



This is a peer-reviewed, final published version of the following in press document and is licensed under Creative Commons: Attribution 4.0 license:

Simmonds, Philippa ORCID logoORCID: <https://orcid.org/0000-0003-3929-4934>, Ingram, Julie ORCID logoORCID: <https://orcid.org/0000-0003-0712-4789> and Maye, Damian ORCID logoORCID: <https://orcid.org/0000-0002-4459-6630> (2026) Soil carbon markets in the making: power relations and matters of concern in offsetting and insetting. Environmental Policy and Governance. doi:10.1002/eet.70128 (In Press)

Official URL: <https://doi.org/10.1002/eet.70128>
DOI: <http://dx.doi.org/10.1002/eet.70128>
EPrint URI: <https://eprints.glos.ac.uk/id/eprint/16448>

Disclaimer

The University of Gloucestershire has obtained warranties from all depositors as to their title in the material deposited and as to their right to deposit such material.

The University of Gloucestershire makes no representation or warranties of commercial utility, title, or fitness for a particular purpose or any other warranty, express or implied in respect of any material deposited.

The University of Gloucestershire makes no representation that the use of the materials will not infringe any patent, copyright, trademark or other property or proprietary rights.

The University of Gloucestershire accepts no liability for any infringement of intellectual property rights in any material deposited but will remove such material from public view pending investigation in the event of an allegation of any such infringement.

PLEASE SCROLL DOWN FOR TEXT.

RESEARCH ARTICLE OPEN ACCESS

Soil Carbon Markets in the Making: Power Relations and Matters of Concern in Offsetting and Insetting

Philippa Simmonds  | Julie Ingram  | Damian Maye 

Countryside and Community Research Institute, University of Gloucestershire, Cheltenham, UK

Correspondence: Philippa Simmonds (philippajsimmonds@gmail.com)

Received: 23 January 2026 | **Revised:** 9 July 2026 | **Accepted:** 27 July 2026

Keywords: carbon farming | carbon insetting | carbon offsetting | matters of concern | power relations | soil carbon

ABSTRACT

This paper investigates emerging soil carbon markets and seeks to identify the groups of actors and power relations that constitute their structure and function. Voluntary soil carbon markets (VSCMs) are emerging globally as a key mechanism for generating carbon removals as part of climate mitigation efforts. Developments are characterised by both carbon offsetting and supply chain insetting for Scope 3 emissions reductions. Despite their increasing prominence, VSCMs remain poorly understood as socio-technical and political arrangements. This paper examines how UK VSCMs are being implemented, governed, and contested, and how they are shaped by power relations. Drawing on economic sociology and political ecology, we conceptualise VSCMs as ‘markets-in-the-making’, and extend Callon’s notion of markets as *in vivo* experiments by explicitly incorporating power relations. To investigate different groups’ influence on market development, we apply an adapted Net-Map methodology via 17 semi-structured interviews and a validation workshop with stakeholders involved in UK VSCMs. Our findings reveal a fragmented and experimental governance landscape and identify key matters of concern, including pricing asymmetries, knowledge gaps, opacity in insetting arrangements and reduced agency for tenant farmers. While regulation is widely viewed as necessary to improve market integrity, current frameworks insufficiently address insetting. We argue that without deliberate efforts to ‘civilise’ VSCMs by embedding transparency, procedural justice, and inclusive governance, these arrangements risk reproducing existing inequities within agri-food systems. The paper contributes methodologically and theoretically by advancing tools for analysing emerging market governance, and highlighting power relations underlying VSCMs.

1 | Introduction

This paper investigates emerging soil carbon markets and seeks to identify the groups of actors and power relations that constitute their structure and function. Globally, the prominence of private finance in shaping the design and implementation of climate governance mechanisms (Bigger and Dempsey 2018; Bridge et al. 2020; Knox-Hayes et al. 2020) has provoked debates centring on carbon governance and its reliance on marketisation, calculative practices and standards (Purdon and Byakagaba 2025). A central theme underpinning this discussion has been the power of financial capital to discipline social and political forces through the imposition of neoliberal governance

practices (Lane and Newell 2016). These debates have gained new momentum following numerous net-zero pledges by countries and corporations, and rising concerns around climate justice (Reay 2020; Wibeck et al. 2026).

Voluntary carbon markets (VCMs) have emerged as a major politico-economic tool in global climate efforts following the 2015 Paris Agreement. They signify instruments of governance that are actively reaffirmed and reframed through actions and activities of private market actors (Asadnabizadeh and Moe 2024; Kreibich 2024). Historically, built on the offsetting model, VCMs are understood and defined as markets in which carbon credits are obtained and sold within defined standards

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2026 The Author(s). *Environmental Policy and Governance* published by ERP Environment and John Wiley & Sons Ltd.

to cost-effectively reduce net emissions of carbon dioxide (CO₂) and other greenhouse gases (Asadnabizadeh and Moe 2024). Key players influencing VCMs include large corporations, start-ups, governments and a range of political institutions, and VCMs incorporate a large and growing collection of sub-markets related to trading offsets from different emission reduction and removal activities, with forestry, agriculture and other land use being prominent among them (Reed et al. 2025).

Recognition that agricultural soil carbon sequestration is an important mitigation option (IPCC 2022) is driving an interest in voluntary soil carbon markets (hereafter 'VSCM') (Johansson et al. 2025). VSCM, whereby farmers sell carbon credits linked to soil carbon sequestered through carbon farming¹ practices (Keenor et al. 2021), have seen a growing marketplace in the United Kingdom and internationally (Black et al. 2022; Buck and Palumbo-Compton 2022; Paul et al. 2023). They are also central to the green business model within the EU's bioeconomy policy (European Commission 2024a). VSCM shares characteristics with existing carbon markets, featuring many of the same market actors who manage and trade in carbon credits, such as buyers, brokers and validation and verification bodies (Ingram et al. 2025; Reed et al. 2025). These actors can operate within similar infrastructures and use similar software.

Parallel to offsetting efforts in VSCM is the corporate practice of insetting, where agri-food businesses reduce emissions within their own supply chain. This is in response to increasing scrutiny of their environmental and social impacts, including Scope 3 greenhouse gas emissions,² driven by corporate social responsibility (CSR) and sustainability performance reporting requirements (European Commission 2024b; Forests, Land and Agriculture 2026; Knapp et al. 2025). Agri-food businesses are incentivising their primary suppliers to implement farming practice changes that reduce emissions or sequester carbon in soil or biomass. Incentives can involve premium payments for products, and the generation of (often low integrity) carbon certificates via an intermediary which can be purchased by the agri-food company. In the United Kingdom, major food retailers and processors have announced net zero targets by 2050 (Arla UK 2023; Tesco 2023). This means that, in future, processors and retailers are likely to increasingly require farm businesses to demonstrate net zero compliance as a condition of purchasing their products (The Carbon Trust 2023). Insetting involves new governance actors such as the Science Based Targets initiative (SBTi) a global institution promoting high-integrity corporate emissions reductions (3Keel 2025; Knapp et al. 2025). However, insetting schemes have been critiqued for often lacking independent verification (Hackfort and Haas 2025).

Soil carbon offsetting and insetting therefore represent two intersecting economic activities, creating a complex and diverse carbon governance landscape. Another complexity within this arena is that soil carbon sequestration is highly contested, due to the inherent materiality of soil and its multiple functions. In the United Kingdom, soil carbon has been shown to deliver billions of pounds worth of ecosystem services (Jones et al. 2026). However, there are longstanding debates over the role of soil carbon in mitigation, described by some as a promissory climatic regime (Kon Kam King et al. 2018), with prominent issues around additionality and permanence (Oldfield et al. 2022;

Paul et al. 2023). High spatial and temporal variability of carbon stocks, and multiple management and context variables, make monitoring, reporting and verification (MRV) challenging (Black et al. 2022). This raises questions about how knowledge is authorised, contested and stabilised (Karnøe et al. 2022) as different actors make and translate soil carbon markets, and how these emerging economic arrangements are mediated through power relations (Carton 2020; Romm et al. 2025).

The space for controversy is heightened in contexts where there is less regulation; arguably more so where insetting and offsetting options compete, thus increasing complexity. VSCMs thus signify relational properties underpinned by wider governance dynamics and market contestation. For this reason, the term 'markets' refers here to both offsetting and insetting, even though insetting technically involves supply chains funding their own carbon removal projects without necessarily transacting via a public registry. In both processes, a company's 'responsibility' or 'obligation' is translated into a measurable product that in offsetting can be traded (a carbon credit), and in insetting can be reported.

Globally, researchers have identified low confidence amongst farmers and agri-food actors in VSCM integrity and governance. In the United Kingdom, farmers expressed uncertainty about many aspects of how the markets would operate (Phelan et al. 2025). In the United States and Australia, farmers were found to be more interested in the co-benefits of mitigation practices than receiving offset credits (Barbato and Strong 2023; Fleming et al. 2019). Issues of distributional and procedural equity have been raised by UK and US farmers, whereby tenanted, small farms, and those managed by minoritised farmers are at risk of being excluded (Gross et al. 2026). In VSCM-specific research, the role of intermediaries, at the interface between farmers and the marketplace, has been shown to be important. Wang et al. (2026) conceptualise these actors as pragmatic economists in a comparative analysis of VSCM *agencements* in Taiwan and the United Kingdom, respectively, while in the United States, project developers employed competing environmental discourses that both recreated neoliberal structures and provided points of resistance, informed by social justice narratives (Colby et al. 2025). From an economic perspective, scholars have investigated how soil carbon units derived from MRV frameworks might be integrated with farm financial reporting, thus generating economic benefits for smaller farms and improving equitable participation (Medeckytė-Žydelė 2025).

Due to their relative novelty, VSCMs have received limited research attention regarding processes of market development, or marketisation, compared to forest-related carbon markets, with the exception of Wang et al. (2026). Furthermore, there has been limited examination of the intersection between offsetting and insetting markets for soil carbon. Given the potential for VSCMs to deliver carbon removals at scale, and recurring controversies around existing nature-based VCMs in terms of both efficacy and fairness, it is vital to build knowledge that can help to inform effective policy. This paper builds on existing research and theory by incorporating market-making concepts with an adapted participatory methodology to investigate the main actors involved in VSCMs and the power relations between them. We use the UK VSCM as a case study.

