

Learning from the past and embracing future opportunities: Perceptions of new Environmental Land Management Schemes and private nature markets

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ABSTRACT

The combination of Brexit and UK government targets, e.g., to address climate change and biodiversity loss, has accelerated the development of new Agri-environmental Scheme (AES), the Environmental Land Management Schemes (ELMS). To improve ELMS design and implementation, it is timely to understand farmers' and farm advisers' views on these schemes, including their design, rollout and fit with pre-existing and new nature markets, e.g., carbon, Biodiversity Net Gain (BNG). Previous research has assessed AES for their attractiveness to farmers and effectiveness. This study examines new challenges associated with the increasing role of the private sector in funding nature recovery on farms, expected increased levels of participation and an increased requirement for collaboration to deliver landscape-scale nature recovery.

To understand how this new policy landscape is perceived by the agricultural sector, 18 interviews were conducted with farmers and advisors (farmer advisors and nature market experts). Findings show that perceptions are shaped by previous involvement with AES (e.g., payment rates, participation costs, inflexibility) which although largely negative, highlight areas for better scheme design. New insights on farmer participation emphasise the roles of policy uncertainty, market integrity concerns, and collaboration, including with non-farmers, e.g., conservation organisations, water companies. Slow policy release was stressed as a key reason for low adoption and underscores the importance of aligning AES incentives with policy objectives. Furthermore, participants raised a need for cross market compatibility, compliance flexibility and fundamental questions about achieving carbon neutrality as a prerequisite for carbon market participation. On the positive side, participants agreed that new schemes/markets are breaking down social barriers through the necessity to work with a wider group of stakeholders and have been a driver for increasing interest in farm clusters.

1. Introduction

Agricultural policy in England has undergone the greatest change in 50 years due to growing climate commitments, biodiversity targets (Markwick, 2023; UNFCCC, n.d.) and the phasing out of European Union Common Agricultural Policy (CAP) subsidies to farmers (Basic Payment Scheme, BPS), which represented between 7 % (horticulture) and 82 % (lowland grazing livestock) of total farm business income between 2020 and 2021 (Duchy College, Rural Business School, 2021). Post-Brexit agricultural policy has accelerated the development of finance mechanisms for ecosystem service delivery, such the publicly funded ELMS (GOV UK, 2020), and private nature markets including compliance market schemes (Biodiversity Net Gain, BNG, Nutrient Neutrality, NN, carbon), and voluntary carbon and Natural Flood Management (NFM) schemes (HM Government, 2023a).

These finance mechanisms range in scope and scale, with some (e.g., Landscape Recovery, BNG, carbon) aiming to draw in private investment through increasing emphasis on habitat creation and long-term management agreements. In contrast, lower tiers of ELMS (e.g. the

Sustainable Farming Incentive (SFI)), share similarities with previous AES as they involve smaller scale actions which can be achieved alongside farming (e.g. buffer strips, agroforestry). However in contrast to old AES (which peaked at 39 % of agricultural land use in 2013 before dropping to 16 % in 2020), the SFI aims to increase nationwide adoption to reach 70 % of farmers (GOV UK, 2023). Although an individual farmer scheme, it is increasingly being used by farmer clusters to fulfil collaborative environmental outcomes or local nature recovery strategies (pers comm, 2024). Table 1 provides a summary of some of the main AES (under CAP), ELMS, and new nature markets discussed in the study.

To promote AES and nature market participation, evidence that AES can improve the income and social capital of participants, while addressing barriers to adoption, e.g., increased workload (Mills, 2012) need to be explored and addressed. Early ELMS research suggests that farmers may be hesitant to participate given their previous experiences (Hurley et al., 2022), which include; low payment rates, a lack of trust in the ministerial body overseeing schemes (Department for Environment Food and Rural Affairs (DEFRA)) largely driven by penalties enforced, existing workload, age (Huang et al., 2022; Hurley et al., 2022),

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bureaucratic issues, and the underlying complexity and rigidity of the schemes (Coyne et al., 2021; Westaway et al., 2023). To overcome previous barriers, principles of policy co-design were implemented during the design of the SFI, including a pilot which included over 800 farmers on a broad range of farm types and 10,000 actions delivered (Evans, 2024). Despite reported issues with the co-design of the policy including insufficient communication between DEFRA and farmers and a lack of transparency (Little et al., 2024), the pilot did influence scheme design, i.e., increasing payment rates which resulted in a 5-fold increase in coverage from 358,000 ha (2021) to 1,675,000 ha (2023) (DEFRA, 2024a).

As well as pre-existing barriers such as high upfront capital costs, limited equipment, and administrative bureaucracy (reported for the Peatland Code) (Moxey et al., 2021), Landscape Recovery (LR) and private nature markets present new challenges due to long-term commitments, funding challenges (Barkley et al., 2024), and the need for a broad range of advisors (Barkley et al., 2024; Jones et al., 2023; Tyl-lanakis et al., 2023). Despite this, research on long-term environmental agreements within UK agriculture highlights a willingness to collaborate to achieve landscape-scale change (Jones et al., 2023; McKenzie et al., 2013). Previous research has found geographic connectivity and similar cultural perspectives are essential (Jones et al., 2023; Kam, 2024), which highlights a need to further explore the elements of successful collaborative practices in agriculture.

This is a critical time in English agricultural policy with the roll out of ELMS and new focus on nature markets. Furthermore, internationally, the direction of travel for agricultural policies is moving towards public goods provision, e.g., new *Good Agricultural and Environmental Conditions* required for the European Union's Farm to Fork Strategy (European Commission, 2024), and landscape quality payments in Switzerland (Mann et al., 2023). Yet, as an early mover in transitioning public farmer support based solely on public goods delivery (Bateman and Balmford,

2018), England is an interesting case study from which other countries can learn. This research uses semi-structured interviews with farmers and advisers to update knowledge on perceptions on agri-environmental policy and to gain new insights on private nature markets and policies. The study is the first to integrate the public-private finance stakeholder perspective, providing important cross-policy insights on how both financial mechanisms may be utilised to achieve large scale, long-term nature recovery and to secure farm business resilience.

2. Methods

The research design and methodology were approved by the University of East Anglia's Science Faculty Research Ethics Subcommittee (ETH2324-0496, December 2023). Consistent with this, all participants were sent a participant information sheet, a consent form and are pseudonymised.

Contextual information on participants was gathered before interviews. Two questionnaires were developed one for farmers/landowners and a second for farm advisors/natural capital experts (hereby referred to as "advisors"). The former collected demographics (including gender and age) and farm characteristics and the latter information on their role and location of work. Two semi-structured interview scripts were developed. The scripts grouped discussion around five broad topic areas: (1) previous participation in AES; (2) perceptions of the ELMS; (3) perceptions of private nature markets; (4) the provision of advice to farmers interested in new finance streams (advisor script only); and (5) the importance of collaboration in achieving the outcomes of these markets, (see supplementary material). Both scripts were piloted, the farmer/landowner script with a landowner, and the advisor script with a land agent.

