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REVIEW AND SYNTHESIS

Aligning strategic and participatory approaches to agri-environment scheme design and implementation to enhance nature recovery outcomes

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Abstract

1. Nature recovery requires the provisioning of resources in the right place and in sufficient quantities to support wildlife populations and improve ecological processes. Agri-environment schemes (AES) have been a major mechanism for delivering environmental management across EU-farmed landscapes, but measured benefits to nature are often negligible in large part due to a lack of strategic spatial targeting of management actions.
2. As an example, AES in England are often delivered using a participatory strategy, typically at individual farm scale, with types of management agreements and uptake reflecting the business model and interests of each farm. However, this implementation model can result in poorly distributed conservation resources and, consequently, a failure to recover nature across larger scales, even if individual agreements are delivered well.
3. Achieving effective, large-scale nature recovery through AES requires aligning its implementation with spatially targeted approaches that prioritise specific conservation goals. We discuss the rationale for, and major barriers to, aligning AES design and implementation to these approaches. We then highlight how, through the framework of *systematic conservation planning*, both the strategic and participatory components of AES could be aligned better to enhance nature recovery outcomes.
4. To ensure AES help achieve nature recovery goals, clear and measurable targets must be set with the type and spatial configuration of actions designed to enable meeting targets. Strategic spatial targeting must also be carried out with the implementation phase in mind, accounting for socio-economic opportunities and barriers to engagement and acknowledging that uncertainties around farm-scale implementation mean plans must be adaptable. Participatory approaches for AES design and implementation that support the delivery of spatially targeted

management actions are required, most notably by facilitating collaboration or cooperation across farm holdings.

5. For AES to contribute effectively to nature recovery goals, aligning strategic and participatory approaches in its design and implementation is crucial. This requires uniting knowledge across disciplines and cultures and ensuring that information is shared to support progressive refinement of scheme design and guidance towards achieving overall nature recovery goals.

KEYWORDS
agri-environment scheme, collaborative AES, nature recovery, participatory strategy, spatial prioritisation, systematic conservation planning

1 | INTRODUCTION

Intensified farming and associated land use has proved one of the greatest threats to terrestrial biodiversity (Maxwell et al., 2016). With world food demand expected to increase by 30%–62% by 2050 (van Dijk et al., 2021), this places great importance on conservation actions in farmed landscapes for supporting nature protection and recovery (Kehoe et al., 2017). The financial investment in ensuring that farming and biodiversity conservation are compatible is, in many parts of the world, substantial. In the EU, around €51 billion has been spent on agri-environment schemes (AES) since 2014 (Ait Sidhoum et al., 2023). Although biodiversity conservation is not the sole purpose of AES, there is no doubt that expenditure on habitat management designed to benefit biodiversity is considerable and arguably AES represents one of the most extensive and expensive biodiversity conservation initiatives to date (Batáry et al., 2015). Despite this investment, biodiversity in farmed landscapes continues to decline (Gamero et al., 2017; Gregory et al., 2019; Hayhow et al., 2019). In the United Kingdom, a recipient of EU agri-environment payments, the problems have been particularly acute. Between 1970 and 2016, 41% of monitored species declined in abundance and it now has among the most depleted biotas globally (Hayhow et al., 2019).

The intensification of farming has meant that habitats capable of supporting wildlife have been declining in terms of quantity, quality and connectivity (Clough et al., 2020; Robinson & Sutherland, 2002). Attempts to create wildlife habitats on farmland through AES (e.g. provisioning of flower-rich margins for pollinators or seed-rich stubbles for birds) have not reversed the declining trends of priority species at national scales, despite local scale responses of these species to management (Baker et al., 2012; Redhead et al., 2022). This is in large part because uptake of management options that deliver the most benefits has been very limited, more popular general options are of insufficient quality for threatened biota, and the spatial arrangement of these resources has been too ad hoc to have population-level impacts (Baker et al., 2012; Gamero et al., 2017; Pywell et al., 2012). AES options in England have generally been selected and delivered at the farm-scale, largely because of the highly fragmented nature of land ownership patterns and occupancy across the country. However, evidence gathered from studies carried out across Europe demonstrates that more than a third of amphibian, reptile, bird and mammal species, and many invertebrate species, forage in the breeding season over ranges that are larger than the size of a typical English farm (146 ha; Carvell et al., 2017; McKenzie et al., 2013) indicating a need for larger scale coordination of actions across landscapes. To reduce extinction risks associated with populations occupying small, fragmented habitat patches, habitat management must be targeted better using landscape conservation planning principles that manipulate the total amount, spatial arrangement and quality of habitat in agricultural landscapes (Lawton et al., 2010).

The potential for AES to halt or reverse biodiversity declines is not however based solely on their ecological design. Rather, the main obstacles and most effective solutions often occur at the interface between people and nature (Josefsson et al., 2018). While one might attempt spatially to target management actions within landscapes for a particular biodiversity outcome, ultimately the uptake and delivery of proposed measures depends on the willingness and engagement of people (Brown et al., 2021; De Snoo et al., 2013; Maas et al., 2021). Cultural and social factors will influence farm management decisions by shaping different conceptualisations of what constitutes a 'good farmer' (Burton, 2004), with some factors more likely to lead to biodiversity-friendly practices than others. For example, a farmer's age, willingness to interact and work with peers, as well as their land tenure and interest in nature, all have important effects on the way they manage the land and, hence, on the likelihood and extent of their tendency to exhibit pro-biodiversity behaviour (Brown et al., 2021; Mills et al., 2017). Interactions between people and nature are commonly governed by coupled feedback, nonlinear dynamics and social tipping points. Understanding and overcoming the negative impacts of these has the positive potential to encourage and foster future pro-biodiversity management (Lenton et al., 2022).

For AES to deliver more effective nature recovery outcomes requires better integration of strategic and participatory approaches to AES design and implementation and the effective integration of knowledge and theory from across social, ecological and economic disciplines (Table 1), as well as from across other knowledge cultures

TABLE 1 Agri-environment scheme (AES) design and implementation aligned to stages of systematic conservation planning (SCP), an inherently participatory socio-ecological process for landscape conservation planning, highlighting the importance of both the strategic and participatory aspects of landscape-scale conservation fundamental to enabling successful nature recovery.