Relatively recent estimates of the total UK land area involved in offset markets were 60,000 ha (corresponding to about 150 farms generating credits); approximately 0.35% of the 17 m hectares available (AlliedOffsets 2022; Elliott et al. 2022). Detailed VSCM participation data is not yet available due to the immaturity of the market. There are, however, reports of at least eight companies now offering agricultural soil carbon credits in the United Kingdom (Reed et al. 2025), which likely work with both insetting and offsetting. There is a high level of diversity across different UK regions in terms of geology, meteorology, soil types and main farming uses: from upland sheep farming to large-scale arable operations. Of note, 64% of the total farmable area in the United Kingdom is wholly or partly managed by tenant farmers (The Tenancy Working Group 2022); we highlight issues pertaining to tenant farmers later in this paper.

The rest of the paper proceeds as follows. First, using literature from economic sociology and political ecology, we develop a conceptual approach to better understand potential inequitable market outcomes, combining analysis of market-making and explicit engagement with power relations. Second, we present our methodology: an adapted version of the Net-Map approach. Third, we show how UK VSCMs function and involve specific power imbalances and governance challenges, partially related to their messy and experimental nature. In the final section, we discuss the implications of the findings and framework, attending to how VSCMs might be better designed and, to use Callon's (2009) term, 'better civilised'.

2 | Civilising Soil Carbon Market-Making: Governance, Power and Matters of Concern

The carbon governance landscape has been described as pluralistic, with the work of calculating, standardising, accounting and verifying carbon distributed amongst multiple actors in complex networks (Knox-Hayes et al. 2020; Wolf and Ghosh 2020). Within this landscape, the processes by which 'carbon is brought into being' as a marketable commodity (Gutiérrez 2011), or a reporting metric, are dynamic and evolving. Assemblages comprising formal rules, norms, incentives, accountability processes and devices are both the objects and the mechanisms of governance (Löwbrand and Stripple 2011). Compared to other forms of carbon removal, governance issues for soil carbon are particularly acute for both offsetting and insetting. Central to this is a lack of transparency, environmental integrity and standardisation in MRV (Ingram et al. 2025), with variable methods used to deliver and generate carbon credits and to monitor supply chain compliance. As such, soil carbon can be described as 'uncooperative' to commodification (Bakker 2004) and lacks market integrity (Reed et al. 2025). This has implications for farmer engagement.

In VSCMs, offsetting and insetting necessitate new practices of abstracted carbon metric governance and credible MRV systems (Bridge et al. 2020; Lovell 2015). This can lead to power asymmetries and knowledge controversies (Chartier and Tsayem Demaze 2022; Granjou and Meulemans 2023). In offsetting, expert knowledge authorises a 'technocratic toolbox' which works to maintain the 'hegemonic position that carbon

markets enjoy in climate policy, in that knowledge claims inevitably come imbued with values, interests, and power relations' (Carton 2020, 1355). Literature on insetting also describes how agri-food systems have been subject to 'new technologies of audit' (Rosin et al. 2017, 90), where metrological regimes reduce complex ecosystems into standardised and accountable objects, and metrics become tools of powerful institutional actors (Rosin et al. 2017). This constitutes a form of 'techno-political governance' (Freidberg 2014), where new practices of soil carbon metric governance are authorised and enacted. Farmers have had limited political capabilities in insetting contexts where markets and supply chain compliance act to reinforce existing inequalities. In relation to both insetting and offsetting, they can also experience high administrative burdens and transaction costs attached to MRV in carbon farming (Spijker 2024).

Building on carbon governance work, Hackfort and Haas (2025) connect market analysis and discursive power in the 'cultural political economy' of carbon farming. This includes the motivations, approaches, and material and discursive practices behind agribusiness corporate interests in carbon farming. A key insight is that corporations '...attempt to position themselves as part of the solution to the climate problem and develop corresponding imaginaries which, at the same time, aim to enable them to continue their existing business models' (Hackfort and Haas 2025, 7). While the practices associated with carbon farming can have co-benefits for biodiversity and ecosystem health, the concept is associated with an agricultural pathway that perpetuates existing power imbalances (Hackfort and Haas 2025). This resonates with work by Johansson et al. (2025), who investigated carbon farming programs globally and found that 'agri-chemical companies, agri-tech companies and new carbon farming start-ups mainly target large-scale farmers in the Global North' (Johansson et al. 2025). These actors employ a 'triple win' narrative, using regenerative agriculture branding to highlight climate mitigation, sustainable agriculture and farmer profit. However, this often serves corporate interests, and material commitment to transformation is lacking (Johansson et al. 2025). These two papers align with observations of power imbalances in political ecology scholarship (Carton 2020; Romm et al. 2025). Concerns raised include offsetting's character as a market instrument, the commodification of carbon (and associated data), the ongoing 'carbon grab' and the assumptions, values and expert knowledges that underpin carbon as a tradable commodity.

In this paper, we pursue a constructivist analysis of marketisation processes and power imbalances. Observing and analysing offsetting and insetting arrangements is useful not only to underscore their emergent imperfect nature as a 'market', but also to raise moral questions about the standards, responsibilities and governance arrangements needed to ensure VSCMs are fair and just for all actors, including farmers. In this regard, we take inspiration from Callon's (2009) concept of 'civilising markets' to introduce a moral assertion that frames markets as 'doing good'. This necessitates approaching emerging markets, such as VSCMs, as socio-technical arrangements. Constructivist approaches are critiqued for dealing inadequately with questions of power; thus, we explicitly include this in our empirical approach. We adopt a Foucauldian understanding of power as relational, and therefore 'the name that one attributes to a

complex strategic situation in a particular society' (Foucault and Hurley 1978).

Callon (2009) conceptualises VCMs as 'economic experiments'; not 'abstract spaces', but 'messy' constellations of independent buyers and sellers governed through rational calculation. Markets emerge as innovations without prior testing. Testing happens 'in vivo' as live experiments, with markets continually evolving and shifting as they develop. While VSCMs are in relatively early stages of development, they are 'live', and therefore evaluation and reflection are essential to support 'good market design'. Social science can examine how the 'VSCM experiment' functions, and thus begin to assess the capacity to 'better civilise [soil carbon] markets' (Callon 2009, 535).

Continuing to draw on Callon, we can describe VSCMs as a social and technological '*agencement*', meaning 'an arrangement of things, people and ideas' that hold together different actor agencies through practices of ordering, measurement and assessment (Callon 1998). To connect relations between market formations and power imbalances, the key point is that calculative agencies and experiments not only play a role as mediums for techno-political governance, but also have the capacity to generate controversies. In Callon's (2009) analysis of VCMs, this translates to accounting for 'matters of concern' (see also Wang et al. 2026). From a moral economy perspective, systematically mapping concerns is instructive, particularly through the inclusion of more marginal voices. Controversy and disagreement can be generative and provide strategic feedback for designing better arrangements (Chivers et al. 2025). Although Callon's concepts traditionally have an explicit market focus, here we argue to extend them by including inseting, which is interrelated with the VSCM and emerging *agencement*, bringing its own matters of concern.

This paper views voluntary carbon and supply chain markets as techno-political metrological regimes underpinned by forms of carbon metric governance, actor enrolment and power relations. These intersect, disrupt and increasingly influence established rules and norms in agriculture, food commodities, and supply chain governance. We therefore ask three key questions. First, what groups of actors are involved in VSCMs? Second, how are these markets structured, and what power relations are involved? Third, what power imbalances (matters of concern) emerge from these arrangements, and how might these kinds of markets be 'civilised' (Callon 2009)?

3 | Methodology

We adopted a qualitative approach to promote uncovering and understanding social constructions of meaning relating to environmental governance (Säwe and Hultman 2018). To address the research questions we adapted the Net-Map methodology described by Schiffer and Waale (2008). This approach was developed to understand multistakeholder governance of complex issues, and can be applied at local, national and international scales. Although designed in the context of understanding sustainability transitions in the Global South (Metelerkamp and Schiffer 2020), Net-Map has previously

been utilised in European contexts to investigate situations featuring complex multistakeholder relations, such as governance innovations in the northern European forestry sector (Sattler 2022) and envisioning sustainable futures in Spanish drylands (Cortés-Calderón et al. 2025).

Net-Map methodology is a participatory, interview-based tool for mapping and visualising complex situations, key actors and analysing power dynamics and relationships affecting a specific outcome. Central to the method is the principle of including a range of voices and perspectives. We employed a purposive sampling strategy to incorporate a range of positionalities within UK VSCM. Based on our literature review, we identified categories of stakeholders with high interest in and influence on UK VSCM, and invited a selection of people from each category to interview. As the interviews progressed and we consolidated our knowledge about the structure of the market, we iteratively developed our categorisation to ensure we included the full range of stakeholders. The final iteration featured eight categories, of which two contained two subcategories (see Table 1). The only category not represented in our sample was that of inseting buyers: although we approached several, none were available to participate in an interview. To ameliorate this, we interviewed several stakeholders who either worked closely with inseting buyers and/or had academic expertise on the subject. In the Results section, we note in brackets which group each quoted participant was categorised under.

Practically, Net-Map combines approaches from social network analysis and power mapping tools (Schiffer and Hauck 2010; Schiffer and Waale 2008). The original method is low-tech and involves drawing maps and building 'influence towers' from board game pieces. We used the online visualisation tool Miro, and a numerical rating to denote influence.

We conducted 17 semi-structured online interviews with 18 participants in total, of which 16 interviews took place online via Microsoft Teams, and one was conducted asynchronously over email. After initial open questions to establish rapport and baseline understanding of the interviewee's role in VSCM, the mapping began with a blank Miro 'board'. The first step of the Net-Map process asks the interviewee to write down all stakeholder groups involved in the activity under analysis. It is best to have a clearly defined question to guide this first stage (Schiffer and Waale 2008); in our case, this was:

'From your perspective, who are the important stakeholder groups in the emergence of soil carbon markets in the United Kingdom?'

