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PERSPECTIVE

Using a multi-lens framework for landscape decisions

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Abstract

1. Landscape decisions are multi-faceted. Framing landscape decision-making as a governance process that requires a collective approach can encourage key stakeholders to come together to co-inform a discussion about their priorities and what constitutes good governance, leading to more holistic landscape decisions.
2. In this paper, we recognise that a suite of complementary and multi-dimensional approaches are in practice used to inform and evaluate land use decisions. We have called these approaches 'lenses' because they each provide a different perspective on the same problem. The four lenses are (i) power and market gain, (ii) ecosystem services, (iii) place-based identity and (iv) ecocentric. Each brings a different set of evidence and viewpoints (narrative, qualitative and experiential, as well as quantitative metrics such as monetary) to the decision-making process and can potentially reveal problems and solutions that others do not.
3. Considering all lenses together allows dialogue to take place which can reveal the true complexities of landscape decision-making and can facilitate more effective and more holistic decisions. Employing the lenses requires governance structures that give equal weight to all lenses, enable dialogue and coexistence between top down and bottom-up approaches, and permit adaptation to local and granular place-specifics rather than developing "one-size-fits-all" solutions.
4. We propose that formalising the process of balancing all the lenses requires public participation, and that a lens approach should be used to support landscape decisions alongside a checklist that facilitates transparency in the conversation, showing how all evidence has been considered and critically assessed.

KEYWORDS
co-informing, ecocentric, ecosystem services, landscape decisions, participatory approaches, place-based identity, power and market gain

1 | INTRODUCTION

The ecosystem service (ES) approach plays a positive role in landscape decision-making by providing a framework for representing landscape multi-functionality and for allowing the disparate social consequences of decision-making to be more easily compared. It provides a multifaceted understanding of how nature promotes human well-being. In this line, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) recently redefined ecosystem services as nature's contributions to people, as many services fit into more than one category. This stresses "pluralism", with biophysical, social-cultural, economic, health, and holistic understanding of what people derive and co-produced with nature (Díaz et al., 2018; Pascual, Balvanera, et al., 2017). However, landscape decision-making is a complex interaction between multiple sectors, and actors, and different (and excluded) parties that often see the landscape through different perspectives. The landscape decisions that the ES approach is set out to influence, are invariably a highly contested matter; and the ES concept for all its strengths cannot be expected to resolve these contested positions. In this paper, we frame landscape decision-making as a governance process that requires a collective approach that can encourage key actors to come together to co-inform a discussion about their priorities and what constitutes good governance.

Most landscape decisions are localised and are generally perceived as having local impacts, yet the framing for these decisions is often driven by strategies, decisions and policies at a larger scale. A typical decision is embedded in a spectrum of scale through international, national, regional and local policy from which top-down and bottom-up decisions are made. Top-down decisions tend to address issues at the wider scales, such as greenhouse gas emissions, water, biodiversity, habitat state, rural and urban sustainability, while bottom-up decisions focus on issues in the narrower scales, related to local planning, restoring and conserving local habitat/species and aesthetics and the local impacts of land use change. Even though there is an expectation that consultation with stakeholders and communities affected should take place, the actual decision-making remains cloistered. This tendency is perhaps understandable given how contested many landscapes are, but it needs to be improved as the effects of a participation deficit are that people feel locked out of decisions that affect their lives. For example, the Community Empowerment and Landscape report (Dalglish, 2018, p. 2), looking at decision-making around landscape designation in rural Scotland, concluded that:

> There is a gap between the principle of participation—which is enshrined in some (but not all) aspects of policy—and the delivery of participation in practice. There is a strong sense of exclusion from the processes through which the characteristics and qualities of the land are defined and through which areas of land are designated and managed for the purposes of conservation.

The decision-making processes are perceived locally to be the preserve of governmental policy makers whom any local aspirations to encourage socio-economic development are seen as a threat to be legislated against (Dalglish, 2018). These findings, while pertaining to Scotland's Highlands and Islands, clearly have a much broader political resonance. A widespread sense of democratic deficit, perceived as an injustice, may occur, as a reaction to deep disaffection with decision-making processes. Using again a UK illustration, this disaffection among disadvantaged communities across England was leveraged by campaigners using the slogan "taking back control" in order to secure the electorate's decision to leave the European Union (MacLeod & Jones, 2018). Scotland, which voted to remain in the EU, already had devolved legislation in place to enable greater levels of locally led governance, though it remains to be seen how this will translate into action. Meanwhile, in neighbouring Ireland, locally led environmental governance models such as that pioneered by The Burren Programme, are being adopted nationally (Macken-Walsh, 2019).

The courtroom metaphor of dispute resolution is one approach that could be used to mediate contested decisions. Planning applications, and the appeals process that accompanies them, are a pragmatic example of this approach. However, a more productive and sustainable approach is one that emphasises diplomacy, conviviality, listening and exchange (Büscher & Fletcher, 2019). This might be described as a partnership approach to governance in which stakeholders deploy their perspectives to pull together towards a consensus in which everyone feels ownership of the decisions made. The ES approach is one view or 'lens' that can include valuable insights on ES synergies and trade-offs in a tractable way, particularly for the case of readily quantifiable environmental goods and services, however we argue that ES approach represents a particular worldview that must be supplemented by a suite of other perspectives and approaches.

Literature on the social construction of environmental worldviews highlights this need for multiple dimensions in decision making (Clapp & Dauvergne, 2011) and has its foundations on the work of 'collective-action frames', or the way meaning is made for complex and contested social problems (Benford & Snow, 2000). The key relevant insight from this work is that an environmental problem can be framed in countless ways. These frames become dominant across language, imagery and knowledge artefacts and provoke action with associated material consequences (Hannigan, 2006). In addition, the work of collection-action frames is done by different groups who wish to resolve a particular claim or grievance by key actors with the capacity to do so. For example, if a dominant frame of productivism defines the nature of humans and farmland, then farming practices that boost yields and maximise efficiency enjoy broad legitimacy. For these practices to change, key actors must successfully turn their claims into a master frame that is capable of contesting productivism.

The aim of this paper is to describe a rationale for an expanded framework of multiple perspectives in landscape governance that reflect the complexity and multifunctionality of landscape decisions more holistically and fairly than a reliance on just the ecosystem

services approach. To the best of our knowledge, this is the first time that multiple perspectives have been considered together with an emphasis on recognising their full complexity, their interrelations and their equal weight and bring them together in landscape decision-making. The paper describes our approach, each lens in turn, the benefits of multiple lenses and then proposes a process for balancing all the lenses in landscape decisions.

2 | METHODOLOGICAL PROCESS

The UK's National Research and Innovation funding organisation (UKRI) instigated a research programme across disciplines on Landscape Decisions (LDP). To encourage cross-disciplinary thinking on common themes of debate in landscape decision-making the LDP coordination team (University of Leicester, UK) devised 4 topical workshops, including plenaries and breakout sessions that were held remotely during the Covid-19 pandemic (June and July 2020) that brought together the experiences of personnel on 52 UKRI landscape projects. A particular theme that was identified from the workshops was "Are ecosystem services used effectively in landscape decision-making to capture the complexities of multifunctional landscapes? What are the challenges and how do we move beyond them?" LDP researchers who could commit and contribute appropriately to address this emergent theme convened remotely and regularly over the space of 18 months during 2020 and 2021 with a chair from the LDP. Based on their knowledge and experience from various UK-based case studies using different disciplinary backgrounds in landscape decisions, the following themes were analysed in those discussions: (i) the different perspectives and discourses that emerge frequently that need to be respected and integrated into landscape decisions; (ii) the governance challenges required to provide better inclusivity and voice for unrepresented parties in landscape decisions; while (iii) evaluating the role of the ecosystem services approach in this process and the ecosystem service approach's ability to represent these different perspectives in (i).

We drew on several approaches that analyse, compile, understand and solve environmental problems. We followed, Clapp and Dauvergne (2011), which argues that ways to solve pressing environmental problems can mapped on to what they call dominant worldviews, which carry a set of logics, rationales, epistemological underpinnings and moral paradigms. Thus, the outcome of landscape decision making consists not only of filling knowledge gaps with more precision, but the extent to which scientific debates support a larger frame of understanding. In that sense, Hannigan (2006) describes the construction of a frame within environmental dilemmas consisting of *assembling*, *presenting*, *and contesting*. The rationale and epistemology dimensions of landscape decision making that we discuss, for example, key actor and knowledge sources, can be mapped onto *assembling* a frame relying strongly on scientific evidence. We discuss the dynamics in landscape decision making lenses through analysis of their philosophical thought and ethics, in line with *presenting* a frame, in which claims to morality and philosophical orientation become increasing important. Our discussions of ways to balance the lenses for a more holistic landscape decision making is similar to Hannigan (2006) *contesting* frames concerning how successful frames become 'sticky' and become embedded in the law, politics and/or customs. Additionally, we consider temporal and spatial scales (scene and setting) as key dimensions of landscape decision making, building on Cronon's (1992) work on the centrality of narrative on environmental history putting forward metaphors from storytelling (characters, plot, moral, scene and setting) as the key ingredients that define how we make meaning out of the complexity of human nature relationships.

Our interdisciplinary reflections led us to use the construct of 'lenses' representing different viewpoints on the same inherently complex problem can be seen in parallel. Each lens has a viewpoint which embodies a particular value system, represents a particular way of thinking and carries with it particular forms of knowledge. We assume that a lens highlights the analytical work of landscape decision making, often cutting across different dimensions of the framing process. In our analysis, we thus suggest a frame helps give landscapes their meaning, but a lens describe how actors decide how they ought to act on the land to achieve a certain outcome. We recognise that these findings relate to input from our backgrounds, experiences and UK based research (see full positionality statement, Appendix 1), so we have not necessarily accounted for all global circumstances.

