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## Deliberative-analytic approaches to Ecosystem Services as a way forward for the land sparing/sharing debate

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# 1 Deliberative-analytic approaches to Ecosystem Services as a 2 way forward for the land sparing/sharing debate

## 3 Abstract

4 *Growing concerns about the impacts of food systems have led to fierce debate over the pros and cons*  
5 *of different modes of production. In parallel, conservationists have debated “land-sparing” versus*  
6 *“land-sharing” as competing rationales for a land use policy that aims to halt biodiversity loss. As a*  
7 *contribution to these debates, we share research conducted in the South-East of England where*  
8 *contrasting practices for managing land and livestock coexist in close proximity and approximate a*  
9 *land -sparing versus -sharing gradient. The research used an Ecosystem Services (ES) framework to*  
10 *explore the social, ecological and health outcomes of these practices, as understood from different*  
11 *perspectives. In this paper we analyse and interpret both qualitative and quantitative data generated*  
12 *through a participatory deliberative appraisal exercise that formed part of the research. Despite*  
13 *demonstrating the relevance of ES for appraising land use and management practices, we uncover a*  
14 *lack of sensitivity of conventional ES frameworks to the specific concerns, priorities and ambiguities*  
15 *of agroecological practices; an inability to encompass multiple scales and localities; limitations to*  
16 *incorporating site-specific considerations; and a polarising effect on the perspectives of*  
17 *conservationists and farmers. We conclude by offering an approach that may help to bridge between*  
18 *divergent perspectives and engage both on their own terms.*

## 19 Keywords

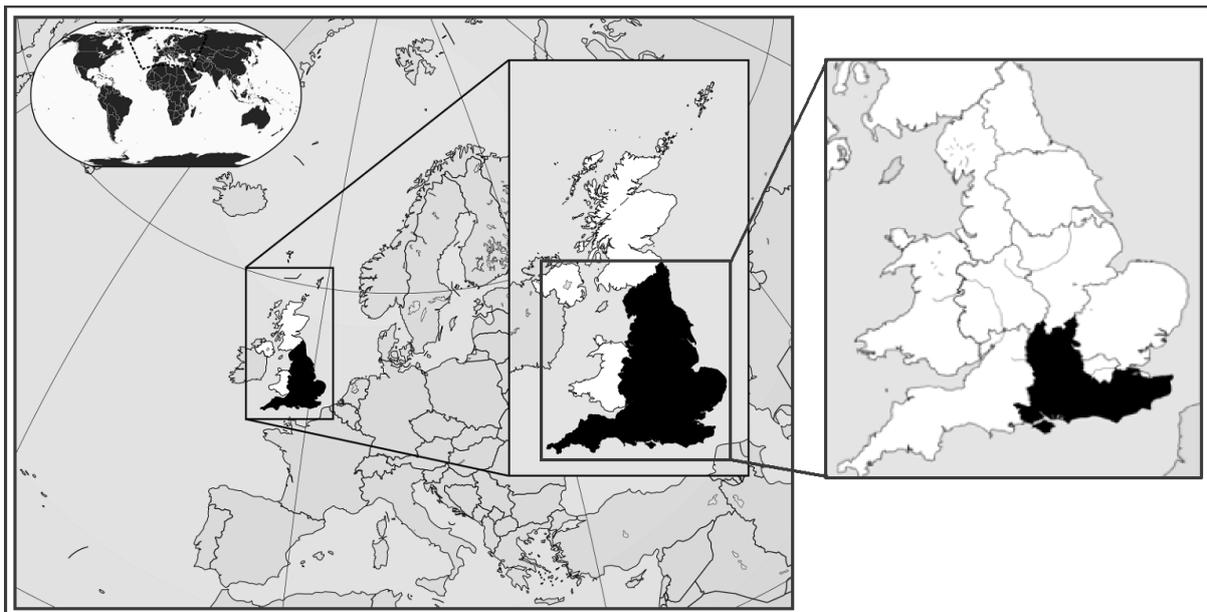
20 Agroecology; Rewilding; Conservation Grazing; Environmental Land Management Scheme (ELMS);  
21 Millennium Ecosystem Assessment (MEA); Multi-Criteria Mapping (MCM)