An opportunity and snowballing sampling approach was taken to reflect the broad range of advisors involved in new private nature

Table 1
Finance streams for ecosystem services provision.

Funding	Scheme	Contract Term	Scale	Reference
CAP Agri-environmental schemes				
Public	Environmental Stewardship: Entry Level Stewardship and Organic Level Stewardship	5-year	Individual farm actions (organic actions for organic agreements)	DEFRA, (2005a, 2005b)
	Environmental Stewardship: Higher Level Stewardship	10 to 20-year agreement	Individual farm actions – aims for significant environmental benefits in high priority areas. More complex actions	DEFRA, (2005c)
	Countryside Stewardship: Capital Grants	NA	Small scale restoration of boundary features such as hedges or stone walls	DEFRA, (2014)
	Countryside Stewardship: Mid-Tier	5-year (longer in some circumstances)	Individual farm actions to address widespread environmental issues	DEFRA, (2014)
	Countryside Stewardship: Higher-Tier	5-year (longer in some circumstances)	Individual farm actions – aims for significant environmental benefits in high priority areas. More complex actions	DEFRA, (2014)
Post-Brexit AES: Environmental Land Management Schemes (ELMS)				
Public	Sustainable Farm Incentive (SFI)	3 to 5-year agreement	Individual farm actions – but may be applied in a cluster context	DEFRA, (2024b)
	Countryside Stewardship Plus	5-year (longer in some circumstances)	Individual farm actions – aims for significant environmental benefits in high priority areas. More complex actions	DEFRA, (2024b)
Initially public with transition towards self-finance (private markets)	Landscape Recovery (LR)	Long-term agreements	Landscape scale projects involving multiple landowners	DEFRA (2023b)
Nature Markets				
Private	Carbon	Medium to long term	Range of scales	IUCN, (2023); Woodland Carbon Code (no date)
	Biodiversity Net Gain	30-year agreement	Range of scale depending on developer requirements	DEFRA (2024c)
	Nutrient Neutrality	80-year agreement	Range of scale depending on developer requirements	Natural England (2022)
	Natural Flood Management	Range of agreement lengths	Range of scales	Environment Agency and DEFRA, (2024b)

markets and ELMS-Landscape Recovery, e.g., farmer/conservation advisors and natural capital advisors as well as the perspectives from farmers/land managers. Agricultural advisors not only provide their professional perspective, but also indirectly represent the perspectives of a wider group of farmers and land managers (Hurley et al., 2022). Furthermore, advisors may provide their own personal perspective as a farmer/land manager themselves since some farmers may also work in an advisory capacity. Natural capital advisors were included to provide an insight into novel private markets. Interviewees were identified via: (a) existing contacts of the researchers; (b) networking at popular agricultural conferences, e.g., Oxford Real Farming Conference (ORFC, <https://orfc.org.uk/>); (c) emailing potential participants using publicly available addresses; and (d) a snowball sampling strategy. For the latter, at the end of each semi-structured interview the participant was asked to recommend and provide contact information for other potential interviewees.

A final participant recruitment step identified gaps in the participant types. Gaps were identified for the farmer group using farming enterprise, farm size and location, and previous participation in AES, leading to the researchers contacting upland farmers and farmers with no previous participation in AES. The advisors were identified by spatial location (i.e., agricultural production regions) and job role, e.g., ecologist, to reflect the broad range of advisors involved in new private nature markets (e.g. Biodiversity Net Gain) and Landscape Recovery, leading to the researchers contacting a farm advisor from a water company. The outcome of this final recruitment step was two new interviews; one with a farmer who had never participated in AES, and one with a water company farm advisor, to provide insight on Nutrient Neutrality and Natural Flood Management schemes.

Interview invitations were emailed to 53 potential participants, of which 30 participants responded (57 % response rate) and 18 interviews were scheduled and completed between January and May 2024 (34 % interview rate) using three different modes ($n = 18$; 1 via telephone, 3 in person, and 14 on MS Teams). In total, eight interviews were with farmers/land managers and 11 interviews were with advisors. One interview was undertaken with two participants from the same organisation and was treated as one interviewee in the analysis (Advisor_4). Participant information is summarised in Table 2 and summarised questionnaire responses are in the supplementary data.

Each interview was recorded either on an audio recorder and then transcribed using MS Word or on MS Teams with the transcription option enabled. Farmer/land manager interviews lasted between 30 min and 84 min (mean 45 min) and the advisor/natural capital advisor interviews lasted between 26 min and 52 min (mean 41 min). Although interviews continued until data saturation was reached (Braun and Clarke, 2006), this did not lead to a geographically representative sample of farmers as a high proportion of the farmer interviewees were based in East Anglia (5/8) and upland farmers are unrepresented. Mitigating this, some of the advisors interviewed worked within upland regions (North West = 6/11, South West = 4/11) so therefore incorporated experiences in these regions. Furthermore, all farmers interviewed in the study identified as male, meaning that a female farming perspective is absent. However, as 84 % of farmers in the UK are male (DEFRA, 2024b), the interview sample mostly aligns with the wider farming demographic.

Transcripts were checked twice by the lead researcher for accuracy and amended. At this stage identifying information was anonymised and interviewees were pseudonymised to protect participant identity. All interviewees were sent their transcripts for review and had the opportunity to make amendments. One interviewee (Advisor_2) amended their transcript to remove perspectives that they wished to not be used in the study. Transcripts were inductively coded for thematic analysis using NVivo (20 January 7, 1534) (Braun and Clarke, 2006). The number of participants confirming a viewpoint, e.g., $n = 6$ and extracts from the interviews (in italics) are presented in the results section alongside a breakdown of farmer (F) and advisor (A) responses.

Table 2

Interviewee background and pseudonym.