Systematic conservation planning stage	Relevance in AES design	Domain-specific information and knowledge type: Ecological	Economic	Social
1. Objectives and context Compile information on biodiversity and socioeconomic-cultural conditions of the planning region and identify broad conservation objectives.	• Identify regional biodiversity priorities reflecting diverse ways of valuing nature (e.g. functional, cultural, economic). • Align AES objectives with national and/or regional conservation goals. • Describe and map key socioeconomic-cultural barriers and opportunities for AES (e.g. historical participation in AES).	• Measure trends in biodiversity, including monitoring species populations and habitat loss, and attributing drivers of changes. • Establish appropriate baselines for nature recovery that reflect the extent of historical habitat and species losses. • Map existing biodiversity distributions. • Identify and map threats.	• Determine roles of incentive structures, preferences, and production in driving land use practices linked to positive and negative changes in biodiversity within the planning region.	• Determine the role of individual and societal attitudes and beliefs in land use practices and land use change. • Understand perceptions on biodiversity change (including shifting baselines). • Describe and, where possible, map opportunities and constraints for AES arising from social and cultural factors. • Identify surrogates for social and cultural factors that cannot be directly mapped (e.g. historical engagement in AES).
2. Targets Set quantitative targets and identify suites of management options specific to the planning region that could contribute towards meeting targets.	• Set quantitative targets for outcomes (e.g. percentage increase in population size or habitat extent, ecosystem function outputs, such as pollinator services). • Match potential management actions to regional biodiversity features, farming characteristics or styles.	• Identifying quantitative targets for nature recovery (e.g. minimum viable population sizes, percentage increase in area of occupancy or population size). • Determine specific management practices required to deliver targets.	• Determine links between ecological condition and societal benefits (e.g. ecosystem services) • Identify economic thresholds and tipping points for engagement with AES. • Set price points for options, incentivising most beneficial actions. • Consult with land managers to refine the above results.	• Understand how society values biodiversity to help ensure inclusive selection of conservation features (e.g. based on different valuing processes and cultural values). • Identify factors contributing to the quality of engagement with AES, focusing in particular on barriers to engagement with actions identified as most critical to nature recovery in the region. • Consult with land managers to refine the above results.

(Continues)

TABLE 1 (Continued)

Systematic conservation planning stage	Relevance in AES design	Domain-specific information and knowledge type: Ecological	Economic	Social
3. Prioritisation Conduct conservation assessment to identify spatial priorities for conservation activity and the temporal scheduling of actions within the planning region's socio-economic context.	• Conduct a spatial prioritisation, typically using decision theoretic tools to identify potential spatial configuration of AES that can meet ecological targets. • Incorporate socioeconomic-cultural values and include aspects of more, bigger, better, joined.	• Apply principles of landscape-scale conservation planning to setup and identify spatial and temporal patterns of implementation most likely to achieve targets. • Integrate information on species' traits (e.g. dispersal distances, minimum patch size), to reflect species' ecology.	• Consult with land managers to determine implementation costs of management under different permutations to identify economically efficient solutions that still achieve targets. • Spatially map cost of actions to capture spatial heterogeneity in the cost of AES.	• Engage with land managers to Identify contexts in which management actions are likely to be difficult to implement based on cultural values, traditions, and beliefs, and identify pathways for overcoming these barriers. • Engage with land managers to identify methods of presenting and summarising information to maximise engagement.
4. Implementation Agree on spatial prioritisation with stakeholders and implement conservation actions.	• Consult with stakeholders to agree on spatial prioritisation of AES that is sufficient to deliver the scheme objectives. • Begin agreeing AES actions with land managers aligned to spatial prioritisation. • Design implementation strategy to promote landscape scale approaches.	• Help facilitate agreement on the spatial prioritisation with stakeholders, highlighting key ecological trade-offs of different spatial prioritisations. • Provide species- and habitat-specific guidance on management actions. • Update spatial prioritisation depending on implementation of AES in the landscape.	• Consult with land managers to agree on the spatial prioritisation with stakeholders, including with respect to ecosystem services. • Discuss farm-specific economic consequences of implementing different suites of management actions with land managers.	• Help facilitate agreement on the spatial prioritisation with stakeholders, including opportunities for coordinated or collaborative actions. • Work with land managers to enhance engagement (e.g. based on cultural values, traditions, and beliefs) • Engage with land managers to Identify actions to overcome participation barriers (e.g. more guidance, peer-support networks), including work processes.
5. Monitoring Maintain habitat quality, monitor outcomes against objectives, and update actions accordingly.	• Ensure monitoring is aligned to the AES objectives and targets. • Ensure mechanism exists for land managers to obtain feedback and advice on management and outcomes and provide comment on the scheme and share advice.	• Track indicators of biodiversity targets (e.g. population trends). • Update spatial prioritisation depending on implementation of AES in the landscape to ensure progress towards targets.	• Identify potential barriers to uptake based on payment rates, conditions, and mechanism design. • Provide advice on revising these factors to better align delivery with targets. • Feed this information back to update the spatial prioritisation.	• Engage farmers as 'citizen scientists' to assist in monitoring and feedback. • Monitor changes in attitudes and beliefs in response to engagement with AES. • Identify emerging opportunities (e.g. positive feedback and tipping points). • Feed this information back to update the spatial prioritisation.

Note: SCP stages are adapted from Margules and Pressey (2000). The contribution of domain-specific information to AES design and implementation illustrates the importance of ecological, economic, and social-cultural factors in successful nature recovery and their contribution to design, implementation, and evaluation components of AES.

(e.g. farmer and land manager; Oliver et al., 2012). England is currently undergoing a period of agricultural subsidy reform including major changes to AES payments. In light of this, it seems timely to use England to examine how the strategic spatial targeting of AES aligned to conservation planning principles might be achieved to improve nature recovery outcomes and increase the cost-effectiveness of taxpayer-funded AES.

After introducing the ecological rationale for and socio-ecological barriers to strategically targeting AES management options within landscapes, we highlight how strategic targeting approaches and participatory design, and implementation of AES might be integrated better. We do this through the framework of *systematic conservation planning* (SCP), the principal participatory approach for conservation decision-making, emphasising the importance of: (1) setting clear objectives and quantifiable nature recovery targets and ensuring that these targets can be achieved in the scheme design and implementation; (2) accounting for key socio-economic determinants of AES uptake when spatially prioritising AES management actions; (3) developing participatory approaches for implementation that support the delivery of AES guided by spatial targeting (e.g. collaborations across holdings, farm-scale guidance informed by landscape context) and (4) creating feedback links between strategic and participatory stages to refine methods and guidance as new information is gathered.

2 | ECOLOGICAL RATIONALE FOR SPATIAL TARGETING OF AES MANAGEMENT

More than 50 years of research into landscape-scale conservation suggest that AES would deliver better outcomes for nature recovery if implementation was aligned better with spatial conservation planning principles (Cabeza & Moilanen, 2001; Soulé & Simberloff, 1986; Strassburg et al., 2020). This work draws heavily on the classic approaches to protected area design, namely encouraging bigger and more sites, enhancing connectivity among sites, and improving habitat quality. While spatially targeting conservation resources for a single species is relatively straightforward, AES often aim to benefit multiple species, each with unique resource requirements and varying responses to interventions. Trade-offs between these elements affect overall biodiversity outcomes (Feniuk et al., 2019) and present challenges for identifying optimal arrangements of management actions to implement across a landscape to maximise biodiversity benefits. To address these challenges, conservation planning draws on the principles of representation and complementarity to efficiently target actions for multiple species or habitats by exploiting spatial overlap of these ecological features (Lehtomäki & Moilanen, 2013). Computational modelling approaches designed to address complex, multi-species spatial conservation planning decision-making are now well established and capable of finding efficient (e.g. with respect to costs or land area used) solutions for targeting resources towards specific conservation objectives (Margules & Pressey, 2000; Pressey & Bottrill, 2009; Watson et al., 2011). A key insight from models that allocate conservation resources across landscapes to support multiple species is that untargeted management often yields considerably worse outcomes for biodiversity at a given cost than targeted interventions (Ando et al., 1998; Strassburg et al., 2020).