Positionality

This paper is an exercise in bridging epistemological and ontological divides about landscape, and translating that collaborative approach into advocacy for inclusive decision-making frameworks by which place-based approaches to addressing our twin global nature crises, can be managed successfully. The authors' varied positionalities determined this paper's advocacy for more pluralistic approaches, critical of the prevailing trend for modifying the ES frameworks to be more inclusive. This advocacy emerges not least from the significant learning each member of the consortium took away from what was a deliberately convivial discursive process. This is how our positionality shaped the origins of 'multiple lenses' concept.

3 | MULTIPLE LENSES FOR LANDSCAPE DECISIONS

Our methodology enabled us to form four major lenses which each have characteristic perspectives and elements that most individuals

or groups can directly identify with. During this process some elements evolved from existing elements and that these lenses are not necessarily exhaustive of all possible world views. It is also important to note that the lenses are not intended to be mutually exclusive, for example some individuals or groups will hold characteristics of multiple lenses in different decision-making contexts. We describe the following:

(i) Power and market gain lens.
(ii) Ecosystem services lens.
(iii) Place-based Identity lens.
(iv) Ecocentric lens.

3.1 | Power and market gain lens

3.1.1 | Decision-making rationale and key actors

The "Power and Market Gain" lens is concerned only with private interests and informs landscape decisions through a perspective of individual sovereignty, and long-term stewardship, seen through this lens, is only possible through actions that deliver a financial return, which may be reinvested in the maintenance of the asset or utilised outside of the landscape system. This lens envisions a number of actors operating in their own self-interests, maximising the private financial benefits from the natural assets that they have the power to control. This rationale is closely associated with the logic of markets as the optimal way to distribute resources. It has, perhaps, been the dominant decision-making paradigm historically and relies on deep historical and legal traditions of individual rights and a liberal vision of the state. For example, in much of the "Global North" the right to property is strongly tied to concepts of an individual's freedom to make decisions about their assets, often ignoring the consequence of those decisions to others, often termed as externalities (Sax, 1971, 1993). In fact, it is well-known that market failures justify the intervention of the state in the economy. A core purpose of the state is also to distribute, uphold and defend the property rights of its citizens (Kedar, 2003). In these legal contexts, a property holder's ability to manage their assets is strongly protected from state interference, a power granted to individuals by the state itself (Sikor & Lund, 2009). Landscape decisions, therefore, tend to be made by private actors through this powerful agency of distributed ownership (Blomley, 2017).

As applied to landscapes, property rights grant private actors dominion over their property to dispose of and modify land. These rights to property exist among owners of land (which can be individuals and collectives), but also owners of businesses that are often best left unregulated in order to provide economic growth. Tenancy agreements, depending on their terms and conditions, may offer strong or weak access to land resources, either approaching the power and incentives of an owner, or in contrast, producing diverging interests. Key international development and trade policy has followed this rationale, as it is recognised that land use improvement depends upon clearly measured and legally protected land tenure (Bromley, 2009; De Soto, 2000) and agricultural subsidy payments that are directed to land owners (Matthews et al., 2013). Key institutions that influence landscape decisions through this lens point out that successful stewardship is supported through strongly protecting property rights and then engaging the empowered rights holders in projects of collaboration or awareness raising. This is, in this lens, to influence environmental conservation decisions from which there can be societal gains, there must be a demonstrated financial gain to the private actors and legal entities who currently have rights and ability to make changes to their management units.

3.1.2 | Sources of knowledge and how this is obtained (epistemology)

This lens stems historically from liberal thought about the best way to maximise freedom and wealth creation (Hayek, 1944). It draws on micro-economics concepts such as rational-choice-theory, which assumes that individuals are likely to operate in their own best interest. Therefore, if policy or regulation is to influence change, it should seek to promote the maximising of private benefits for landowners. Project appraisals to guide private decisions, do not correct for market failures, and therefore social benefits and costs of private decisions are ignored. This lens underpins the potential open-access dilemma (Hardin, 1968; Ostrom, 1990) where the fact that, common-property natural resources are nonexcludable can lead to their over-exploitation, because the individual drive to maximise private benefits ignores the social external cost of their actions, and thus individual rational decisions become socially irrational. Game theoretical analysis has contributed to explain the difficulties of co-operation and the potential remedies of local and global commons (Diekert, 2012).

3.1.3 | Spatial and temporal scale

The default scale of the "power and market gain lens" is often the parcel (field or farm). Expanding the scale of decision making requires some form of social or institutional innovation. For example, there are powerful illustrations of collaborative land ownership landscape partnerships, where adjacent landowners make voluntary changes to their management in order to maximise the benefits to all members of the partnership, but often a significant investment from third sector organisations or state funding agencies is required to make these collaboration successful (Bidwell & Ryan, 2006). The temporal scale is limited by the time horizons relevant to the owning entity. For example, many mutual fund companies model investment returns over a 30 year timeframe and landowners often benefit from intergenerational asset appreciation. This lens may be predisposed to a relatively short-term perspective (i.e. the desire for immediate results) and can ignore long term consequences. However, the guiding rationale is maintenance of control over their assets

which can extend through relations of inheritance over generations (Piketty, 2011). Motivated by narratives of stewardship and legacy, powerful actors who are secure in their access to natural resources may make decisions intended to ensure the these produce value well into the future, such that those inheriting them (an heir for example) will also benefit.

Consequences outside of the individual's domain (externalities) are often neglected, and intervention of the state, although contested, is required, through either regulation (command and control strategies) or the use of economic incentives to encourage shifts in land use via inducing individual actions to take into account the environmental consequences of their behaviour. Examples of government intervention include "public money for public good" policies, as payments for ecosystem services schemes (PES), that align market-based lens behaviour with a more ecosystem services focused perspective (detailed below), as this instrument motivates landowners to provide public good (therefore non-marketed) ecosystem services using financial payments. These schemes are currently being applied worldwide (Ezzine-de-Blas et al., 2016).

3.1.4 | Role of humans with respect to environmental philosophy and ethics

This lens prioritises individual liberty over other principles, but stresses that an individual with power to decide provides the best pathways to preservation. This can be linked to concepts of dominion and stewardship. While financial private gain dominates, individuals with power over land can orient their land use to any philosophy they choose. The concept of stewardship requires land managers to be authoritative actors on the land over generations, developing both the competency to influence landscape change or maintain the status quo.

3.1.5 | Example

Consider an owner of undeveloped, biodiverse land being approached by a housing developer. The landowner must decide to sell land for a hefty profit or keep it under its current management. Under the "power and market gain lens", the owner and developer may seek to maximise their private benefit. However, because the benefits of habitat protection are largely unpriced due to the public good nature of many of the societal benefits from biodiversity conservation, and the owner is likely to obtain a higher financial return for the sale of the land, converting the land into homes is often an attractive choice. Alternatively, the owner may be motivated by other personal values to reject the developer's offer, but these values must outweigh the immediate private benefit gained by the sale. Importantly, the interests of the developer and the potential demand for housing they aim to serve, have no power to compel the owner's decision, other than through the market mechanism of price.

3.2 | Ecosystem services lens

3.2.1 | Decision-making rationale and key actors

The ES approach (Costanza et al., 1997; de Groot, 1987) is based on the idea that the natural environment provides many and varied goods and services that underpin human well-being. It recognises the complex interdependencies in human-nature relationships and provides a framework to acknowledge, organise and assess the trade-offs and synergies among ecosystem services in a transparent and tractable manner to inform decision-making (e.g. Dasgupta, 2021; Polasky et al., 2019). It often involves the quantification of changes in environmental goods and services, often using a common (monetary) unit (e.g. Bateman et al., 2013; Liekens et al., 2013) to help comparison of the multitude of different consequences of almost any landscape decision. The ES lens is anthropocentric, and it emphasises the need to account for how social welfare is affected by decisions. It therefore integrates both the private financial gains and public-good values of changes in nature associated with decision-making. The ES lens derives the value of nature's contributions to human well-being. This value is associated how people benefit from the natural world, affected by peoples' knowledge, practices, beliefs, and moral principles that guide interactions with nature, and also judgements regarding the importance of nature in specific context, whether it is instrumental, relational, or intrinsic (IPBES, 2022). The ES lens is therefore able to facilitate a governance system where the needs, benefits and impacts of a landowner decision on nearby landowners and overall community can be better taken into account. Unfortunately, few ecosystem services assessments consider all ES components simultaneously, and often focus only those that are more amenable to be quantifiable and/or which can be more easily measured, often in monetary units. Furthermore, studies that then also disaggregate the ES flows to beneficiary groups can go on to look at the winners and losers of changes to ecosystem service (Jopke et al., 2015). Cruz-Garcia et al. (2019) demonstrate how the perceived importance of a given ES may be affected by gender, and Sandifer et al. (2015) summarise the existing evidence on the wide range of actors that need to be considered when looking at the health effects of biodiversity and ecosystem degradation. Sandifer et al. (2015) call-to-arms for more interdisciplinarity in ES research to ensure that more causal links are established within this subject area.

