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Identifying economic and societal drivers of engagement in agri-environmental schemes for English dairy producers

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ABSTRACT

Livestock production is under increasing scrutiny regarding its impacts on the environment and its wider role in climate change. Consequently, there are a growing number of private agri-environmental schemes (AES) now operating alongside public AES that offer farmers economic rewards to maintain and enhance the environment. This study focused exclusively on a small number of commercial dairy producers located in the North West of England who were all suppliers of a global food producer and members of the producer’s own private AES. The study explored the economic and societal drivers of adoption of agri-environmental behaviours and perceptions of the private processor AES.

The study adopted a mixed-method approach. In Stage 1 a structured questionnaire was used to explore the role of an AES offered by the global food processor in the financial stability and environmental sustainability of dairy farms (n = 20). The survey sought to understand the range of interventions adopted, explore future adoption intentions and identify possible ways in which AESs could be extended. The results from the questionnaire were explored further in Stage 2, through qualitative in-depth interviews (n = 12). A thematic analysis approach was taken to describe the key themes that motivated farmer engagement in agri-environmental schemes.

Overall, farmers felt that income from the private AES provided stability and resilience to their businesses, permitting them to have greater confidence in business planning and budgeting for the upcoming year. The majority of the farmers were not part of a public AES, but were already undertaking some agri-environmental behaviours and were motivated to join the private scheme primarily by financial incentives and by a desire to maintain the natural environment. A minority of respondents identified that the financial incentives offered had directly motivated a behaviour change. Decisions over which agri-environmental behaviours to adopt were driven by the existing animal management practices, geography and landscape of the farm.

Farmers compared the private scheme favourably to available public AESs, which they perceived as more restrictive and providing insufficient reward for the “red tape” involved. In contrast, private scheme membership was perceived to have been beneficial for both their farm business and the local environment, and many reported personal satisfaction from engagement in agri-environmental behaviours. It is important that the design of future public AES does not “crowd out” private schemes, giving farmers increasing AES choice and increasing the overall amount of funding available for the delivery of public goods from agriculture.

1. Introduction

The resilience and sustainability of agriculture has never been more important, as countries attempt to meet growing demand for affordable food in the context of climate change and declining soil and water quality (Willett et al., 2019). The intensification of agriculture has resulted in negative consequences for soil health, biodiversity and ecosystems, making it increasingly likely that more “planetary boundaries” will be crossed, triggering abrupt environmental change with potentially catastrophic effects (Armstrong McKay et al., 2019; DEFRA, 2019a;...
Private investment in agricultural landscapes ranges from land-based projects funded under the voluntary and compliance carbon markets, to national and sub-national ecosystem markets (typically paying for climate mitigation, water quality, flood risk alleviation or biodiversity benefits) and informal, bilateral agreements between private investors and landowners as a Corporate Social Responsibility activity (Gosal et al., 2020). However, to date there are very few schemes targeted at dairy systems, and there has been limited research on the operation and outcomes of these schemes from the perspective of participating farmers. We do not know what factors might prompt farmers to engage with private versus public schemes, or how the characteristics of private schemes influence farmer behaviours and the adoption of interventions that might deliver public goods. This is an important gap in our knowledge, given the rapid proliferation of private schemes seeking farmer engagement around the world.

The complexity of these challenges is compounded in the UK by its departure from the European Union, which requires the development of new national agricultural and environmental policies. In each of the (devolved) countries of the UK, new agricultural policies are (to varying extents) being developed to provide “public money for public goods”. The Department of the Environment, Food and Rural Affairs (DEFRA) is testing and trialling a number of different approaches that could enable publicly funded Agri-Environmental Schemes (AES) to operate alongside privately funded ecosystem markets. Their new Nation for Climate Fund (recommended by Natural Capital Committee, 2020) integrates and uses public funding to leverage additional private funding for multifunctional management of forests and extensive sheep farming on peatlands, and this integration of public and private funding is being further promoted through a new scheme designed to accelerate environmental markets.

However, the majority of literature has focussed on publicly funded AES (e.g. (Batáry et al., 2015; Chaplin et al., 2019; Kleijn et al., 2006; Kleijn and Sutherland, 2003)) and studies of private schemes have tended to focus on quantifying or valuing ecosystem service delivery (e.g. (Upson et al., 2016; West, 2014), discussing scheme governance (e.g. (Brown, 2020; Rodgers, 2019)) or farmer attitudes towards hypothetical future engagement (rather than actual engagement) with private schemes (e.g. (Akrigg and Winthrop, 2014; Muenzel and Martino, 2018; Schroeder et al., 2013). To date there is only very limited understanding of farmer perceptions of national carbon markets (Reed et al., 2017), and there have been no studies of regional ecosystem markets that channel finance from local companies to farmers to enhance national capital and reduce their exposure to environmental risks.

This study seeks to fill these gaps in our knowledge by exploring the economic and societal drivers of dairy farmer engagement with a private AES in England. This study is the first to explore dairy farmer perceptions of, and engagement with privately organised AESs. This is important, given the prominence of dairy production within England and the impending changes to UK agricultural policy. We sought to understand farmer perspectives on the role of private AESs on the future resilience of the dairy sector, particularly those smaller, less resilient farms located in upland areas. Such insights are significant for our understanding of farmer behaviour in highly dynamic environmental governance contexts. They will enable targeted policy development and more effective communication to ensure greater levels of engagement with private AES and future post-Brexit schemes, as well as contributing to the broader literature regarding the drivers of AES engagement.

2. Background

2.1. Agricultural policy and Brexit

The UK’s exit from the European Union (EU) along with increasing political and societal scrutiny of the livestock sector, are paving the way for new policy development with different priorities to the EU Common Agricultural Policy (CAP). Historically, CAP focused on subsidising agricultural production, sometimes to the detriment of the natural environment. It has been argued that CAP is designed to financially incentivise farmers to clear habitat rich lands for food production in order to qualify for direct payments (Souchère et al., 2003). For example, the CAP has been associated with a decline in wild birds populations in a number of European countries (DEFRA, 2019a; Donald et al., 2006; Reif and Vermouzek, 2019). Although CAP policy discourses has increasingly emphasised the environmental benefits of sustainable agriculture since the mid-1980s (Matthews, 2013), CAP budget allocations suggest that the policy retains a primarily productivist approach, with “greening” used primarily as a justification strategy, described by some as “greenwashing” (Erajvec et al., 2015). Whilst conservation and environmental regeneration do play a role within the CAP (under Pillar 2) the implementation of agri-environmental schemes (AES) has only accounted for a small proportion of CAP’s overall budget, which has led to concerns over their effectiveness in achieving sustainable environmental outcomes (Wilson and Hart, 2000). In response, policy makers are reshaping agricultural policy in England, Scotland, Wales and Northern Ireland, that will include the provision of financial support for producers to conserve the environment, prioritise biodiversity and promote sustainable agricultural practices; a principle labelled ‘public money for public goods’ (Coe and Finlay, 2019; DEFRA, 2018a, 2018b).

Under Pillar 2 of the CAP, the English government launched the AES known as the Countryside Stewardship Scheme (CSS) in 2016, which was a modified version of the earlier Environmental Stewardship Scheme (ESS) (Cross and Franks, 2007; DEFRA, 2019b). Scheme membership was voluntary and offered farmers payment for providing environmental services to enhance the local landscape and ecosystems. In 2018 around 60 % of English dairy farms were members of the CSS. These farms were significantly more likely to be larger farms rather than smaller sized holdings, which highlights the uneven distribution of uptake and delivery of environmental outcomes (DEFRA, 2019b).

Following the UK’s withdrawal from the EU, the CSS is to be superseded by the new Environmental Land Management Scheme (ELMS) that is currently under consultation and due to launch in 2024. The proposed three tiered scheme will engage with farmers to deliver environmentally sustainable farm practices (Tier 1), land managers to deliver locally targeted environmental outcomes (Tier 2) and projects that can deliver land use change at scale that delivers added value to Tier 1 and 2 (Tier 3) (DEFRA, 2020). It is, however, recognised that the scale of environmental challenges faced are unlikely to be able to be funded publically and there is an important role in the UK for parallel private or indeed public private partnerships to fund ecosystem services and significant market opportunities for the commercialisation of natural capital delivery (DEFRA, 2018b).