3 | BARRIERS TO IMPLEMENTING AES ALIGNED TO SPATIAL CONSERVATION PLANNING

While the ecological rationale for the strategic spatial targeting of AES is strong, overall, it is the interaction between socio-economic, cultural and ecological drivers that determine delivery success and impact. This can create barriers to aligning strategic and participatory approaches to AES design and implementation to achieve specific nature recovery outcomes. For example, a challenge in many landscapes is that AES is often implemented through self-selected farmers, typically delivering agreements at individual farm holding scale, with the types of options and management agreements reflecting the business model and interests of each farm (for context, England's contemporary farmed landscape comprises of over 10,000 independent farm holdings; Defra, 2022). This single-site focus of many AES implemented in England has meant that, up until recently, more emphasis has been placed on the relationship between individual farmers and the state rather than enabling widespread collaboration between farms across landscapes to strategically target AES (Nye, 2018). This is further exacerbated by variations in land tenure relations, which have been shown across the EU to impact on AES adoption and ecological effectiveness of AES delivery. This may arise from different institutional frameworks, length of agreement, landlord and industry relations (Bartkowski et al., 2023). While effects can be variable there is some evidence that short contracts can lead to minimal AES adoption, while longer contracts may encourage more substantial AES (Bartkowski et al., 2023).

Economic and business factors also present a major barrier in this context. For most land managers whose primary aim is agricultural production and business viability, participation in landscape-scale conservation practices requires at least some level of financial recompense (Brown et al., 2021). In landscapes with spatially heterogeneous costs and benefits, strategically targeting AES management has great potential for increasing the efficiency (i.e. in terms of benefits per unit cost) of conservation action (Armsworth et al., 2012; Matzdorf & Lorenz, 2010). A particular challenge here is that increasing flexibility of schemes to accommodate regional variation in costs, opportunities and threats (e.g. climate change vulnerability) may lead to increasing administrative costs, whereas simplifying a scheme to minimise costs can make it more likely to fail because it lacks flexibility to deliver for biodiversity or other ecosystem services (Day et al., 2024). Thus, a key aspect of AES design is achieving a balance between flexibility and cost effectiveness, with the objective being to maximise the diversity of AES options within budget constraints to provide maximum flexibility and specificity for making choices about the placement of management in the landscape (Nguyen et al., 2022).

Business and practical elements also interact with personal and social factors that shape each land manager's willingness and ability to undertake environmental practices (Mills et al., 2017) and these have been shown to have a direct influence on the success of AES (McCracken et al., 2015). For example, engagement in AES has, for many, contradicted entrenched beliefs relating to what it means to be a 'good farmer' (Burton, 2004; e.g. tidy vs untidy farms and productive vs less productive farming methods) and encountered cultural resistance towards state-defined goals (Burton et al., 2008). While this mindset is gradually changing (Wheeler et al., 2021), it is likely that the single-site focus of previous AES has slowed potential shifts towards more effective holistic conservation-friendly approaches, acting as a barrier to the accrual of social, cultural and symbolic capital (Bourdieu, 2011), and creating a considerable barrier for achieving better alignment of AES implementation with strategic spatial targeting. Additionally, a lack of advice and guidance, such as through a facilitator who can build relationships and engage with farmers and other stakeholders, can hinder efforts to build trust and gain buy-in from the community (Nye, 2018; Prager, 2022; Wheeler et al., 2021), while a lack of opportunities for farmers to input into the design of schemes can result in misalignment between the goals of the initiative and the needs and priorities of the farmers (Nye, 2018; Prager, 2015; Wheeler et al., 2021). Feedback on outcomes through environmental monitoring has been found to be important for motivating farmers to engage in high-quality environmental management but is often lacking due to insufficient resources for monitoring outcomes, including providing training to farmers to conduct monitoring themselves (Boulton et al., 2013; Emery & Franks, 2012). Thus, a major component of strategically targeting AES implementation is understanding the conditions conducive to the type of high-quality engagement required to deliver targeted management across complex social landscapes.

4 | ALIGNING STRATEGIC AND PARTICIPATORY APPROACHES TO AES DESIGN AND IMPLEMENTATION

The degree to which any AES integrates conservation planning principles to guide uptake varies highly, but in general these aspects are not well integrated into scheme design and implementation (Table 2). Schemes in England over the past two-decades have adopted a range of designs, with increasing requirements for spatial targeting and approaches to engagement depending on their purpose (Hodge & Reader, 2010). Initially, schemes like Environmental Stewardship (2005–2014) focused on individual farm-level actions (e.g. Defra, 2013). While more recent initiatives, such as the Countryside Stewardship Entry Level stewardship (from 2015) and the Sustainable Farming Incentive (SFI, from 2021), have emphasised collaboration among farmers to target priority habitats and species, although they were designed as a 'broad and shallow' schemes to improve the general condition of the environment on farmed landscape (Defra, 2024). These schemes could be placed in the top-left of Figure 1 as they lack a detailed spatial targeting component but were designed to be easy for farmers to enrol in the schemes. In contrast Countryside Stewardship High Level Scheme and the recent Landscape Recovery scheme (Table 2) were designed to enhance the effect of the background agri-environment management provided by SFI through more focused intensive environmental management (Defra, 2023). Landscape Recovery would be placed towards the bottom-right of Figure 1 as it requires setting specific goals aligned to regional priorities but has higher administration and implementation costs that limit the scheme's spatial footprint (Table 2). Both schemes have desirable aspects but the potential of each to have positive effects on nature recovery is limited by different design elements. The key is to identify the specific design aspects of an AES that either make it amenable to alignment with spatial conservation planning or not (i.e. move towards the top-right of Figure 1).

In this section, we use an SCP framework to identify how AES design and implementation could be better aligned to nature recovery goals and targets. The rationale for this framing is that SCP, the principal participatory spatial conservation planning framework, is designed specifically to integrate ecological, social, and economic information, notably including stakeholder perspectives and information from diverse knowledge cultures, to determine spatial priorities for achieving specific ecological goals within the socioeconomic-cultural context of the focal planning region (McIntosh et al., 2017; Pressey & Bottrill, 2009). The approach aims to identify and formally state the conservation goals within a planning region and set quantitative targets aligned to these goals to provide objective criteria to judge potential spatial conservation planning solutions. Typically, mathematical methods are used to identify solutions that satisfy conservation targets whilst being efficient with respect to costs, using the principle of complementarity to identify combinations of sites that together contribute to meeting targets for multiple species or habitats, or other conservation features (e.g. ecosystem services), simultaneously with minimal redundancy (Kukkala & Moilanen, 2013). Principles of conservation planning are incorporated via rules that, for example, favour adding new habitat areas adjacent to existing habitat patches and account for individual variation in species' dispersal to identify habitat networks that are functionally connected (Lehtomäki & Moilanen, 2013). Spatial prioritisation methods have traditionally focused on choosing areas to protect in order to secure the persistence of species (or other conservation features) in the landscape, but the approach can be used to prioritise the targeting of specific management actions towards nature recovery (e.g. Cattarino et al., 2015). In an AES context, this might entail trialling different AES options (e.g. *pollen and nectar flower mix*, *winter bird food on arable and horticultural land*, or *grassy field corners and blocks*) within planning units (e.g. field parcels or land block) across the planning region to optimise the spatial configuration of option placement to meet specified targets (e.g. for a subset of farmland bird and pollinator or plant species).