## 22 1 Introduction

23 Concerns about the environmental impacts of animal sourced foods have been steadily growing over  
24 several decades, especially in relation to greenhouse gas emissions (Steinfeld, Gerber et al. 2006,  
25 Garnett 2008, Garnett 2009, MacMillan and Durrant 2009, Committee on Climate Change 2019), but  
26 also in relation to (among others) biodiversity loss, soil loss and water availability (Garnett 2015). In  
27 combination with increasing public health concerns about the role of meat consumption in relation  
28 to dietary diseases (Lang and Rayner 2012, Willett, Rockström et al. 2019), this has led to both an  
29 intense focus on red meat (ruminants) as a key culprit, but also fierce debate over the pros and cons  
30 of different production systems (Garnett, Godde et al. 2017). Comparisons have focused on (*inter*  
31 *alia*) ruminant versus non-ruminant, intensive versus extensive, grain-fed versus pasture-fed, indoor  
32 versus outdoor, organic versus conventional, and specialised livestock systems versus mixed crop  
33 and livestock systems. In parallel, ecologists and conservationists have recently debated “land-  
34 sparing” versus “land-sharing” as competing rationales for underpinning a land use policy that aims  
35 to halt biodiversity loss (Green et al. 2005, Fischer et al. 2008, Loos and von Wehrden 2018). At one  
36 end of this spectrum lies the idea that food production is intensified on a small land footprint to  
37 make room for biodiversity, for example creating large tracts of land on which trophic ‘rewilding’ can  
38 be attempted (Lorimer, Sandom et al. 2015, Svenning, Pedersen et al. 2016). At the other lie  
39 ‘agroecological’ and ‘wildlife friendly’ mixed crop and livestock farming practices that combine –  
40 rather than separate – conservation and agricultural production by enhancing biodiversity on farmed  
41 land. Both fundamentally rely on large herbivores (wild or domestic) to regulate vegetation structure  
42 and provide fertility.

43 Land use policy frameworks that adopt or attempt to reconcile these varying positions take various  
44 forms. At the international level, the ‘universal’ post-2015 development agenda (United Nations  
45 2015) includes relevant targets under Sustainable Development Goals (SDGs) 2 (End Hunger), 3  
46 (Health) and 15 (Life on Land), among others – with various interactions, co-dependencies and  
47 conflicts (Alcamo et al. 2020). Different national priorities, let alone social, cultural and agri-  
48 environmental contexts, have led to a diversity of policy approaches. Path-dependency in ministerial  
49 responsibilities and institutional frameworks has also shaped responses in different EU member  
50 states and regions (Bonnieux et al. 2006), as well as in the EU as a whole (Baylis et al. 2008, Heyl et  
51 al. 2021). As such, it is sensible to target policy-relevant research at national – or even sub-national  
52 – levels, taking into account the policy and political dynamics at play.

53 In the South-East of England (see **Figure 1**) these contrasting practices currently coexist, alongside  
54 more conventional livestock production systems and areas of conservation grazing. The South-East is  
55 a region of intense competition over land where national and sub-national policy-makers are  
56 attempting to address and balance multiple objectives (Defra 2018, Defra 2018, Defra 2018), making  
57 it a valuable case study with increasing relevance as pressures on land and resources continue to  
58 intensify globally. Extensive livestock production is one of the dominant land uses in this area (Defra  
59 2013). However, other land uses also coincide which utilise large herbivores for conservation  
60 grazing, ranging from peri-urban nature reserves to a substantial rewilding<sup>1</sup> project.



61  
62 **Figure 1. Nested maps locating the South East of England within England, Europe and the World.**  
63 **(Built on original images shared under Creative Commons license, by Wikimedia Commons).**

64 Although these different land uses are currently underpinned financially by area-based payments  
65 and Higher Level Stewardship (HLS) payments through the European Union’s Common Agricultural  
66 Policy (CAP), the UK Government is developing a new Environmental Land Management Scheme  
67 (ELMS) to replace CAP measures following the UK’s departure from the EU. Both HLS and the new  
68 ELMS are policy instruments used with a view to assessing, rewarding and ultimately incentivising  
69 environmentally sustainable forms of land use and management, which is a complicated goal, not

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<sup>1</sup> ‘Rewilding’ implies the return of land to a wilder and more natural state and is used especially with reference to the reintroduction of (large) mammals of (or similar to) species that were exterminated locally at some earlier period (Oxford English Dictionary).

70 least because the science behind such assessments is continuously evolving (Linstead, Barker et al.  
71 2008). Nonetheless, policy approaches such as these, which are based on scientific understandings  
72 of 'Ecosystem Services', represent the most widely recognised of such frameworks.

73 The extent to which Ecosystem Service (ES) delivery is optimised by either separating agricultural  
74 production and nature conservation (land-sparing), on the one hand, or through agroecological and  
75 wildlife friendly farming practices (land-sharing), on the other hand, is now an important frontier  
76 for land use policy and research. Though initially framed as an "either/or" dilemma in relation to  
77 optimising trade-offs between biodiversity conservation and productivity, criticism of this has led to  
78 more nuanced views that recognise the value of "both/and" framings (Kremen 2015). Recent  
79 studies, for instance, have explored the use of spatially-differentiated approaches to optimising ES  
80 delivery through sparing land in some places and sharing in others (Maskell et al. 2013). However,  
81 given the historical and continued emphasis on production efficiency in agriculture and minimal  
82 harm in conservation (Wittman et al. 2017), as well as a failure to integrate agricultural and  
83 environmental policymaking (Candel and Pereira 2017), land-sparing has dominated policy and  
84 practice in the Global North by default. Despite gaining substantial attention from social-political  
85 scholarship (Glamann, 2017), land-sharing approaches such as agroecology, mixed farming and  
86 smallholder agriculture have suffered from a lack of effective support (Batary et al. 2015). Therefore,  
87 our aim within this paper is to explore connections between the management of large herbivores in  
88 the South East of England, through both land-sharing and land-sparing practices, and ES, as they are  
89 understood from a broad range of relevant perspectives. To do this we will present evidence from a  
90 participatory deliberative appraisal exercise in which expert stakeholders from across the policy-  
91 practice and farming-conservation spectra were asked to assess different land use and management  
92 options with respect to their capacity to enhance biodiversity, food security and broader  
93 sustainability.