Participant Pseudonym	Participant Background
Farmers and Land Managers: <i>Participants who own, tenant or contract land (i.e. options to directly participate in schemes/markets)</i>	
Farmer_1	Arable – previous participant in AES and SFI
Farmer_2	Arable – previous participant in AES, current participant in public AES and private nature markets.
Farmer_3	Mixed farm – previous participant in AES, current participant in SFI and BNG.
Farmer_4	Mixed farm (inc dairy) – previous participant in AES, current participant in SFI and interest in private markets
Farmer_5	Mixed farm (inc poultry) – previous participant in AES, current participant and worker within private carbon scheme, SFI participation, interest in BNG.
Farmer_6	Arable and agri-business – previous participant in AES, current participant in private carbon scheme
Farmer_7	Mixed farm (inc forestry) – previous participant in AES, current participant in public AES and private nature markets
Farmer_8	Mixed farm (inc pigs) – previous nonparticipant – considering SFI.
Natural Capital Experts: <i>Knowledgeable experts in ES markets not in an advisory position</i>	
Nature_market_expert_1	Private finance expert (commercial agricultural advisor)
Nature_market_expert_2	Private finance expert (independent organisation)
Agricultural Advisors: Farmer/land manager advisors	
Advisor_1	Commercial agricultural advisor
Advisor_2	County Council
Advisor_3	Farming charity
Advisor_4 (2 persons)	Conservation charity
Advisor_5	Agri-business
Advisor_6	Conservation charity
Advisor_7	Rural union
Advisor_8	Water company

*Description taken from participants response to contextual questionnaire.

3. Results

Four overarching key factors were identified as influential to participation and therefore are critical in the delivery of the Environmental Land Management Schemes (ELMS) and private nature markets, they are design, integrity, uncertainty, and collaboration.

3.1. Design

Financial, flexibility and regulatory aspects of schemes were discussed by participants. The design findings are summarised in Table 3, and detailed extracts are presented below. Perspectives summarised in Table 3 are likely to be an underestimate of participants' views, as due to the open structure of the interviews, not all participants discussed every scheme/market.

As with previous Agri-environmental Schemes (AES), financial incentives, and the opportunity to diversify income were cited as key factors influencing new scheme uptake ($n = 18$, $F = 8$, $A = 10$). The prospect of improving financial resilience was described as a driver to take up previous and new AES schemes ($n = 5$, $F = 2$, $A = 3$):

“So upland farming, for instance, is a real challenge when it comes to making ends meet, so the schemes are obviously really important for filling out financial hole,” (Advisor_6)

However, payment levels under the old AES were identified as insufficient ($n = 5$, $F = 3$, $A = 2$) as with the carbon market ($n = 4$, $F = 1$, $A = 3$). In contrast, payment levels were discussed as being particularly favourable in ELMS ($n = 6$, $F = 3$, $A = 3$), Biodiversity Net Gain (BNG) ($n = 4$, $F = 2$, $A = 2$), and Nutrient Neutrality (NN) ($n = 2$, $F = 1$, $A = 1$).

For both AES and private nature markets, participation costs were

Table 3

Summary of Design Findings (number of participants agreeing or disagreeing).

	Improves financial resilience		Good payment levels		Low transaction costs		Flexible scheme structure		Lenient regulation	
	Agree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Disagree
Previous AES	4	-	1	5	-	4	-	6	-	7
Environmental Land Management Schemes	2	-	6	3	-	4	11	-	3	-
Carbon	1	-	1	4	-	1	2	2	-	-
Biodiversity Net Gain	-	-	4	1	-	5	-	6	-	-
Nutrient Neutrality	-	-	2	-	-	-	-	2	-	-
Natural Flood Management	-	-	-	1	-	1	-	-	-	-
Private Markets (General)	1	-	3	2	-	-	-	1	-	-

often stated as a barrier, e.g., management costs were discussed in context of old AES ($n = 3$, $F = 3$). However, the availability of free advice under the old AES reduced transaction costs and boosted confidence ($n = 2$, $F = 1$, $A = 1$), suggesting it could be incorporated into the ELMS policy. Management-related cost issues were also cited for BNG. However, the source of costs was related to the novel design, specifically the one-off upfront payment and the 30-year agreement length with associated monitoring, reporting, and legal costs ($n = 5$, $F = 3$, $A = 2$).

Rigid scheme design was identified as a key barrier to participation in previous AES ($n = 6$, $F = 3$, $A = 3$) and may also influence participation in new private nature markets, such as the long-term agreements required in BNG ($n = 6$, $F = 2$, $A = 4$):

“Where you’re in long term family ownership and that’s long long term, then I think the 30 years is fine, but not everybody wants to tie up land for 30 years to get a payment.” (Advisor_5)

In contrast, the Sustainable Farming Incentive (SFI) was described as simple and more flexible ($n = 11$, $F = 5$, $A = 6$). This was the largest cited driver of participation as it provides freedom in the actions delivered and the shorter agreements could enable tenant farmers to participate in the scheme.

Closely linked to rigid scheme design, (over) regulation was cited as a barrier to participation in the context of old AES ($n = 7$, $F = 5$, $A = 2$). Strict enforcement damaged relationships between farmers and the Rural Payments Agency (RPA):

“You hear the stories where again a neighbouring farmer who went into a five-year Countryside Stewardship scheme got paid for five years, then had the end audit and they [RPA] came round and measured everything up. He’d got lot of measurements wrong and basically [they said] right, we want all our money back. (...) OK that’s scary. I must admit (...), I don’t want the Big Brother (...) looking over me and sort of saying you’ve done that wrong you’ve done this wrong. Well, the money you’ve just received we’ll take that all back thank you very much. (...) I think well I’ll keep out [of the schemes] because it just frightens me a bit.” (Farmer_8)

In contrast, light touch regulation under ELMS was discussed as a driver to participation ($n = 3$) and a model to engage farmers.

3.2. Integrity

Underlying perceptions of market integrity are beliefs in the conceptual underpinning of schemes, with integrity concerns most frequently discussed in context of the carbon market ($n = 11$), BNG ($n = 10$), and ELMS ($n = 4$).

The design of public-funded schemes was also linked to integrity by participants, with under-regulation identified as a risk factor contributing to low integrity markets ($n = 5$, $F = 2$, $A = 3$). For instance, some participants raised concerns that the more flexible ELMS could backfire ($n = 4$, $F = 1$, $A = 3$) if landowners do not achieve environmental outcomes:

“Well, who’s governing all this? Who’s turning around and saying, well, actually, we do need to inspect (...). So yeah, there’s lots of ways that people could be very under hand and so well, I’ll take that £40–50 a

hectare and buy the seed and not actually do anything. Who’s gonna check?” (Farmer_8)

Despite concerns, some participants mentioned the familiarity of the SFI ($n = 3$, $A = 3$) that when combined with the environmental improvement rationale for AES, was viewed as straightforward and low risk, particularly when compared to private markets. Furthermore, the rationale for the Landscape Recovery (LR) was discussed positively ($n = 5$, $F = 3$, $A = 2$) particularly around connecting landscapes and paying farmers for higher tier actions:

“And obviously what they’ve then tried to do is to try to recognise that there are farms and there are landowners who can do more than that. And there, if they’re willing to do more, they get paid more. So that’s fine. So, I think probably the new ELM scheme does actually go much further and much better than the previous schemes have done and, obviously things like Landscape Recovery now coming into the mix where you can do things on a much bigger scale.” (Advisor_7)

For privately funded schemes, views on integrity varied. The concept of offsetting in the BNG market was discussed as good policy ($n = 4$, $F = 2$, $A = 2$), but integrity concerns ($n = 10$, $F = 3$, $A = 7$) were also raised around farmer relationships with developers, baselining accuracy, the quality of onsite provision, and achieving long-lasting equivalent ecological habitats.