TABLE 2 Evaluation of three distinct AES designs employed in England, each with significant biodiversity goals, against key criteria derived from systematic conservation planning necessary to align management actions with broad scheme goals, alongside suggested design elements drawn from examples to better align AES design and implementation with spatial conservation planning.

Criteria	AES 1: sustainable farming incentive (SFI)	AES 2: landscape recovery (LR)	AES 3: payment by result (PBR)	Key design elements drawn from examples to better align AES with spatial conservation planning
Scheme description	Pays land managers to carry out farming activities in a more environmentally sustainable way, producing food alongside environmental goods and services. Designed to be universal (e.g. broad-and-shallow), with actions straightforward to undertake.	Complementary to SFI, supporting action at farm/cluster level towards sustainable farming and nature recovery. Funds a small number of longer-term, larger-scale, bespoke projects aiming to deliver significant benefits.	Aims to directly link payment to the level of environmental outcomes achieved, and not simply to the management actions undertaken.	
Scheme has clear biodiversity goals and social objectives informed by consultation with range of stakeholders.	Comprises broad but typically vague biodiversity goals and socio-economic objectives informed by consultation with land managers taking up the scheme and aligned to policy.	Clear biodiversity and socio-economic goals informed by consultation with a range of local stakeholders. LR criteria include how proposal aligns with regional nature recovery strategies.	Clear biodiversity goals informed by consultation with land managers taking up the scheme, although wider stakeholders unlikely to be consulted.	• Goals specifically defined and aligned between broad-and-shallow and results-based schemes. • Goals linked to specific elements of biodiversity, outcome states, and timeframes for delivery. • Goals tailored to regions as determined through regional stakeholder consultation.
Clear quantitative targets for biodiversity aligned to national/regional objectives and with a clear ecological rationale (e.g. supported by ecological theory or modelling).	No clear quantitative targets linked to goals for aspects of biodiversity (e.g. particular priority species, measures of diversity, or habitats) underpinned by ecological models or theory.	Clear targets set for each project area for the 'maintenance or restoration of protected sites or features' and 'creation, restoration, or continued effective management of wildlife-rich habitats, outside of protected sites', with outcomes monitored closely (Defra, 2023). The quantitative nature of targets (e.g. area restored) not necessarily linked to supporting ecological theory or modelling.	Clear targets set at farm-level, but no clear objective mechanism suggested to ensure that these contribute to broader scheme goals across the wider landscape.	• Quantitative targets for each feature aligned to objectives, based on intended outcome (e.g. percentage reduction in species extinction risk). • Place-specific actions associated with expected contribution to specific targets and broad goals.
Management options aligned to goals and capture regional variation in ecological characteristics and farming styles.	Options are not tailored regionally. Instead, a broad range of options are offered, which can be selected based on location. Broad priority areas are indicated for some options and others must be endorsed based on site suitability, which can require a site visit.	Does not involve choosing from suite of management options. The bespoke nature of the scheme means it necessarily captures place-specific ecological characteristics and farming styles.	Land managers are given ownership of the actions to be taken to achieve set outcomes and are, therefore, responsible for choosing the management options they think are suitable for achieving those outcomes.	• Regional variations in management options should be built into schemes through goals and targets, aligned to spatial conservation planning.

(Continues)

TABLE 2 (Continued)

Criteria	AES 1: sustainable farming incentive (SFI)	AES 2: landscape recovery (LR)	AES 3: payment by result (PBR)	Key design elements drawn from examples to better align AES with spatial conservation planning
Payments are aligned to regional importance of management options and difficulty of management action or achieving desired outcomes.	SFI payments are not aligned to regional importance given the universal design of the scheme, although endorsed options can only occur where deemed suitable. However, payments for actions have been set to reflect difficulty, among other considerations.	The scheme provides no indication that payment is aligned with regional importance of action.	Payments made on the basis of performance, using a scoring system, such that payments reflect the quality of the outcome.	• Schemes should have flexibility to set payments to achieve sufficient uptake of appropriate management to achieve goals. • Likely more emphasis placed on payment-by-results model, which aligns better with target and outcome driven objectives.
Implementation is guided by spatial conservation planning, that: 1. Is spatially explicit 2. Incorporates more, bigger, better, joined 3. Involves stakeholders to agree on prioritisation	While there is some degree of consultation with stakeholders on priority actions, SFI tends to exclude the other components of this criterion due to the schemes universal design.	The implementation is guided by each component of this criterion, although not necessarily informed by a quantitative conservation assessment process.	The implementation is guided by each component of this criterion at farm-scale, although not necessarily informed by a quantitative conservation assessment process in the context of the wider-landscape.	• All elements of AES should be aligned to spatial conservation planning, conducted to identify efficient pathways towards meeting specific targets. • Planning must incorporate key ecological principles and socio-economic conditions.
Coordination and/or collaboration is a component of the implementation process.	No, this is a farm-focused scheme.	Coordination and collaboration are central to the scheme.	No, this is a farm-focused scheme.	• Coordination and/or collaboration a significant part of implementation. • Must present guidance based on spatial conservation planning (e.g. through accessible digital platforms).
Advice at farm or cluster scale is guided by a spatial conservation planning.	Guidance is provided but one-to-one advice not considered necessary despite being widely sought by land managers. No explicit guidance based on spatial conservation planning.	Much guidance is provided but one-to-one advice not considered necessary by Defra, although encouraged in the guidance document.	Each land manager is provided with group and one-to-one guidance and training opportunities. No explicit guidance based on spatial conservation planning.	• Implementation conducted in reference to regional spatial conservation planning. • Planning updatable to reflect patterns of uptake, thus aiding spatial cohesion in uptake even where collaboration is minimal.
Outcomes are measured against qualitative goals and quantitative targets using suitable field data and methods.	Self-monitoring of actions is enforced by this scheme but in the absence of clear quantitative targets linked to scheme goals.	Yes, outcomes are measured against both qualitative goals and quantitative targets.	Yes, outcomes are measured against both qualitative goals and quantitative targets, with monitoring conducted by the land manager after training.	• Outcomes measured directly against goals and targets set at the outset of the SCP process. • Monitoring designed such that targets can be accurately assessed at appropriate scales. • Likely requires investment in landscapes-scale structured monitoring.