There is growing recognition of both public and private responsibilities, as well as, business cases for private investment into the delivery of ecosystem services and socio-political imperatives for the private sector to support the landscapes and actors upon which their supply chains rely (Gosal et al., 2020). Alongside public funding, a voluntary market for the funding of ecosystem services in the UK has emerged and a number of private schemes that harness commercial

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1 Reed et al. (2017) reported farmer perceptions of the Peatland Code but there have been no assessments of the UK’s other national carbon market, the Woodland Carbon Code, from the landowner perspective.
significant body of research that has explored the factors influencing dairy farmers. The broader literature indicates that engagement is or barriers to delivery of natural capital. The characteristics of the influence by both internal and external factors that can act as enablers services there has been limited focus specifically on the motivations of mental and economic sustainability, to secure resilient and sustainable

2.2. The UK dairy industry and the role of AES

The UK dairy industry has experienced a dramatic decline in the size of the national herd and the number of producers in the last 30 years (Bate, 2016). However, there has been a compensatory increase in milk yield per cow and in individual herd size. This has resulted in an increase in total production to 14.6 billion litres in 2014 (Bate, 2016). Increased milk yield per cow has been accompanied by a transition away from extensive grazing systems towards supplementary feeding together with high quality silage (Clay et al., 2020). Supplementary concentrates are often based on imported feedstuffs including soy; arguably the result of unsustainable production (Stoll-Kleemann and O’Riordan, 2015). However, a 2014 study showed that over 90% of UK herds graze their milking cows for at least some part of the year, highlighting the importance of grass production, land management and the environment for UK dairy producers (March et al., 2014).

The average size of a UK dairy herd was 148 cows in 2018 (AHDB, 2018). A study exploring the characteristics of high performing dairy farms in England identified that farms with larger herd sizes were generally the higher performing and more productive dairy farms, with smaller herd sizes being associated with lower farm productivity. For example, a farm with a larger dairy herd but with the same costs and land as a smaller herd is more efficient (Jones, 2020). Many smaller herds are on low input, family-run farms that rely on grass-based systems (Winter and Lobley, 2016). These farms contrast with intensive dairy systems that aim to maximise production through larger herd sizes, housing cattle and adopting a high energy, zero grazing feeding system (Clay et al., 2020). The viability of these smaller, less intensive farms is under threat and their resilience to external events, volatility of milk prices, climate change and the lack of options for scalability is poor (The Andersons Centre and DEFRA, 2013). Dairy farms operating in remote regions and in or close to areas of outstanding natural beauty, are typically small and often family-run farms (Davidova and Bailey, 2014; Wiggins et al., 2010). In these remote regions, dairy farmers operate under challenging conditions, farming in uplands or on hill farms that are classified as Less Favourable Area (LFA) (Harvey et al., 2013). For example, a DEFRA survey in 2012 of farm practices in English Uplands, identified there had been a significant decline (40%) in the dairy holdings within the Lake District National Park between 2009–2012, with many dairy farms converting to grazing farms (DEFRA, 2012). Hence there is a need for both private and publically funded AES that could offer reliable financial support and contribute to the resilience of this sector.

2.3. Agri-environment scheme engagement

Existing research indicates significant heterogeneity within farming communities and amongst individual farmers in terms of awareness, willingness and ability to engage with environmental management initiatives (Emery and Franko, 2012; Mills et al., 2017). Whilst there is a significant body of research that has explored the factors influencing farmer engagement with and participation in the delivery of ecosystem services there has been limited focus specifically on the motivations of dairy farmers. The broader literature indicates that engagement is influenced by both internal and external factors that can act as enablers or barriers to delivery of natural capital. The characteristics of the scheme has also been show to play a role in the influencing farmers eligibility, ability and willingness to engage (Mills et al., 2017; Zanella et al., 2014). An overview of the influences identified in the extant literature are summarised in Table 1. There should also be recognition of the difference between structures and factors; structures (i.e. farm geography or size) may be difficult to change, whilst factors (i.e. attitude or personal interest in conservation) are more aligned with active decision making and more easily influenced (Buck and Kristensen, 2014).

To investigate farmer adoption of agri-environmental behaviours it is useful to use a theoretical framework to explore influencers on behaviour change. Psychological theories are particularly useful in helping to understand how farmers engage with the environment. The theory of planned behaviour (TPB) is one such example that links personal beliefs with behavioural actions. The central premise of the theory is that attitudes, social norms and perceived behavioural control all influence an individual’s behaviours and behavioural intentions (Ajzen, 1991). Therefore, interventions aimed at driving lasting behaviour change are best targeted at modifying the attitudes and beliefs of the individuals. The theory has been applied to explore dairy and beef farmer adoption of agri-environmental behaviours. Previous studies identified that social pressure to change behaviours, farmers’ perception of their own ability to undertake a particular measure and farmers’ assessment of the resources available have influenced farmer engagement with agri-environmental behaviours (Borges and Oude Lansink, 2016; Daxini et al., 2018; Senger et al., 2017).

Given the highly dynamic, evolving landscape of public and private AES, it is essential that future measures are designed to support an environmentally and financially sustainable dairy sector. Most importantly, we need a clearer understanding of why farmers do or do not choose to engage in AES, in order to improve uptake and maximise the benefits from both public and private AES initiatives. Gaining a detailed understanding of farmers’ attitudes towards payments for ecosystem services, specifically, understanding farmer motivations, will help develop environmental and agricultural policies that are more likely to be adopted and ensure long-term sustainability and resilience in the sector (Mills et al., 2017; Riley, 2016). This study is the first in the UK to focus on dairy farmer engagement in private AES and provides novel insights in agri-environmental behaviours which will provide essential information for the development of future private and public AES initiatives.

3. Methods

This study used a mixed-methods approach to explore farmer perspectives on the impact of private AESs on their own farms and the wider dairy sector. Initially, a structured questionnaire was used to explore the motivational drivers of small holder dairy farmers in the North West of England for engagement in AESs and the processor’s own scheme, of whom they were members. The survey also sought to understand the range of interventions adopted on farm and future adoption intentions of this group of farmers, as well as, solicit views on possible ways in which AES schemes could be extended (Stage 1).

The results from the questionnaire were explored further through qualitative interviews (Stage 2). The questionnaire results were used to guide the design of an interview topic guide intended to gain a more in-depth understanding of farmers’ views and identify the barriers and enablers to adopting agri-environmental measures on farms.

3.1. Participant sample population

The aim of this study was specifically designed to focus on a small group of dairy farmers (n = 35), situated in a remote region of North West England. At the time of data collection, all farmers supplied their milk to a manufacturing plant that, in turn, supplied a major global food processor. All farmers were also members of the global food processor’s own AES (herein referred to as the “processor AES”). This AES
incentivised farmers to manage the farm environment in order to promote soil health, water quality and biodiversity in exchange for a guaranteed fixed milk price for six months and an additional sustainability bonus. Each farmer could choose from a menu of options that suited their particular farm and gained points for each activity. Across the farms, median farm size was 128 ha with a range of 30.35 ha and 515 ha. The farms had a median herd size of 130 milking cows with a range between 58 and 450 cattle.

### 3.2. Questionnaire methodology (stage 1)

The survey was informed by the outputs of a stakeholder workshop held in October 2018. The workshop included members of the processor AES and explored their experiences of the AES, evidence of the effectiveness of interventions and considered possible future additions to the scheme. The findings of this workshop fed directly into the survey design, the aim of which was to:

<table>
<thead>
<tr>
<th>Influences</th>
<th>Description of influence</th>
<th>Author</th>
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<tbody>
<tr>
<td><strong>Internal</strong></td>
<td>Farmer identities are deep rooted, pride through production is at the core of the “good farmer” identity. Productionist values can be at odds with environmental objectives. Attitudes, values and beliefs can be challenging to change although there is evidence that traditional productionist symbols of good farming are being re-negotiated to include environmental goals. Increasing evidence that farmers have an intrinsic respect and care for the environment and environmental land management is an important part of farming discourse and increasingly part of the “good farmer” construct. Agricultural practices that cause avoidable harm is increasing consider unacceptable. Environmental policies and AES can help to facilitate the same sense of pride in environmental land management as production outcomes. Related to demographic factors such as age, education level, gender, knowledge and skills that can influence decision making.</td>
<td>Bottazzi et al., 2018; Burton et al., 2008; McGuire et al., 2015; Mills et al., 2017; Wheeler et al., 2018; Wynne-Jones, 2013; Yazd et al., 2019</td>
</tr>
<tr>
<td><strong>Personal characteristics</strong></td>
<td>Younger farmers more likely to have higher educational attainment, motivating environmental land management behaviours. Older farmers are more likely to be more conservative and less likely to make changes based conservation motives. Farming tradition and values linked to passing farm land on to successive generations in as prosperous conditions as it was inherited and likely to motivate farmers to engage with environmental land management.</td>
<td>Kristensen et al., 2016; Mills et al., 2017; Siebert et al., 2006</td>
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<td><strong>Succession status</strong></td>
<td>Land owners have greater levels of engagement with AES than tenant farmers. Period of residency also shown to influence farmers landscape decision making, longer residency is linked to the formation of stronger ties to the location and in turn, increased inclination to improve the environment. AES can provide additional income streams and increase resilience to financial shocks, farmers with a higher degree of dependency on farming income are less likely to engage in landscape activities.</td>
<td>Burton, 2014; Kristensen et al., 2016; Mills et al., 2017</td>
</tr>
<tr>
<td><strong>Land ownership/tenancy</strong></td>
<td>Farmers landscape decision making, longer residency is linked to the formation of stronger ties to the location and in turn, increased inclination to improve the environment. AES can provide additional income streams and increase resilience to financial shocks, farmers with a higher degree of dependency on farming income are less likely to engage in landscape activities.</td>
<td>Busck and Kristensen, 2014; Siebert et al., 2006; Wilson and Hart, 2009</td>
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<tr>
<td><strong>Level/proportion of income from farming</strong></td>
<td>Suitability of the farm (i.e. conservational features and amount of on-intensively farmed land)</td>
<td>Emery and Franks, 2012; Siebert et al., 2006; Wilson and Hart, 2000</td>
</tr>
<tr>
<td><strong>External characteristics of the farm</strong></td>
<td>Suitability of the farm (i.e. conservational features and amount of on-intensively farmed land)</td>
<td>Emery and Franks, 2012; Siebert et al., 2006; Wilson and Hart, 2000</td>
</tr>
<tr>
<td><strong>Fit with farm management approach/plans</strong></td>
<td>Larger holdings are more likely to engage with AES. Environmental land management planning and the level of flexibility offered within AES. Prior experiences of AES can influence future engagement intentions. Positive experience may lead to greater openness to engagement whilst negative experiences might act as a disincentive for farmers. Opportunities to engage with others to exchange knowledge and experience of agri-environmental behaviours can help to embed environmental land management practices into farming practice. Level and method of payment i.e. payment on results, yearly, upfront or revenue payments over time.</td>
<td>Busck and Kristensen, 2014; Siebert et al., 2006; Wilson and Hart, 2000; Wynne-Jones, 2013</td>
</tr>
<tr>
<td><strong>Prior experience of AES</strong></td>
<td>Extent to which schemes fit with current and future environmental land management planning and the level of flexibility offered within AES. Prior experiences of AES can influence future engagement intentions. Positive experience may lead to greater openness to engagement whilst negative experiences might act as a disincentive for farmers. Opportunities to engage with others to exchange knowledge and experience of agri-environmental behaviours can help to embed environmental land management practices into farming practice. Level and method of payment i.e. payment on results, yearly, upfront or revenue payments over time.</td>
<td>Kumanoff et al., 2016</td>
</tr>
<tr>
<td><strong>Peer support</strong></td>
<td>Suitability of options to fit around existing management practices.</td>
<td>Ruto and Garrod, 2009</td>
</tr>
<tr>
<td><strong>Financial incentives</strong></td>
<td>Length and type of contract influence environmental outcomes and engagement (i.e. shorter contracts may encourage engagement but may not be as effective in delivering outcomes).</td>
<td>Ruto and Garrod, 2009</td>
</tr>
<tr>
<td><strong>Contracts</strong></td>
<td>Level of support provided by schemes/peers to support environmental decision making.</td>
<td>Busck and Kristensen, 2014; Kumanoff et al., 2016</td>
</tr>
<tr>
<td><strong>Messaging</strong></td>
<td>The way messages about environmental schemes are framed</td>
<td>Kumanoff et al., 2016</td>
</tr>
</tbody>
</table>

**Table 1**

Influences on engagement with AES.
3.3. Qualitative interview methodology (stage 2)

In-depth semi-structured face-to-face interviews were conducted with a subset of the dairy farmers who answered the telephone questionnaire (n = 12). An interview topic guide was designed based on the results from Stage 1 and a review of the relevant peer reviewed and grey literature. The interview guide was designed based on Lofland and Lofland’s guide to preparing a qualitative interview (Lofland and Lofland, 1995). The interviewer encouraged free conversation with the use of open questions but used the interview guide to prompt farmers to express views on a range of subjects and scenarios. Interviews were undertaken by the lead author. The discussion guide contained five broad question areas:

1. The impact of processor and retailer policy on herd health, welfare and disease prevention
2. Farmers relationships with the processor and milk buyer
3. The role of the processor and milk buyer in environmental management
4. Experience of other AESs including those managed by Natural England
5. Economics relating to agri-environmental behaviours and the wider management of the farm

Two initial interviews were undertaken to pilot the interview topic guide and following this, minor revisions were made. For example, discussions focused on the contrasts between the government and processor AES and explored different incentives for farmer engagement with the different schemes. The transcripts from the two pilot interviews were compared and contrasted with the other eighteen interview transcripts by two authors (LC and DW). Through discussion both researchers considered these to contain sufficient parallel themes and consistent ideas and to be of acceptable quality to be subsumed into the main sample.

For the purposes of analysis all interviews were recorded, transcribed verbatim and anonymised. The thematic analysis approach outlined by Braun and Clarke (2006) was used to undertake in-depth analysis of the interview transcripts and data management was undertaken in Atlas.ti V.7.7.1 (Atlas.to Scientific Software Development). Data analysis was conducted in a three stage process by members of the research team (LC and DW). Firstly, interview transcripts were read iteratively by LC and reoccurring ideas, views and concepts were independently coded into minor themes. Secondly, themes were refined via discussion between LC and DW in order to ensure inter-coder reliability. Both researchers reviewed these minor themes in the context of the wider data set and through discussion, further refined and classified these into major themes based on shared subject areas or views. Thirdly, themes were evaluated to ensure that each was meaningful, distinct and relevant to the research question (Patton, 2002). Data saturation was considered to be achieved when no novel themes were defined from the interviews transcripts. The interviews were conducted following ethical approval from the University of Liverpool VREC693.

4. Results

4.1. Stage 1: questionnaire results

4.1.1. Respondent profiles

Data were downloaded and descriptive statistical analysis performed using SPSS Statistics for Windows, Version 25.0. (Armonk, NY: IBM Corp, released 2017). The study had a response rate of 57%, in total, n = 20 of the possible 35 dairy farmers in this region supplying the processor and enrolled in the processors AES completed the questionnaire, n = 16 of whom were male and n = 4 were female. The age profile of participants is summarised in Table 3, with the majority of participants aged between 46–55 years.

Respondents had a median of 33 years of experience working in the farm sector with a range from 1 to 60 years. More than half of respondents (n = 13) worked on mixed livestock farms, n = 5 were from farms with only dairy cattle and n = 2 were from farms with a mixture of both arable and livestock systems. Farmers gained a median of 78% of their household income from dairy farming with a range from 60% to 100%. All respondents were members of the processor AES, n = 12 farmers were only members of this specific scheme, n = 8 were members of more than one scheme, the processor AES and ‘Natural England’s Countryside Stewardship Scheme’ (CSS). One participant reported that they were part of the processor scheme and the Woodland Carbon Code (WCC).

4.1.2. AES activities and drivers of farmer engagement

The most popular agri-environmental activities undertaken on farm, within or out with an AES included; planting and maintaining hedges which had been adopted by n = 16 and woodland by n = 12 farmers respectively. Dry stone wall building and maintenance had been adopted by n = 12 farmers as had soil testing. Activities that were adopted by just under half of the participants included, pasture management (n = 8) and activities to promote community engagement, such as school visits to the dairy farm (n = 6). Fencing watercourses was undertaken by a quarter of participants (n = 5) and

<table>
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<th>Table 3</th>
<th>Participant age profile (questionnaire).</th>
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<tbody>
<tr>
<td>Age category</td>
<td>Participants n = 20</td>
</tr>
<tr>
<td>20–35</td>
<td>1</td>
</tr>
<tr>
<td>36–45</td>
<td>3</td>
</tr>
<tr>
<td>46–55</td>
<td>9</td>
</tr>
<tr>
<td>56–65</td>
<td>5</td>
</tr>
<tr>
<td>Over 65</td>
<td>2</td>
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the maintenance of buffer strips by a fifth (n = 4). Fencing off woodland; energy and fertiliser use reduction measures; and mixed crop or crop rotation, were infrequently adopted, or were adopted by only one farmer respectively. Understanding how farmers decided which agri-environment activities to engage in, the extent to which these activities represented existing practices or whether they were incentivised by engagement with the AES was explored in more detail during the interviews (Stage 2).