3.2.2 | Sources of knowledge and how this is obtained (epistemology)

While scientists and environmentalists have discussed ES implicitly for decades, the formal process of ES accounting evolved in the 1970s and 1990s—when nature was often little more than an afterthought in many landscape decisions, which scope was largely restricted to those environmental goods and services that are traded in markets (Gómez-Baggethun et al., 2010). The approach

became widely accepted internationally after the United Nations (UN) Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2005). This was then followed by a number of international and national initiatives which subsequently cemented some of the concepts into policy (e.g. The Economics of Ecosystems and Biodiversity (TEEB) UN initiative: Kumar & Martinez-Alier, 2011) and the United Kingdom (UK) National Ecosystem Assessment: (2011). Despite the implementation gap between ES research and its use in practice (Laurans et al., 2013), many environmental policies now rely on the ES approach as a justifiable means for government target-setting, reporting and planning. The ES approach has also gained backing in the private sector. The Natural Capital Protocol sets out a framework for how businesses can identify and measure their impacts and dependencies on natural capital to inform decision-making (Natural Capital Coalition, 2016). Across a number of sectors, the idea of recognising the many societal benefits of a healthy ecosystem to society are now widely accepted.

The ES approach to environmental stewardship has, in part, developed through the recognition of environmental damage caused by evolving priorities and policies in landscape use. For example, in the UK, during and after World War 2, policy was dominated by the drive to increase agricultural efficiency and improve national self-sufficiency. This demanded increased productivity assisted by a combination of scientific and technological developments (e.g. new crop varieties, new machinery, more fertilisers and new pesticides), accompanied by increases in farm specialisation, artificial drainage, field sizes and changes in crop rotations. The unintended consequences of these developments included increased leaching of soil nutrients to surface- and ground-waters (Holman et al., 2010; Howden et al., 2010; Whitmore et al., 1992), potential reduction in soil carbon stocks (Bellamy et al., 2005) and a loss of biodiversity in the landscape (Stoate et al., 2001). The ES concept helped to challenge the dominance of productivity in the landscape decision-making process and helped policy move away from the single objective of maximising financial private returns, towards a multi-objective approach which included improved environmental outcomes and societal benefits. In the UK, the ES and natural capital framework are now at the heart of many national policies, including net zero carbon budgets and reversing declines in biodiversity, as outlined in the UK 25 Year Environment Plan (Defra, 2018).

3.2.3 | Spatial and temporal scale

ESs are not bound by spatial scale and are dynamic through time (Raudsepp-Hearne & Peterson, 2016; Sun et al., 2019). However, in order to formally assess them, researchers need to define the spatial extent of the area of interest and acquire data for particular points in time. ES production, consumption, management (including engineering and access to the landscape), supply and demand, and "bundles" of ES can all be defined in these terms at different scales, although across spatial scales there are also contradictions, generalisations and loss of information which are somewhat difficult to predict (Madrigal-Martínez & Miralles i García, 2020; Raudsepp-Hearne & Peterson, 2016; Sun et al., 2019). Clearly in this conceptualisation, upscaling and downscaling of ESs is challenging, and until this is fully understood, ES processes, interactions and quantification (or transfer of values) are smudged with unintentional or hidden trade-offs (Pascual, Palomo, et al., 2017). The consensus is that a better understanding of the scale issues will help governing and provisioning of these services, but there is currently little on offer for how this could be achieved.

A few relatively easily quantifiable provisioning, cultural and regulating services tend to dominate ES research and practice (Crossman et al., 2013; Egoh et al., 2012; Wong et al., 2015). These include changes in provisioning services (e.g. the products of agriculture or forestry), carbon stocks, water fluxes, and recreational benefits. Moreover, whilst people benefiting from natural services is a vital part of the ES concept, the flows of ESs to some local and marginalised communities are often neglected (Sangha et al., 2019). Moreover, benefits are also often linked to inconsistent (e.g. much larger) scales that become meaningless for decision-making. For example, the large-scale contribution to societal well-being of farmland in providing clean air, flood control and the important role farming plays in culture and heritage are rarely understood at fine spatial scales at which land use decisions are usually made—e.g. the individual farm.

3.2.4 | Role of humans with respect to environmental philosophy and ethics

Despite its clear advantages, the ES concept has been widely criticised, particularly the anthropocentric nature of the approach, which promotes a utilitarian view of nature—nature only 'serving' human wellbeing (McCauley, 2006; Thompson & Barton, 1994). Some authors have argued against using the ES concept in decision-making, highlighting its inadequacy in dealing with equity, environmental justice and moral values (Chee, 2004; McCauley, 2006; Victor, 2020). Operational challenges of ES assessments include uncertainties in our current understanding of how changes in ecosystems lead to changes in present and future flows of ecosystem services, how different ES can be quantified (and potentially monetised) and how intangible ES, such as cultural identity, experience, learning and mental health can be accounted for (Daniel et al., 2012; Polasky et al., 2019). Thus, the framing of cultural ES has conceptual limitations. "Cultural services" have been described as spatially and temporally distinct, intangible, subtle, mutable and intuitive in nature, based on ethical and philosophical perceptions. It can be argued that they are, thus, largely unique to the individual and essentially unquantifiable (Church et al., 2014). Moreover, the logical underpinning of the cultural service concept is that things of value to people provide a service. However, for many people, when a particular place has value to them because it is integral to their life, the cultural benefit provided cannot be satisfactorily conceived in terms of means and ends—in the conceptual terms of cultural services (James, 2015).

Similarly, attempts to capture aesthetic and spiritual value in terms of a "service" are not always commensurate with the nature of the relations being described (Cooper et al., 2016).

3.2.5 | Example

In Wales, ESs are, by law, central to landscape decisions. Specifically, Part 1 of the Environment (Wales) Act aims for sustainable management of natural resources, including building resilience into Welsh natural resources so that their services continue to be provided now and for future generations (Welsh Government, 2018). This is further expanded as ESs are considered in wellbeing goals under the Well-being of Future Generations (Wales) Act 2015, whereby actions must improve economic, social, environmental and cultural well-being both at local and global scales (Welsh Government, 2015). Other examples of policy-making using ES lens is the PES schemes mentioned earlier. The global portfolio of PES schemes has been estimated to be more than USD $36 billion annually (Ruggiero et al., 2019). However, the effectiveness and equity outcomes of this investment in payments for ES provision is still questionable. Ruggiero et al. (2019) used a counterfactual approach to evaluate two well-established PES programmes in South America. They found that PES was associated with an additional 2.8%–5.6% of area covered in native forest over a five-year period, as well as a non-significant trend towards decreased loss of vegetation. However, this represents a relatively minor success because achieving robust forest restoration gains at this rate would require approximately 180 years (Ruggiero et al., 2019). Furthermore, substantial effort is required to support communal governance mechanisms and promote participatory and transparent decision processes, to ensure that the resulting distribution of benefits within a PES scheme is fair; evidence for the livelihood impacts of PES schemes is even weaker (Hayes & Murtinho, 2018).

3.3 | Place-based Identity lens

3.3.1 | Decision-making rationale and key actors

'The place-based Identity lens articulates those ways of valuing and knowing a landscape that are representative of the local and indigenous population in their everyday identification with place. This lens represents those people constituted by a place and whose culture is both a component of the landscape and is shaped by it. They may be local farmers (often pivotal to this lens), gamekeepers and land managers, but they might equally be local artists, naturalists, historians and whosoever immerses themselves in the particularities of that locale. As such, this lens contributes evidence to decision-making that pertains to belonging, identity and the particularities of a place.

The Place-based Identity lens is key to accessing the on-the-ground complexity that quantitative approaches and modelling can struggle with because it brings to the decision-making process, the knowledge, nous and vernacular expertise that is embedded in local people, whose livelihoods and culture are enmeshed with the landscape about which decisions are being made (Lowe et al., 2019). This is the lens that provides the granular detail, the counter-intuitive and the non-conforming particulars, without which any decision could be flawed. Thus, the place-based Identity lens should not be thought of as equivalent to the 'cultural services' portfolio in ES approaches (e.g. Plieninger et al., 2013), though of course it is indispensable to understanding the intangibles that the latter seeks to capture.

3.3.2 | Sources of knowledge and how this is obtained (epistemology)

The sources of knowledge that contribute to the place-based Identity lens are diverse and will vary from place to place and from context to context. Unlike the ES lens, which codifies its knowledge gains through secondary sources (e.g. peer-reviewed papers, policy reports and pre-existent databases), access to vernacular expertise requires more local knowledge at the outset. The principal repositories of expertise will be individuals who are known and respected in their communities for their knowledge. Local trusts, charities and foundations will also pool some of this localised knowledge.

If we take the farmer as a key repository of this type of landscape knowledge, his or her acquisition of learning begins as a child when helping out on the farm and becoming familiar with the landscape's particulars through the stories that parents and grandparents tell as well as through watching and engaging in practical interactions with the land, the livestock and crops. The practical side of these interactions develops the functioning of common sense which becomes a methodology of learning. Affect and attachment aligned with daily observation of and immersion in the landscape provide an intimate understanding of stability and change across the landscape (Brook, 2012; von Bonsdorff, 2005). As Calvo-Iglesias et al. (2006, p. 334) discovered, "farmer's knowledge is a valuable source of information for documenting past and present land-use practices, local cultural heritage and changes in the landscape, all of which are helpful for the design of landscape-orientated policies". These narrative and experiential sources of understanding are complemented by knowledge exchange with other farmers at auction marts and at social events, interactions with other landscape professionals, as well as attentiveness to farming publications, periodicals and other media. Many farmers in developed nations will also have graduated from universities and so have a good working knowledge of the science pertaining to their farm business.