As the interviewee named stakeholder groups, the interviewer recorded these in circles on the board. When the interviewee was satisfied they had included all relevant parties, the interviewer offered prompts to elicit further stakeholders, for example, 'Some people have put tenant farmers as a separate group. What do you think about that?'

The second stage is drawing 'links' between the stakeholder groups, illustrated with coloured arrows. The research team developed the following set of colour-coded links:

TABLE 1 | Classification of stakeholders guiding purposive sampling for interviews.

Main categories	Subcategories	Number of interviewees	Number of workshop attendees
Landowners and land managers ^a	Farmers	2	1
	Other (e.g., investment firms, local authorities and NGOs)	1	0
Farm advisors	—	2	1
Project developers	—	3	1
Intermediaries, markets, and brokers	—	2	0
MRV service providers	—	3	2
Buyers	Offsetting	1	0
	Insetting	0	2 ^b
Governance and policy (e.g., government, standards bodies and environmental NGOs)	—	3	1
Scientific community	—	2	2
Actual total (accounting for dual roles)		17	9

Note: the number of participants exceeds the actual total, as two participants held dual roles.

^aLandowners refer to those that own land, including owner-occupier farmers, while land managers include tenant farmers and salaried farm managers who manage land but do not own it.

^bIt proved very challenging to engage insetting buyers in the project, so the two stakeholders recruited here were consultants who provided advice to insetting buyers.

- ‘Money’—movement of financial capital between groups, such as a buyer paying a project developer for carbon credits.
- ‘MRV data’—transmission of data between groups, such as farmers sending soil sample data to project developers.
- Knowledge and advice transfer of knowledge and advice between groups, such as a farming advisory service providing guidance to farmers about VSCMs.
- Disruption/disturbance—where a group disrupts or disturbs the activity of another group, such as news media reporting stories that impact the reputation of international standards agencies. This helped to identify ‘matters of concern’.

We also prompted participants to suggest any other links, and to critique our classification if they felt it was inadequate. For example, the link ‘MRV data’ was originally called ‘MRV’; however, this caused confusion as it was not clear in which direction the arrows should flow.

In the third stage of the Net-Map method, we asked each interviewee to give a numerical score, using the following prompt:

On a scale of 1–5, how strongly can each of these stakeholder groups influence the development of (or control) UK soil carbon markets?

The interviewer would then ask them to explain why, with follow-up questions as appropriate. For example, the interviewer might ask why a stakeholder group had scored a two when the interviewee had previously mentioned that they were very

influential. This encouraged participants to reflect on and critically examine their statements, often eliciting richer data.

We omitted the final stage of the Net-Map approach, which adds the orientation of actors, as we were not researching a specific polarised issue within UK carbon markets.

Figure 1 shows an example of a map created with a participant (in this case a project developer) for illustrative purposes. Different stakeholders portrayed different levels of granularity, with some focusing more on the part of the network that interacted most with their day-to-day work.

Interviews were recorded and transcribed using Microsoft Teams, with the transcript corrected by the lead author and imported to NVivo. Transcripts were coded using a mixed deductive/inductive thematic analysis approach (Braun and Clarke 2006). The initial deductive categories were: Assumptions, Development of the market, Groups and their influence, Links, Opportunities, Power imbalances, Risks, Sources of evidence and credibility and Storylines (see Table S1). The interview transcripts and maps generated with participants informed the creation of an aggregated map, in which we sought to describe the UK soil carbon market at the time of data collection in the second half of 2024.

In early 2025, we conducted a validation workshop with interviewees and other key stakeholders. For this, we recruited three new participants (partly based on interviewee suggestions) in addition to inviting prior interviewees: one of the new participants was an academic, and two offered consultancy services to insetting buyers. Our efforts to recruit insetting buyers (and further offset buyers) were unsuccessful, so

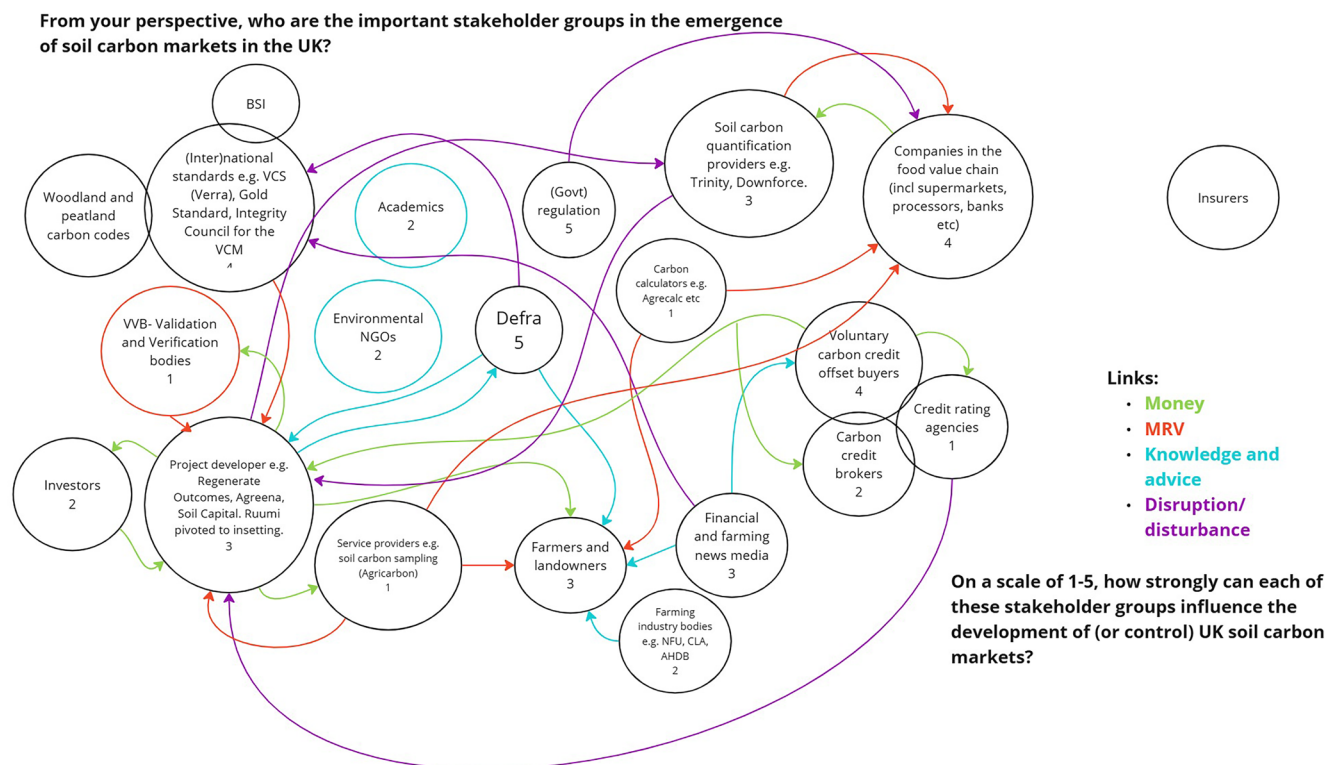


FIGURE 1 | Example of map created with participant using adapted Net-Map method.

we focused on ensuring that we had insetting expertise represented in the workshop. A total of nine participants joined the recorded workshop, where we presented the master map and our preliminary themes. This resulted in some further refinement of the map to increase clarity, and recordings from the workshop were transcribed and incorporated into a subsequent round of inductive thematic analysis, building on the codes identified previously.

4 | Results

4.1 | Market Structure and Relations

Overall, we found that UK VSCMs involve a wide range of stakeholder groups. Figure 2 shows the final iteration of the aggregated Net-Map, illustrating the main groups involved in VSCMs, with landowners and land managers (henceforth ‘farmers’), project developers, and buyers emerging as core components. Figure 2 also shows how money and data flow between the different actors, with the carbon ‘benefit’ ultimately passing to the buyer. Importantly, the flows through validation and verification bodies and international registries/standards only occur for high-integrity carbon credits.

The blue circles represent influential stakeholder groups who do not necessarily engage directly, but rather offer advice and support that may influence how the market develops. The gold circles represent stakeholder groups with governance roles, such as the UK government and independent international organisations. The circles with bold outlines (UK government, landowners and land managers, and buyers) are groups that were

consistently rated by participants as having the most power to influence development of the UK soil carbon market. As mentioned previously, this is a dynamic situation and market structure is likely to evolve.

Generation of a high-integrity carbon offset credit begins with the relationship between a farmer (or group of farmers) and a project developer. The farm will undergo a baseline measurement of soil carbon, using services from the measurement service providers group. The farmer will then undertake designated practices, such as cover cropping, reduced tillage or legumes in rotation. In a few cases, payment will be dependent on measurable increases in soil carbon, but in most cases payment is for practices rather than outcomes. The farmer provides data to the project developer to quantify what they did over what land area. The project developer then shares data with validation and verification bodies and with an international standard/registry (in most cases this is Verra). When the credit is generated, it appears on the registry and can be sold to a buyer. ‘Retiring’ a credit means a buyer has used it to offset their residual emissions, and it can no longer be traded. Farmers receive payment from the project developer, typically at a lower rate than what the buyer paid, to cover the project developer’s costs.

In the case of insetting, there tend to be fewer actors involved, as companies in agri-food supply chains often liaise directly with their suppliers and may involve a project developer to help generate ‘carbon certificates’. These are low-integrity credits that have not gone through the verification procedure described above but may be used by inset buyers to claim reductions in their Scope 3 emissions.