Nearly all participants (n = 19) reported that they undertook additional activities without membership of any AES, which they considered to be delivering ecosystem services. Example activities included footpath maintenance, adoption of precision farming technologies, rare species conservation (for example, the provision of habitats for red squirrels and bats), maintenance of undisturbed wetland and forest areas to promote species conservation, as well as activities aimed at controlling slurry use and fertiliser application. The reasons and motivations behind this behaviour were explored in more depth in Stage 2. Fig. 1 summarises the range of interventions reported to have been implemented on farms.

Just over half of respondents (n = 11) reported that they had applied to an AES for a capital grant. Improvements to farm infrastructure, such as dry stonewall restoration, was the most common reason for applying for funding, other reasons included hedge planting, slurry treatment, as dry stonewall restoration, was the most common reason for applying to an AES for a capital grant. Improvements to farm infrastructure, such as dry stonewall restoration, was the most common reason for applying to an AES for a capital grant. Economic considerations were reported to be the primary factor motivating farmer engagement with the processor AESs, this driver was cited by n = 17 participants. Membership of the processor AES was reported by participants to ‘make good business sense’. Concerns for the environment and improving biodiversity were cited by just under half (n = 8) the participants. A smaller proportion of farmers cited improved animal welfare (n = 3), community engagement (n = 3) and maintenance and aesthetical improvement of their farm and the wider landscape (n = 2) as factors motivating their engagement with schemes.

4.1.3. Agri-environment scheme activities and possible extensions

Participants were presented with a summary of activities for which there was substantial scientific evidence that they would deliver ‘public goods’, some of which represented activities already included within processor AES scheme. Others represented possible additions to that scheme (Supplementary material Table S2). Of particular interest were the activities that participants had not adopted but expressed a future willingness to consider adopting on their farms. These included, ‘Cover of slurry store and digestate storage or use of slurry bags’, n = 9 reported that they might consider this on their farm and n = 7 were considering adoption in the near future. This response was possibly influenced by farmer awareness of incoming legislation aimed at reducing ammonia emissions (DEFRA, 2018c).

There was a polarisation of responses around the following activities; ‘Slurry separation and transportation of solids for use on arable farms’, n = 8 had already adopted this intervention whilst n = 10 respondents stated that it would be difficult to adopt on their farm. ‘Increasing time between pasture re-seeding’ had already been adopted by n = 8 respondents, and n = 10 participants stated they would not consider adopting the practice on their farm. ‘Direct drilling to eliminate the need for ploughing’ was already adopted by n = 11 participants but n = 4 respondents reported that they would not consider adopting the practice and n = 2 argued that adoption would be challenging on their farm.

Respondents identified additional environmental land management interventions that they considered could potentially be effective in delivering ‘public goods’. These activities were not currently supported by the processor AES, although farmers identified these as activities requiring financial support to undertake and could potentially be a focus of research into effectiveness and/or included as intervention options in the processor or other privately funded AES. The suggested activities and the perceived ‘public goods’ that the farmers suggested would arise from the proposed interventions are summarised in Table 4.

4.2. Stage 2: qualitative interview results

4.2.1. Profile of interviewees

A total of twelve interviews were undertaken with dairy producers belonging to the same processor AES in the North West region of England. This was the same scheme that participants in stage 1 were recruited from and some participants took part in both stages of the study (n = 7). Some farmers were also members of the government CSS AES (n = 3), some were former members (n = 5) and the remainder had never been members (n = 4). Interviewee demographic information is shown in the Supplementary Material Table S1.
control, whilst driving both farmer attitudes and the farmers and illustrated multiple concepts of the TPB, although some themes Similarly, attitude formation and many of the emergent themes were cross-cutting themes had on farmer intention to undertake agri-environmental be

4.2.2. Thematic analysis and application of the theory of planned behaviour

The thematic analysis defined six major themes that influenced farmer agri-environmental behaviours. These themes were ‘farmer customs’; ‘agricultural factors’; ‘hard health’; ‘economic factors’; ‘socio-political landscape’ and ‘AES requirements’. The TPB was used to form a conceptual framework to help explore and illustrate the influence that the themes had on farmer intention to undertake agri-environmental behaviours and engage with AES. All themes were identified to influence attitude formation and many of the emergent themes were cross-cutting and illustrated multiple concepts of the TPB, although some themes were more prominently associated with certain factors than others. For example, the emergent themes economic factors, disease pressure and socio-political landscape were considered to influence all three concepts, farmer attitude, normative beliefs and the farmers’ perceived behavioural control. Economic factors were considered to strongly influence farmer attitudes towards the private scheme, the financial rewards for the delivery of environmental land management interventions motivating whether farmers perceived that they could engage with a particular behaviour or requirement (perceived behavioural control). Similarly, agricultural factors, farmer customs were also identified as driving both farmer attitudes and the farmers’ perceived behavioural control, whilst AES requirements also influenced farmers normative beliefs regarding the social expectations to perform certain environmental practices (Fig. 2).

The themes represent participant perspectives on the environmental challenges facing the dairy industry, as well as, specific motivators for engaging with the private agri-environmental scheme. The themes are presented in this order and verbatim quotes drawn directly from the data are used to illustrate the respective themes.

4.2.2.1. Socio-political landscape. Socio-political landscape represented the wider socio-political environment within which UK dairy farmers were operating, the societal pressures and political uncertainties facing the industry and the impact that this had on their attitudes towards and intentions to engage with environmental stewardship. Farmers perceived the dairy industry to face considerable societal and political pressure, regarding the perceived negative environmental effects of agriculture, specifically the levels of greenhouse gas emissions associated with dairy production. Farmers considered public perceptions of the environmental impacts of dairy farming to rarely be supported by credible evidence. However this external pressure had contributed to farmers’ normative beliefs surrounding their responsibility to undertake agri-environmental activities. Farmers felt that much of these negative public perceptions were in opposition to the aims of the processor AES, which promoted regenerative agriculture and grass based systems. Through their engagement with the scheme, farmers believed that they were directly addressing some of the negative coverage levelled at the dairy industry.

‘The whole country... They’ve all got their back up against the red meat industry... There is a political agenda here, it’s not just come out of the blue. Greenhouse emissions cannot be anything... They’re talking about methane versus carbon dioxide. It’s two different subjects here. Nobody wants to tackle the real battle, which is air miles, transport.’ (F8)

“They’re on about cows polluting the atmosphere. There’s been cattle here all the time. Cattle, surely, it must be natural to go and eat the grass. They get a bit of food. It’s not like they’re locked in a shed 24/7 all year round. Fed on all other... your soya’s and all that stuff. It’s coming from who knows where in the world..... I think what (the processor AES) is wanting here, smaller type of herds that they do graze, five or six months a year.’ (F5)

Farmers were anxious regarding the political uncertainty surrounding the UK’s withdrawal from the European Union. There was shared concern that leaving Europe would result in the withdrawal of direct

Figure 2. Application of the Theory of Planned Behaviour to the major themes relating driving engagement in agri-environmental behaviours by dairy farmers (Adapted from (Ajzen, 1991)).

<table>
<thead>
<tr>
<th>Activity (support for…)</th>
<th>Perceived public good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision farming equipment</td>
<td>Efficient application of inputs (i.e. reductions in pesticide and fertiliser application)</td>
</tr>
<tr>
<td>Growing high protein crops</td>
<td>Beneficial to the environment (nitrogen fixation, soil erosion, nesting grounds for birds, insects)</td>
</tr>
<tr>
<td>Rainwater harvesting</td>
<td>Reduces water taken from water courses and national grid</td>
</tr>
<tr>
<td>Slurry handling (i.e. acidification, separation, enhanced storage capacity)</td>
<td>Reduced ammonia production and atmospheric release</td>
</tr>
<tr>
<td>Habitat for threatened species (i.e. bats and red squirrels)</td>
<td>Habitat enhancement and conservation</td>
</tr>
<tr>
<td>Support for marginal lands</td>
<td>Habitat enhancement</td>
</tr>
<tr>
<td>Maintenance of public footpaths</td>
<td>Improved public safety, health and wellbeing</td>
</tr>
<tr>
<td>Improved drainage management</td>
<td>Reduced run-off and reduced risk of waterway pollution</td>
</tr>
</tbody>
</table>

Table 4: Participant identified activities delivering ‘public goods’ and possible additions to AES schemes.
payments, upon which, many farmers rely. Consequently, there would be a significant reduction in the livestock industry with many farms, particularly smaller less intensive dairy farms, no longer being financially viable as they were unable to compete with larger and more intensively managed herds. A concern illustrated by the contraction in the dairy industry in England.