TABLE 2 (Continued)

Criteria	AES 1: sustainable farming incentive (SFI)	AES 2: landscape recovery (LR)	AES 3: payment by result (PBR)	Key design elements drawn from examples to better align AES with spatial conservation planning
Feedback mechanisms permit update and refocus of strategy, including spatial priorities, based on outcomes.	Individual agreement can be changed on an annual basis. Defra also learning from feedback to redesign SFIs.	Data is collected on a regular basis for monitoring of outcomes and reflective monitoring of change over time leading to refocus of strategy.	In the pilot phase, plenty of feedback opportunities were provided to land managers.	• Dynamic linkage between spatial conservation planning, implementation, monitoring, and guidance to enable adjustments at each stage.

This well-established approach to spatial conservation planning is ideally suited to the context of schemes such as AES, where design and implementation should ideally occur using a participatory approach or co-design (Hölting et al., 2022) and where conservation actions must take place within the context of other demands on land use (e.g. multifunctional landscapes) and a specific social, economic and ecological context. This approach is explicitly ecological, with the principal objective to find patterns of spatial prioritisation of conservation actions that meet specific quantitative conservation targets. Consequently, viewing AESs through the lens of SCP enables the identification of major challenges for spatially targeting AES, such that the scheme is capable of achieving specific nature recovery goals. Table 1 shows the broad stages of SCP (adapted from Margules & Pressey, 2000) and describes how AES design and implementation aligns with each stage. In this section, we consider the framework alongside existing AESs designed and implemented in England (Table 2), to draw out and discuss four major components necessary for AES design and implementation to be aligned better with spatial targeting.

4.1 | Setting specific nature recovery goals and targets is necessary to target conservation resources effectively

The major strength of SCP is that the spatial prioritisation is conducted against objective criteria agreed upon prior to analysis by stakeholders, with specific quantitative targets for biodiversity set based on ecological principles and aligned to overall conservation objectives (Margules & Pressey, 2000). The aim is to develop spatial conservation plans capable of achieving the stated ecological goals whilst also being efficient in terms of costs (e.g. land area required and associated financial costs). Key in the initial stage of SCP is devising broad goals capable of being converted into specific criteria for decision-making (Nicholson & Possingham, 2006). For example, vague statements such as *improving biodiversity* or *conserving wildlife* (Defra, 2013) are more readily converted into objective criteria for conservation planning if stated as *maximising species richness in the planning region* or *ensuring no species extinctions in the planning region* (Nicholson & Possingham, 2006). Formulating precise goals that capture ecological priorities across a planning region and are inclusive of the broad range of ways society values nature is the first stage of SCP and requires broad stakeholder engagement and participatory methods across disciplines to resolve differences between stakeholders (Table 1). Obtaining broad stakeholder consensus on goals is critical for gaining trust and securing engagement in planning activities and, in the long-term, driving the type of high-quality engagement with environmental activities necessary to deliver ambitious objectives (Sayer et al., 2013).

Goals of broad-and-shallow AES typically lack the specificity to permit spatial targeting while more intensive, localised schemes are usually designed to deliver very specific nature recovery goals,

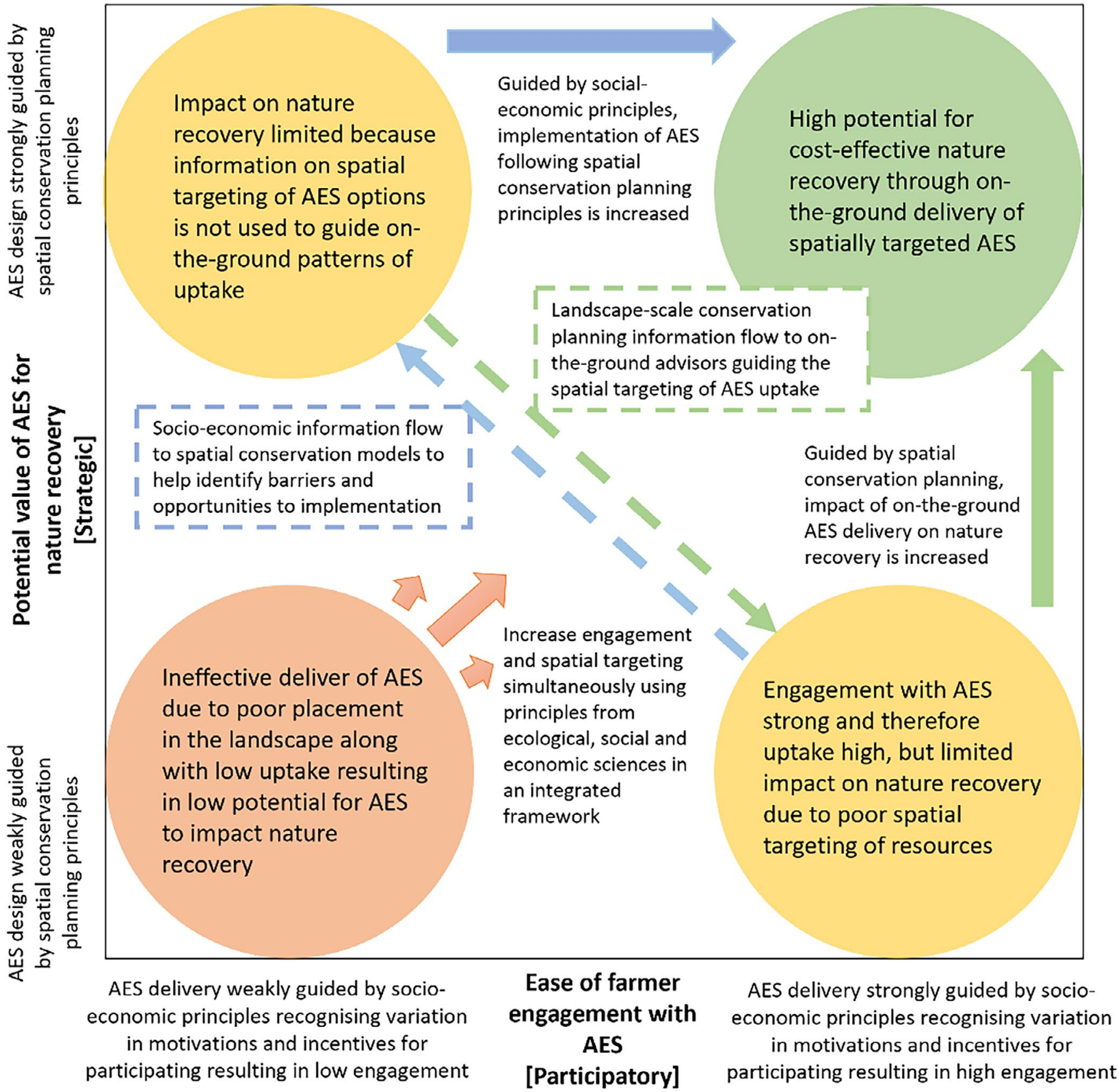

FIGURE 1 The cost-effective implementation of management targeting nature recovery outcomes through agri-environment schemes (AES) requires input from spatial conservation plans (strategic, *y*-axis) to increase the potential for the AES to have positive effects on nature recovery and an implementation strategy driven by socio-economic principles that increases the likelihood of farmer engagement and uptake (participatory, *x*-axis). Integration of ecological, social, and economic information is required to reach this desired state of AES delivery (top-right), with information flows between strategic planning and participatory implementation components to identify and overcome barriers to impactful on-the-ground patterns of AES uptake.