Integrity-related issues were cited as the biggest barrier to participation in the carbon market ($n = 11$, $F = 4$, $A = 7$) with the market being viewed as suspicious, “a Wild West”, and enabling greenwashing. Of most concern was carbon ‘insetting’ ($n = 8$, $F = 2$, $A = 6$):

“We are staying completely out of carbon trading because we don’t think we (or any other farmer) should sell carbon without knowing their whole farm operation is carbon negative. Farmers who sell carbon credits to third parties could well find themselves financially exposed in a few years’ time if someone turns up with a carbon tax bill for the farm. If that happens, the farmer will have to buy carbon credits from someone else, most likely at a higher price than they’re trading at now. Hence, it makes sense to deal with your own footprint first, by insetting your emissions against the sequestration your land achieves through its woodland, hedgerows and soils.” (Farmer_4)

Carbon insetting barriers are closely tied to worries about future market access ($n = 4$, $F = 2$, $A = 2$):

“And also talking to the supply chains and seeing (...) they have legally binding targets to report on their Scope 3 emissions and their carbon footprints. They were offsetting and buying credits, [and have] now come [to the] realisation that’s not good business [so] their insetting their carbon footprints down to the supply chain, to farmers. And that’s how I see [if I] sold my carbon, I can’t enter a market in the future where they want to inset.” (Farmer_1)

3.3. Collaboration

A major break with previous AES was an increased role for collaboration. In the context of LR which invites and, in some cases, relies on

private market funding for the projects to be viable, collaboration was fundamental with the necessity to commit to agreements with multiple landowners and stakeholder groups ($n = 17$, $F = 7$, $A = 10$). A key driver for collaborative efforts was to bolster farm business resilience ($n = 7$, $F = 1$, $A = 6$) and this rationale is incentivising farm cluster participation:

"I think that one of the reasons why farmers, or there's probably a couple of reasons why farmers are more interested in joining cluster groups now. One is obviously there's the potential for funding to come through other met means if they do things together. So that's one thing. So obviously, they're looking at their holes in their finance and realising that actually doing things together is a good thing." (Advisor_6).

Participants cited knowledge exchange as essential to successful collaborations ($n = 16$, $F = 7$, $A = 9$), with an emphasis on farmer-to-farmer knowledge exchange ($n = 10$, $F = 5$, $A = 5$) and the influence of leaders in the field of AES and natural capital markets ($n = 6$, $F = 2$, $A = 4$). For instance, an environmental project lead discussed exemplar ventures to inspire their adoption of natural capital markets on their land:

"I'd say farm clusters have been invaluable in doing all this [Knowledge Exchange] as well. Peer-to-peer learning. Collaborating with wider farm clusters and like-minded landowners is really important when trying new things. Understanding what other people are doing, you know, learning from other projects, people like Knepp [(Knepp Estate, n.d.)] and Nattergal [(Nattergal, n.d.)] has been really quite inspirational and enabled us to see that it's all doable" (Farmer_2).

Farming events such as conferences and farm visits ($n = 8$, $F = 4$, $A = 4$) and the popular farming media including the internet ($n = 4$, $F = 4$) were viewed as enablers of farmer-to-farmer knowledge exchange. Advisors were noted as key players in bringing groups of farmers together to facilitate peer-to-peer learning ($n = 6$, $F = 3$, $A = 3$). Within this group, conservation charity advisors were seen to provide essential ecological advice ($n = 7$, $F = 2$, $A = 5$) particularly as this expertise is not yet fully covered by traditional advisory roles such as land agents and agronomists ($n = 3$, $F = 1$, $A = 2$). However, several participants noted the importance of forming a relationship with farmers, such as provided by traditional advisory roles ($n = 3$, $F = 1$, $A = 2$), such as keeping the advice short and simple, as described by an experienced land agent:

"I suppose it's sharing information. I think face-to face meetings are important. You've got to try and find the way that the people you're trying to attract will best receive the information. For instance, there's a meeting which I think is organised by the NFU [National Farmers Union], but it's an update meeting maybe once a year and they have probably 6 or 8 very short sharp updates from people which might be the water company, what they're doing, FWAG [The Farming and Wildlife Advisory Group], the Wildlife Trust, and it's just little bits and pieces. And if you can get farmers along to that sort of thing, then I think they can have a two-way discussion and that's useful. It's gotta be small, small bytes, nothing too major or a lot of people will not be interested in participating" (Advisor_1).

Despite the positivity discussed surrounding collaboration, a major barrier related to traditional attitudes and the current structure of the agricultural industry ($n = 12$, $F = 3$, $A = 9$), necessitates a cultural shift. The way public money is being allocated under ELMS represents a change in the agricultural sector from food production-centred to environmental service delivery ($n = 3$, $F = 1$, $A = 2$). Furthermore, CAP subsidies and previous AES schemes were for individual farmers and land managers which encouraged independence. ELMS and nature markets require a shift away from the isolation and independence of farmers ($n = 5$, $F = 1$, $A = 4$) that has been amplified through competitive marketplaces created by supermarkets:

"So, there's the horizontal collaboration between growers, but actually it's the vertical systems that they each operate on that are making the

large-scale growers much more competitive with each other cause basically supermarkets are playing them off against each other all the time. And they're in this really cut-throat situation where they, umm, yeah, they are having a unique selling point about something, if it, even if it's an environmental thing, then they don't want to share that with the next person because then it won't be a unique selling point." (Advisor_7).

Nevertheless, a lack of common ground between stakeholder groups can occur ($n = 5$, $F = 2$, $A = 3$) and be caused by preconceptions of interests, as explained by a farm advisor for a conservation charity:

"I think some of the language that's coming out from the eNGOs isn't always the most helpful in these situations and I sometimes think there's almost a lack of knowledge, amongst the eNGOs, on the kind of practicalities of farming. I'm not saying this is across the board, but I do think that it can be quite easy for either eNGOs or farmers to not see the opposing opinion and why that might be quite a valid thought as well. (...). I definitely think there is still a bit of a barrier based on our individual and organisational preconceptions" (Advisor_3).

