dependent on the market. Demand has a major impact on price, with drastic reductions in cost with increasing offer. The price of carbon credits also differs according to the carbon farming strategy that was performed (i.e. regenerative agriculture, agroforestry, peatland restoration etc…). Some schemes also take into account the initial costs to the farmers associated with the carbon farming efforts[xiii].

Carbon credits are also often awarded according to the potential quantity of GHG that a unit of land could offset[xiv]. Although, as a result of this, bigger landowners may end up benefiting from the scheme more than smaller-scale farmers, whom may have put more effort in the transition in the first place, proportionally to their means.

Carbon trading and carbon offsetting controversy

Once obtained, carbon credits are put on carbon markets. There, stakeholders hoping to offset their own emissions, can purchase them and "subtract" the equivalent quantity of GHG emissions from their own annual emissions total. This is a win-win situation where carbon farmers are financially rewarded (and can continue on with their carbon mitigation efforts) while credits buyers are given the opportunity to meet their sustainability targets.

A substantial issue in this case comes from the fact that carbon markets are not standardised (i.e. criteria differ among the markets). Therefore, the benefits of the practice are not always consistent and cannot always be ensured. Carbon credits are not "created equal", which has earned the practice the reputation of not being reliable on the large-scale.

The trade of carbon credits for the purpose of carbon offsetting remains the subject of debate and a source of controversy. Originally developed as an incentive for businesses and industries to reduce their carbon footprint, it is contested as a way for large polluters to "buy their way out" of taking meaningful actions towards carbon emissions reduction, while continuing to release huge amounts of GHG in the atmosphere. High profile environmental activist groups, such as Greenpeace, have argued that buying carbon credits from carbon farmers will be a way to continue on with the same polluting practices in the long term. Essentially calling out the practice as "greenwashing"[xv].

A recent example is found in the 2022 Men's Football World Cup hosted by Qatar. FIFA has reported that the competition (and all the associated preparations leading up to it) has led to more than 3 million tonnes of CO2-equivalent being emitted[xvi] – an estimate contradicted by The University of Lancaster which estimated a number closer to 10 million tonnes[xvii]. Qatar has pledged to offset 100% of the reported emissions – by purchasing carbon credits – making it the first ever carbon neutral World Cup[xvi]. If anything, the discrepancy in reported numbers highlights the fact that the first strategy should always be to avoid emissions in the first place, and that carbon credits should come as last resort for totally unavoidable emissions.

The future of carbon farming

Carbon farming is regarded as a very promising tool for climate change mitigation, and is becoming a cornerstone of the EU's climate action and agricultural strategies[xviii]. Regenerative practices have clear benefits, and a transition towards more sustainable agricultural practices surely goes in the direction of a circular bioeconomy. However, there remains a lack of scientific consensus on the large-scale and long-tern potential of carbon farming, with experts calling for the establishment of system-wide approaches to the issue. The complexity of ecosystems, and their circular nature, calls for flexible and holistic carbon farming strategies which are tailored to different environments. Regular monitoring is also required to ensure that the practices are beneficial to the environmental, the costs of which are considered a barrier, especially to smaller-scale farmers and landowners.

Current carbon farming schemes also do not take into account the long-term fate of soils dedicated to carbon farming. For instance, a landowner may receive carbon credits for their efforts to plant native trees on a portion of their land, however, there is no guarantee that this same portion of land will continue to be managed in the same way further down the line. That same farmer may choose to grow crops there later, or the land may be bought out by developers to build on it. Currently, carbon farming does not "protect" land and the carbon being stored onto it. This remains a big caveat which has, so far, not been addressed.

In conclusion, it is probably safe to say that carbon farming has (and probably should have) a bright future ahead. There is an urgent need for a long-term GHG emissions mitigation strategy, and carbon farming proposes a solution which could become an integral part of the global agricultural system. However, it is also certain that there is still a lot of work to be done in making all of this happen in a way that will truly benefit the planet and its global population.

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