94 By doing so we will produce insights into how both land-sharing and land-sparing practices are  
95 understood from different perspectives, thereby contributing towards a shift in the balance of  
96 stakeholder representation within scholarly debates about the trade-offs between food production  
97 and biodiversity conservation. We will also draw out some challenges concerning the usefulness of  
98 ES frameworks for assessing land use and management options and make suggestions about how  
99 they might be overcome through the development of participatory social appraisal tools and other  
100 deliberative-analytic approaches. We hope that this intervention is of particular use to individuals  
101 and organisations working at the research-policy and research-practice interfaces, including those  
102 seeking to both leverage evidence and encourage the adoption of improved methods with a view to  
103 influencing the direction of policy development in rural and peri-urban land use and management.

## 104 2 Materials and methods

105 The research presented in this paper is based on a Multi-Criteria Mapping (MCM) exercise that was  
106 undertaken between January 2018 and March 2019. MCM is a participatory social appraisal tool  
107 developed by Stirling et al. (see particularly Stirling and Mayer 1999, Stirling and Mayer 2001) as a  
108 way to intervene in complex policy debates by opening them up to include a broad range of  
109 perspectives, instead of intervening in order to "close down" debate around a narrow set of  
110 perspectives. Indeed, our choice to use MCM as a tool for policy appraisal, over alternatives, stems  
111 from the fact many other such tools "restrict the technical assessment of particular options under  
112 specific criteria to selected (even individual) specialists" (Stirling 2006: 103), whereas MCM provides  
113 a more open procedure within which participants can (re)define the terms of their appraisal  
114 iteratively and at multiple points during the exercise. An additional advantage of this is that it

115 generates qualitative data which is more amenable and appropriate for exploratory analysis through  
116 open coding than would have been generated through a more prescriptive procedure.

117 The MCM exercise included (1) a research design phase in which desk research, scoping interviews  
118 and a focus group meeting were conducted, (2) a formal structured interviewing phase through  
119 which the data presented in this paper was gathered (Stirling and Coburn 2014), and (3) a workshop.  
120 As part of this, a range of experts from across the South East of England were engaged, who  
121 represented different perspectives on the issues – both in policy and practice – surrounding the  
122 management of large herbivores on both agricultural and conservation-oriented sites. The  
123 remainder of this section will be focused on first outlining some key concepts and then describing  
124 the data collection and analysis techniques used in phases 1 and 2.

## 125 2.1 Concepts

### 126 2.1.1 Ecosystem Services

127 Developed in the 1970s and 1980s, the Ecosystem Services (ES) approach to sustainable land use and  
128 environmental management – which is most comprehensively exemplified within the Millennium  
129 Ecosystem Assessment (Millennium Ecosystem Assessment 2005) – hinges on the notion that by  
130 clearly articulating the benefits that ecosystems provide to people, science and policy can positively  
131 influence global ecosystem change (Haines-Young and Potschin 2010). This approach has been  
132 applied widely in an attempt to appraise options on the basis of their ecological implications. In  
133 particular, land use changes and their impacts on ecosystem services have been widely studied  
134 (Crossman et al. 2012, Maes et al. 2013; Fu et al. 2015; Hasan et al. 2020) and applied in various  
135 ways to decision-making (Reyers et al. 2009; TEEB 2018; Ribeiro and Šmid Hribar 2019). However,  
136 much less attention has been paid to the application of ES frameworks on the ground and the  
137 implications of translating the theory into policies and practices that can support transitions towards  
138 sustainability (though see Dendoncker et al. 2018 where this has been attempted through the  
139 development of more integrated procedures for valuing ES in relation to agroecology).

140 The ES approach has also been criticised for the potential of ES valuation to socially and historically  
141 decontextualize environmental degradation and thereby occlude more socially transformative  
142 pathways (Melathopoulos and Stoner 2015). In a process akin to the disembedding of “fictitious  
143 commodities” from their social and natural roots (Polanyi 1944), scholars have raised further  
144 questions about the disempowerment associated with applying ES approaches to “green grabs”  
145 linked to “biodiversity conservation, biocarbon sequestration, biofuels, ecosystem services,  
146 ecotourism or offsets” (Fairhead et al. 2012). But despite these criticisms, ES frameworks have  
147 become perhaps the dominant approach to valuing (in monetary or other terms) land use options  
148 beyond agricultural market values and have been taken up explicitly in UK policy (Bateman,  
149 Harwood et al. 2013).