Participants discussed potential solutions to bring collaboration efforts to the forefront. For instance, farm clusters were viewed as a useful starting point for breaking down social barriers between farmer groups and other stakeholder groups ($n = 5$, $F = 2$, $A = 3$), thereby making working with neighbours more appealing:

"I've been quite interested to note that a lot of farmers, when you talk cluster groups or talk about facilitation groups or you talk about landscape recovery, most of them are all ears. Which means that a lot of farmers are interested in working together. Now that's a complete change to what I was experiencing 5–10 years ago, you know, farmers would be very much about their business and yeah, they talk to their neighbours a bit, you know, but their business was their business (...) and they made their money. But now it's very much that everybody's realising, they've got to talk to their neighbours, and they've got to work together with everybody else." (Advisor_6).

A final aspect of collaboration discussed was the role for financial support ($n = 11$, $F = 4$, $A = 7$). Facilitation funding for farm clusters provided under previous AES was viewed as bureaucratic and rigid ($n = 3$, $F = 1$, $A = 2$). There was hope that privately funded clusters might offer a more flexible approach ($n = 2$, $F = 2$) as described by a farmer and farm cluster coordinator:

"So, we did an application for XXX Water Biodiversity Fund effectively to say, we're thinking of running this cluster, could we please have £25,000 to run it for two years? We hope it will improve waterways, biodiversity and soil health, by getting farmers engaged and enthused about these topics. The water company said yes. And the reason we applied for XXX Water funding was because the Facilitation Fund is notoriously rigid, prescriptive, bureaucratic and doesn't provide sufficient funding to cover the time and costs involved in running a cluster." (Farmer_4).

3.4. Uncertainty

Another noticeable difference with previous AES is the rise of uncertainty. Policy uncertainty was central to interviewees responses ($n = 18$) with it influencing involvement both in ELMS and private markets as (early) participation was seen as a business risk. Uncertainty about the schemes and markets contributes to a lack of trust between farmers and governmental organisations:

"It's just so depressing that (...) we're the people that have to put up with this kind of uncertainty" (Farmer_3)

A key aspect of uncertainty identified was slow policy release in the context of ELMS ($n = 8$, $F = 2$, $A = 6$), with this resulting in hesitation by landowners and farmers:

"I think also the government has a part to play in that because if they're not open and honest with the direction with the pending ELMS strategy. (...) I think a lot of farmers have been sitting on the fence. They want to do something, but there's so much uncertainty from the government about what potentially could be promised (...), they just sit on their hands and wait." (Advisor_4)

Uncertainty has also been problematic in the context of BNG (n = 9, F = 5, A = 4); with this making participation seem risky:

"a lot of very kind of significant detail has just been sort of (...) dribbled out. Um so we've just been having to (...) do [BNG] speculatively (...) in good faith that there will be a market for what we are producing." (Farmer_3)

Furthermore, the risk has been exacerbated by a lack of clarity about tax implications (n = 3, F = 2, A = 1):

"So, if you are receiving a large payment up front from sale of BNG units, what are the tax implications? If half of it disappears off to the tax man, then it's not as exciting as first thought. These are long, 30-year commitments, which are likely to result in a permanent change of what you're allowed to do on the land, even after the 30 years expires. The priority is managing land for habitat outcomes rather than food production, so many farmers will be nervous about whether they can trust their children will be able to generate income from that type of land management in the future. Also, what are the inheritance tax implications of changing a farm field to a biodiversity habitat? Is the field no longer defined as "agricultural"? That may mean the owner can't benefit from agricultural property relief to leave it to their children without a tax bill on death." (Farmer_4)

The ability to stack public and private schemes was discussed by half

of the interviewees as a key aspect of scheme uncertainty that directly effects the attractiveness to participate in private nature markets (n = 9, F = 3, A = 6):

"in terms of making those two things [public and private finance] work, they have got to work together. Now how they work together is another question, perhaps. But yeah, that is definitely true and that's not really there yet, I don't think." (Advisor_6)

This is critical as stacking was viewed as being essential to unlock private finance, particularly in ensuring that LR is successful long-term:

"The Landscape Recovery program is a fantastic mechanism for delivering landscape-scale change if we can get the private finance piece right, which is still very nascent. Having public money [from DEFRA] blended alongside private finance significantly de-risks investment, but whilst there is some interest from investors, it is not really flowing yet. Everyone is still learning; landowners, Government and investors" (Farmer_2)

4. Discussion

Design, integrity, uncertainty, and collaboration was found to influence AES and nature market participation, see Fig. 1. These themes overlap and build on the framework for financing nature recovery in the UK by 2030 which finds that high integrity environmental markets require good market design and well-functioning governance and operation rules (Broadway Initiative, 2023).

Under **design**, unsurprisingly, *financial factors* were a key determinant of participation in AES and nature markets (Chaplin et al., 2021; Coyne et al., 2021; Hurley et al., 2022; Jacqmarcq et al., 2024; Westaway et al., 2023). Previous AES payment levels were described as

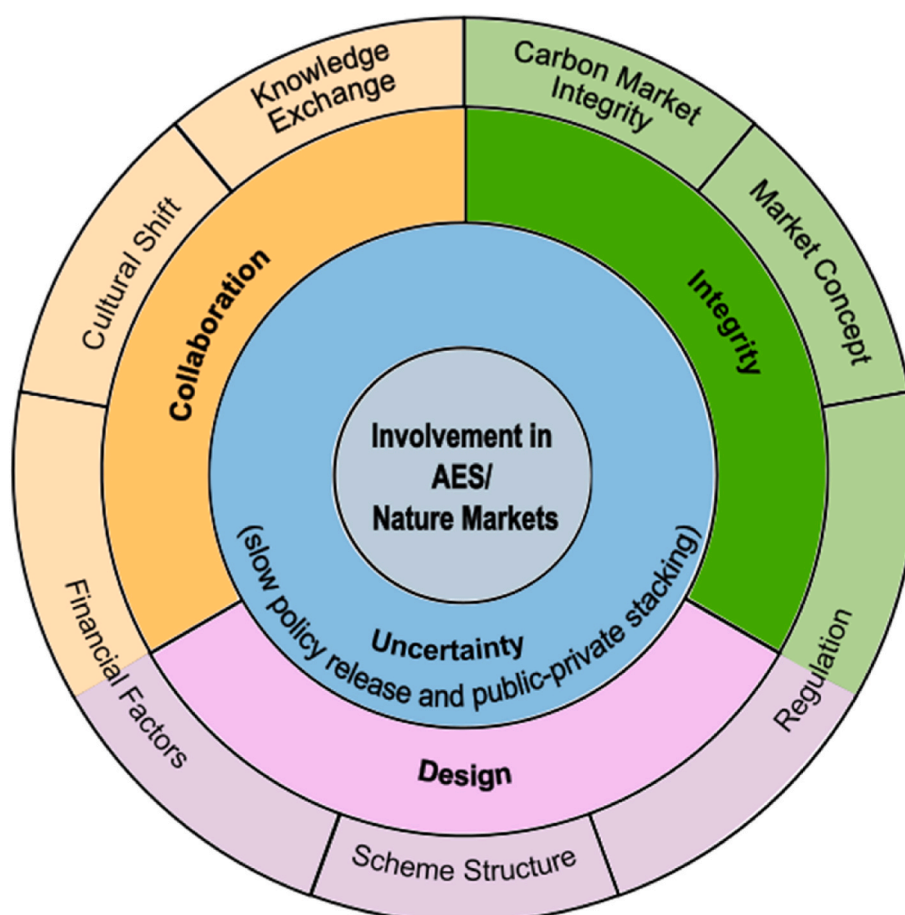


Fig. 1. Key factors underpinning agri-environmental and nature market involvement as identified by study participants.