‘If we do come out (of the EU) and we don’t have the CAP payments anymore for being farmers, for producing food on the land… if that stops, there are very, very few farmers around here who have got a future at all. They’re not sustainable without that payment. Food is too cheap, especially that specialist food, like upland sheep, suckler cows.’ (F3)

‘Things have changed in our farming life, there used to be nearly every farm down here that both produced milk… most of them have gone.’ (F1)

Many farmers identified that the processor AES provided them with the financial stability to continue as a viable business. Whilst the industry standard has been to move towards larger and more intensively managed herds, there was the shared opinion between farmers and designers of the processor’s scheme, that support for smaller dairy herds was essential to ensure that they remain in the social landscape of milk production.

4.2.2.2. Farmer customs. Farmer customs represented motivational influencers that contributed to positive attitudinal and subjective norm development regarding the adoption of agri-environmental behaviours. The majority of farmers identified that membership of an AES was a route through which they were financially rewarded for the delivery of established agri-environmental behaviours. Many reported that scheme membership had not directly influenced behaviour, rather it had prompted farmers to organise and manage their environmental land management decisions, directing normative pressure form milk processors and the producer to the farmer. For example, scheme requirements often set deadlines and defined time periods for the completion of agri-environmental actions. Thus, scheme membership required farmers to adapt their behaviours and manage their farm according to the scheme requirements. For a small minority of farmers membership of the scheme had directly influenced their subjective norm and incentivised them to deliver environmental enrichment behaviours on their farm.

‘A lot of the things were ongoing. Like normal farming ways. But when we joined the schemes the… it multiplied the amount we had to do because we’d got like a load of jobs to do to get the payments which we had to do within two, three years of joining. So we’ve done all that and we did a lot more. Planting hedges and stuff.’ (F11) ‘If we weren’t with [milk buyer name] and being encouraged to do so, we definitely wouldn’t be planting trees.’ (F6)

Farmers identified that undertaking agri-environmental behaviours were considered to be socially responsible and considered to be an important part of being a ‘good farmer’. These behaviours were well established, farmers demonstrated a sense of personal pride in maintaining the landscape which was driven by social norms regarding the social responsibilities of the farmers/landowners as custodians of landscapes.

‘Our walls were always up and maintained. We don’t like walls down or anything so we keep them put up. So when there are grants to put walls up we don’t get it because it’s already done.’ (F11)

Personal satisfaction was gained from undertaking agri-environmental behaviours as well as recognition that the farm and the wider landscape in which it was embedded benefited from undertaking these activities. Maintenance of wildlife habitats, improving the farm environment and contributing towards wider global environmental concerns were cited as motivating agri-environmental behaviours. Some farmers also identified that agri-environmental behaviours were driven by succession as they expressed a desire to maintain their farm environment for future generations, with participants recognising that agri-environmental behaviours may also be passed down to successors and are habituated.

‘We haven’t made a lot of money on the job but we’ve bettered the farm with the hedgerows and the fences and what we’ve done so… We’ve got the protection for the wildlife and things like that, with the hedgerows. I think that would be the main thing that’s benefitted us.’ (F11)

‘The smaller farms look after the hedges and walls and everything far better than larger ones because they have time… Most smaller farms are family farms and it’s where you’ve been brought up. So you try to pass on the things that you’ve seen to your children.’ (F1)

Respondents were positive towards sharing ideas and collaborative working between farmers and considered that engagement with the processor AES had facilitated this. Meetings and workshops offered by the processor AES created opportunities for knowledge exchange which was beneficial to herd health, productivity and the environment. Farmers reported to feel more motivated to adopt agri-environmental behaviours after attending workshops facilitated by the producers AES, with these foyrings acting as a mechanism for increasing individual perceived behavioural control.

‘You get a lot of workshops to go to. A lot of the farmers are in there. It has brought a lot of us together. It has made it a lot better. I enjoy going on all the farm visits and tours and it is really good fun like. Interesting.’ (F11)

4.2.2.3. Economic factors. Across the sample economic drivers were identified to be the primary factor motivating engagement with the processors scheme. Financial rewards offered by the scheme drove positive attitudes towards environmental land management and increased farmers perceived behavioural control by providing adequate financial support to facilitate the delivery of environmental interventions. Instability and unpredictability in milk prices was identified by farmers to represent significant financial pressures on farm businesses, which operated under the pressures of short notice price fluctuations. This pressure was considered to be particularly challenging in the face of growing production costs.

‘Our costs are more aren’t they? Well vet fees have gone up, drugs have gone up… and our vet’s £136 an hour when he comes on the farm.’ (F7)

The stability in milk prices offered by the scheme had given participants confidence to reinvest in their farms; an opportunity not considered possible with contracts offered by other milk buyers or public schemes.

‘As we were getting paid for the milk, it was a fluctuating price which could change from month to month. Whereas when we first talked to (the processor), they would give us a milk price for the year which is brilliant, because if you had a milk price for the year you know where you were at. You could cut your cloth to fit.’ (F3)

There was an observed bias towards engagement with schemes that offered the greatest payments for the delivery of environmental interventions. In this instance the guaranteed milk price, for a set period, offered by the processor AES was the primary driver for choosing to supply to them over competitors. Insufficient financial rewards were cited as a factor that disencentivised farmers from engaging with alternative schemes, including public AES. The economic orientation of farmers also influenced their perceptions of certain environmental or conservation behaviours, specifically those that required farmers to take
land out of production, due to concerns regarding potential economic losses if implemented.

The herd was recognised to be the economic capital at the centre of decisions affecting dairy farm businesses. Farmer livelihoods relied primarily on the dairy herd; with any profits or losses acting as either a barrier or motivator for farm management decisions, including engagement in AESs. Farmers identified that economic drivers were integral to decisions over the size of the dairy herd. Whilst across the sample preference for smaller herds was indentified, although, pressures had driven many to increase the size of their herds in line with industry trends.

‘If I had it my own way I’d be milking 50 or 100 cows, but… There’s a true saying in farming. ‘If you’re not going forwards you’re going back.’ And once you go back that’s it. You’re finished really. I’ve got up to 400, and I don’t want to go up any more now.’ (F12)

Many described the processor AES scheme as principled in its support of smaller and less intensive dairy herds. Scheme membership had offered financial security that had supported farmers to avoid intensification of the herd. The schemes support of smaller herds was consistent with the farmers normative beliefs of traditional dairy farming advocating smaller herds which is beneficial for herd health and in the light of increasing production costs also reduced the financial liability associated with maintaining this.

‘They’ve (processor) helped… keep the herds the same if you know what I mean, not try and push anymore, to get any more milk, you know. They’re wanting a nice smaller type dairy farm aren’t they? Come over that way and you’d like to think you’d try to keep it that way instead of trying to push things and go for more and more milk and producing cows.’ (F5)

‘Well, yes, they’ve helped… Helped to keep it going and keep the herds the same if you know what I mean, not try and push anymore, to get any more milk, you know. They’re wanting a nice-smaller type dairy farm aren’t they? Come over that way and you’d like to think you’d try to keep it that way instead of trying to push things and go for more and more milk and producing cows.’ (F)

They’re trying to get us to farm it as naturally and healthy and the stock healthy… the least antibiotics…(the milk processor) need a good-a good background, they need everything looking well, don’t they, when they’re selling their produce? They’re a big company, worldwide company.’ (F5)

‘Our equity is in the cows, you see. All the cows are ours so the bigger the herd got our equity grows with it. All equity is walking around really. It’s not like in property or anything like that. As a whole we’ll get bigger, it throws off more cash, more surplus cash.’ (F9)

Farmers identified that public schemes such as the CSS offered capital grants which supported farmers to invest in their farm including to improve farm infrastructure and/or conduct larger land management projects. However, only a minority of interviewees had been successful in obtaining these from public bodies. Many identified that there were flaws in the allocation of grant funding with strict restrictions and requirements, which presented a barrier to farmers accessing financial support to undertake agri-environmental behaviours. For example, some farmers reported that there were geographical restrictions, which meant that they were not eligible for certain grants and recognised the potential for private schemes to offer grants or low interest loans to support investments in farm infrastructure that could improve the environmental impacts of their practice.