benchmarked against an established baseline, but affecting relatively small areas. The impact of both scheme types could no doubt be increased through clear alignment of precise goals and subsequent strategic spatial targeting of resources, such that uptake in schemes is complementary, contributing towards the same set of precisely defined objectives. This is important as AES tend to have multiple objectives (e.g. delivering for biodiversity and multiple ecosystem services) and this aspect has been criticised for the potential of actions to conflict and weaken effectiveness (Cullen et al., 2018). Creating specific nature-focused goals for AES, alongside specific goals for other elements targeted by the scheme, would help clarify the contribution of actions in a location towards broad goals, and minimise conflicts and maximise synergistic actions (Cimon-Morin et al., 2013). It would be relatively straightforward to create more precise objectives aligned to government policy but tailored to regional spatial variation in conservation priorities.

The process of converting broad scheme objectives to species targets requires identifying specific conservation features to be entered into the spatial prioritisation process. Conservation features are typically species or habitat types, but other ecosystem processes and services, such as carbon storage, can also be integrated into the spatial prioritisation process (Villarreal-Rosas et al., 2020). The principal consideration is that features can be spatially mapped with some degree of accuracy at the resolution of a planning unit across the entire planning region. Selecting conservation features could follow several routes but will involve wide consultation with experts and stakeholders through a participatory process that aims to capture a broad range of ways in which society values biodiversity to help ensure an inclusive selection (e.g. in terms of cultural, recreational, aesthetic and economic) as well as ecological value (Kelemen et al., 2013; Table 1). Links between ecological condition and societal benefits (e.g. ecosystem services) are critical for determining the relative weight given to particular biodiversity features, for example, where small increases in abundance delivered might drive large ecosystem service benefits (Baker et al., 2019; Gaston et al., 2018). Recognising that not all priority species and habitats are sufficiently mapped to include as conservation features, a key element of selecting conservation features is choosing a suite of species that are representative of a range of priority biodiversity features that cannot be included in the prioritisation (Wiens et al., 2008).

Targets for AES are most likely to be directed towards halting population declines (i.e. ensuring a landscape supports at least a minimum viable population) and, in the long term, reversing negative trends. For example, in England, the Countryside Stewardship Scheme's (CSS) main priority is to 'protect and enhance the natural environment, in particular, the diversity of wildlife (biodiversity)' (Defra, 2017); while these objectives are vague, CSS clearly has some ambition towards recovering nature. Ambitious targets may aim to recover each priority species fully to a viable and ecologically functional state across their entire historical range relative to a specific baseline (Grace et al., 2019). Targets, however, must recognise that changing conditions (e.g. climate change and food production demands) might make some historical baselines impossible to meet (Grace et al., 2019). Thus, targets should be ambitious but achievable, reflecting the policy commitments and financial resources committed to the AES. Determining specific targets for a conservation feature requires a pragmatic approach that recognises that detailed demographic data is seldom available for any given species and other measures of biodiversity (e.g. species richness) are often poorly mapped at high resolution (Hughes et al., 2021). Scheme objectives may not be linked directly to specific species but instead aim to increase general measures of biodiversity, such as maximising species richness by optimising the configuration of habitat based on established species-area relationships (Pressey et al., 2003). Targets could also focus on restoring ecological function and processes, and this can be achieved by setting species or habitat specific targets based on relationships between abundance/cover and ecological function (Baker et al., 2019; Villarreal-Rosas et al., 2020). Targets set in this way may be higher than those set with only species or habitat persistence in mind because species can often persist long after they are functionally extinct (McConkey & O'Farrill, 2016).

Incorporating strategic spatial targeting in AES design and implementation requires setting clear and precisely stated goals with respect to biodiversity and nature recovery with associated quantitative targets to serve as objective criteria for conservation planning and evaluating outcomes. Linking objectives to appropriate quantitative targets, allows resources to be strategically and efficiently allocated. Where AES goals are common across scheme elements it is important that they align (e.g. in England SFI and Landscape Recovery schemes) but for maximum impact these elements and targets should be linked with other strategic conservation management activities (e.g. actions targeting non-agricultural land, such as urban areas and woodland; Table 2). Furthermore, setting clear cross-cutting goals and targets for conservation features enhances the identification of trade-offs between biodiversity and ecosystem services goals of AES (Cimon-Morin et al., 2013), and the identification of nature-based solutions (e.g. for carbon storage and soil erosion control) that act in synergy, contributing towards targets for multiple objectives.

4.2 | Strategic spatial targeting must account for socio-economic context of the planning region

Socio-economic realities necessarily constrain which actions can be taken and where within agricultural landscapes and an important strength of SCP is that the spatial prioritisation stage can incorporate such information in order to reduce implementation barriers (Ban et al., 2013; Naidoo et al., 2006). The primary aim for most farmers is agricultural production and business viability, and participation in landscape-scale conservation practices requires at least some level of financial recompense to cover not only payments for operating costs related to the management but also the net income foregone (i.e. opportunity costs; Brown et al., 2021; Schaub et al., 2023). Whether compensation is likely to be sufficient to incentivise engagement with an AES and facilitate uptake of particular options, will vary across landscapes and between farms, but understanding this spatial variation is most critical in the spatial prioritisation process. Similarly, whilst economic incentives are important for gaining participation in environmental initiatives, particularly where widespread engagement is required, they are only one of an array of considerations influencing land manager decision-making and should not be viewed in isolation. For example, while they may constitute important incentives, financial payments alone fall short of ensuring high quality engagement in nature recovery activities. Several personal, social, business and practical factors, as well as the detail of any proposed scheme, will also shape each land manager's willingness and ability to undertake environmental practices (Mills et al., 2017). Farmer social factors have been shown to have a direct influence on the success of AES (McCracken et al., 2015). Examples include variation in the strength of belief that an activity will result in a desired outcome, perceptions about the ease or difficulty of performing an activity, perceived social pressure towards the performance of a certain activity, and perceptions about whether other people in the reference group perform the activity (Defrancesco et al., 2008; McCracken et al., 2015; Mills et al., 2017).