insufficient to promote widescale uptake (Coyne et al., 2021; Westaway et al., 2023). However, participation in previous AES, was perceived to improve financial resilience (Chaplin et al., 2021; Hurley et al., 2022; Jacqmarcq et al., 2024). Consequently, attractive payment rates were commonly discussed as essential to incentivise ELMS adoption and secure post-Brexit business resilience. Sustainable Farming Incentive agreement data confirm this, initial participation was low (2200 agreements in 2022) (DEFRA, 2024a) before substantially rising to 13,900 agreements (pending >20,000) in 2024 (DEFRA, 2024c) after payment rates were increased in early 2024 (DEFRA, 2024d). Nevertheless, despite the Sustainable Farming Incentive having a familiar agri-environmental **design**, meaning some associated costs are known, there are still concerns relating to the lack of free advice that was available and appreciated under the old AES.

Scheme structure, especially flexibility has been researched as a determinant of participation (Barkley et al., 2024; Jones et al., 2023; Westaway et al., 2023). In this study two interlinked dimensions of flexibility were highlighted; contract length and (agri-environmental) action. The three-year contract length of the Sustainable Farming Incentive was often noted as a driver of participation. In addition, action flexibility was highlighted in discussions about the Sustainable Farming Incentive as it provides farmers the ability to choose actions that suit their farm system, such as, the introduction of rotational options (DEFRA, 2024e). Of note is that both contract length and action flexibility have opened ELMS up to a wider farming demographic, namely tenant farmers, as now the contract length corresponds to the average length of a farm tenancy (3.03 years). This increased scope for participation may grow the scale of adoption as tenanted holdings represent 64 % of the total farmable area in England (Rock, 2022).

Conversely, private nature markets tend to have longer agreements (e.g., Biodiversity Net Gain 30 years, Nutrient Neutrality 80+ years). Unlike other countries with conservation easements such as in the USA (Barkley et al., 2024; Brown et al., 2023; Rodgers, 2019), lengthy environmental agreements have not been commonplace in the UK. Interviewees discussed concerns around land use lock-in and farm succession which are likely to reduce the scope and scale of participation in long-term agreements and thus limit schemes reliant on private investment, i.e., Biodiversity Net Gain, Landscape Recovery or Nutrient Neutrality (Barkley et al., 2024; Jones et al., 2023; Kam and Potter, 2024).

In the context of the Sustainable Farming Incentive, a key contradiction in participant perspectives were mixed views on flexible compliance in scheme **design**. This was welcomed by farmers who had negative experiences with old AES compliance (such as penalties) that has engendered a legacy of mistrust in the government and could hinder future participation (Emery and Franks, 2012; Hurley et al., 2022). However, lenient regulation raised **integrity** concerns such as land managers taking advantage of lucrative options or that options will not be implemented to the standard required to deliver additionality. This has also been raised by Stewart et al. (2022) who suggested that lax ELMS *regulation* could be linked to potential future failure to conserve butterflies. Furthermore, the lure of Sustainable Farming Incentive (2023) payment rates and inappropriate use of flexibility provisions, resulted in 1 % of farmers entering >80 % of their land into actions, specifically, IGL1, IGL2, AHL1, AHL2, AHL3, IPM2 (taking their land out of production) and subsequently led to the government limiting these options to 25 % of a farm's total area to protect food security (DEFRA, 2024f). In addition, on the 11th March, 2025, the Sustainable Farming Incentive abruptly stopped accepting new agreements (DEFRA, 2025). This closure tallies with participants' concern that scheme regulation might become stricter over time, and further contributes to the feeling of **uncertainty** surrounding scheme participation.

Favourable payment rates were highlighted for ELMS and Biodiversity Net Gain. However, due to differences in market **design** (ELMS is a familiar structure, Biodiversity Net Gain is nascent), costs of market participation are still unclear and management and advisory costs have

affected farmer participation in past schemes (Stewart et al., 2022). Further research into the costs of Biodiversity Net Gain is required to ensure this is not a barrier to future market participation. In contrast, carbon credits were not seen as financially appealing. The low price of nature-based carbon credits is a common theme globally and reported as a key reason, combined with policy uncertainty and market integrity, for farmers' non-participation (Dumbrell et al., 2016; Han and Niles, 2023; Kragt et al., 2017).

There is limited research relating to the **integrity** of nature markets from the farmers' perspective, with this research linking integrity to uptake. Study participants often raised integrity as a non-financial participation factor. In this context, the Sustainable Farming Incentive was perceived as a familiar and low risk option; this could reflect that it utilises an AES *structure* as introduced in the Environmentally Sensitive Areas Scheme (1986) and the Countryside Stewardship Scheme (1991) (Lobley and Potter, 1998). Some participants supported the (*market*) *concept* of 'public money for public goods' that was incorporated into the Agriculture Act 2020 (UK Government, 2020). Landscape Recovery was also positively discussed including the aim to promote **collaboration** between stakeholder groups and farmers to achieve large-scale habitat connectivity (GOV UK, 2023). Interview findings support research where the most connected habitats are the most preferred (Jones et al., 2023), and that farmers would be willing to collaborate to achieve landscape-scale change (McKenzie et al., 2013). Furthermore, the collaborative nature of the Landscape Recovery to include facilitators and conservation charity support is likely to increase its effectiveness (Barkley et al., 2024).

Biodiversity offsetting (and net gain) was also generally accepted by study participants as a good idea, with participants viewing the market as an opportunity. Nevertheless, several negative personal attitudes towards housing development, e.g., difficult working relationships with developers, and the integrity of the market, may hinder uptake. The conflict between development and agricultural land use is not a new issue (Barlow, 1988; Bibby, 2009; Munton, 2009), however, the role of new schemes in reframing the relationship between farming and development is yet to be explored in the literature.