3.3.3 | Spatial and temporal scale

The strength of this lens is in its alignment to the hyper-local and to the minutiae and character of the landscape (e.g. individual fields, hillsides, streams and habitats) via immersion in the landscape on

most days of the year. Because this knowledge is acquired and applied within the context of a local culture, it also extends across the local scale, encompassing parish, catchment, county and region. This knowledge is also contextualised by national and global inputs with respect to markets, diseases and policy, so ought not to be typecast as insular.

3.3.4 | Role of humans with respect to environmental philosophy and ethics

The principal reason the place-based identity lens is necessary is that it brings evidence and ways of understanding to the table that are beyond the scope of other lenses. However, there are also other components that reinforce this necessity. Landscape decision-making has long been, and continues to be, a contested matter and too often it is those with the least power to influence decisions who have to live with the consequences, namely the local population. If people are not participants in a decision, then they are unlikely to endorse it nor engage with the consequences that flow from it. If, instead, local people feel that, through deliberative democratic processes their knowledge and values are reflected in a decision through trusted representatives, then not only will they endorse it, but they will work collectively and imaginatively to ensure that it achieves its desired outcomes over the medium and long term (Sayer et al., 2013).

It is this lens that delivers the keys to sustainability within landscape decision-making, as the driver is rooted in local identity, in belonging to a particular landscape, being constituted by it and having a deep relation with it that penetrates far further into the particularities of place than modelling can capture.

3.3.5 | Example

The £3.6 million, lottery funded Heart of Teesdale (HoT) Landscape Partnership, County Durham, England operated from 2011 to 2016, and developed a cultural landscape approach that foregrounded place-based identity and in so doing, drove local engagement and facilitated local design and delivery of programme objectives. As described in the independent evaluation.

> A particular feature of HoT is its focus on the area as a cultural landscape. This has helped generate unity of purpose across all elements (not merely those projects involving the arts and creative media) and it has helped foster grassroots engagement. In this regard, HoT has been to the fore in exploring a cultural landscape approach to vernacular landscapes
>
> (Clarke, 2016, p. 40)

The starting point for HoT's programme was the artistic celebrations of the dale from the 16th century onwards by artists such as Glover, Turner and Cotman, and writers like Defoe, Wordsworth, Scott and Dickens. This emphasis on experience and narrative opened up the opportunity to engage with contemporary stories of local landscape character and landscape change and particularly upon how the dale continues to be a worked landscape. A key innovation was to involve local organisations in the vision and delivery of the partnership's programme, rather than, as is commonplace, put the delivery in the hands of large NGOs that are experienced in such programmes.

The partnership manifested the value for money argument of integrating the place-based identity lens, synonymous with cultural landscape approaches, into decision-making processes. It demonstrated the adaptability and responsiveness of this approach to local complexity and granularity. By empowering local expertise and local capacity in the delivery of its programme, the partnership has driven longer-term and lasting engagement with landscape-scale issues at the local level, one of the key legacies of the project.

3.4 | Ecocentric lens

3.4.1 | Decision-making rationale and key actors

The ecocentric lens takes a non-anthropocentric whole-system viewpoint that sees no separation between human and non-human nature (e.g. Leopold, 1949; Naess, 1973). It asserts that biophysical diversity and the complexity of ecosystems require representation within decision-making from a perspective that is outside the limited anthropocentric service logic of the ES lens, because humans do not have a monopoly on defining the 'value' of other things and other entities have needs, wants and objectives that require independent representation (Brown & Dilley, 2012; Wolch, 2017).

The lens promotes ecological awareness by reaching out of human-centric scales, timeframes and concerns to consider the wider implications of decisions on other species, the physical environment, ecological interactions and planetary-scale biophysical processes (Hakkarainen et al., 2020). The ecocentric lens reminds us that this complex interlinked web is not an optional aesthetic extra but is in fact essential, not only for ecosystem function, but also for the stability of these functions over time. The lens accepts that it is impossible, and in many ways meaningless, to try to quantify the importance of any single link or entity within this highly complex web. The goal should, therefore, be to maintain the diversity and complexity of the whole. Maintaining biophysical diversity better enables evolutionary adaptation of ecosystems to changing environmental conditions and this, in turn, promotes stability in whole-system processes, such as nutrient cycling and temperature regulation, which in turn ensure the continued habitability of the whole Earth system (Ochoa-Hueso et al., 2021). This implies that each species (including *Homo sapiens*) plays an essential role in maintaining whole-system functioning and that decisions should avoid prioritising the needs of a single species over the needs of others. The lens acknowledges that species extinctions are an integral part of the natural selection processes that generate diversity, but decisions must not increase

species extinction risks, disadvantage recovering populations, or lead to a situation where habitat and species extinctions exceed speciation rates and cause loss of biodiversity. This lens' decision-making rationale therefore has at its core the desire to maintain biophysical diversity in order to maintain earth's habitability and sustain life in general.

The lens encompasses multiple actors, all operating according to their own compulsions, whether this is a species engaged in competition or facilitation, or a river assuming the course of least resistance over time. These actors may be individuals capable of making decisions based on their own knowledge/sensory information, or physical entities simply following the laws of physics. Usually, only some of these actors will be given representation at the table of human decision-making processes, for example protected species must be given consideration under law. Knowledge from the ecocentric lens is, therefore, often filtered through the incomplete understanding of a human advocate and may be coloured by that advocate's inherent biases or priorities, including those of future generations to a greater or lesser extent, making it essential to involve multiple advocates with different areas of expertise in order for the interlinked complexity of the whole system to be properly represented (Gray et al., 2020).

Nonetheless, this lens offers an essential contribution because (i) the needs of other species are as complex as our own, (ii) non-human actors are an integral part of good decisions and can contribute to the recovery of natural complexity, (iii) decisions on small spatial scales can have long-term and far-reaching consequences due to the mobility of species and the interplay between land-use, biodiversity and biophysical ecosystem processes, and (iv) preserving complexity is essential for prolonging life on—and as a result the habitability of—the Earth.

3.4.2 | Sources of knowledge and how this is obtained (epistemology)

Whereas the place based lens represents the knowledge/nous of local people, the ecocentric lens represents the combined knowledge of human, non-human species and the planet's biophysical system. Decision-making humans may access this knowledge indirectly through monitoring of indicator species and our planet's physical vital signs (temperature etc.), through the scientific study of ecology and environmental science, through local first-hand knowledge of particular species and landscapes (e.g. gained through the place-based identity lens), through knowledge embodied in cultural practices, philosophies or religious beliefs (e.g. Berkes et al., 2000; Lefale, 2010; Pierotti & Wildcat, 2000) or through empathy (gained by being embedded within the same ecosystem as other species/entities). The lens emphasises the need to monitor and observe widely in order to understand the behaviours and responses of multiple species, detect signs of imbalance and identify causes and consequences within complex interacting ecosystems. However, it also acknowledges that human knowledge of biophysical ecosystem functioning is still, and will always be, incomplete; that there are multiple sources of uncertainty due to the sheer complexity of the system; and that there is a risk of irreversible effects. The ecocentric lens reminds us that decisions should be constantly revisited and adapted in the light of subsequent (potentially unexpected and/or irreversible) change.

3.4.3 | Spatial and temporal scale

Fundamentally, the lens advocates for diverse landscapes but the scale at which it views this diversity is not fixed. It acknowledges that many ecosystems (such as peatlands) are geologically and hydrologically constrained in terms of where they occur and, in these locations, their interests may be given priority, and that some species or processes operating at large spatial scales may require large continuous patches of uniform habitat. The lens, therefore, does not require every landscape to have habitat diversity at the same spatial scale but views variation in patch size and heterogeneity between landscapes as equally essential.

This lens gives information on the consequences of landscape decisions integrated over multiple spatial and temporal scales, by considering the perspectives of multiple species and ecological processes, operating at spatial scales from sub-meters to thousands of kilometres, with life spans/timescales from a few weeks to centuries and even millennia. It enables the landscape-level context of decisions to be taken into account and exposes the inappropriateness of 'benefit transfer' tools that omit the complexities of multi-scale processes and habitat configuration. By taking a whole-system approach, the lens encourages consideration of potential consequences at the scale appropriate to each biophysical process, from, for example catchment scale to ocean scale, from daily or seasonal to geological timescales. Its multi-species viewpoint means it does not use fixed scales but instead uses scaleable concepts, such as foraging or dispersal distances, and uses these to interpret landscapes in terms of their habitability for other species.

3.4.4 | Role of humans with respect to the environmental philosophy, ethics

The lens views humans as part of the ecosphere; humans are not separate from it and not superior to it but are one of the millions of species that have evolved within it. Humans are therefore part of the complexity that contributes to supporting life on Earth and the lens recognises that human actions can be essential for maintaining diversity through creating and maintaining habitats (Ellis, 2021).

In this way, scientific users of the ecocentric lens might categorise the role of humans, alongside other species such as beavers that also significantly influence ecosystem habitability for others, as 'ecosystem engineers'. With this comes a responsibility to engineer fairly, giving other species equal opportunity to coexist in order to maintain diversity. In acknowledging our incomplete knowledge of

other species' needs, the lens advocates precautionary approaches when interacting with the ecosystem, limiting risks, emphasising the need for improving ecosystem health and, crucially, making space for other species to also carry out their own engineering roles within the ecosystem (which links to the philosophy of 'wilding').