‘I think it’s unfair, we can’t get a grant around this area… There’s people two or three mile away get grants to nearly rebuild the farm and I can’t get anything here. They’re just not available where we are. They say the habitat is too clean. Or clean enough that it’s not causing any problems.’ (F5)

4.2.2.4. Agricultural factors. Agricultural factors such as farm landscape, animal management and time of the year were considered by farmers when deciding to engage with AES and when selecting which agri-environmental measures to adopt. Unique features in both the geography and the environment of the farm, dictated the management decisions made by the farmers. Farmers described a need for environmental enrichment measures that would compliment established farm management practices. The range of interventions offered by the scheme gave participants the flexibility to select activities that aligned with the conservation features and existing land management practices of their individual farms. This increased farmers’ perceived behavioural control and ease of delivering interventions that worked on their land.

‘Such is the geography of (the region) there’s no two farms the same. I can take you 10 miles from here and be on a completely different system. Well, it’s like a different part of the world, to be honest. And it’s always interesting, because you all get the same problems…’ (F12)

4.2.2.5. AES requirements. Scheme requirements including the the range and perceived suitability of intervention options coupled with the administrativte burden of the scheme, directly influenced farmers attitudes towards the scheme, their level of engagement and their willingness to deliver agri-environmental interventions. Participants welcomed the clarity and simplicity of the the planning process, the intervention options and the monitoring and evaluation processes of the processors scheme. These requirements were not regarded to be too onerous and outcomes were considered achievable. This increased farmer beliefs in their ability to deliver environmental interventions which which in turn had a positive impact on behavioural intention to act. Most participants considered membership of the processor AES to have been a positive experience.

‘I think the (processor) scheme is pretty easy, fair, works well. You see what your points are, you know what you commit to doing 200 m of hedging and you know you’re going to get x-fencing, you’re going to get x-soils, workshops, so you know exactly what you’re doing to get.’ (F10)

In contrast to the positive views on the processor AES, the majority of farmers had found public funded AES to be problematic. Government schemes, such as the CSS, were described as having too many limitations on grazing and environmental enrichment behaviours; restrictions which were considered to have increased over time. Farmers identified insufficient financial reward, too many demands and ‘red tape’ as hurdles to joining or continuing their membership. These perceived restrictions in public schemes were argued to prevent farmers from maximising the productivity from their land and were cited as a common justification for discontinuing scheme membership.

‘We felt like why can’t we do this and why can’t we put trees here, or hedges there, but the stewardship scheme wouldn’t let us, we had to tick certain boxes; it was quite strict.’ (F9)

There were shared concerns that the requirements of all AESs were growing over time and recognition that when such schemes introduce new requirements others may replicate this. Farmers expressed concerns that requirements of the processors scheme was increasing over time and argued that having too many requirements to fulfil, placed them under increasing time pressure. There was a shared preference for spending time in undertaking agri-environmental behaviours rather than completing associated administrative paperwork.

‘At the end of the day, I would rather be out there working with nature, planting hedge plants and putting fences up, than sitting at a table filling in paperwork. Which I do spend a lot of my time doing.’ (F12)
4.2.2.6. Herd health. Herd health recognises the importance farmers placed maintaining herd health and ensuring high animal welfare standards. Farmers were concerned about the unpredictable nature, perpetual threat and uncertain outcomes of disease in dairy herds. Farmers identified disease pressure as a constant worry and noted the economic burden associated with loss in herd productivity as a result of disease. The majority of interviewees valued the role of a closed herd in minimising the threat of disease introduction from the wider environment.

‘There’s diseases in every herd. Everybody’s got disease and it’s what a common denominator disease and what’s a hidden disease... Past experience, a lot of people would have quite a shock if they knew what was actually in their cows.’ (F10)

The processor was perceived to share values with the farmer on the importance of herd health. The processor’s principal interest was identified to be sustaining their supply of milk and ensuring positive public perceptions regarding the quality and sustainability of their production processes. The processor was noted to promote natural dairying methods including: favouring smaller herds, requiring herds to have access to pasture during the grazing season as well as having industry leading animal welfare standards that require all suppliers to adhere to farm standards that exceeded industry requirements, alongside their commitments to the environment. The farmers perceived the requirements of the AES scheme to align with their personal values regarding dairying.

‘Our cows have always gone out through summer, apart from a really wet spell. We might fetch them in just because the ground can’t take them anymore. On the whole, they’re out for four to five months, which is what (the processor) want to see. I’m an old guy now, but to me, when the cows go out it’s like Christmas Day to me. It’s Christmas Day for me because there’s a lot of work goes out with them, but it’s Christmas Day for them because they really enjoy going outside. They skip and jump...’ (F3)

5. Discussion

The aim of this study was to understand the drivers of dairy farmer engagement, agri-environmental behaviours and what factors motivated farmers to engage with privately funded AESs. Stage 1 of the research was conducted to provide an overview of participating farmers perspectives on the processor’s scheme, understand the nature of the interventions adopted as part of this and identify possible ways in which participating farmers thought the scheme might be expanded. Underpinned by the Theory of Planned Behaviour (Ajzen, 1991), Stage 2 sought to generate more nuanced understanding of the role of the processor’s scheme in motivating positive environmental land management behaviours. Six themes emerged from the data that were considered to illustrate multiple concepts within the TPB. Findings of this research indicated that the themes identified to influence farmers’ engagement with the processor’s scheme represented multiple components of the TPB. The findings of both parts of the study are discussed and the influence of these is explored in relation to the concepts within the TPB.

5.1. Dairy Farmer attitudes towards environmental land management

Dairy farmers in this study acknowledged that they played an intrinsic role in the delivery of environmental land management and their cooperation in regenerative agricultural practice was a key requirement of public funding and was also becoming a prominent feature of private contracts between suppliers and producers. This cohort demonstrated underlying commitments to farming in an environmentally responsible manner. Farmers identified positive benefits for the natural environment, especially on their farm, as a motive for engaging with AES and driver for adopting agri-environmental behaviours. Wheeler at al. (2018) argue that most farmers “wish” to farm, where possible, in a way that is respectful of the environment, although intention can be constrained by having to ensure profitability; a fundamental challenge in most farming sectors. For this group of farmers, farming in an environmentally diligent way was part of their social norm and farming identities. Farmers have their own normative beliefs of what defines a “good farmer”. Typically, this is centred on the ability to maintain high level productivity, however, it is recognised that the “rules of the game” (Riley, 2016 p. 73) are changing and environmental stewardship is now recognised to be a component of the “good farmer” identity and a “good farmer” is one that is environmentally aware (Wheeler et al., 2018; McGuire et al., 2013; Silvasti, 2003).

Farmers reported feeling a sense of pride and personal satisfaction from environmentally responsible farming and this also motivated them to undertake agri-environmental behaviours. Similarly, Vanslembrouck et al. (2002) identified that personal satisfaction plays an important role in motivating agri-environmental behaviours particularly if the farmer perceives that the results will ‘beautify’ the farm for themselves and their family (Vanslembrouck et al., 2002). This may show that agri-environmental behaviours are influenced by farmers’ moral and environmental concerns, whereby adopting these behaviours compensates for environmental anxieties and gives them some control over the natural environment (Dessart et al., 2019; Festinger, 1962).

Farmers considered the themselves and the processor to have shared values regarding key aspects of dairying, for example, maintaining small herds and the importance of heard health. Shared perspectives helped to incentivise engagement with wider requirements of the processor, including the delivery of public good along side production. For some farmers, membership of the processor AES had directly motivated them to adopt new agri-environmental behaviours. However, for the majority of farmers, interventions such as hedgerow management and planting trees were long-established behaviours that were not directly motivated by membership of the private scheme. The existing commitment to the delivery of environmental interventions demonstrated by farmers illustrated positive farmer attitudes towards environmental land management and behavioural intention which the processor’s scheme had legitimised. Schemes were shown to have developed farmers’ experience and confidence in delivering environmental interventions and in turn increased their levels of perceived behavioural control. Financial rewards validated behaviours and supported the continuation of conservation behaviours through continued scheme participation.