Integrity was the biggest barrier to participation in the *carbon market* discussed and is likely to hinder its success in the UK. Key issues raised by the study's participants, are the net zero status of participating farms as UK agriculture is still a net emitter and responsible for 11 % of the UK's greenhouse gas emissions (DEFRA, 2024g) and market access related *regulation*. These comments were potentially influenced by recent media coverage on uncertainty surrounding the 'Green Tractor' labelling and supply chain in-setting requirements (Clarke, 2023). These issues are despite there being established carbon codes in the UK such as the Woodland Carbon Code (WCC) (Woodland Carbon Code, n.d.) and the IUCN Peatland Code (IUCN, 2024). The concerns raised are broadly comparable to a global mistrust in nature-based carbon offsetting with issues such as greenwashing, permanence, food security, and low trust of national governments (Low et al., 2024) dominating recent media (Greenfield, 2023; Lakhani, 2024). Yet, integrity was not identified in UK research on perceptions of the peatland code, where barriers included design elements such as participation costs, bureaucracy (Moxey et al., 2021), and inconsistencies between carbon calculators leading to unreliable measurements (RSK ADAS Limited and DEFRA, 2021). Despite these issues and integrity concerns, the Woodland Carbon Code is projected to sequester 22,948 tonnes of CO₂ in the next 100 years (Forestry Commission, 2023) and peatland restoration could sequester between 23 and 72g carbon m⁻² year⁻¹ (Dunn and Freeman, 2011; Gorham, 1991). Therefore, improving integrity of *carbon markets* through clear policies on supply chains and insetting is urgent as this financial mechanism has a huge potential to enhance UK and international sequestration rates.

As a result of increased opportunity and funding available in the UK, there is growing research and stakeholder interest in landscape-scale collaborative agreements between farmers, with participation and

funding for **collaboration** and advice being perceived by study participants as essential for involvement in some emerging ecosystem service markets (Landscape Recovery, Biodiversity Net Gain, Nutrient Neutrality, Natural Flood Management). The prospect of **collaboration** was met with enthusiasm by most participants ($n = 17$), supporting earlier work by McKenzie et al. (2013), which found that most farmers (81 %, $n = 32$) are willing to collaborate to achieve landscape-scale change. Nevertheless, this study suggests that collaborative practice needs fostering; adequate and flexible funding for peer-to-peer knowledge exchange, and trusted advisors are necessary to ensure that **collaboration** attempts are successful, including facilitating a *cultural shift*, i.e., overcoming isolationist cultural norms and changes in the emphasis placed on public subsidy for public goods delivery. Similar *cultural shift issues* have been seen in Europe, with farmers protesting over increasing greening measures in the Common Agricultural Policy leading to a watering down of environmental policies (Mennig, 2024). This mirrors changes made to the framing of ELMS due to low early adoption rates from prioritising only public goods delivery to later include a dual emphasis on food production (DEFRA, 2023a).

Farmer-to-farmer knowledge exchange was highlighted as a key determinant of successful **collaboration** in this study supporting earlier findings (Kam, 2024; Kam and Potter, 2024; Riley et al., 2018). Participants cited different event formats such as open farm walks, farm cluster meetings, and popular conferences (e.g., Oxford Real Farming Conference, <https://orfc.org.uk/>, Groundswell, <http://groundswellag.com>). Such events facilitate understanding of market participation as they enable farmer-to-farmer knowledge exchange which focusses on practical experiences of participation alongside running a commercial agricultural business (Kam, 2024). Furthermore, these exchanges and events can make interactions between farmers less intimidating and improve social relations between them (Thomas et al., 2020) through allowing personal experiences to be shared with likeminded individuals (Wood et al., 2014).

Within peer-to-peer learning, influential farmers, exemplar farms, and conservation projects were highlighted as central to knowledge exchange through demonstrating feasible business models of market participation. Examples mentioned included well-connected farmers and well-known conservation projects such as the Knepp Estate and Nattergal which has shared their experiences publicly and influenced policy. Other research also found landowner participants had positive perceptions of the Knepp Estate rewilding rollout (Jacqmarcq et al., 2024) and identified the role of strong lead farmers within cluster groups which has led to the self-funding of additional facilitator time (Prager, 2022). Furthermore, social media has been reported as having a growing role with farmers using twitter/X to share their experiences, allowing them to efficiently reach a wider group of stakeholders outside their circles (Mills et al., 2019).

The emphasis placed on farmer-to-farmer learning also points towards a mistrust/distrust between some farmers and conservation organisations. A few participants explained that this could be attributed to conflicting stakeholder interests, e.g., when advice from conservation organisations neglects the logistical challenges of implementing environmental actions within a commercial farm business. There is limited research on this cultural tension in the literature, but research on farmer perceptions of rewilding in the UK has found that rewilding advocates' frequent idealising of the practise does not consider practical difficulties to implementation and its effect on farming and rural communities (Jacqmarcq et al., 2024). This underscores recent research on farmer **collaboration** (Kam, 2024) that found that although all farmer groups studied agreed that collaborating on a landscape-scale facilitated knowledge exchange, they also recognised that long-term conservation would require strong relationships and trust between conservation organisations and land managers. Furthermore, Sutherland et al. (2013) found some farmers were mistrustful of advice from the Royal Society for the Protection of Birds (RSPB), due to negative public statements made about farming. In contrast, farmers were most likely to trust

pro-agricultural organisations with a long-standing reputation including the Farming and Wildlife Advisory Group (FWAG), Linking Environment and Farming (LEAF), and Agriculture and Environmental Consultancy Services (ADAS).

Despite this, this study highlights that conservation organisations are important for providing ecological expertise, facilitating knowledge exchange, and providing administrative support. The role of facilitators and advisors such as initiating contact, running cluster groups, and sending newsletters, has been highlighted in the literature (Jones et al., 2023; Kam, 2024; Prager, 2022). Therefore, to (re)build relationships with farmers and to enable successful facilitations, NGO advisors could learn from and work alongside long-standing agricultural advisors. Commercial agricultural advisors interviewed noted that farmers appreciate strong long-term relationships with their advisors (as also found by Wood et al., 2014), which builds trust in their advice and that they prefer information in small chunks (as also found by Thomas et al., 2020). Another study on agricultural advisors found that 64 % of advisors had visited farmers who had received conflicting advice, with participants pointing towards a lack of knowledge exchange between advisory groups (Vrain and Lovett, 2016). Despite this research, little was discussed in the interviews relating to advisor-to-advisor **collaboration** opportunities, with participants focussing on how they collaborate with farmers. Therefore, further research on the benefits of **collaboration** between different agricultural advisors could determine whether sharing expertise would result in more efficient and effective use of advisor time and resources.