150 Therefore, with a view towards the application of the framework in a cautious, critical manner, we  
151 will use a blended ES framework which combines the categories of ES used within the Millennium  
152 Ecosystem Assessment and the UK-relevant ES categories used by Haines-Young and Potschin in  
153 their report for Defra (Haines-Young and Potschin 2008, following Linstead and Barker et al. 2008) as  
154 a heuristic device to aid our interpretation, thus enabling us to identify correspondences and  
155 divergences of our data from the ES categories and explore alternative meanings and their  
156 implications (see section 2.3 below). In line with the Millennium Ecosystem Assessment (2005), we  
157 will include ‘supporting’ services, but we will combine them in the same category as ‘regulating’  
158 services (see section 2.3 below), as empirical instances of these two types can be particularly hard to  
159 disentangle from each other in practice (Haines-Young and Potschin 2010, Fu, Su et al. 2011).

## 160 2.1.2 Environmental impacts and participatory social appraisal

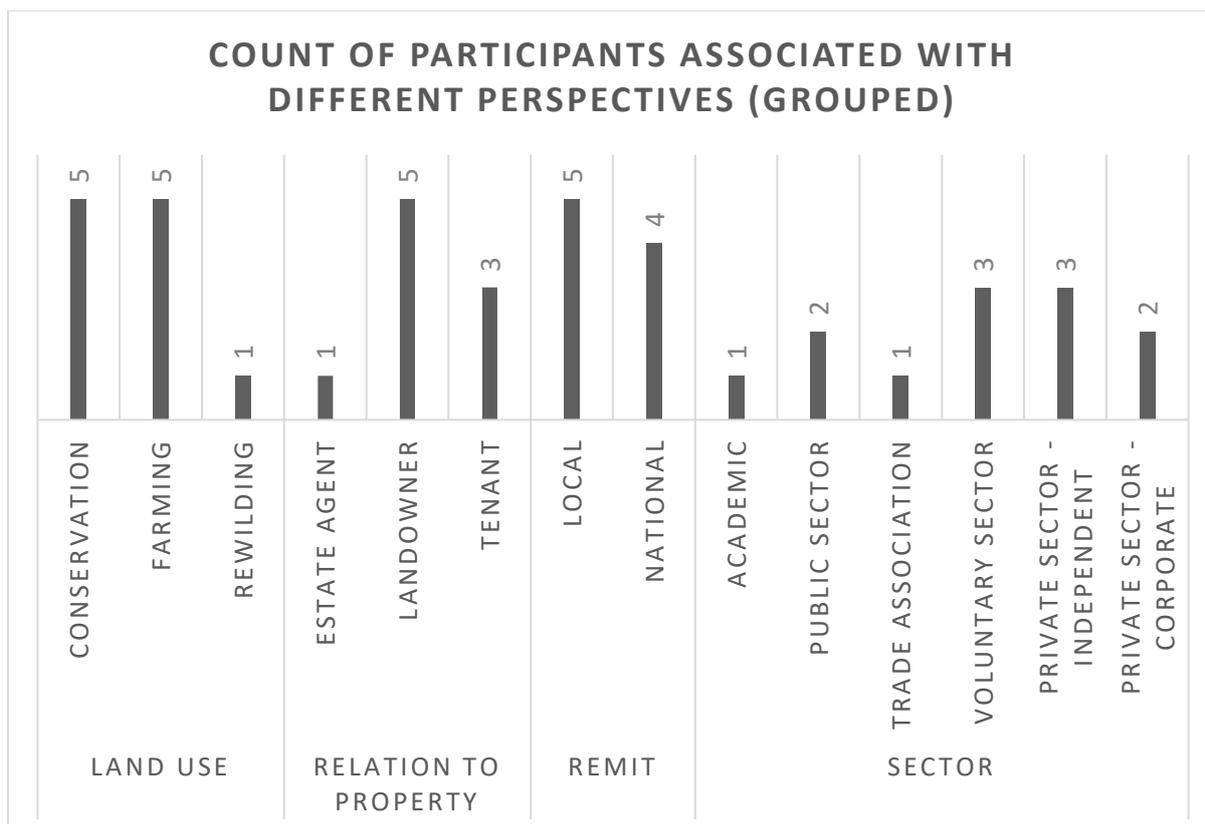
161 Debates about the environmental impacts of animal sourced foods and the land-sparing versus land-  
162 sharing debate are characterised by different forms of incomplete knowledge (including examples of  
163 uncertainty and ambivalence (Stirling 2010)). For instance, in attempts to compare the  
164 environmental impacts of different livestock production systems, scientists have struggled with  
165 uncertainty over how to most robustly quantify relevant factors, from the relatively discrete (e.g.  
166 GHG emissions from rumination) to the open-ended (e.g. changes in global food demand). However,  
167 they have also struggled with ambiguity over which factors are relevant to assessment in the first  
168 place. Given the degree of division between proponents of competing visions of the future for a  
169 more environmentally sustainable global food and farming system, i.e. implied by the Life Sciences  
170 versus Agroecological/Ecological paradigms (Lang and Heasman 2004, Levidow 2015), ambiguity –  
171 that is “a state of knowledge in which there are acknowledged to exist divergent, equally valid ways  
172 to frame different possible outcomes” (Leach, Stirling et al. 2010) – is a defining characteristic of  
173 these debates.