Other users of the ecocentric lens may not derive the roles and responsibilities of humans from a scientific evolutionary perspective but they may instead arise from religious or cultural perspectives (Washington et al., 2017). For example, in some indigenous societies, non-human species may be recognised as relatives and/or teachers, who are respected and honoured accordingly, and people's contributions towards ecosystem maintenance—and the identification of human roles with the roles of other species—may be well recognised through Traditional Ecological Knowledge (Pierotti & Wildcat, 2000). By extending the idea of the community to include other species and entities, the ecocentric lens therefore opens up a much more complex range of roles for humans with respect to the ecosystem (just as individual humans may take up a wide range of roles within a human community), bringing with it a correspondingly diverse range of responsibilities, duties and ethical standpoints.

3.4.5 | Example

Public response to biodiversity crises can be considered as an example of taking an ecocentric perspective and environmentalists often identify with this lens (Kopnina, 2012). Committees formed to advise on the management of local wildlife sites are examples of the use of advocates representing multiple species-specific ecocentric perspectives, and multi-species place-making projects within urban environments have used participatory arts-based approaches to give voice to multiple non-human interests (Sachs Olsen, 2022). Examples of improving legal representation of ecocentric perspectives include enshrining the rights of nature in law in Ecuador (Charman, 2008) and granting legal personhood to the Whanganui River in New Zealand (Hutchison, 2014). Some ('re')wilding projects can be considered examples of taking the ecocentric lens beyond consideration of other species' needs to its second level of also viewing other species as enactors of landscape decisions and acknowledging there are situations where other species may be more effective and considerate agents than humans. However, rewilding projects that perpetuate the idea of humans and nature as separate entities remain at odds with the core conviction of the ecocentric lens that humans are a natural part of the Earth's biophysical system (albeit one whose role within it needs redefining into something more responsible). The concepts of "Planetary Boundaries" (Rockström et al., 2009), "One-Health" (Zinsstag et al., 2011) and "Strong Sustainability" (e.g. Ekins et al., 2003) approaches seem all examples of trying to link human health and wellbeing explicitly to whole-system planetary health and habitability. However, they may retain anthropocentrism at their core and so also do not necessarily reach the full philosophical position of the ecocentric lens in terms of its redefinition of the role of humans within this system (Washington et al., 2017). The UK's net gain policy, like similar biodiversity offset schemes implemented globally (Bull & Strange, 2018), which attempt to compensate biodiversity losses from development with gains elsewhere, is currently unable to adequately represent the ecocentric perspective, as it uses a single biodiversity metric approach that struggles to represent the complexity of biodiversity. (Natural England, 2021; Needham et al., 2019), and the chosen metric is based on a human-determined habitat prioritisation system that overlooks the fact the definition of 'habitat' and its value is species-specific (Mayfield et al., 2022).

3.5 | Multiple lenses, multiple benefits

Let us suppose that a local authority was required to allocate land for 1000 new homes whilst simultaneously implementing measures to reduce flooding and increase carbon capture. This is a pertinent example since urban sprawl, driven by population growth and economic development, is a global environmental challenge. Urbanisation affects both peri-urban and rural environments (Shaw et al., 2020), often at the expense of agriculture and woodland (van Vliet, 2019). It causes ecosystem fragmentation (Dupras & Alam, 2014), enhances urban heat islands, increases rapid runoff and hence flood risk and may contribute to global warming (Bassett et al., 2020; Eigenbrod et al., 2011). In the UK, for example, urban land increased from 4.5% in 1975 to 5.8% in 2014 (Bassett et al., 2020), some of the highest values in Europe (Hennig et al., 2015). Each of our proposed lenses will have a favoured solution for the local authority's dilemma, due to their different viewpoints. This is illustrated in Figure 1.

The *power and market gain lens* would provide evidence on existing land ownership structures, the cost and legal difficulties of disrupting these structures and the financial benefits that human-centred development would bring to current and future owners, as well as wider financial benefits through, for instance, local taxes and custom to local businesses. This may favour the development of premium (high cost) housing on land owned by the local authority, at a high build density, and well connected to existing transport networks. Flood protection would be based on a risk-based financial analysis, favouring those areas of high revenue or concentrated power (Schanze, 2006). Technical solutions would be based on the net present value benefits, as individuals tend to attach less value to outcomes that they will experience in the future. Future benefits are discounted using a private rate of time preferences, which is determined by the market rate of return of private investments in financial assets. Solutions for carbon capture which, in itself, may not be profitable, might focus on solutions with financial co-benefits, for instance through afforestation projects that generate also timber harvesting benefits.

The *ecosystem service lens* would provide evidence on the different pathways through which natural land benefits/provides value to society. For flood management, as well as carbon sequestration, it is likely to favour Nature Based Solutions (also referred to as Natural Flood Management, Dadson et al., 2017). These will have the

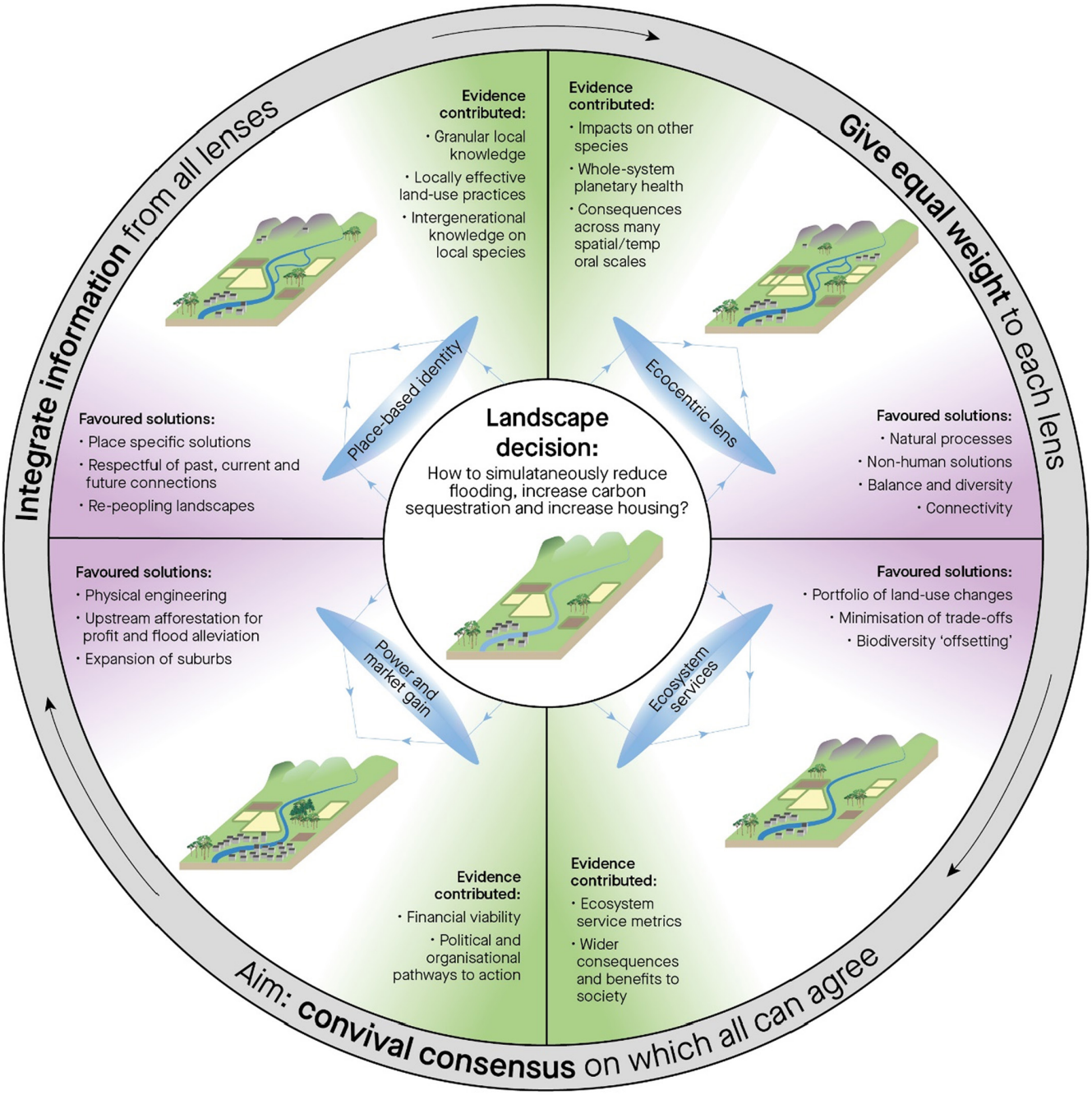

FIGURE 1 Evidence and favoured solutions provided by the four lenses—ecosystem services (ES), place-based identity (PI), power and market gain (PMG), ecocentric lens (EC)—to the problem of reducing flooding while simultaneously increasing housing and carbon sequestration. If the ES route alone prevails, many other evidence forms and potential solutions will be ignored. The outer circle describes the cycle required to integrate the perspectives provided by all the lenses into more holistic decision-making.

potential to deliver a range of societal benefits to the wider population, for instance related to ecosystem services changes in air quality, noise, recreation opportunities, crop pollination and biodiversity, as well as potential flood mitigation, albeit probably only for small and medium sized events (Soulsby et al., 2017). The development of housing would also be informed by the disruption this would create to existing ecosystem services. Design solutions may be preferred that maintain, restore or introduce some public-good ecosystem services, for instance through the inclusion of ample green and blue space for its human health and wellbeing benefits, including (where applicable) rewetting peatlands upstream by blocking drainage channels and upstream woodland creation. Cost–benefit analysis and ecosystem services assessments typical inform these decisions, where future ecosystem services benefits are also discounted but using a social discount rate, which accounts among other things for the societal preferences over intergenerational equity, implying that this discounting effect of future benefits is lower than using the private market discount rate.