Incorporating socio-economic information in the spatial prioritisation stage of SCP requires the spatial mapping of socio-economic data, which can be a challenge due to the general absence of publicly available information, resulting from the sensitivity of farm level data on practices, operational costs and profitability. Practical solutions often involve the use of weak predictors of social or economic factors, such as assuming costs per area of conservation management are homogeneous across land parcels, with the total land area selected for conservation action used as a measure of the total cost. However, such measures can be mis-leading, especially when applied across large scales where land parcels can vary considerably in both value and the costs associated with conservation activity (e.g. due to location, accessibility and agricultural productivity; Naidoo et al., 2006). Frequently, non-monetary predictors, such as the distance from urban areas or threat maps (i.e. under the assumption that threats are correlated with costs) are used to capture this spatial variability in costs (Naidoo et al., 2006; Sacre et al., 2019). More sophisticated approaches have moved away from static costs to consider temporally dynamic costs and benefits, such as the reduction in management costs over time (Puri et al., 2022), or using more direct measures of economic costs, such as harvest data (Ban & Klein, 2009). Where social data have been considered important but spatially explicit information is absent, attempts have been made to predict engagement in nature-positive activity by landowners based on physical (e.g. property size and land use) and social characteristics (e.g. social networks and education; Tulloch et al., 2014), as well as using social network data to map and incorporate stakeholder connections into prioritisation processes (Mills et al., 2014). Despite being highly incomplete, predicted social information has proven a useful predictor of observed data when generating cost-effective spatial conservation plans (Tulloch et al., 2014).

It is important to recognise that AES have historically been designed to achieve a range of objectives in multifunctional landscapes, not only nature recovery. Schemes, such as Countryside Stewardship, aim to deliver multiple ecosystem services, spanning biodiversity, water quality improvements, carbon storage, flood management, air quality improvements, resilience to climate change, coastal erosion reduction, heritage and access to nature (Defra, 2021). The multi-objective nature of these schemes requires trade-offs between the provision of different services across different areas and to reflect these trade-offs through locally targeted price signals and engagement with farmers to determine and communicate priorities. From an economic perspective, making these trade-offs necessitates considering the marginal social value of different land uses and management, but even with perfect information this is not an easy task because the marginal social value depends on the location, scale and configuration of activities on the land (Bateman et al., 2013). Opportunities to obtain multiple benefits from spatially targeted management across landscapes can be identified through SCP approaches, typically with large increases in cost-effectiveness (Moilanen et al., 2005; Strassburg et al., 2020). In addition, however, it is critical that ecological effects are explicitly considered in the spatial prioritisation and not assumed to follow from interventions made for other purposes (Strassburg et al., 2020).

Thus, to increase the likelihood that AES implementation can be targeted based on the outputs from a spatial prioritisation, it is critical that the socio-economic context of the planning region, including opportunities and constraints, are adequately reflected in the suggested actions. The emergence of socio-economic models of land-use capable of capturing spatially and temporally explicit increases and decreases of multiple ecosystem services (e.g. food, timber, greenhouse gas sequestration, river water quality and flooding) provides a wealth of information to incorporate into SCP at spatial scales relevant to implementation (Day et al., 2020). More difficult to capture is spatial variation in social attitudes towards, and the likelihood of, high-quality engagement with AES. Therefore, spatial targeting must be conducted such that plans are robust to gaps in uptake due to patchy engagement and sufficiently flexible to adapt where necessary (e.g. by providing alternative but equal actions elsewhere in the landscape). Considering the outputs from spatial prioritisations as a dynamic rather than static process is likely to be advantageous for AES, where realised patterns of AES uptake can feedback to update spatial targeting to ensure guidance is still aligned to meeting AES targets. Finally, farmers often have strong preferences for which parcels of land to enrol in AES, focusing on specific, often unproductive or difficult-to-manage land. Understanding the motivations for these choices will help to design conservation strategies that work within the realities of farm businesses, while spatial modelling can be used to identify irreplaceable areas in the landscape for nature recovery, which could be targeted for higher levels of payments for actions in those areas, particularly in a results-based context.

4.3 | Implementation through collaboration and cooperation is required to target AES spatially

Though Lawton et al. (2010) advocated that environmental delivery might be more successful if management plans were coordinated via some form of collaboration or cooperation, details as to how this might manifest were lacking. The 'individualisation' (sensu Beck & Beck-Gernsheim, 2002) of farmers due to the slow dissolution of social institutions, for example, based on the family, class, and gender, has resulted in a move away from traditional 'collective' structures and created strongly entrenched identities. This historical shift from collective to more individualistic values among the farming community means that encouraging farmers to not only invest themselves in a group but also to become an engaged and active group member might be a challenge (Chiswell & Lobley, 2018; Riley et al., 2018). Research has shed considerable light on factors affecting engagement with individual or collective conservation activity and this knowledge is critical to delivering effective conservation across farmed landscapes (De Snoo et al., 2013; Maas et al., 2021; Wheeler et al., 2021).

While cooperation among farmers has continued to exist at some level, decisions around land management have been individualised and are often taken out of these realms of collective activity (Riley et al., 2018). Farmers rarely communicate about activities aimed at delivering environmental outcomes, to the extent that they often struggle to place value on the conservation activities of neighbours (Riley et al., 2018). Social contact between farmers appears to be declining with structural changes to farming (e.g. shifts from local to national-level contracts; Junquera et al., 2022). While some collaborative initiatives have been successful, such as catchment-sensitive farming programmes or farmer-led initiatives (e.g. Keenleyside, 2013), there is still a need for a significant shift in the social and cultural norms of the farming community to incentivise more joint efforts. It is important to measure the success of landscape-scale conservation not only in terms of uptake or group participation under a more collaborative model but also in terms of social, cultural, economic, and environmental outcomes. Consequently, landscape-scale conservation may be determined by economic and social factors more than ecology.

Paying attention to non-financial factors is important where collaboration is required across landscapes to deliver nature recovery, particularly where cultural practices emphasise working independently (Emery & Franks, 2012; Franks et al., 2016; Riley et al., 2018). The particular design of the initiative and level of cooperation required is also pertinent, as forms of cooperation where participants remain fully independent but undertake activities coordinated by a trusted third party may be more appealing to some land managers than those requiring a closer degree of integration and joint working with others (Hodge & Adams, 2013). The appropriate level of cooperation for any initiative will, however, depend on the socio-ecological system (Ostrom, 2009) and the ecological objectives being sought—some large-scale habitat creation, for instance, will require significant cross-boundary working between farmers, whereas reduced nutrient runoff in a specific water catchment might be achieved through external coordination of individual actions (Wheeler et al., 2021).

There are some good examples of farmer-led groups and networks that have successfully facilitated large-scale environmental management despite no direct financial payment being offered (Wheeler et al., 2021), although there may be indirect economic benefits to participants (Nye, 2018). In these cases, land managers are typically strongly motivated by their own desire to protect the environment, as well as by other factors such as opportunities for social learning and network creation, developing good practice, preparing for anticipated policy changes, a sense of social responsibility and a desire to improve the public reputation of farming (Nye, 2018; Wheeler et al., 2021). Attempts to drive landscape-scale conservation must acknowledge these additional or alternative motivations and optimise associated benefits for land managers, rather than relying on a financial incentive alone, which may be insufficient. This will not only assist with initial recruitment, but also increase the likelihood of achieving genuine and sustained engagement that results in long-term environmental management and positive conservation outcomes.