174 Participatory social appraisal is a particularly relevant analytical approach to inform decision making  
175 in policy and practice in situations characterised by ambiguity (Leach, Stirling et al. 2010). Combining  
176 participation and research, participatory social appraisal is a way to incorporate “more diverse,  
177 extensive and context-specific bodies of knowledge and to take more careful and explicit account of  
178 divergent values and interests” (Stirling 2006: 96), whilst also addressing a normative imperative to  
179 increase democratic participation in decision making. Moreover, from the perspective of ES  
180 proponents, policy appraisal procedures are seen as important sites for embedding ES frameworks  
181 within public policy (Turnpenney, Russel et al. 2014), making our decision to combine ES and policy  
182 appraisal all the more relevant. In the next section, we will describe how we have used Multi-Criteria  
183 Mapping (MCM) to do this.

## 184 2.2 Data collection

185 The interviewees (participants) that were recruited for the exercise included 13 individuals, covering  
186 14 different ‘perspectives’ (in the MCM lexicon, a perspective is “a grouping of viewpoints that may  
187 be seen on the basis of MCM analysis to display certain features in common” (Stirling and Coburn  
188 2014). These perspectives relate to: (1) the dominant land use type of any relevant site that the  
189 individual is connected to; (2) the participant’s relationship to land/property; (3) the remit of their  
190 professional roles; and (4) the sector that they are most closely associated with. Individual  
191 participants were assigned to multiple perspectives, though not all perspective groups were found to  
192 be relevant to all participants (**figure 2**). Taken overall, the 14 perspectives encompass the most  
193 prevalent stakeholder positions with respect to the farming and conservation landscape in the South  
194 East, representing large landowners (including agricultural and conservation-focussed estates),  
195 tenant farmers, farm-workers, conservation charities, land agents, legal advisers specialising in  
196 environmental and property law, utility companies, trade unions, local authorities and national  
197 government departments.

198 This list of target perspectives was arrived at through a period of background research and reflection  
199 that involved accessing secondary sources and mapping key actor positions operating within regional  
200 conservation and agricultural systems. In order to identify relevant individuals and assign them to  
201 the different perspectives, a database was built up through a combination of desk research focussed  
202 on accessing relevant websites and online archives, and informal scoping interviews conducted by  
203 telephone. This database was then used to sequentially select and recruit individuals into the  
204 research, so that in combination, all perspectives were covered. Full details of which participants  
205 were assigned to which perspectives can be found in the **appendix** (Appendix A).