The *place-based identity lens* might advocate using the housing allocation to re-people the landscape by providing potentially cheaper rural homes, regenerating rural economies and reconnecting people with landscapes from which they have historically become disconnected, with a focus on promoting integration with the existing population in order to preserve historical characteristics and share local knowledge. In terms of flood alleviation, it would offer the granular perspectives of land managers whose knowledge encompasses information on historical changes in land use and practices at the local level. Using this knowledge, bespoke local solutions may be identified and implemented in the most appropriate places. In terms of carbon capture, this local knowledge could prevent woodland creation in locations where trees are unlikely to grow well, based on prior experience, or where this would negatively impact species known to currently depend on such locations for alternative habitats. For instance, if a field identified for woodland creation by an ES assessment is known by a land manager to be regularly used by breeding lapwings, despite that field's deviations from their typical recorded habitat, a more suitable location for woodland creation could be selected instead. This lens, therefore, enables more suitable and effective selection and location of options, because it allows for place-specific peculiarities and deviations from the expected norm.

The *ecocentric lens* would question whether more land really needs to be dedicated to human-centric habitat and whether existing housing could not be improved and measures taken (e.g. via investment and incentives) to relocate housing demand to places where there is already adequate housing supply, in order to maintain a balance of habitats. It might view housing development at specific habitat types, where some species thrive and others simply cannot exist; without relying on the use of cost–benefit analysis (and positive discount rate) tool for appraising these decisions, as economic efficiency is not pursued (Wegner & Pascual, 2011). Since different species require connectivity and heterogeneity at different spatial scales, it advocates any new houses that are constructed (as with any habitat type) should occur in patches of varying size and concentration in order to produce a heterogeneous landscape across multiple spatial scales. This increases the diversity of niches available for different species to occupy. It also advocates that 'house habitat' should provide resources for multiple species, not just humans, for example through requiring that each dwelling should provide multiple nesting/roosting/hibernating/foraging opportunities for other species and that a set proportion of native vegetation and open water are present within developments. Similarly, in terms of flood alleviation and carbon storage, the lens values the natural dynamics of river flooding, the diversity and complexity it creates within the landscape and the opportunities it offers for a variety of species to thrive. Since floodplain ecosystems (like peatlands) are geologically and hydrologically constrained in terms of where they can occur, their needs should be given particular weight when balancing priorities in these locations. The lens advocates land-use changes that promote restoration of complex ecosystem processes since, having captured carbon or reduced downstream flooding, such processes are then expected to subsequently maintain a neutral carbon flux balance and be more resilient to future perturbations. It advocates that other species should be given the space to carry out such restoration, for example through natural regeneration or careful support of keystone species. However, it also acknowledges the crucial contribution of humans and their land management practices (particularly traditional practices, now often neglected) towards creating habitat and maintaining an appropriate balance. The lens advocates that converting habitats from one type to another should only be done after considering the impacts not only on those species using habitat at a given location and time but also on those species which may require it to travel between other (more suitable) habitat patches or require it as part of a habitat mosaic, or which may only require it for only part of their lifecycle (e.g. amphibians or migratory birds).

Several elements drive the lens's differing solutions: perspective, decision-making rationale, epistemology, discourse, scales of impact (spatial and temporal) and their view on human-environment interactions (Table 1). While the lens discourse and role of humans are major drivers of differences between the lenses, there are also compatible and complementary elements between the lenses. The way knowledge is obtained and used, often through principles of social science, ecology and economics, requires some form of observation and boundary of judgement that can be communicated with reason. Each lens can be accountable to a particular set of scales, thereby enhancing the understanding of networks and structures and cross cutting scales between the lenses clarifying the impact of a decision. For instance, the place-based lens operates with methods that provision types of evidence that other techniques fail to observe or represent. We argue then, that many lenses should be considered because each lens not only brings a different perspective on a decision but, when combined with the other lenses, they together create a multidimensional view of any given landscape decision.

Combining multiple lenses is, therefore, not just about being equitable to everyone who has an interest. It may also enable a better decision to be reached by allowing a wider range of evidence to be taken into account. Considering the decision through multiple lenses empowers stakeholders to have their views recognised and may also reveal a fuller range of potential options and solutions than could have been identified through the perspective of a single lens. Even if you have a full view of all the different lenses this does not make a decision easier. The challenge is how to understand the way the lenses represent information and how these sources can be combined to make a better decision. We propose that an operational system needs to be devised and implemented to make this happen (i.e. how the different lenses can co-inform one another).

4 | CO-INFORMING: COMBINING INFORMATION FROM DIFFERENT LENSES

4.1 | The multiple lens framework

Decisions about landscapes by their very nature involve a large number of stakeholders (not all of which are human beings). This is evident in decisions at small scales, such as planning decisions or public

TABLE 1 A comparison of the main elements of the different landscape decision lenses.

Element		Lens			
		Power and market gain	**Ecosystem Services**	**Place-based Identity**	**Ecocentric lens**
Perspective/decision-making rational		Financial viability of assets, private gains	Society as a whole enjoys multiple benefits from the environment via economic efficiency of public goods	People as part of the landscape and landscapes as particular or unique	Complexity, diversity and balance; no single species' needs are more important than any other, with every entity having an equally valued place/role in the system; precautionary principle
Epistemology	How knowledge is obtained	Micro-economics, (rational choice theory)	Ecology, study of biophysical processes, environmental and ecological economics, GIS	Direct personal experience of humans, human geography, human affect	Experience of other species which is mediated (necessarily) incompletely through ecology and expert naturalists observations, study of biophysical processes, traditional ecological knowledge, empathy, deep history
	Forms of knowledge provided	Financial viability	Ecosystem services assessments, cost–benefit analysis, natural capital accounting, predictive modelling, mapping, metrics	Local specifics, granular, individual testimony, narratives, artistic responses, historical accounts	Whole-planet health, habitability and bio-physical diversity, direct observations, ecological data, interspecies-empathy, geology, planetary 'boundaries'
Key discourse		Finance, security, asset management, market-based individual decision-making, market-based discount rate	Optimisation, maximising societal net benefits, multifunctional landscapes, natural capital management, social discount rate., inclusive wealth	Equity, power relations, justice, reparations, identity, connectedness	Complexity, diversity, processes, interdependence, relationships, flux, variability, balance stability, resilience, responsibility
Innate spatial scales		Range from a land holding to a nation but can extend beyond (e.g. colonialism)	Correspond to ecosystem processes, but often curtailed by the scales of human beneficiaries (e.g. countries) ignoring spill overs	Range from field-scale, to a parish, to a portion of a catchment, to a county	Range from spatial scales relevant to smallest species (e.g. foraging range of a solitary bee ~50 m) up to global (e.g. circulation of ocean currents)
Innate temporal scales		Lifetime of owning entity	Correspond to ecosystem processes	Intergenerational	Range from ~week-long life-time-scales of smallest species up to geological and astronomical timescales

(Continues)

TABLE 1 (Continued)

Element	Lens: Power and market gain	Ecosystem Services	Place-based Identity	Ecocentric lens
Role of humans with respect to the environment, environmental philosophy and bio-ethics	Dominion, individual sovereignty, human right to property, Liberal	Beneficiaries, utilitarian, service-user	Relational, rights-based, stewardship, care	Communal (i.e. humans are a part of ecological community) leading to a range of roles & responsibilities as diverse as those humans experience within human communities, responsibility to contribute towards maintaining diversity, respect, duty/obligation
Examples of key stakeholders using lens	Individuals, landowners, business, governments	Statutory agencies, business (natural capital protocol)	Individuals, land managers, landowners	Individuals, communities, wildlife trusts, conservation organisations, (re)wilding initiatives

rights of way, as well at large scales, such as major infrastructure developments. When good landscape decisions are made, we hope that they take heed of a variety of interests, perspectives and sensitivities. We have now been able to define at least part of this variety through the viewpoint of four complementary lenses (Figure 1). An actionable framework for policy makers that can integrate these lenses is now required. Currently, there are institutional structures that are more attuned to some lenses and their associated considerations than to others and a more balanced representation is required. Such a framework needs to build in structures that will balance the power relations between the different lenses to improve landscape decision-making. This framework needs to appreciate and address several challenges including different perspectives and scales, types of knowledge (e.g. narrative or numeric), equality of voice, how the lenses are represented and the mechanism or participation required for the decision-making, as well as being transparent in justifying the outcome. These challenges will be discussed in the following subsections.

4.2 | Perspectives and scales

A landscape decision is made and enacted within the boundaries of the spatial and temporal scales of the decision maker. However, that decision always has wider consequences which are multidimensional in both the spatial, temporal and social domains due to the complexity of the landscape system. The challenge is for land use decision makers to appreciate the contributions each lens can make towards illuminating these wider-reaching spatial and temporal perspectives, the likely conflicts that may be thrown up and where compromises can be found to reach a consensus.

Presently, top-down policy-making commonly adopts a quantitative ES lens, often as a counter-balance to the power and market gain lens. In contrast, the detailed local narrative of the cultural lens and place-specific knowledge from the ecocentric lens may drive more bottom-up decision-making. More often than not, top-down decisions fail to consider local needs and knowledge leading to the loss of relevant local functional practices. These are highlighted by the other lenses, which often orientate around bottom-up decisions. Top-down decisions need to allow for a range of cultural variations at the smaller scales, and bottom-up decisions need to be able to identify their contribution to wider (national and international) contexts.