From a scheme perspective this raises concerns that the scheme was financially rewarding farmers for delivering interventions that would have occurred without private investment. This raises concerns about the scheme’s ability to demonstrate additional benefits as whilst in the short-term this advantages farmers who are the recipients of funding for activities that are already part of their farming practice, in the long term this could have a negative impact on private investors in the voluntary ecosystem services market (Gosal et al., 2020). Irrespective, the financial rewards for delivering agri-environmental interventions, regardless of whether these are existing or new behaviours, may be the ‘nudge’ required to incentivise farmers to adopt a wider range of behaviours with positive environmental outcomes; where farmers begin to see these behaviours as ‘desirable’ and beneficial for the farm setting and wider environment (Wheeler et al., 2018; Barnes et al., 2013; Thaler and Sunstein, 2008). These findings are supported by previous studies that showed that having an established positive attitude towards the environment is an enabler towards farmers undertaking agri-environmental management behaviours on their farms (Barreiro-Hurlé et al., 2010; DeFrencesco et al., 2008; Lastra-Braavo et al., 2015; Ruto and Garrod, 2009). However, the success of the ‘nudge’ approach in encouraging farmers to undertake agri-environmental behaviours is variable. Allcott and Rogers (2012) concluded that whilst nudges may lead to a greater uptake of environmental measures, these may be transient if they do not become habitual and long-term activities by farmers (Allcott and Rogers, 2014; Sutherland et al., 2012). Additionally, Wheeler et al. (2018)
recognised that complacency could result in apathy towards environmental issues. For example, if a farmer believes that as a good farmer they are already engaging with agri-environmental behaviours they may lack incentive or dismiss policies or schemes that aim to incentivise greater environmental consciousness in farming.

5.2. Engagement motivations

Both stages of the research identified dairy farmers’ attitudes towards, and engagement with, the private AES to be primarily motivated by economic factors. In this instance, the guaranteed financial stability of static milk prices for at least 6 months created favourable attitudes towards the delivery of environmental land management activities. The levels of financial reward permitted investment in agri-environmental activities and increased farmers’ behavioural intention to engage with the scheme. This was identified to be the primary factor incentivising participation in the processor’s AES. Economics are at the centre of all major decisions that dairy farmers make for their herd as well as for the wider farm environment (Dessart et al., 2019; Mills et al., 2017; Wilson and Hart, 2000). Financial pressures and uncertainty in the economic landscape have been identified as major drivers towards both the contraction in size, and increased intensification, of the dairy industry (Clay et al., 2020). Our findings are consistent; all farmers considered that economic pressures had resulted in many neighbouring farms expanding their herds and changing management practices to maximise productivity and remain viable. The financial stability offered by membership of the processor AES was identified as a positive financial incentive to enable smaller and more extensive dairy farms to continue as sustainable businesses. This finding is consistent with existing research that highlights the link between participation in AES and the financial security of farm businesses (Saunders, 2016; Sutherland et al., 2012; Wheeler et al., 2018).

Increases in the cost of production and fluctuating milk prices are a perpetual challenge for the dairy sector (Clay et al., 2020; Shortall et al., 2018). Our findings showed that economic uncertainty and instability in milk prices were a significant stress on business operations. There is also a strong incentive for the milk processor to ensure a reliable, constant supply of milk to its processing plant. Consequently, the milk processor has a vested interest in maintaining a positive relationship with farmers; this was achieved through offering producers a guaranteed milk price for a fixed period of time (Berger, 2016). Fixed milk prices offered by membership of the processor AES was identified as a positive financial incentive to enable smaller and more extensive dairy farms to continue as sustainable businesses. This finding is consistent with the observations of other farmers exchanging knowledge and experiences of agri-environmental behaviours. The ability of farmers to engage with others within their peer group, to exchange ideas and strategies with farming peers and reflect on the benefits of this for their herds with this forum acting as a mechanism for increasing farmers levels of perceived behavioural control, confidence and willingness to deliver agri-environmental activities. This study also suggests that there may be greater engagement with schemes that are compatible with or build on existing farmer values, beliefs and norms (e.g. around the importance of the environmental infrastructure. Similarly, Schulte et al. (2018) highlighted that volatility in milk prices can significantly decrease farmer confidence in re-investing in the farm. Thus, guaranteed milk prices can give farmers the economic capital and confidence to reinvest in their farm.

There is increased scrutiny over the contribution of livestock production to climate change and there is likely to be greater pressure on farmers to mitigate these impacts over time (DEFRA, 2018b). In the UK and across Europe, farmers have been under increasing pressure from the media, politicians and the general public regarding the role they are perceived to play in global climate change (Ricart et al., 2019). Although at present, there has been limited assessment of the direct impact of climatic change on English dairy production, unanimously, all the farmers identified that climatic changes had required them to adapt and change their herd and land management behaviours. Farmers in the study reported that they felt increasing media scrutiny regarding the role of livestock production in climate change and this had prompted them to engage with schemes aimed at encouraging agri-environmental behaviours. These social pressures were considered to contribute to the subjective norms as a driver for behaviour in the TBP. Pressure from politicians and negative public perceptions were also identified to be major stressors in the lives of dairy farmers. Socio-political pressures have been associated with long term stress and negative consequences for the mental health of livestock producers (Hagen et al., 2019; Lunner Kolstrup et al., 2013; Yazd et al., 2019).

5.3. Barriers and facilitators to agri-environmental behaviours

The use of the TBP as a conceptual framework is useful in identifying the barriers to forming longer-term behaviours. To ensure that behaviours become habitual it is essential that farmers perceive themselves to have personal control over their behaviours. Farmers identified that the range of intervention options provided by the processor AES was an important factor that motivated their engagement. Ensuring that interventions were easily integrated into the farm setting and accounting for variations in farm landscapes and conservation features (e.g. soil type, proximity to watercourses), existing farm management practices, herd management and season were also important drivers of engagement with the processor scheme. Flexibility to select interventions that work for the individual farm and their existing land management practices can help to embed agri-environmental behaviours. This is consistent with the existing body of literature that indicates that in order to maximise the adoption of agri-environmental interventions and achieve lasting behavioural change, AES are required to include options that account for variations in type of farm (Mills et al., 2013; Siebert et al., 2006; Wilson and Hart, 2000), suitability of available land (Wynn et al., 2008), farm geography (Mills et al., 2017; Wilson and Hart, 2000) and season (Mills et al., 2013).

The ability of farmers to engage with others within their peer group, to exchange knowledge and experiences of agri-environmental behaviours is proposed as a route through which to establish agri-environmental behaviours and increase farmers’ sense of autonomy in the delivery of environmental land management practices (Allcott and Rogers, 2014; Mills et al., 2017). Dairy farmers in this study valued the opportunities to exchange ideas and strategies with farming peers and reflect on the benefits of this for their herds with this forum acting as a mechanism for increasing farmers levels of perceived behavioural control, confidence and willingness to deliver agri-environmental activities. This study also suggests that there may be greater engagement with schemes that are compatible with or build on existing farmer values, beliefs and norms (e.g. around the importance of the environmental natural environment, leading to satisfaction from the creation of wildlife-friendly farm environments) and traditions (e.g. the maintenance of hedgerows and stone walls that are part of the cultural identity of the landscape). This finding is consistent with the observations of Riley (2016) that farmers are not passive recipients of scientific conservation knowledge, highlighting the importance of knowledge generation through observations of other farmers’ experiences and interpretations of AES.

Farmers value feedback and formal recognition of agri-environmental behaviours that reward their environmental conservation efforts and ensure they feel that their actions are valued (Mills et al., 2017). However, farmers in this study perceived there to be a lack of evaluation and feedback regarding of the interventions that they adopted within the processor AES. Feedback can act as a foundation ensuring that agri-environmental behaviours are embedded as part of the ‘good farmer’ persona, as well as increasing farmers levels of perceived behavioural control and confidence in their abilities to deliver environmental management activities (McGuire et al., 2013). For example, Kuhfuss et al. (2009) showed that recognition and support for...
agri-environmental behaviours acted as a driver to maintain such behaviours even in the absence of additional financial incentives. Positive feedback may also support a change in farmers’ attitudes and increase the value they place in environmental management and conservation and act as a “nudge” to further incentivise commitment to environmental land management (Kuhfuss et al., 2016) (Allcott and Rogers, 2014; Sutherland et al., 2012).