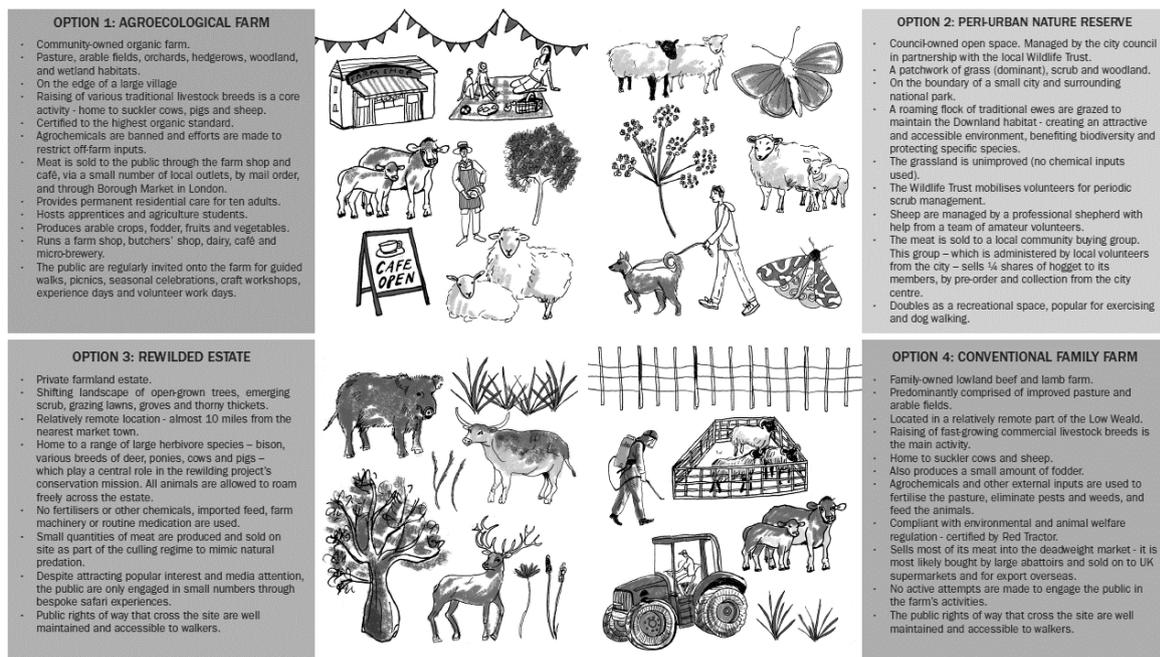


206

207 **Figure 2. Bar chart showing the numbers of participants representing each of the 14 perspectives.**

208 The thirteen expert interviewees were individually led through an appraisal process in which they  
 209 were invited to assess contrasting land use and management *options* (phrased in terms of  
 210 “*strategies* for enhancing biodiversity, food security and broader sustainability through the  
 211 management of large herbivores within peri-urban and rural landscapes in the South East of  
 212 England”). At no point did the brief mention ecosystem services or any service categories or sub-  
 213 categories. Participants were provided with four core options to appraise and were asked to  
 214 volunteer any additional options that they thought warranted appraisal in parallel. They were then  
 215 asked to volunteer their own criteria for conducting the appraisal (typically 4-8 criteria). This  
 216 involved coming up with criteria titles, key features and more detailed descriptions. Some of the  
 217 participants had come to the interview with a list of criteria that they had pre-prepared, whereas  
 218 others took time to think about and discuss their criteria with the interviewer. Next, they were led  
 219 through a scoring process that enabled them to attribute pessimistic (‘at best’) and optimistic (‘at  
 220 worst’) scores for each of the options against each of the criteria. The use of scoring ranges instead  
 221 of discrete scoring allows for the articulation and exploration of uncertainty and ambiguity in  
 222 relation to the performance of options under different conditions (see Stirling and Coburn 2014).  
 223 Finally, they were asked to weight the criteria that they had used, before being presented with a  
 224 ‘final ranking picture’ that showed the average scoring ranges for each of their options – combining  
 225 the scores for all criteria, weighted accordingly – so that they might be able to reflect on their overall  
 226 assessment of the options. Throughout the interviews, participants were seated at a computer  
 227 terminal next to the researcher, who typed their definitions and comments into the screen using the  
 228 MCM tool (Stirling and Coburn 2014). Participants were asked to review each entry as they  
 229 progressed through the appraisal and were invited to type their own entries, though none opted for  
 230 the latter.

231 The four options that the interviewees were presented with were carefully constituted through a  
 232 multi-staged process during the spring and summer of 2018. The aim of this was to produce a set of  
 233 discrete options that collectively encompass a broad range of relevant practices on the sparing-  
 234 sharing spectrum, are divergent enough to allow comparison, and are indicative of the sorts of  
 235 practices currently in use in the region. The first stage involved reviewing official statistics and  
 236 literature on contemporary conservation and agricultural practices used within the South East of  
 237 England (including Greater London, East and West Sussex, Kent, Surrey and Hampshire) and  
 238 empirically mapping the different sorts of practices currently in use in the area (which ruled out the  
 239 inclusion of intensive indoor livestock production as an option; for more information see the  
 240 Compassion In World Farming report (2019)). Data concerning the types of livestock kept as well as  
 241 legal, managerial, social and ecological characteristics of the sites, was gathered through desk  
 242 research on a total of 46 sites on which large herbivores were being kept. Two draft versions of the  
 243 options were produced from this stage. The second stage involved conducting scoping interviews  
 244 with expert informants who indicated their preference between the two draft versions and helped  
 245 to improve the favoured version. The final stage involved piloting the MCM interview process with  
 246 members of the research team and two additional expert informants, in order to further improve  
 247 the options. A final version of the four options was produced from this stage (**figure 3**). This was  
 248 incorporated into a briefing booklet that outlined the MCM interview process and was distributed to  
 249 interviewees prior to their interviews; a digital copy is provided as a supporting document to this  
 250 paper.