Major landscape decisions are usually related to broad landscape functions, such as agriculture, forestry, and urban and peri-urban development. They are also facilitated by large-scale quantitative evidence from either an inventory, census, or mapping. This usually provides data along continuous surfaces in classes of grids or polygons that stratifies the landscape into broad regions. A plethora of national agencies may provide these data (e.g. planners, custodians of biodiversity, water managers). However, a pre-prescribed stratification at a predetermined resolution risks excluding other interests and perspectives. Each lens would naturally stratify the landscape at different scales and using different systems of categorisation (e.g.

for the cultural lens, this might be a farm holding or portion of a catchment or parish; from an ecocentric lens view it might be a river catchment or an animal's home range, migratory route or habitat preferences). This will rarely coincide with a national or administrative stratification. In addition, a low-level stratification adhering too closely to the ES lens may provide no localised context for the consequences of this decision. A landscape decision maker would benefit more from a combination of thematic information (e.g. maps plus narratives) relevant to the context of the decision in order to help understand the multiple dimensions of all (known and unknown) problems that might be faced. One area where this approach has seen much development is in participatory mapping (PM). PM is an interactive approach in which potentially less tangible stakeholder concerns are mapped to become more prominent, visual and better understood, with the aim to improve decision making. There is mixed evidence of the success of the approach, as the improved knowledge base for decision making is not always reflected in the ultimate decision (Brown et al., 2018).

The lens approach can improve this situation by gathering both specific and general information that cuts through different scales. For each lens, some information may solely come from that lens and be quite specific but highly important. Other information may align with and complement several lenses (Table 1). As this information is gathered, it becomes more obvious what and where the intended and unintended consequences will be, and the different scales and extents involved. With a better understanding of the intertwining of different lenses and scales, landscape decision-making processes will be better-informed and, thus, able to reach better decisions. The key to making this work is a mechanism that will allow equal knowledge exchange, representation, understanding and defence for the different lenses.

4.3 | Types of knowledge and voice

To some extent, real world decisions often do take into account the perspectives of multiple lenses. Protected species legislation is an attempt to give representation to some aspects of the ecocentric lens, and public consultation can elicit some information from the place-based identity lens. However, lens-specific information derived in this way is often patchy, incomplete and rarely integrated simultaneously or given equal weight in the decision-making process. Such asynchrony and imbalance can prove costly when an apparently sound decision, dominated by information from a single lens, is later revealed to be inappropriate or impractical through the late integration of information from an overlooked lens. For instance, agri-environment interventions that are demonstrated to perform under general conditions may fail at a local level if local landowner/farmer knowledge, specific to regional adaptations, is overlooked or not permitted during implementation. Furthermore, earlier integration of knowledge from multiple lenses may reveal solutions to the problem that could never be identified when examining it through a single lens.

This suggests that better decisions could be made if a process can be established that ensures information from all lenses is considered in full from the outset. However, even if it is possible to present information from all lenses to the decision-maker, it is very likely that some lenses may present opposing solutions and the decision-maker would still be forced to make their own judgement on the relative importance of each lens in determining the outcome of their decision. The bias the decision-maker places on information from each lens is almost certainly influenced by the degree of alignment of that lens with the decision-maker's own value-system. Thus, even when the perspectives of all lenses are available, poor decisions can be made, particularly where the value-systems of those in control of decision-making are different to the value-systems of those experiencing the consequences. Avoiding this situation requires further work on formalising how the different lenses are measured and balanced against each other, to reduce potential decision-maker bias and to ensure that different, quiet and silent voices are represented. It is particularly important that the place-based identity and ecocentric lenses are given equal consideration alongside other more frequently dominating lenses.

Integrating both numeric and narrative information can be a challenge when weighing evidence, which suggests a need for a post-normal approach to scientific conclusions about landscape decisions (Funtowicz & Ravetz, 2018; Martinez-Alier et al., 1998). Some of the lenses we propose here are more predisposed to numeric information (e.g. the power and market gain lens and the ES lens). In contrast, the place-based identity lens represents knowledge stored predominantly in narrative form, whilst the ecocentric lens can incorporate information in both formats (e.g. combining statistics from environmental and ecological surveys with anecdotal observations of local species behaviour; Molnár & Berkes, 2018). This may lead to conflicts in representing understanding of the landscape. An approach that can integrate these two forms of information (narrative and numeric) is, therefore, crucial in decision-making using the lens framework.

To include these factors there needs to be increased democratisation within decision-making and an acceptance of accountability to the needs of those who are affected by the arising decisions but do not 'own' the land themselves. Thus, the decision-making needs to be able to involve, and give equal consideration to, both numeric and narrative evidence.

4.4 | Representation

For a landscape decision to be thorough and effective with multiple lenses, the scales and data sources that represent each lens need to be identified, combined and presented with equality within a deliberation and decision-making process. Initially, one might consider a hierarchical modelling framework to identify who should be involved and who dominates the decision, at which scales. We may begin with stratifying the landscape with mapping and numerical modelling of networks, but this kind of desk-based analysis has

the potential to overlook relevant local stakeholders. Stratification should be complemented by a local survey in the surrounding landscape and involving people who interact with the land itself, investigating which species use it and what habitats and physical features exist that might need representation. Such a procedure or protocol may take the following steps, albeit with flexibility to account for the dynamic nature of individual landscape decisions. Here, we define the entity starting the decision-making process as the proposer. We would advocate the use of an independent arbitrator to oversee the process and ensure fair representation from the outset. The subsequent decision-making process is outlined in Figure 2.

First, the landscape decision is defined by the proposer in terms of what problem needs to be addressed and the proposed solution from their perspective (e.g. a major road project to improve mobility, housing expansion to accommodate a growing human population, land use change to improve biodiversity, etc.) from which the directly affected land can be readily identified. The proposer's solution, whether they are aware of it or not, will align with one or more of the lenses.

Bringing in the wider lens framework allows the proposer to identify, mobilise and involve stakeholders, advocates and affected parties who understand the encroachment of the decision into the different domains of each lens. Their knowledge of the heterogeneity and complexity of landscapes and the networks within them enable the impact of the decision to be considered more fully and in greater detail. Together they reveal the multidimensionality of the decision and the consequences at different scales inside and outside the directly affected land, from the perspective of each lens. Crucially, allowing the different lenses to identify affected parties and to gather and represent evidence in their own ways (e.g. Table 1), should reveal more fully the consequences of the decision and preserve many important aspects that may otherwise be overlooked. This collective knowledge base provides a body of evidence for the potential consequences of the landscape decision and an improved understanding of the land system. This could include far reaching consequences, from national concerns such as carbon emissions, and economics, to more local impacts on cultural heritage and knowledge, and the interconnectedness of habitats in local, regional and national ecosystem functioning. This

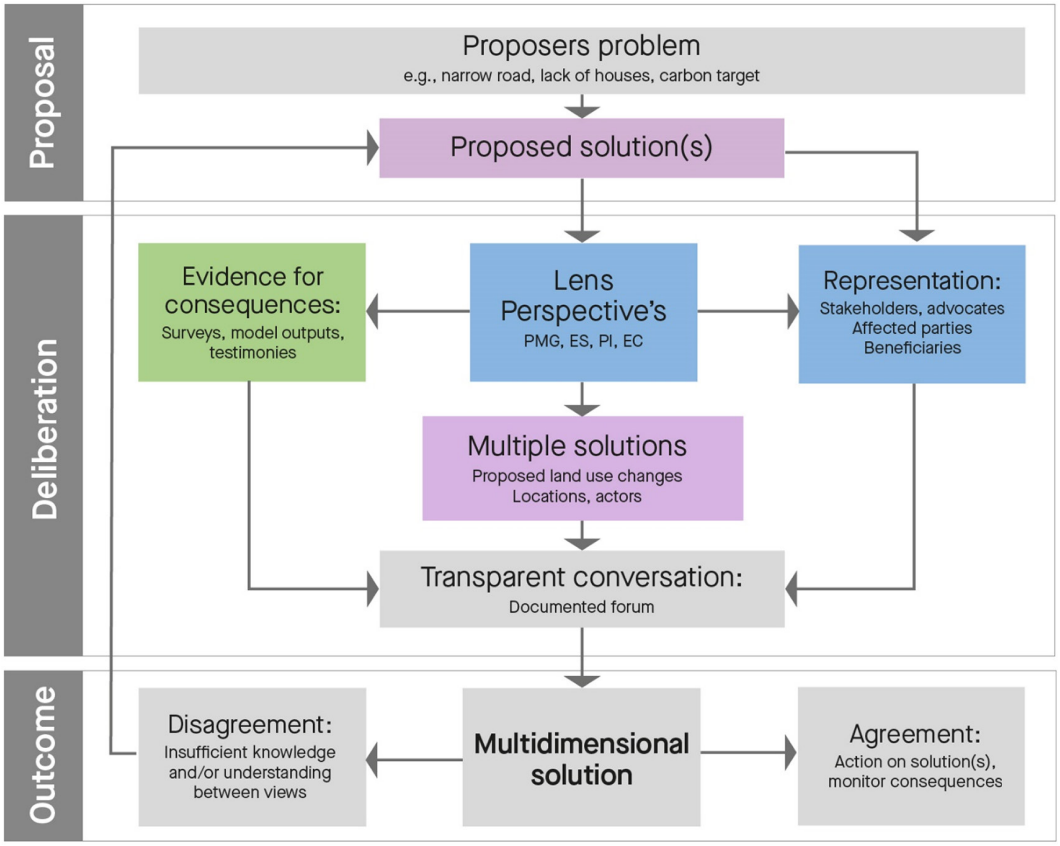

FIGURE 2 Putting the multiple lens framework into practice within landscape decision-making. The proposer perceives a problem and proposes a solution but has a limited understanding of the wider implications of the proposed solution. Stakeholders and advocates that represent interests within each of the lenses contribute evidence and offer a better understanding of who/what else needs to be considered. This leads to a deeper knowledge base and identification of affected parties and appropriate knowledge holders who can contribute evidence, potential solutions, evaluate options and contribute to the debate. A wider transparent and convivial conversation then follows to refine and mutually agree on the desired actions required to solve the initial problem. Insufficient knowledge or inability to come to an agreement suggests that a redefinition of the problem and potential solutions is required. Lens perspectives are: PMG, Power and Market Gain; ES, Ecosystem services; PI, Place-based Identity; EC, Ecocentric.

step can be considered analogous to planning support systems that have assisted planners to understand the multiple dimensions of a particular problem, by compiling an understanding of the integration between different stakeholders, networks and their interactions. The outputs from this process could be represented as an atlas (set of maps, graphs, stories and other representations pertaining to a particular area) of different benefits, stakeholder interests, and effects on nature, culture and other aspects viewed through each lens.