In Stage 2, farmers discussed the desire to also sustain a healthy environment in order to enhance their farms and the wider landscape for future generations of their own family. Through engaging with the agri-environmental behaviours farmers perceived that they were safeguarding the farm business for future generations and ensuring that the farm was passed on in the same or better condition than it was inherited. Succession was not a factor identified in Stage 1. Although this was not identified to be a prominent driver of engagement with the processor AES within this research, it does add some support for arguments that the link between environmental land management and cultural values around family farming, which could be better integrated into agricultural policy and within AES (Wheeler et al., 2018).

Time and labour availability has also been identified to be either a barrier or an enabler to the adoption of agri-environmental behaviours (Doyver et al., 2007; Mills et al., 2017). Farmers in this study reported a need to ensure that AESs were realistic in their time demands highlighting the need to ensure that paperwork and recording obligations were minimal. Excessive paperwork, extensive recording processes and complex requests have been identified as barriers to farmer engagement in agri-environmental behaviours and scheme membership (Mills et al., 2013; Ranjan et al., 2019). Unlike other schemes, farmers considered the level of administration associated with the processor AES to be minimal, easy to complete and not burdensome. In comparison, farmers in this study considered publically funded schemes to be overly burdensome and too restrictive. These reservations are echoed in other studies that have shown that negative perceptions are reflected in a downward trend in membership of the CSS and a decline in the uptake of 49 % from 2014 to 2018 in England (Barreiro-Hurlé et al., 2010; Burton and Schwarz, 2013; DEFRA, 2018d; Mills et al., 2013; NERC, 2012). A study comparing a private and government AES in Canada revealed similar trends, with farmers citing too much rigidity and a lack of flexibility in the government scheme as a barrier to farmer engagement (Zagare-Mendez et al., 2020).

5.4. The role of private funded schemes in the delivery of public goods

Private AES are becoming increasingly important internationally in the management of the land, environment and in conservation efforts is likely to be an increasing feature of private processor contracts for livestock farmers (Richards et al., 2013). From a wider governance standpoint the transition towards private standards in the global agri-food system remains controversial with some literature citing its success (e.g. (Hatanaka and Busch, 2008; Higgins et al., 2008)) and others expressing concern over its control over areas which should remain in the public sphere, such as, food safety and environmental conservation (Busch and Bain, 2004). Farmers interviewed for this research compared the private scheme they had adopted very favourably to the existing public AES that was also available to them, which they perceived as more restrictive and providing insufficient reward for the “red tape” involved. In contrast, private scheme membership was perceived to have been beneficial for both their farm business and the local environment, and many reported personal pride and satisfaction from engagement in agri-environmental behaviours. It is worth noting however, that farmers were obliged to engage with the scheme which was a requirement for farmers supplying the producer and to some extent limits comparability with voluntary opt in schemes. It does however, provide valuable insights into farmer perceptions privately funded AESs that can contribute to the development of future privately funded schemes.

To ensure the continued success and future extension of private schemes, such as the one studied in this research, it will be necessary to ensure future public schemes do not “crowd out” private investment. This has been noted to occur, for example, Defra’s Woodland Carbon Guarantee led to the withdrawal of projects that would otherwise have attracted private investment under the Woodland Carbon Code (Prior, 2020). By understanding how privately funded schemes are perceived by farmers, it may be possible to design future public schemes based on the principle of “public money for public goods”, that do not undermine engagement with private schemes. While evidence from this research suggests the private scheme that we studied is unlikely to be threatened by current public AES, it is important to consider interactions between public and private schemes in the design of future post-Brexit schemes that seek to increase flexibility and reduce red tape for farmers. Early evidence from Natural England trials with farmers of new schemes based on “payment by results” suggests similarly positive farmer feedback to our study (Chaplin et al., 2019).

6. Methodological approach

The study had a high rate of response, 57 % for the questionnaire and all farmers who were invited to take part in the qualitative interviews agreed to do so. The response rate compared favourably with similar studies undertaken with dairy farmers on the topic of the environment and livestock production (Baskaran et al., 2009; Troy et al., 2005). Whilst there is potential for response bias, whereby the responders’ perceptions of, and practices on AESs may be different from non-responders, the risk is reduced by the high response rate. Potential reasons for non-response may be related to the high numbers of requests on farmers to undertake surveys, time constraints or potential sensitivities on the subject of the environment and climate change (Porter et al., 2004; Yazd et al., 2019). In addition, there may be limitations and bias in self-reported behaviours whereby participants may respond to questions in a way in which they perceive to be correct rather than report true attitudes or practices (Foddy and Mantle, 1994). However, the honest and open discussions in the qualitative interviews suggest that the study presents accurate opinions and behaviours for this group of farmers. The study only included participants of the processor AES however, it would have been valuable to have interviewed farmers who were not scheme members in order to compare the drivers and motivators of agri-environmental behaviours in the two different participant groups. Whilst this was beyond the scope of this study this, is an area for future research and would add knowledge and evidence for future policy decisions on AESs.

7. Conclusions and policy recommendations

This study has provided detailed insights regarding the motivations of a group of dairy farmers engaged with a privately funded AES to undertake agri-environmental behaviours and provides unique insights into farmer perceptions of, and attitudes towards, private AES requirements. The study draws attention to a stark contrast in farmer perceptions of an industry-led processor AES, compared to competing alternatives in the Government-funded AES. Economic drivers were important in driving engagement with the industry-led scheme, which provided an enhanced and stable milk price in return for on-farm sustainability initiatives. However, the simplicity of the industry-led scheme and its compatibility with local farm types and activities, and farmer values, beliefs and norms, were also important reasons for its popularity. Future research is ongoing to determine the extent to which this scheme actually delivers public goods, and the popularity of scheme options that required limited changes in farmer behaviour may limit the extent to which the scheme delivers “additional” environmental benefits.

Despite the niche sample of the study, drawn from a pool of dairy farmers that were members of a private AES, this study is particularly timely given the transition away from the EU’s CAP towards a new...
agricultural governance framework. The new framework is underpinned by Payment for Ecosystem services and the likely co-existence and indeed integration of public and private funding for the delivery of ecosystem services (DEFRA, 2018a). However, insights into the importance of non-monetary drivers of AES engagement, are relevant internationally for the design of both public and private AES.

There is a need for future AESs to consider the challenges faced by dairy farmers and to recognise that these are different to those faced by other agricultural sectors. Flexibility is important when designing agri-environment options for farmers, to take into account the heterogeneity in agriculture generally and within the dairy industry specifically (Dwyer and others 2007). There is a public appetite for more agri-environment land management practices particularly those that go beyond ‘what we usually do’, however future schemes must take into consideration factors that affect uptake including, flexibility, how remuneration is offered, seasonality, goodness of fit with farm geography and management planning, and, critically, lowering administrative burden for farmers engaging with these schemes.

It is important that the design of future public AES does not “crowd out” private schemes, giving farmers more choice in AES, and increasing the overall amount of funding available for the delivery of public goods from agriculture. This is an important consideration given potential convergence between the design of future public AES and the characteristics of private schemes, as new Government schemes in the UK and across Europe increasingly prioritise the link between public investment and public goods outcomes. If future public schemes undermine private schemes, this may lead to the perverse outcome of public funding being used to finance outcomes that would otherwise have been provided by the market.

This study has for the first time shown how farmers perceive and are engaging with and delivering outcomes from a privately funded regional ecosystem market. The flexibility, simplicity and compatibility of the private scheme with their farm type and operations were key factors prompting farmers to engage with the private scheme instead of alternative public schemes on offer at the time, suggesting that well designed private schemes have the potential to attract new farmers to AES who would otherwise not have engaged, leading to additional delivery of public goods. While the focus of this study is on a private AES operating at a landscape scale within the UK, the growing interest in regional ecosystem markets internationally makes lessons from this study of wider interest to those seeking to design private AES or to design public AES that interface with (or leverage) private investment in the natural capital of agricultural landscapes.

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Declaration of Competing Interest

The Resilient Dairy Landscapes project is evaluating the operation and outcomes of Landscape Enterprise Networks (LENS). The authors are collaborators on the project but do not receive any financial remuneration from any of the commercial partners involved in the LENS.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi: https://doi.org/10.1016/j.landusepol.2020.10.5174.

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AHDB. 2018. UK And EU Cow Numbers. Stoneleigh, UK.


CRediT authorship contribution statement

I. Coyne: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing, Visualization.

H. Kendall: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing, Visualization.

R. Hansda: Methodology, Investigation, Formal analysis, Writing - review & editing. M.S. Reed: Conceptualization, Writing - review & editing, Supervision, Funding acquisition.

D.J.L. Williams: Conceptualization, Writing - review & editing, Supervision, Funding acquisition.

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