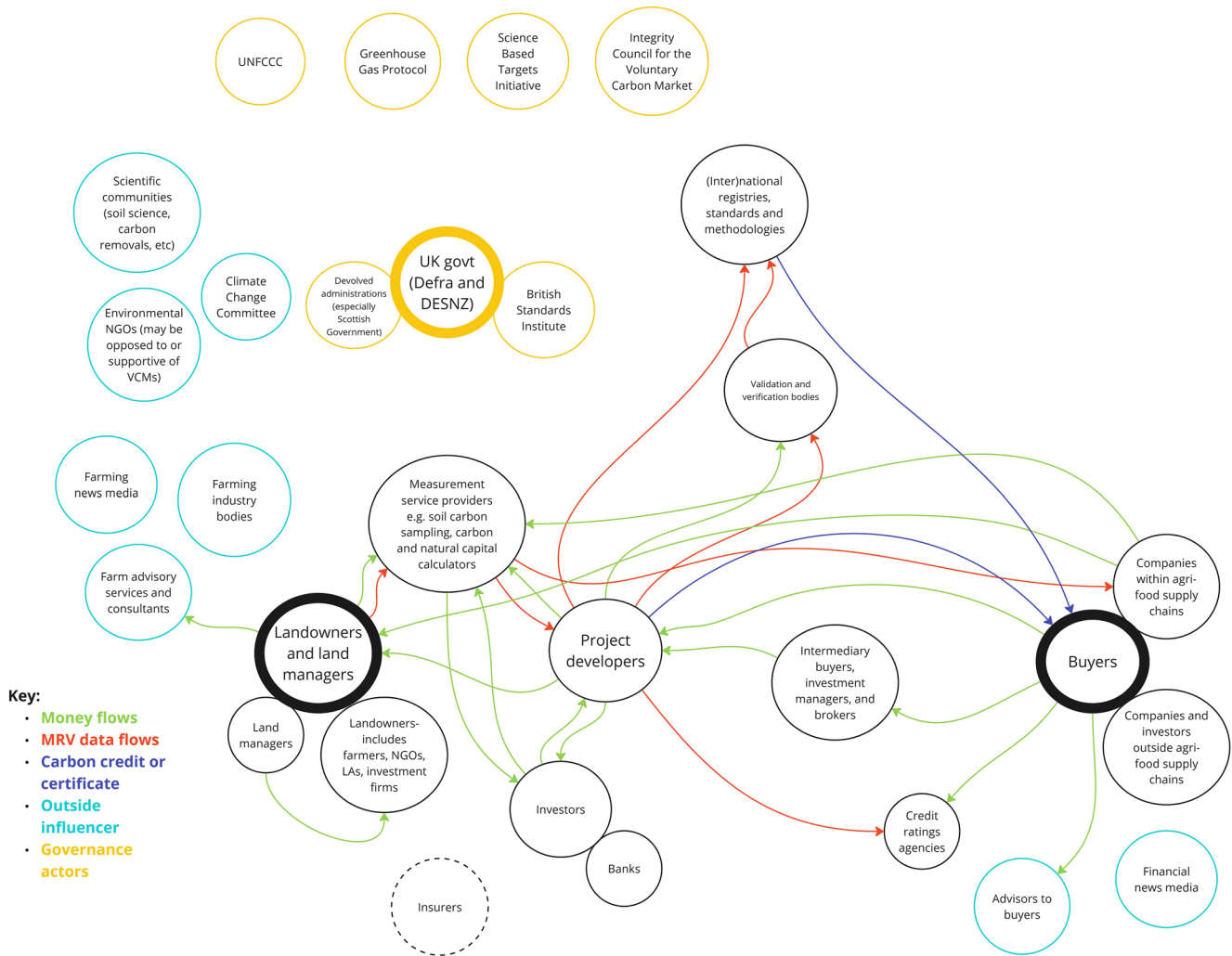


FIGURE 2 | Aggregated Net-Map of UK VSCMs based on interview data.

4.2 | Market Development

Our data confirmed that VSCMs share structural similarities with other types of carbon and nature markets:

...you need a buyer, and then you'll potentially need an intermediary like me in the middle [...] a kind of market maker who works between suppliers, project developers and the client. Not always the case, lots of people are building a team that would do direct buying themselves.

Interview 15 (Intermediaries, markets, and brokers)

This quotation illustrates the core relationship within VSCMs: supplier, intermediary, and buyer. As Callon (2009) explains, even nascent markets have a range of peripheral actors involved, and this is what became apparent from the Net Map methodology. Groups such as NGOs, government, and researchers all played roles in shaping the market through activities such as highlighting harmful consequences, shifting the rules of the game, and designing new processes and metrics (Karnøe et al. 2022). We also identified groups such as farm advisory

services who play a significant role in influencing whether farmers participate in such markets.

Meanwhile, our data suggested that UK VSCMs were growing in terms of the number of actors involved, with some stakeholders describing a proliferation of new actors:

...so, the carbon credit companies there seems to be a new one popping up every week. And the end, well, there's the companies coming up with the calculators, they may be an NGO or they may be a for profit company...

Interview 1 (Measurement service providers)

However, stakeholders also highlighted businesses that had gone bankrupt and/or no longer participated in the market. So, market growth in terms of number of companies involved was limited by some businesses being unsuccessful, and the landscape was constantly shifting:

So, I think almost every day [there] is disruption by the fact that this is such a new market. Everything is

changing and there is no accepted baseline to move off from. So, I think there's a lot of change happening.

Interview 10 (Farm advisors)

Many stakeholders felt the market was unlikely to grow significantly given the high price of soil carbon in the United Kingdom compared to credits generated in the Global South. One interviewee suggested there are few corporate buyers of soil carbon at present:

For two reasons. One is because they are not required by law to do this. So, whoever is a buyer is only because they do it voluntarily. (...) And the second thing is when it comes to doing this voluntarily, you can do it by buying credits in the Global South at \$5 per credit. So if you're a buyer, you can either spend \$5 per credit, if you do it in the global South, or £50 per credit if you do it in the UK. And so, 99% of them want to pay \$5.

Interview 4 (Intermediaries, markets, and brokers)

Although this was mentioned as a main reason why soil carbon offset markets are not growing rapidly in the United Kingdom, stakeholders suggested there is likely to be increasing pressure on corporates to meet their net zero targets:

...these claims and targets that you're making, I think that's going to be increasingly under scrutiny, especially when you're having the disclosures and the mandatory emissions and removals reporting. Scope 3 comes into play as well.

Workshop, breakout 2

So, overall, stakeholders tended to suggest that the cost of carbon will continue to rise in the coming decades as legislative deadlines approach and companies scramble to deliver on their net zero targets. Interviewees also suggested that carbon removal credits (such as soil carbon) were likely to become increasingly important. Measures to increase soil carbon sequestration may therefore become more financially valuable in future offset markets, though this remains uncertain.

4.3 | Market Function

As mentioned previously, there are two main ways soil carbon can be governed in the United Kingdom: offsetting and insetting. Our findings suggest that soil carbon offset markets are not particularly mature in the United Kingdom. For example, one participant from the buyer stakeholder group argued that there is no coherent soil carbon market, just a collection of projects and tools:

I'm not aware of any equivalent turnkey validation and verification framework akin to the woodland carbon code or the peatland carbon code, for example, that would enable me to interact directly with a coherent existing voluntary soil carbon market.

Interview 5 (Buyers—offsetting)

In general, offset markets are likely to involve strategies to reduce risk and ensure a return on investment for project developers:

In terms of the buyers of those offset credits you can again have a direct relationship where you have a preidentified buyer of those credits before you start, which is preferred to 'just put them out on the open market and see who bites'.

Interview 12 (MRV service providers)

Our data show that soil carbon insetting is more prevalent in the United Kingdom compared to offsetting. Insetting is at an experimental stage, with little consistency in approach between companies:

...that's where you start to see this like incentivisation within the supply chain [...] we're seeing a lot of pilots at the moment where people are trying to get a handle on what their baseline [is]. There's a lot of flux in the space around that. [...] There's no uniformity at all in terms of what those supply chain companies who are looking to inset, how they would structure their programmes.

Interview 12 (MRV service providers)

There are exceptions, as some companies have a clear supply chain with named suppliers. However, many companies do not know exactly who they are sourcing from. One example given during the workshop was wheat producers, who often sell their product as a commodity via an aggregator.

As with offsetting, project developers are important in insetting, and:

...typically provide an intermediary service that is especially focused on bringing farmers together under a contract where the farmer agrees to make certain practice changes that restore soil carbon.

Interview 14 (MRV service providers)

Project developers will contract with measurement services providers to measure soil carbon and then 'package' it in a way that is aligned to carbon accounting protocols. Corporates need the expertise of project developers because, as one stakeholder put it, 'ultimately [...] you're a retailer, you're not a carbon farming expert' (Int 14).

As researchers, one of the challenges we faced was identifying stakeholders in food and beverage companies who were open to being interviewed. This aligned with our data, which suggests that inset markets are less transparent than more traditional offset markets. We discuss this further in the following section.

4.4 | Power Relations and Matters of Concern

In this section, we will highlight some key matters of concern pertaining to VSCMs, via the lens of power imbalances and their potential negative consequences.

4.4.1 | Farmers and Offset Markets

Within offset markets, project developers can set the price they pay farmers, thereby exercising power over this relationship:

...the companies that are issuing carbon credits often determine the price that they're willing to pay the farmer. And this is where we start getting discrepancies (...) They will do the farm quantification and they'll say you've created 200 tonnes of sequestration and we will pay you X for those certificates. (...) And then they'll either keep it, as part of some scheme, or they'll sell it into the market at the prevailing price....

Interview 1 (MRV service providers)

Furthermore, this participant highlighted the situation of venture capitalists creating or investing in new project developers; with generating profit as the overriding priority and little attention to delivering climate benefits or fairly paying farmers.

Participants also raised the issue of project developers and other intermediaries limiting communication between farmers and buyers, thus making their pricing less transparent:

At the moment the purchasers are largely kept away from the farmers and vice versa, and they're [intermediaries] the ones who ultimately make this happen. And the verifiers and the brokers are keeping those relationships very much through themselves. (...) I think farmers would like to see more opportunities of connecting farmers to the purchasers, and probably the purchasers would like that as well actually, (...) a bit more competition and a healthier market.