Interviewees highlighted that collaboration can improve farm finances due to participation in markets, strength in numbers, and climate resilience, as also previously reported (Jones et al., 2023; Kam, 2024). However, research has also highlighted farmer concerns about the loss of productive land and that it might be difficult to demonstrate how collaborative practise can open new funding opportunities (Jones et al., 2023). This also underlines the importance of initial **collaboration** funding (Prager, 2022). Within cluster **collaboration** models, participants discussed the funding of their groups which ranged from farmer subscriptions, facilitation funding, and private sector funding (e.g., from water companies). Both farmers and advisors interviewed discussed rigidity and bureaucratic issues related to government facilitation funding and publicly funded AES, supporting earlier research that 34 % of advisors found that the bureaucracy surrounding the facilitation funding prevents close collaboration with farmers (Jackson, 2023; Jones et al., 2020; Prager, 2022). Furthermore, cluster groups often have to find alternative financial provision to continue after facilitation funding has ended (Prager, 2022).

Policy **uncertainty** has not been commonly cited in the literature as a barrier to AES participation perhaps reflecting the stable policy environment provided by the Common Agricultural Policy Pillar 2 schemes and financial resilience provided by Pillar 1 payments. The significance of this result is closely tied to the timely nature of this research, placed in a post-Brexit policy landscape. It is now a central issue discussed in popular farming magazines (e.g., Country Land and Business Association (CLA) magazine, Farmers Guardian, Farmers Weekly), recent literature regarding ELMS policy (Jones et al., 2023; Little et al., 2024; Purewal et al., 2022), and EU agri-environmental policy (Hasler et al., 2022). More specifically, uncertainty can also increase the amount of payment that farmers require to undertake AES actions (Tylianakis et al., 2023). Unlike previous research, this study linked uncertainty to both public and novel private markets (Biodiversity Net Gain, Nutrient Neutrality) with interviewees viewing uncertainty as a barrier to participation and a rationale for decisions to 'wait and see' before committing to new public and private schemes.

In the context of ELMS, interviewees reported that *slow policy release* and trickling information delivery has hindered early scheme adoption and may have reinforced previous mistrust in government. Slow policy information rollout was also reported in the context of Nutrient Neutrality and Biodiversity Net Gain, with unresolved issues relating to

land value, *regulation*, and baselining still occurring after the markets had already launched. A key concern was the uncertainty surrounding inheritance tax implications of participation in nature markets. Others have highlighted this as a reason why farmers might sell their land in a post-Brexit policy landscape (Kam and Potter, 2024). The uncertainty of private market policy has exacerbated the risk associated with participation, supporting early research on Ecosystem Service market design by Lockie (2013) which found that sufficient policy information and clarity are essential for successful Ecosystem Service markets. However, since the interviews, there has been clarification that land under environmental schemes will be treated in the same way as farmland for agricultural property relief and inheritance tax purposes, although the overarching effect this will have on uptake remains unknown (Horne, 2024).

Further clarity issues discussed related to the “stacking” of public schemes and private markets. The participants’ uncertainty on stacking rules was despite the release of government guidance (HM Government, 2023b). Research suggests that the ability to stack ecosystem service markets will increase participation (Dunklin et al., 2024). Furthermore, private market advisors interviewed for this research noted that the lack of clarity on stacking rules compounded by the ease of ELMS participation might “crowd out” private markets. This could unintentionally restrict further mobilisation of private sector funding, which currently only accounts for 18 % of nature-based solution finance globally (United Nations Environment Programme, 2023). In the UK context, this could delay or hinder the achievement of a government target to stimulate £500 million of private sector investment annually into nature recovery in England each year by 2027, rising to at least £1 billion annually by 2030 (HM Government, 2023b). Furthermore, scheme and market compatibility is critical for the success of the Landscape Recovery scheme as in the long-term, projects need to secure private funding to ensure longevity (DEFRA, 2023b).

This study has described key barriers and opportunities to nature market participation, covering novel insights on determinants including policy uncertainty and scheme integrity. Although political uncertainty during the study period may have steered interviewee discussion towards recent policy changes, this highlights the direct and indirect importance of policy stability on scheme involvement and farm business resilience. This research also explored novel private emerging Ecosystem Service markets. However, Nutrient Neutrality and Natural Flood Management were not frequently discussed by study participants. This could reflect the geographical scope of these markets, with interviewees commenting on their specific and localised nature ($n = 2$ Natural Flood Management, $n = 6$ Nutrient Neutrality), for example Nutrient Neutrality is only applicable in 27 catchments as of May 2024 (Natural England and DEFRA, 2024). It may also reflect the opportunity sampling used in the study whereby although some participants were in the preliminary stages of market exploration, none were participating in the nascent, locally specific Nutrient Neutrality or Natural Flood Management markets. This contrasts to the frequently discussed ELMS, carbon, and Biodiversity Net Gain markets, which are more established and straightforward. Future research could provide more insight on specific conservation agreements (Nutrient Neutrality, Natural Flood Management) that may occur between farmers and private businesses, and on newer policies such as water neutrality agreements (Ministry of Housing, Communities and Local Government et al., 2024).

5. Conclusions

Findings from this study contribute to improved understanding of the opportunities and barriers for farmers and landowners to participate in the Environmental Land Management Schemes and private nature markets. Boosting participation is a UK government goal driven by the dual importance of the agricultural sector in contributing solutions to environmental policies, such as enhancing biodiversity, and to contribute to farm business resilience. Moreover, the findings are of

international importance due to increasing global interest in public goods delivery on agricultural land.

As expected in a time of turbulence, with the phasing out of the Basic Payment Scheme, payment rates that contribute to farm business resilience were highlighted by participants. Land use flexibility was also important and may partially explain the early success of the Sustainable Farming Incentive compared to markets with long-term agreements such as Biodiversity Net Gain and Nutrient Neutrality which may be hindered by succession issues, uncertainty surrounding tax implications, and a lack of flexibility. Despite this, participants noted that a key benefit of these new markets and the Landscape Recovery scheme was the increased collaboration opportunities that they are providing, such as through farm clusters, which have been praised for the social benefits they achieve. In addition, new determinants of participation and early adoption have been spotlighted including political uncertainty and carbon market integrity. Both of these issues require detailed and stable policies, to ensure that environmental additionality can be measured to meet government targets, enhance private sector involvement in nature recovery, and to secure the future of farm business resilience.

CRedit authorship contribution statement

K. Dewally: Writing – review & editing, Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **R.H. Bark:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization. **A.R. Harwood:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization. **A.A. Lovett:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jrurstud.2025.103723>.

Data availability

The authors do not have permission to share data.

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