For AES implementation to align effectively with spatial targeting, mechanisms must exist to facilitate coordination and/or collaboration across landscapes. Mechanisms might be integral to AES design (i.e. Landscape Recovery, Table 2) or be facilitated by resources made available to individual land managers or advisors, such as through digital platforms offering advice guided by outputs from spatial prioritisations targeting resources. For example, feedback from on-the-ground implementation could be used to update spatial targeting plans given realised changes across a landscape (Figure 2). Such information could be used at an individual farm scale, with information from neighbouring farms anonymised, to guide collaborative agreements negotiated across neighbouring holdings. Such information is ultimately designed to guide decisions, rather than be definitive, with negotiations designed to reconcile disagreement between outputs from the spatial targeting process and on-the-ground conditions. Thus, providing spatial guidance that offers flexibility in decision-making

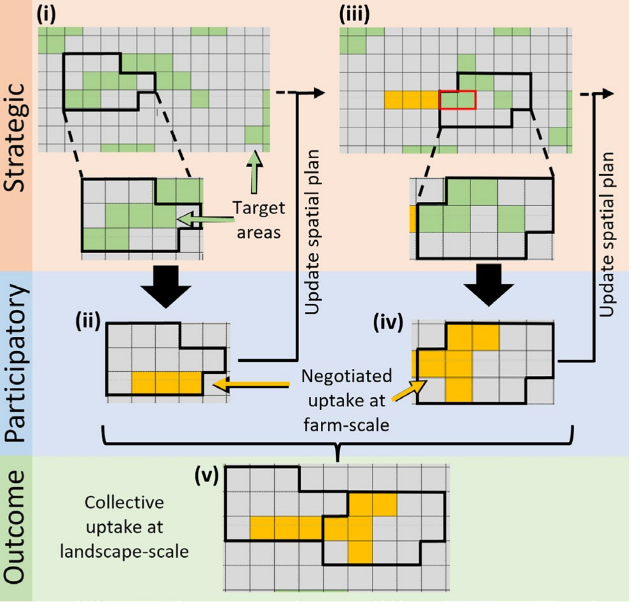

FIGURE 2 Spatial conservation planning requires updating based on patterns of AES uptake arising from implementation negotiated at farm-scales, via participatory strategy, where patterns could diverge from the landscape-scale spatial plan. In this example, the original spatial conservation plan (i) seeks to target adjacent land parcels across land holdings to increase patch size and connectivity. Uptake on the first holding deviates from the original plan (ii) and this must be reflected in guidance provided on the adjacent holding (iii), which influences the pattern of AES uptake on this second holding (iv) to ensure a satisfactory outcome is achieved at the landscape-scale (v).

across land holdings is likely to be critical in facilitating coordinated and/or collaborative AES uptake.

4.4 | Monitoring and evaluation must be linked to quantitative targets and objectives

Monitoring and evaluation are critical components in any conservation intervention and a key stage in SCP. Targets set during SCP provide objective criteria against which outcomes can be evaluated and the ability to evaluate progress towards targets should be a key consideration when selecting conservation features and targets. Inadequate monitoring data is a major barrier to evaluating progress towards goals in SCP (McIntosh, 2019), but with forethought, effective monitoring protocols can be designed that are specific to each quantitative target such that there is sufficient statistical power to detect the desired state change. Evaluating outcomes at the appropriate spatial scale is important because monitoring should not just aim to measure regional or national scale progress towards targets but must also aim to provide information useful to individual land managers, where feedback on outcomes has been found to be important for motivating engagement in high-quality environmental management (Boulton et al., 2013; Emery & Franks, 2012). Sharing monitoring results with farmers and involving them in monitoring processes can help enhance their ecological knowledge and confidence and facilitate a sense of shared responsibility for achieving environmental objectives, while also helping to identify solutions where there has been a lack of progress towards environmental objectives (Wheeler et al., 2021). Evidence from research on result-oriented AES (e.g. payment-by-results; Table 2) also suggests that a focus on environmental outcomes can help drive innovation and boost opportunities for developing non-economic forms of capital (Burton & Schwarz, 2013; Chaplin et al., 2019).

Better aligning AES with spatial targeting approaches within the context of SCP provides a clear framework for monitoring outcomes against specific quantitative targets and goals, providing opportunities to identify aspects of scheme design and implementation, as well as the spatial targeting approach, that are more or less successful. Where the intended goals of AES are to contribute to the delivery of specific nature recovery outcomes then ultimately the key evaluation criteria will be performance-based (Adams et al., 2019). The spatial targeting is designed to guide AES implementation, yet, when the success of implementation is measured against ecological responses that take years or decades to be realised, conformance-based evaluation might be highly valuable. For example, tracking strong deviations in uptake from spatial targeting plans provides a short-term means of evaluating the potential of the scheme to meet specific targets, inferred through analysis of uptake patterns against targets. This information can then be used to inform changes in scheme design and implementation where the scheme is anticipated to fall short of specific targets. Ultimately, once sufficient time has elapsed for targets to respond to management actions, biodiversity monitoring could be designed to feedback into the SCP process, helping to shape scheme design and implementation. Spatial prioritisation algorithms within SCP can incorporate temporal change in habitat state and responses of conservation features to these changes, thus enabling the anticipation of responses of specific conservation features against targets and providing intermediate benchmarks against which to measure progress towards targets over extended timeframes. It is, therefore, very important to set clear timeframes for achieving broad goals and specific targets in the initial stage of SCP.

5 | CONCLUSION

While a lot is known about designing and implementing AES in a landscape context, much of this information remains in disciplinary silos and is not adequately shared across knowledge cultures. Improving outcomes for nature recovery and providing cost effective public benefits through AES requires more effective alignment of spatial conservation planning theory and methods with participatory approaches for AES design and implementation. Strategic spatial targeting of AES options can be integrated into AES differently, depending on the overall goals of a particular scheme, but critical to all schemes is setting clear goals and quantitative targets for AES. Without these it is difficult to develop a spatial prioritisation for targeting AES actions and to evaluate performance and cost effectiveness. Where multiple schemes exist within a landscape (e.g. SFI and LR; Table 2), objectives and targets must be aligned where appropriate such that actions contribute towards targets effectively and actions across schemes do not conflict and undermine outcomes. For universal 'broad-and-shallow' type schemes, spatial targeting can be aligned with the current paradigm, where uptake is often negotiated at an individual farm scale, by using digital platforms to present portfolios of 'good' choices at farm holding scales aligned to broader nature recovery goals and targets, thus facilitating coordination of actions at scale. In the longer-term, collaborative cross-holding approaches to AES uptake are needed to facilitate alignment with spatial targeting, which will require novel financial mechanisms and legal frameworks, as well as shifts in farmer attitudes towards collaboration. Given the increasing demand for food worldwide, efficient and effective conservation on farmland is vital for nature recovery and will only be successful if strategic and participatory approaches to AES delivery are united.

AUTHOR CONTRIBUTIONS

All authors were involved in the conceptualisation of the article. David J. Baker led the development and writing with contributions from all authors. Charles Masquelier conducted expert interviews to obtain background information on specific aspects of AES design.

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This article does not include any data.

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