The knowledge base enables exploration of what-if scenarios and their effects by the proposer, lens representatives, stakeholders and affected parties. This will facilitate discussions to support cultural debates, throw up unnoticed or unimportant environmental impacts and hazards, reveal multiple potential solutions, which the proposer may have previously been unaware of, and provide deeper information for different modelling techniques. At this stage, different types of modelling could be used to augment the evidence base, but these would require some competence and knowledge to operate. They should allow for uncertainties and they will all have errors. This may include cognitive, numerical and network modelling. Cognitive modelling (Fuzzy Cognitive modelling, Analytical Hierarchy Process) may produce conceptual outcomes and highlight important features of the problem. Numerical modelling can identify interdependencies, synergies, conflicts, consequences, costs and benefits. However, its apparently objective nature should not cloud the fact that such models are limited representations of reality. They, thus, contribute to the plurality of evidence and should not, by themselves, be the sole means of making decisions. For the same reason, it is more useful for models to provide insight into some potential consequences than to necessarily weigh alternatives or provide optimal solutions.

In most cases, the aim will be to collapse the set of multiple potential solutions into a single solution that takes into account all dimensions of the decision, as represented by the lenses (the 'multidimensional solution'). This would also mean that different solutions, or different blends of solutions, could be adopted in different locations in the landscape. This is carried out through the next stage of transparent conversation, in order to consider all the evidence and potential solutions where all lenses continue to have equal say in considering their combined arguments and carefully collected evidence.

4.5 | Participation in the decision-making

Our proposed framework aims to promote a transparent convivial conversation, rather than a contested one, with the ultimate objective of agreeing a landscape decision where all stakeholders, decision makers and those affected can mix in an open forum, agreeing on the best course of action (Figure 2). The challenge is the complexity of information that the lenses represent. We do not intend to give the definitive answer of how this stage should progress, since it will be influenced by socio-cultural context, but instead consider some possible directions.

An analogy that deals with such a mismatch of information is the courtroom, where the legal system routinely considers narrative and numeric information types together when considering witness testimonies alongside forensic evidence. Perhaps some of the roles that allow this to happen (witnesses, advocates and juries) can inspire the landscape decision-making process. Crucially, all three roles should include representatives from all four lenses, that is all lenses contribute evidence or information, their perspectives are all represented, and all are involved in the evidence-balancing decision-making stage in the form of a jury or council of lens representatives. This would ensure information from each lens is given equal consideration and that the enactor of the decision is otherwise held to account. This process already happens in many nature reserves, where there is often an advisory board providing evidence on, and representing the interests of, different species and the reserve managers then make habitat management decisions based on the contributed information, knowing that the council will later hold them to account. However, the courtroom can also be a site of massive injustice and, arguably, a battle. The ultimate aim for a decision-making process would be to move beyond the combative analogy of a courtroom towards a more convivial process, where dialogue between the advocates of each lens enables decision-makers to understand the perspectives of all those affected, where the process itself dismantles the combative standpoints participants typically enter with, and where a good decision would be defined as a consensus reached after the value in all lens perspectives has been recognised (Abelson et al., 2003; Owens, 2000).

An example of such a forum for convivial exchange of perspectives is known as the "landscape approach" which can help stakeholders to overcome some of the siloed thinking that could give rise to conflicts over landscape decision-making. "In a landscape approach, no single stakeholder has a unique claim to relevant information, and the validity of different knowledge systems must be recognized. All stakeholders should be able to generate, gather, and integrate the information they require to interpret activities, progress, and threats." (Sayer et al., 2013, p. 8352). The multiple lenses method advocated here has governance implications which the landscape approach is, in turn, ideally placed to manage because it implements a "long-term collaborative process bringing together diverse stakeholders aiming to achieve a balance between multiple and sometimes conflicting objectives in a landscape or seascape" (Sayer et al., 2017, p. 466). The landscape approach has been promoted by the European Landscape Convention (ELC, 2000). In particular, the Hercules Project (2016) which was part of the ELC, found that the "approach is overtly participative, where policies are based on deliberation informed by experts as well as the knowledge and opinions of lay people, stakeholders and citizens" (Hercules Project, 2016, p. 6). This, in turn, means that "landscape can be a mechanism for communities to reach collective views about the future. A landscape approach to environmental governance is therefore not necessarily, or even usually, protectionist; rather it enables participative

management of change to effect the transition from past to future" (Hercules Project, 2016, p. 7). In the UK, this approach has been used in the Landscape Partnership Programme.

Public participation has long been seen as a means of incorporating a multitude of perspectives and interests in environmental planning, impact assessment and decision-making. Public participation processes are not only seen to lead to better decisions, but also to foster better relations and mutual understanding between stakeholders through social learning (Pahl-Wostl & Hare, 2004). However, public participation is a complex process and its effective implementation remains a challenge. This is a topic of considerable ongoing research and discussion (e.g. Glucker et al., 2013; Mees et al., 2016; O'Faircheallaigh, 2010). Other key concerns include accountability and legitimacy. Uittenbroek et al. (2019) emphasise how influential the framing of the public participation is: who is invited? when? and how is the participation run? Even if appropriate stakeholders and participants are identified, their participation is not certain. The sustained participation requires trust and effective relationship building (Holifield & Williams, 2019). In order to reflect the true complexity of landscape decisions, each lens must be considered equally in the framing of the problem, the engagements of participants, the presentation of views and evidence, the identification of potential solutions and in the summary of the conclusion.

Whichever participatory process is followed, the whole conversation, as well as the agreed outcome, needs to be documented in a transparent way. Checklists can be useful for facilitating transparency and for ensuring that all evidence, from all four lenses, has been considered. In the event that a particular lens has been underrepresented, the proposed solutions need to be reassessed, with a specific focus on redressing gaps in information and representation. All participants have to be confident that all views and evidence have been appropriately considered in arriving at the final verdict which should, ideally, be a reasoned compromise between stakeholders facilitated by the different lenses. We can rarely be sure that we have an optimal solution, but the final decision will be a good one if it is based on all the available evidence, within the environmental, legal, social and political constraints operating at the time. A key message from this paper is that more inclusive decisions will be made when decision makers systematically query viewpoints and potential solutions through all lenses.

5 | CONCLUSIONS

We live at a time when the consequences of decisions which are made predominantly through the power and market gain lens are seriously endangering the habitability of our planet (Dasgupta, 2021). Whilst ES and Natural Capital approaches can play a positive role in reducing some of the harmful externalities of such decisions (e.g. by highlighting the value of carbon sequestration, biodiversity and nutrient and water retention etc.), we argue here that landscape decision-making needs to be even more holistic. This has already been recognised by ES advocates who have attempted to incorporate "difficult-to-measure" aspects of the landscape (such as cultural and heritage services) into ES assessments. However, this approach runs the risk of undervaluing the meaning and importance of these aspects. Instead, we propose a wider framework of lenses through which landscape decisions can be viewed in parallel: (i) power and market gain, (ii) ecosystem services, (iii) place-based identity, and (iv) ecocentric. Each lens brings particular perspectives, evidence base, solutions and pathways to action to landscape decision-making which can be presented and discussed together in an attempt to reach a consensus. We argue that, with a better understanding of the complementarity of these lenses at different spatial and temporal scales, better (more balanced) decisions can be made. The application of the lens approach requires a formal process which enables all lenses to be considered fully and equally from the outset and which avoids bias from any particular lens or value-system. We outline two possible systems by which formalisation could occur; akin to decisions arising from a courtroom or via public participation. While the former can be relatively combative, the latter can provide a forum for more convivial exchange of perspectives which can help stakeholders to overcome siloed thinking that can potentially give rise to conflicts. Both systems would explicitly value transparency and balance, supported by a formal checklist to ensure that evidence and solutions from all lenses are considered and critically assessed. The outcome of the process would be a documented agreement that would, ideally, be a reasoned compromise between stakeholders viewing the same issues through different lenses.

AUTHOR CONTRIBUTIONS

All authors conceived the ideas. The writing group was led by Beth Cole. Beth Cole, Andrew V. Bradley, Simon Willcock, Emma Gardner, Ewan Allinson, Adam J. Calo, Julia Touza and Alex Hagen-Zanker, contributed significant sections of writing to the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix 1. Full positionality statement.

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