Interview 10 (Farm advisors)

Participants overall considered that buyers held a great deal of power in offset markets, as without them the market would not function:

I think corporates hold most of the cards because it's about what they're willing to pay....

Interview 8 (Scientific community)

However, despite this sense that farmers may get a bad deal from soil carbon offset markets and corporates 'hold all the cards', a prominent theme was that farmers have 'power of veto' (Interview 7). As much as buyers are essential to the market, access to land via farmers is also necessary:

Land managers and farmers (...) They're the whole supply side. So, if this gets a bad reputation, and the other actors were to say voluntary carbon market's really bad news (...) and it's a Wild West, and they're going to rip you off, and farmers decide, you know, as a group to dig their heels in. Then yeah, it's not

gonna go anywhere. So I'd say they're a 5 [out of 5]. But again, it's this case where any one farmer is a 0.

Interview 9 (Farm advisors)

Thus, if intermediaries engage with farmers in a way that lacks integrity or results in them feeling they have been short-changed, there is a risk of reputational damage to the broader market (via stakeholder groups such as the farming media). This could have a negative impact on farmer engagement in the long term.

As the above quotation suggests, farmers' power was stated to be collective rather than individual:

Obviously you've got farmers, and I suppose you can divide that up into, a lot of farm clusters are doing really innovative stuff in this space and that's partly a reflection of the fact they want to take better control over the process and partly reflection the fact that it's only really when you bring a lot of farms together at scale that you can start to deliver the impact needed.

Interview 11 (Governance and policy)

Collective initiatives also facilitate aggregating carbon benefits in a more transparent way than individual farms working with a project developer. This representative of a farmer cooperative explained:

So we set up the cooperative so that farmers could trade their natural capital together rather than as individuals, which gave them the advantage of scale so that they, we could really sell a good quantity of some of this stuff to developers or to other buyers. And also it meant that we didn't get picked off by unscrupulous traders trying to corner individual farmers and pay them less than what perhaps it was worth to the end user.

Interview 3 (Landowners and land managers—Farmers)

Estates and farm clusters were therefore considered to be better placed to engage in soil carbon offset markets than individual farm businesses.

Somewhat contrary to the above, one theme within our data was that all stakeholder groups hold similar power to influence the development of UK VSCMs (indicated here by a score of):

And then you need to have that intermediary who owns the code or sets the standard. So, they are probably the next... I'd probably put them all there fives as well really because without them none of it happens. I'll probably put five [out of five] for all of them in the end.

Interview 13 (Landowners and land managers—Other)

This sense of interdependence may have been reinforced by the Net-Map methodology, as it visually displayed the

interrelationships between different stakeholder groups. However, a distinction did emerge between those groups who directly engage with the market, those who influence it from outside, and those that have a governance role and therefore their influence depends on the regulations in place. This nuance is illustrated in Figure 2.

4.4.2 | Farmers and Insetting

As mentioned previously, the most prominent economic activity pertaining to soil carbon in the United Kingdom is insetting. Therefore, one of the major power imbalances identified in our data was between farmers and companies in the agri-food supply chain. This relationship has always been somewhat fraught, given the tendency for retailers to pass costs back to primary producers (Howard 2016), and some participants suggested that insetting would simply reinforce the negative aspects of that relationship:

...in the offsetting world, yeah, the landowners have a lot more power than people give them credit for, but in the insetting world, these are farmers and the people they're supplying have a huge amount of power. So that is the (...) traditional, classic power imbalance, isn't it? The Tesco's of this world versus your family farmer, and what can you do?

Interview 7 (Scientific community, Governance and policy)

A concern, particularly among farmers, was that it would become compulsory for them to include their soil carbon in sales to retailers, and that they would not see any financial benefit:

The imbalances of power are the supply chain having too much power over their suppliers, in other words, saying we're not gonna buy your product off you unless you do X.

Interview 3 (Landowners and land managers—Farmers)

Farmers may see financial costs, as some practices associated with increased soil carbon require investment and can mean reduced yields while soil health recovers (Gosnell et al. 2019). Meanwhile, supply chain companies could demonstrate to their shareholders that they had successfully met their net zero targets, and continue to profit.

Inset markets were also felt to be somewhat opaque in comparison to offset markets. This was attributed to offset markets having received intense media and public scrutiny in the past, while inset markets were newer and out of the public eye:

So there's actually much more dubious things happening in the inset food value chain side, than there is in the offset space because the offset people are really badly burned by the reputational risk of buying dodgy carbon credits. And so some of the bad

press around Verra and things has actually helped make [offset] buyers be more discerning in the underlying projects...

Interview 6 (Project developers)

The lack of transparency in insetting and use of different payment arrangements (such as premium pricing) makes it difficult to assess whether farmers receive a fair price for their soil carbon. Furthermore, at the time of writing, a proposed UK framework for high-integrity carbon and nature markets does not include insetting (BSI 2025a). There is a risk of distributive injustice if retailer contracts mandate that farmers 'sell' their carbon to them for a set price, particularly if offset markets or other alternatives develop. However, some stakeholders advocated insetting as a fairer approach, when properly regulated:

It should only be able to be, to stay within the supply chain (...). Because if you can buy outside your own supply chain, then the risk is you're just buying your way out. You're not actually making genuine reductions for your, responsibility for your impact.'

Interview 1 (MRV service providers)

Overall, there was a sense from interviewees that insetting will be increasingly important as companies in the food supply chain address their residual Scope 3 emissions. In future, this may limit the availability of soil carbon to offset buyers.

4.4.3 | Knowledge Asymmetry

Another theme in our data was the role of knowledge in structuring power relations. On the one hand, farmers were seen as having limited knowledge pertaining to VSCMs, which was potentially negative:

...it's not their expertise. It's not their skill set to do this work. You know their job is farming, it isn't developing a marketplace, and I think they're going to find it challenging to come together to provide a robust resistance to... the market as it evolves.

Interview 11 (Governance and policy)

Knowledge limitations were associated with the high diversity among project developers and intermediaries, as mentioned previously. However, interviewees held different views on the potential outcomes from this situation. Some felt knowledge asymmetries placed farmers at risk of unjust outcomes:

...it's one of these slightly strange markets where the amount of knowledge is relatively small. And so (...) you end up with this situation where those with a relatively small amount of knowledge have a surprisingly large amount of power. Because you know, no one can prove them wrong, bluntly. I think probably what we're seeing is those who are slightly further in front of the market are sharing knowledge.

Interview 10 (Farm advisors)

However, others suggested that a lower level of knowledge among farmers and farm advisers meant they were more likely to avoid engaging with VSCMs altogether, such as in the following quotation from a stakeholder providing farm advisory services:

I mean the big risk and why we've been urging caution (...) if some schemes are found to be untrustworthy, disadvantageous (...) or fail to be transparent, those credits could be called into question, and that's where these, that would have bad implications for the whole space.

Interview 9 (Farm advisors)

The knowledge asymmetry between farmers and project developers therefore has implications both in terms of potentially unjust outcomes, and in terms of the trust required to onboard more farmers and develop the market.

4.4.4 | Land Ownership

The final power imbalance identified through our data is the issue of landowners having greater autonomy than land managers to engage with VSCMs. Land managers may be precluded from participating in soil carbon offset markets depending on the length and terms of their tenancy. On the other hand, they may find themselves under pressure to participate according to their landlord's wishes:

...if the landowner wants (...) an operator to do it, they're gonna be able to influence them to make them do it. Whereas if a farm operator wants the landowner to do it, the landowner doesn't have to do it (...) they're ultimately in control.

Interview 2 (Farmer, Project developer)

Stakeholders often gave tenant farmers a lower influence score than landowners, highlighting their reduced agency. However, some stakeholders were optimistic that the situation could be mitigated:

So there are some, not necessarily major barriers, but some additional considerations (...) The vast majority have got good relationships with their landlord and I'm sure a landlord would be keen for them to ensure they're doing the right thing as sequestering carbon is often a good thing for the soil anyway....

Interview 13 (Landowners and land managers—Other)

Based on our data, tenant farmers likely face restrictions to entering VSCMs, especially if the length of a soil carbon contract exceeds the length of their tenancy. Again, this has implications in terms of their autonomy and in terms of market development. However, stakeholders felt these issues could often be mitigated, particularly in situations where there are positive landlord-tenant relationships.

4.5 | Regulation Would Improve Market Development

A final major theme was that increased government regulation would be positive for development of a UK VSCM. When we conducted this research and at the time of writing, voluntary VSCMs in the United Kingdom remain relatively unregulated when compared to woodland and peatland carbon. This lack of regulation contributes to several of the issues above, such as the generation of low-integrity credits and highly variable approaches between different project developers. These factors contribute to a lack of understanding and trust among farmers, who remain hesitant to engage with these schemes.

Stakeholders highlighted that a major issue within VSCMs was when project developers did not use independent organisations to validate and verify their credits:

...if you are the project developer, you cannot be also the person who is quantifying because you have a conflict of interest. You want to come up with more credits so that you can sell more, you know (...) it's a conflict of interest, and then there is no market. The market is corrupt, basically.

Interview 4 (Intermediaries, markets, and brokers)

Regulation was therefore posed as a solution to low-integrity credit generation. Stakeholders also considered that government had significant power to drive market development. Outside of farmers and buyers, government was consistently rated as having the highest level of power:

...that's how you scale a market, is you drive demand. So it's policymakers, ultimately, that drive demand. (...) Corporate don't do voluntary stuff because it's the right thing to do. Not because they're bad, but because they operate in a legal frame that requires them to maximise profits. So, it all comes back to policymakers.

Interview 5 (Buyers—offsetting)

The British Standards Institute's (BSI) Nature Investment Standards (NIS) programme was being developed at the time when we were conducting interviews, with one stakeholder explaining that although these standards will be voluntary:

...the expectation is that (...) all of the major players will seek certification through BSI to get that kitemark that says that yes, we are a high integrity carbon market, therefore work with us. That will give farmers the assurance that they need to know (...) they're not gonna get ripped off, but also buyers as well, and the hope is that this then gets the market moving, and builds trust in the marketplace.