251  
 252 **Figure 3. The four MCM options used within the appraisal interviews, as rendered within the**  
 253 **participant briefing pack.**

254 **2.3 Analysis**

255 For the purposes of this paper, *quantitative* 'ranks' charts of the core options were produced, which  
 256 show the rankings of the options as assessed by: (1) all of the participants using all the criteria  
 257 (overall ranks), (2) subsets of the participants using all of the criteria (overall ranks, by perspective),

258 (3) all of the participants using subsets of the criteria (sub-ranks, by 'issue'<sup>2</sup>), and (4) subsets of the  
259 participants using subsets of the criteria (sub-ranks, by issue and perspective). Sub-ranks represent  
260 scores (extrema and mean; pessimistic and optimistic), multiplied by normalised weights, that  
261 calculate the ratio of each criterion weight to the sum of all criteria weights, rather than using only  
262 those weights pertaining to criteria within the selected issue groupings (Stirling and Coburn 2014).  
263 These ranks charts were then used to identify particular *options* and *issues* that polarised opinion  
264 and to explore which, if any, of the *perspectives* might be associated with these divisions. They were  
265 also used to highlight areas of common ground between perspectives on particular options or issues.  
266 These preliminary findings were then taken as lines of inquiry to be further explored in the  
267 qualitative data deriving from the MCM interviews.

268 The validity and relevance of the perspective groups was tested by reviewing the ranks charts for  
269 each individual participant and clustering them inductively through an iterative process (i.e. visually  
270 comparing the patterns of ranks and then using logical queries to carefully check their coherence).  
271 The result of this process was to show that the Conservation perspective (n=5) has a high level of  
272 coherence, whereas the Farming perspective (n=5) might be better broken down into three sub-  
273 groups comprised broadly of 'Farmers' (n=2), 'Agroecologists' (n=2) and 'Estate Managers' (n=1), if  
274 the research were to be repeated. It was not possible to test the coherence of the other perspective  
275 groups as the numbers of individuals assigned to them were too small.

276 The *qualitative data* produced from the exercise include definitions of 67 appraisal criteria  
277 volunteered by the 13 participants (each including a title, key features and a description). These data  
278 were subjected to a detailed thematic analysis (Boyatzis 1998), which involved several stages of  
279 iteration, to both test the validity and consistency of the predefined ES categories and to generate a  
280 set of more grounded empirical categories and emergent (interpretive) themes, linked by branches  
281 within a tree of codes. Initially, the three top-level ES categories were used for clustering the criteria,  
282 alongside a residual category for criteria that fall outside of them and a cross-cutting category for  
283 criteria that cut across them. These categories include 'supporting and regulating' or SRES;  
284 'provisioning' or PES; 'cultural' or CES; 'cross-cutting' or CCES; and 'residual' or RES. Then a set of  
285 empirical categories were developed through an analysis of the terms most frequently used to  
286 define the criteria within each ES category. Finally, a subset of interpretive categories was arrived at  
287 through a process of deducing common meanings amongst criteria relating to each of the empirical  
288 categories. This process was revisited, and empirical and interpretive categories were compared  
289 and, in some cases, combined.

290 A graphical representation of the methodological design illustrating the use of MCM analysis (based  
291 on Coburn and Stirling 2019) within the wider participatory social appraisal exercise is provided as an  
292 **appendix** (Appendix B) to the paper.

### 293 3 Findings

294 In this section an account will be provided of the 67 appraisal criteria volunteered by the 13 MCM  
295 participants, in order to demonstrate the relationships between the criteria and the three  
296 predefined ES categories (section 3.1). Attention will then be paid to criteria that do not fit with the  
297 ES categories (section 3.2). Subsequently, an account will be provided of how the performance –

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<sup>2</sup> The option to (dis)aggregate criteria under different 'issues' is an in-built function of the MCM tool, which allows the researcher to define a set of issues and allocate criteria among them. These issue groupings can then be used to produce sub-ranks charts. In this exercise, the 'issues' used to cluster criteria were the same as those used in the qualitative analysis (i.e. SRES, PES, CES, CCES and RES – see below).

298 against these criteria – of the four land use and management options, varies under different  
299 perspectives (section 3.3). To aid readability, both empirical and interpretive categories will be  
300 referred to simply as ‘themes’. The first letters of criteria titles will be capitalised and, as per usual  
301 conventions, any terms or phrases quoted verbatim will be inserted within speech marks and  
302 reference will be made to the participant being quoted. Participants are referred to within the text  
303 using either their organisational affiliation, or, if they opted to make their data responses non-  
304 attributable, either their job role or a descriptive title will be used. We urge the reader to view the  
305 graphical abstract for this paper – within which the research findings are presented visually – in  
306 parallel to reading this section.