Interview 7 (Scientific community, Governance and Policy)

Stakeholders overall welcomed regulation, given its potential to manage power dynamics and reduce conflicts of interest. During the workshop, however, participants discussed that future standards could be lower in integrity than some existing practices, given the high diversity in the existing landscape. We will further discuss the ongoing development of standards for VSCMs in the United Kingdom in the next section.

5 | Discussion

In this paper, we have illustrated how VSCM can be viewed as in vivo experiments, in a state of rapid flux, following from Callon's (2009) work on market-making. We have investigated these markets through a UK case study using the Net-Map methodology, and augmented Callon's approach by incorporating a political ecology perspective that explicitly attends to power relations. Framing soil carbon market-making in this way has allowed us to address power imbalances to provide opportunities to 'civilise' markets to reduce the risk of harmful or inequitable outcomes. Mapping such matters of concern across the emerging offsetting and insetting governance landscape in turn advances market-making theorisation.

5.1 | Market-Making

Our methodology has revealed a pluralistic and dynamic VSCM where power asymmetries are apparent (see Figure 2). Private companies active in offsetting and insetting activities are taking key roles in soil carbon governance in terms of rule-making, monitoring, compliance and enforcement (Knox-Hayes et al. 2020). Multiple actors interact in a dynamic experimental landscape consistent with Callon's (2009) description of 'economic experiments', and complex, socially and technically constructed *agencements* that are constantly evolving and open to political and social intervention.

The sense of a nascent marketplace with a high level of uncertainty surrounding it is captured by interviewee observations. There is a proliferation of new actors, with project developers and measurement service providers taking direct roles, while peripheral actors (e.g., regulators) also have significant influence on market development (see Figure 2). For both offsetting and insetting, the role of the intermediary is key as 'a kind of market-maker' who works between suppliers and buyers. As other scholars have noted, the role of the intermediary is key to market-making but not without its tensions (Colby et al. 2025; Wang et al. 2026). Applying the lens of market-making sheds light on these dynamics and agency as actors make, contest, and transform markets for soil carbon.

5.2 | Matters of Concern

Our analysis also identified key matters of concern pertaining to UK VSCMs. The first of these is unfair pricing and the share of the financial benefits of carbon sequestration between suppliers, intermediaries, and farmers (illustrated via the 'Money' links in Figure 2). Within offset markets, project developers can set the price they pay farmers, thereby exercising power

over this relationship. They also control and limit relationships to avoid direct contact between farmers and buyers (see Figure 2). There was agreement that 'corporates hold most of the cards' although it was also noted that ultimately 'farmers have "power of veto"', particularly if they can work collectively. The latter is thought to be more the case in offsetting rather than in the insetting world, where corporate agri-food companies 'have a huge amount of power'. Demands on farmers to evidence carbon reduction as a means of accessing agri-food markets could effectively limit their opportunities to engage with carbon markets. Within the farming constituency, tenant farmers notably have less instrumental power to control whether and how they might engage with the market. This vulnerability of tenants with respect to engaging in natural capital markets has been raised by others (The Tenancy Working Group 2022).

The role of knowledge in structuring power relations was also revealed. Farmers lack specialist knowledge (about soil carbon metrics and markets) and are reliant on a few intermediaries, leading to a situation where 'those with a relatively small amount of knowledge have a surprisingly large amount of power'. Globally, corporate actors tend to frame carbon farming as a 'win-win-win' for climate change mitigation, sustainable agriculture and farmers' profits; yet their support tends to serve their own interests (Johansson et al. 2025). As found elsewhere, farmers who lack access to credible and appropriate market-related information are at risk of being marginalised (Buck and Palumbo-Compton 2022; Phelan et al. 2024, 2025). Equally, knowledge about the many methods and tools applied to quantify soil carbon sequestration is highly contested (Wang et al. 2026).

The power imbalances being played out as markets emerge resonate with those observed in Global South offsetting contexts (Carton 2020; Lane and Newell 2016). In the literature engaging with VSCMs specifically, Hackfort and Haas (2025, 8) are highly critical, suggesting that 'carbon farming' is '...deeply intertwined with an agricultural policy path that reinforces existing power relations'. As with other metrological regimes, they suggest that this approach '...may further entrench the flaws of the global industrialised food system.'

5.3 | Future Governance to Civilise VSCMs

According to Callon, 'civilising' of markets is an ongoing process in which collective experiments identify, debate, and intentionally manage matters of concern and negative externalities. In essence, stakeholders collaborate to redesign exchange mechanisms for social and environmental goals. One example where the process is advanced is the UK Woodland Carbon Code (WCC), which is considered effective and widely regarded as the United Kingdom's gold standard for nature market integrity. The scheme is backed by government, the forestry industry and carbon market experts. It has been endorsed by the International Carbon Reduction and Offset Alliance since 2021 (ICROA 2026), and is currently under consideration by the ICVCM (ICVCM 2026). However, the WCC is not without critique, and continues to evolve. Scholars investigated how an earlier version of the code failed to make

restoration of ancient woodland 'legible' to carbon markets, and thus required reiteration to deliver this politically desired outcome (Stanley and Cusworth 2025). Meanwhile, others have suggested that the WCC works by 'encoding and enabling the exchange of different values, which for proponents is a positive feature that captures the diverse co-benefits of woodland', while critical actors may view this value exchange as 'a form of greenwashing that benefits carbon buyers' (Koronka et al. 2022, 1). This illustrates how the process of civilising markets continues iteratively through stakeholder experiment and dialogue. The Principles for Responsible Investment in Natural Capital developed by the Scottish government provides a further example where community engagement, a diverse mix of land ownership and management, and values-led market integrity have become embedded into nature governance.

In our data, the power rating component of the Net-Map methodology revealed agreement between participants that the government has significant power to intervene and drive VSCM development through regulation (see Figure 2). Ongoing work developing voluntary standards for UK carbon and nature markets through the BSI aims to provide assurance of soil carbon market integrity (BSI 2025b). This could help increase trust and confidence among market actors, help manage power dynamics, and reduce conflicts of interest. However, at the time of writing, BSI guidance on nature-based carbon benefits only includes inseting principles as advisory recommendations (BSI 2025a). Given the prominence of inseting in the UK VSCM, it is unclear whether this guidance will have a significant impact, although feedback is sought to improve future iterations. Internationally, six principles for high-integrity inseting have been developed, including delivering shared value for people and efficient MRV (Conservation International 2025).

Our data suggest that inseting potentially carries a risk of unjust outcomes, given the existing power imbalance between farmers and companies in the agri-food supply chain. Inseting operates in a complex governance arena, which, according to our participants, is quite opaque in comparison to offset markets. Other research has found that farmers show scepticism towards inseting, questioning transparency and credibility within supply chains and how it can benefit them (3Keel 2025). On the other hand, proponents argue that inseting could reward farmers fairly if best practice principles were followed, as well as helping build resilience to climate change and supporting positive outcomes for nature, farmers and rural communities (3Keel 2025).

The various initiatives and mechanisms for civilising VSCMs presented here only establish market expectations, rely on voluntary compliance and arguably require regulation. Balancing the relations between voluntary and fragmented private sector and more rigid public sector rules is central in this hybrid governance approach to civilising markets (Wolf and Ghosh 2020). This civilising approach, as an evolving experiment, resonates with what Colby et al. (2025) call a 'double movement': where project developers used liberal market framing yet simultaneously argued for regulation, open-source data access, and social institutions like cooperatives. Another complicating factor is that, even if the UK VSCM

were more regulated in future, scientific questions around the reliability of soil carbon metrics and issues with additionality and permanence would likely prove persistent (Oldfield et al. 2022).

Meanwhile, a civilised market is one that actively welcomes and incorporates the diverse perspectives and concerns of all actors affected by its operations, as well as addressing the issues they raise (Callon 2009). Callon (2009) recommends bringing 'peripheral' actors into dialogue with other interested groups to support collective decision-making processes, as part of efforts to 'civilise' markets. This aligns with broader calls for a just transition to net zero, a component of which is procedural justice, that is, people feeling heard in relation to decisions that affect them (Simmonds et al. 2025). Civilisation of VSCMs therefore requires integration of quantitative metrics and accounting strategies with social scientific insights and deliberative process design to include marginalised actors.

6 | Conclusion

International policies continue to identify soil carbon sequestration as a key mitigation measure. As a result, globally corporations and international institutions are increasingly promoting carbon-sequestering practices and the generation of tradable credits through offsetting and inseting. Agriculture-based credits, although still a small segment of the VCM, are growing rapidly compared to other projects. Despite this, soil carbon has received limited research attention with respect to processes of marketisation. Addressing this research gap is pressing given the specific challenges associated with the role of soil carbon in mitigation and the dynamic VSCM governance landscape where offsetting and inseting intersect.

Our study contributes to methodological and theoretical development in this new area of scholarship. Although derived from a UK-specific study, these contributions are transferable to international contexts. First, the study has demonstrated the utility of the Net-Map methodology in understanding 'messy' emerging market configurations featuring in vivo experimentation. Considering the relatively rapid evolutionary pace of VSCMs, we have illustrated how the Net-Map method can support visualisation of markets and capture insights from diverse stakeholders regarding actors, interactions and power relations. We suggest that academic and policy researchers could utilise this method in future when seeking to quickly understand novel market configurations and controversies.

Second, we theoretically advance Callon's work by incorporating an understanding of power relations. The role of knowledge in structuring power dynamics is particularly important with respect to calculative practices and tools as market devices for soil carbon in our study. UK VSCMs are complex, and the unfair distribution of benefits between actors risks delivering unjust outcomes without better understanding among decision makers, inclusion of diverse perspectives, and informed regulation. Furthermore, by extending Callon's market focus to incorporate inseting, we capture the prominent role of agribusinesses in the emerging *agencement*, which brings new actors and different matters of concern. Future social science research can increase clarity on inseting relationships and better understand

their implications for farmers. Private companies are likely to continue to be impactful in shaping the design and implementation of climate governance mechanisms; therefore, our attention should be not only on regulation but also on embedding a culture of procedural justice in supply chains to promote fair outcomes.

Acknowledgements

We are grateful to our anonymous participants for sharing their time and expertise with us. Thanks are due also to Caitlin MacKenzie and Mia Heath for their assistance with data transcription. This work was supported through University of Gloucestershire QR funding.

Funding

This work was supported by the University of Gloucestershire.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Endnotes

¹ Carbon farming practices aim to reduce emissions (e.g., fertiliser and animal management) and enhance soil organic matter (e.g., minimum tillage, cover crops, residue management and rotational grazing). Carbon farming is associated with agroforestry, regenerative agriculture and climate smart agriculture systems.

² Scope 3 emissions for a company are those indirect emissions resulting from value chain activities (Greenhouse Gas Protocol 2011).

References

- 3Keel. 2025. "Addressing Agricultural Scope 3 Emissions: Best-Practice Principles for Within Value Chain Mitigation."
- AlliedOffsets. 2022. "Supply and Demand in the UK Voluntary Carbon Market (Allied Offsets)—Climate Change Committee." <https://www.theccc.org.uk/publication/supply-and-demand-in-the-uk-voluntary-carbon-market-allied-offsets/>.
- Arla UK. 2023. "Carbon Net Zero Roadmap."
- Asadnabizadeh, M., and E. Moe. 2024. "A Review of Global Carbon Markets From Kyoto to Paris and Beyond: The Persistent Failure of Implementation." *Frontiers in Environmental Science* 12: 1368105. <https://doi.org/10.3389/FENVS.2024.1368105>.
- Bakker, K. J. 2004. "An Uncooperative Commodity: Privatizing Water in England and Wales." In *An Uncooperative Commodity: Privatizing Water in England and Wales*. Oxford University Press. <https://doi.org/10.1093/oso/9780199253654.001.0001>.
- Barbato, C. T., and A. L. Strong. 2023. "Farmer Perspectives on Carbon Markets Incentivizing Agricultural Soil Carbon Sequestration." *npj Climate Action* 2, no. 1: 26. <https://doi.org/10.1038/s44168-023-00055-4>.
- Bigger, P., and J. Dempsey. 2018. "The Ins and Outs of Neoliberal Natures." *Environment and Planning E: Nature and Space* 1, no. 1–2: 25–43.
- Black, H. I. J., M. S. Reed, H. Kendall, et al. 2022. "What Makes an Operational Farm Soil Carbon Code? Insights From a Global Comparison of Existing Soil Carbon Codes Using a Structured

Analytical Framework." *Carbon Management* 13, no. 1: 554–580. <https://doi.org/10.1080/17583004.2022.2135459>.

Braun, V., and V. Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3, no. 2: 77–101. <https://doi.org/10.1191/1478088706QP0630A>.

Bridge, G., H. Bulkeley, P. Langley, and B. van Veelen. 2020. "Pluralizing and Problematising Carbon Finance." *Progress in Human Geography* 44, no. 4: 724–742. <https://doi.org/10.1177/0309132519856260>.

BSI. 2025a. "BSI Flex 703 v1.0 Supply of Nature-Based Carbon Benefits." BSI. <https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/bsi-flex-703-supply-of-nature-based-carbon-benefits-specification/>.

BSI. 2025b. "Nature Investment Programme." <https://www.bsigroup.com/en-GB/products-and-services/standards-services/the-nature-investment-standards-programme/>.

Buck, H. J., and A. Palumbo-Compton. 2022. "Soil Carbon Sequestration as a Climate Strategy: What Do Farmers Think?" *Biogeochemistry* 161, no. 1: 59–70. <https://doi.org/10.1007/S10533-022-00948-2>.

Callon, M. 1998. "An Essay on Framing and Entangling: Economic Networks and Heterogeneous Engineers." In *The Laws of the Markets*, 244–269. Blackwell Publishers.

Callon, M. 2009. "Civilizing Markets: Carbon Trading Between In Vitro and In Vivo Experiments." *Accounting, Organizations and Society* 34, no. 3–4: 535–548. <https://doi.org/10.1016/J.AOS.2008.04.003>.

Carton, W. 2020. "Rendering Local: The Politics of Differential Knowledge in Carbon Offset Governance." *Annals of the American Association of Geographers* 110, no. 5: 1353–1368. <https://doi.org/10.1080/24694452.2019.1707642>.

Chartier, A., and M. Tsayem Demaze. 2022. "Hybridizations and Reconfigurations in the Roles of Actors in Voluntary Carbon Offsetting." *Local Environment* 27, no. 8: 1007–1028. <https://doi.org/10.1080/13549839.2022.2091530>.

Chivers, C. A., L. Barkley, and C. Short. 2025. "Agonistic Pluralism for Enhancing the Co-Design of Agri-Environmental Policy." *Ambio* 54, no. 8: 1414–1430. <https://doi.org/10.1007/S13280-025-02158-0>.

Colby, A., M. F. Johnson, C. H. Wagner, and C. B. Wardropper. 2025. "Market Approaches to Sequester Soil Organic Carbon on Farms: Justifications and Suggested Transformations From Embedded Market Actors." *Agriculture and Human Values* 42, no. 3: 1553–1575. <https://doi.org/10.1007/S10460-024-10694-W>.

Conservation International. 2025. "Principles for High Integrity Insetting in the Land Sector. conservation.org." <https://www.conservation.org/projects/advancing-insetting-for-climate-nature-and-people>.

Cortés-Calderón, S. V., M. D. López-Rodríguez, A. Jiménez-Aceituno, A. J. Castro, and M. Mancilla-García. 2025. "Contributions of Net-Map to Sustainability Action Research." *Current Opinion in Environmental Sustainability* 75: 101542. <https://doi.org/10.1016/J.COSUST.2025.101542>.

Elliott, J., J. Ritson, M. Reed, and O. Kennedy-Blundell. 2022. "The Opportunities of Agri-Carbon Markets: Policy and Practice." Green Alliance. <https://green-alliance.org.uk/publication/the-opportunities-of-agri-carbon-markets-policy-and-practice/>.

European Commission. 2024a. "Carbon Removals and Carbon Farming." https://climate.ec.europa.eu/eu-action/carbon-removals-and-carbon-farming_en#eu-carbon-removals-and-carbon-farming-certification-crcf-regulation.

European Commission. 2024b. "The European Green Deal." https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.

Fleming, A., C. Stitzlein, E. Jakku, and S. Fielke. 2019. "Missed Opportunity? Framing Actions Around Co-Benefits for Carbon

- Mitigation in Australian Agriculture." *Land Use Policy* 85: 230–238. <https://doi.org/10.1016/J.LANDUSEPOL.2019.03.050>.
- Forests, Land and Agriculture. 2026. "Science Based Targets Initiative." <https://sciencebasedtargets.org/sectors/forest-land-and-agriculture>.
- Foucault, M., and R. Hurley. 1978. *The History of Sexuality*. Vol. 1. Pantheon Books.
- Freidberg, S. 2014. "Footprint Technopolitics." *Geoforum* 55: 178–189. <https://doi.org/10.1016/J.GEOFORUM.2014.06.009>.
- Gosnell, H., N. Gill, and M. Voyer. 2019. "Transformational Adaptation on the Farm: Processes of Change and Persistence in Transitions to 'Climate-Smart' Regenerative Agriculture." *Global Environmental Change* 59: 101965. <https://doi.org/10.1016/j.gloenvcha.2019.101965>.
- Granjou, C., and G. Meulemans. 2023. "Bringing Soils to Life in the Human and Social Sciences." *Soil Security* 10: 100082. <https://doi.org/10.1016/J.SOISEC.2022.100082>.
- Greenhouse Gas Protocol. 2011. "Corporate Value Chain (Scope 3) Accounting and Reporting Standard." <https://ghgprotocol.org/corporate-value-chain-scope-3-standard>.
- Gross, J. C., A. Colby, M. F. Johnson, and C. B. Wardropper. 2026. "Perceived Equity Dimensions of Agricultural Carbon Markets in the US Midwest." *Journal of Rural Studies* 121: 103940. <https://doi.org/10.1016/J.JRURSTUD.2025.103940>.
- Gutiérrez, M. 2011. "Making Markets Out of Thin Air: A Case of Capital Invention." *Antipode* 43, no. 3: 639–661. <https://doi.org/10.1111/J.1467-8330.2011.00884.x>.
- Hackfort, S., and T. Haas. 2025. "The Political Economy of Carbon Farming: Analyzing Agribusiness' Accumulation Strategy and the Imaginary of Soil Carbon Markets." *Environmental Science & Policy* 171: 104123. <https://doi.org/10.1016/J.ENVSCI.2025.104123>.
- Howard, P. H. 2016. "Food System Concentration: A Political Economy Perspective." In *Concentration and Power in the Food System*, 1–16. Bloomsbury Academic.
- ICROA. 2026. "Endorsed Crediting Programmes." ICROA. <https://icroa.org/endorsed-organisations/>.
- ICVCM. 2026. "Assessment Status." ICVCM. <https://icvcm.org/assessment-status/>.
- Ingram, J., D. Maye, and M. Reed. 2025. "Contestations in the Emerging Soil-Based Carbon Economy: Towards a Research Agenda." *Sustainability Science* 20: 597–611. <https://doi.org/10.1007/S11625-024-01609-Z>.
- IPCC. 2022. "Land-Climate Interactions." In *Climate Change and Land: IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*, P.R. Shukla, J. Skea, E. Calvo Buendia, et al., 131–248. Cambridge University Press.
- Johansson, E., E. Andersson, and K. Fischer. 2025. "The Race for Carbon in Farmland: Global Mapping of the Emerging Voluntary Market for Soil Carbon Credits." *International Journal of Sustainable Development and World Ecology* 32, no. 7: 810–826. <https://doi.org/10.1080/13504509.2025.2561262>.
- Jones, P., J. Hannam, and C. Collins. 2026. "Evaluating the Economic Co-Benefits of Soil Carbon Sequestration: The Test Case of the UK." *Land Use Policy* 161: 107839. <https://doi.org/10.1016/J.LANDUSEPOL.2025.107839>.
- Karnøe, P., J. K. Kirkegaard, and K. Caliskan. 2022. "Introducing the Lens of Markets-in-the-Making to Transition Studies: The Case of the Danish Wind Power Market Agencement." *Environmental Innovation and Societal Transitions* 44: 79–91. <https://doi.org/10.1016/J.EIST.2022.05.003>.
- Keenor, S. G., A. F. Rodrigues, L. Mao, A. E. Latawiec, A. R. Harwood, and B. J. Reid. 2021. "Capturing a Soil Carbon Economy." *Royal Society Open Science* 8, no. 4: 202305. University of Bordeaux. <https://doi.org/10.1098/RSOS.202305/95857>.
- Knapp, E., C. White, M. O. Luff, J. Stout, and Y. M. Buckley. 2025. "FarmCredit: Developing Carbon and Biodiversity Insetting in the Agri-Food Value Chain." In *Agricultural Economics Society 99th Annual Conference*. The University of Bordeaux. <https://doi.org/10.22004/AG.ECON.356725>.
- Knox-Hayes, J., J. Hayes, and E. L. Hughes. 2020. "Carbon Markets, Values, and Modes of Governance." In *Knowledge for Governance*, vol. 15, 193–224. Springer Nature. <https://link-springer-com.glos.idm.oclc.org/content/pdf/10.1007/978-3-030-47150-7.pdf#page=196>.
- Kon Kam King, J., C. Granjou, J. Fournil, and L. Cecillon. 2018. "Soil Sciences and the French 4 Per 1000 Initiative—The Promises of Underground Carbon." *Energy Research & Social Science* 45: 144–152. <https://doi.org/10.1016/J.ERSS.2018.06.024>.
- Koronka, J., P. Ovando, and J. Vergunst. 2022. "Understanding Values Beyond Carbon in the Woodland Carbon Code in Scotland." *Trees, Forests and People* 9: 100320. <https://doi.org/10.1016/J.TFP.2022.100320>.
- Kreibich, N. 2024. "Toward Global Net Zero: The Voluntary Carbon Market on Its Quest to Find Its Place in the Post-Paris Climate Regime." *Wiley Interdisciplinary Reviews: Climate Change* 15, no. 5: e892. <https://doi.org/10.1002/WCC.892>.
- Lane, R., and P. Newell. 2016. "The Political Economy of Carbon Markets." In *The Palgrave Handbook of the International Political Economy of Energy*, edited by T. Van de Graaf, B. K. Sovacool, A. Ghosh, F. Kern, and M. T. Klare, 247–267. Palgrave Macmillan. https://doi.org/10.1057/978-1-137-55631-8_10.
- Lövbrand, E., and J. Stripple. 2011. "Making Climate Change Governable: Accounting for Carbon as Sinks, Credits and Personal Budgets." *Critical Policy Studies* 5, no. 2: 187–200. <https://doi.org/10.1080/19460171.2011.576531>.
- Lovell, H. 2015. "Low-Carbon Economies." In *Research Handbook on Climate Governance*, edited by K. Bäckstrand and E. Lövbrand, 356–365. Edward Elgar Publishing Ltd. <https://doi.org/10.4337/9781783470600.00043>.
- Medeckytė-Žydelė, K. 2025. "Carbon Offsets in Agriculture: Linking Soil Organic Carbon and Measurement, Reporting and Verification Framework With Financial Reporting." *Journal of Financial Reporting and Accounting* 24: 1–28. <https://doi-org.glos.idm.oclc.org/10.1108/JFRA-03-2025-0214>.
- Metelkamp, L., and E. Schiffer. 2020. "Epistemic Cartography: Evaluating Net-Map as a Frontline Tool for Navigating Informal Knowledge Networks." *Southern African Journal of Environmental Education* 36: 73–93. <https://doi.org/10.4314/SAJEE.V36I1.11>.
- Oldfield, E. E., A. J. Eagle, R. L. Rubin, J. Rudek, J. Sanderman, and D. R. Gordon. 2022. "Crediting Agricultural Soil Carbon Sequestration." *Science* 375, no. 6586: 1222–1225. <https://doi.org/10.1126/SCIENCE.ABL7991>.
- Paul, C., B. Bartkowski, C. Dönmez, et al. 2023. "Carbon Farming: Are Soil Carbon Certificates a Suitable Tool for Climate Change Mitigation?" *Journal of Environmental Management* 330: 117142. <https://doi.org/10.1016/J.JENVMAN.2022.117142>.
- Phelan, L., P. J. Chapman, and G. Ziv. 2024. "The Emerging Global Agricultural Soil Carbon Market: The Case for Reconciling Farmers' Expectations With the Demands of the Market." *Environmental Development* 49: 100941. <https://doi.org/10.1016/J.ENVDEV.2023.100941>.
- Phelan, L., P. J. Chapman, and G. Ziv. 2025. "The Role of Information in Shaping the Emerging Agricultural Soil Carbon Market." *Journal of Rural Studies* 120: 103861. <https://doi.org/10.1016/J.JRURSTUD.2025.103861>.
- Purdon, M., and P. Byakagaba. 2025. "Mapping the Ontology and Epistemology of Research Into Forest Carbon Offsetting in Developing

Countries.” *Environmental Policy and Governance* 35, no. 5: 928–944. <https://doi.org/10.1002/EET.70015>.

Reay, D. S. 2020. “Land Use and Agriculture: Pitfalls and Precautions on the Road to Net Zero.” *Frontiers in Climate* 2: 532810. <https://doi.org/10.3389/FCLIM.2020.00004>.

Reed, M. S., J. M. McCarthy, E. A. Jensen, R. Everett, and H. Rudman. 2025. “Governing High-Integrity Markets for Ecosystem Services.” *Ecosystem Services* 75: 101760. <https://doi.org/10.1016/J.ECOSER.2025.101760>.

Romm, J., S. Lezak, and A. Alshamsi. 2025. “Are Carbon Offsets Fixable?” *Annual Review of Environment and Resources* 50, no. 1: 649–680. <https://doi.org/10.1146/ANNUREV-ENVIRON-112823-064813>.

Rosin, C., H. Campbell, and J. Reid. 2017. “Metrology and Sustainability: Using Sustainability Audits in New Zealand to Elaborate the Complex Politics of Measuring.” *Journal of Rural Studies* 52: 90–99. <https://doi.org/10.1016/J.JRURSTUD.2017.02.014>.

Sattler, C. 2022. “Using Process Net-Map to Analyze Governance Innovations in the Forestry Sector.” *Ecosystem Services* 55: 101433. <https://doi.org/10.1016/J.ECOSER.2022.101433>.

Säwe, F., and J. Hultman. 2018. “Two Sustainability Epistemologies in the Marketization of a Natural Resource.” *Environmental Policy and Governance* 28, no. 1: 28–38. <https://doi.org/10.1002/EET.1784>.

Schiffer, E., and J. Hauck. 2010. “Net-Map: Collecting Social Network Data and Facilitating Network Learning Through Participatory Influence Network Mapping.” *Field Methods* 22, no. 3: 231–249. <https://doi.org/10.1177/1525822X10374798>.

Schiffer, E., and D. Waale. 2008. “Tracing Power and Influence in Networks: Net-Map as a Tool for Research and Strategic Network Planning.”

Simmonds, P., D. Maye, J. Ingram, A. Gardner, and S. Raseta. 2025. “Deliberative Approaches to the Climate Crisis: Adapting Climathons for Rural Communities.” *Area* 57: e12994. <https://doi.org/10.1111/AREA.12994>.

Spijker, E. 2024. “Navigating the Complex Policy Landscape for Carbon Farming in The Netherlands and the EU.” *Open Research Europe* 4: 228. <https://doi.org/10.12688/OPENRESEUROPE.18411.1>.

Stanley, T., and G. Cusworth. 2025. “Legitimacy in the Making: Conservatism, Additionality and Natural Capital Accreditation in the UK’s Woodland Carbon Code.” *Environment and Planning E: Nature and Space* 8, no. 6: 2018–2037. <https://doi.org/10.1177/25148486251379613>.

Tesco. 2023. “Tesco’s Ambitious Net Zero Targets Validated by Science Based Targets Initiative.” <https://www.tescopl.com/tesco-s-ambitious-net-zero-targets-validated-by-science-based-targets-initiative/>.

The Carbon Trust. 2023. “Scope 3 Emissions: What Are They and Why Do They Matter?” <https://www.youtube.com/watch?v=QT6FAWwPdKk&t=1s>.

The Tenancy Working Group. 2022. “The Rock Review: Working Together for a Thriving Agricultural Tenanted Sector.” <https://www.gov.uk/government/publications/the-rock-review-working-together-for-a-thriving-agricultural-tenanted-sector>.

Wang, C. M., J. Ingram, P. Simmonds, and D. Maye. 2026. “Soil Carbon Markets for Climate Change Mitigation? Pragmatic Economists and Matters of Concern.” *Environment and Planning A: Economy and Space*. <https://doi.org/10.1177/0308518X261453753>.

Wibeck, V., A. Jaku, S. Lee, and B. O. Linnér. 2026. “The Widening Scope of Just Transitions Research: A Review of an Emblematic Concept.” *Environmental Policy and Governance* 36: 181–193. <https://doi.org/10.1002/EET.70040>.

Wolf, S. A., and R. Ghosh. 2020. “A Practice-Centered Analysis of Environmental Accounting Standards: Integrating Agriculture Into

Carbon Governance.” *Land Use Policy* 96: 103552. <https://doi.org/10.1016/J.LANDUSEPOL.2018.08.003>.

Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Details of the thematic analysis of interview data in NVivo, illustrating the initial deductive parent nodes, those that were identified as most relevant after inductive coding (highlighted grey), and an example inductive code for each of those major parent nodes.