### 307 3.1 Criteria relating to conventional ES frameworks

308 From amongst the 67 criteria, close to 70% (n=49) were found to relate to the predefined ES  
309 categories SRES, PES, CES). Of these 49 ES-related criteria, two were framed in ways that cut across  
310 the SRES, CES and PES categories, offering wide-ranging and generic accounts of goods and services  
311 provided to society (n=2 for CCES). The other 47 were found to relate principally to either the SRES  
312 (n=21), PES (n=13) or CES (n=13) categories. It is worth noting, however, that only two participants  
313 actually used the term ‘Ecosystem Services’ at any point in the interviews, and only one out of these  
314 two participants used this term substantively. In defining a criterion with the title ‘Ecosystem  
315 Services’, this participant listed a range of properties which relate to both SRES and CES categories.  
316 However, in applying the criterion through the allocation of scores, the participant was only  
317 concerned with the SRES aspects, so this criterion was coded to the SRES category. This approach –  
318 of checking consistency between the criteria definitions and the way that they were applied by  
319 participants in practice – was applied throughout the process of allocating all 67 criteria to the five  
320 top-level codes, therefore ensuring high level of validity of the analysis.

321 *Supporting and Regulating Ecosystem Services (SRES):* The most prominent themes that came  
322 from analysing the 21 SRES-related criteria included ‘biodiversity’ and ‘soil’. In total five separate  
323 criteria were volunteered with the title ‘Biodiversity’, a further five having the word biodiversity or  
324 diversity in their titles (including ‘Capacity for Diversity’, ‘Impact on Biodiversity’, ‘Species and  
325 Biodiversity’, ‘Stopping Biodiversity Loss’ and ‘System Diversity’) and a further four being about  
326 aspects of biodiversity (titled ‘Habitat connectivity’, ‘Connectivity’, ‘Plants and Animals’ and ‘Space  
327 for Nature’). Hence, the majority of the 21 criteria relating to SRES are specifically about (aspects of)  
328 biodiversity. Amongst these criteria, both diversity of habitats and diversity of species were  
329 frequently discussed and generally distinguished from each other, though both aspects were  
330 assumed to be a positive feature by all. One participant focussed on species diversity in the  
331 definition that they gave for a criterion titled ‘Biodiversity’, as follows: “abundance of wildlife in  
332 terms of biomass and species diversity, across the site, over a range of habitats, focussing on both  
333 short terms gains, or ‘quick wins’, and longer term sustainability of the species and habitats” (05).  
334 Others, however, focussed more on diversity of habitats. Though this is described in subtly different  
335 ways, the meaning seems fairly consistent across most perspectives and is concisely summarised by  
336 one participant in terms of a “mix of target habitats” (07).

337 A further four SRES-related criteria were primarily concerned with soil, expressed variously in terms  
338 of “soil health” (08, 13), “soil fertility” (09), and “sustainability” and “regeneration” of the soil (11),  
339 within their titles or key features. Soil was also mentioned by several participants in connection to  
340 biodiversity (03, 08, 12), as well as other SRES and PES-related themes. Participant 13, for instance,  
341 summed up soil health in terms of “capacity to support nutritious food production and contribute to  
342 climate change mitigation”. Other aspects of soil highlighted within participants’ criteria included  
343 “balance of nutrients within the soil, mycorrhizal activity and carbon sequestration” (08) “absorptive

344 capacity” (09) and “processes of regeneration” (11). Finally, whereas one out of the remaining three  
345 SRES-related criteria describes a nature-based approach towards land management titled ‘Working  
346 with Nature’ (09), the other two list bundles of services. For instance, one participant listed various  
347 types of SRES under the title of ‘Environment’, including air quality, water quality, flood water  
348 management, carbon sequestration, climate change objectives and soil health (03).

349 *Provisioning Ecosystem Services (PES):* With 11 separate criteria relating to it, the provision of food  
350 emerged as the most prominent PES-related theme and second most prominent theme from across  
351 all the criteria. In fact, only two other environmental ‘goods’ were mentioned, by only two  
352 participants: energy and water. Framed predominantly as an output, food was considered in terms  
353 of both its intrinsic values (relating to quality, quantity and variety), as well as its contribution  
354 towards extrinsic or relational values (such as affordability, security and sustainability). In terms of  
355 quantitative appraisals of food output, this was generally construed in terms of the amount of food  
356 produced by unit area, with calories per hectare given as a likely metric. Issues relating to quality  
357 that were mentioned by participants include taste (12), nutrition – i.e. “nutrients, balance of fatty  
358 acids, health-giving properties” (11) or “fat content [and] carcass quality” (08), and safety (03).  
359 Variety, which was the other intrinsic value mentioned, was expressed by one participant as a  
360 measure of the “diversity of products” produced from the different options (04).

361 In terms of more extrinsic or relational values, one participant (03) mentioned the importance of  
362 “affordability and availability of food to the majority of people” as a consideration. This concern for  
363 the way that food outputs from the different options might be accessed and consumed by people  
364 was a common theme. Hence, another participant asked: “Is sufficient food produced to meet  
365 societies’ needs?” (12). Other participants made links between food security, healthy eating and  
366 sustainability, touching on aspects that relate to the CES category. One in particular was concerned  
367 with the “capacity of the model to contribute to local and national food security, linking food  
368 security to dietetic advice and health agendas” (13); for another, the different options hold variable  
369 potential to contribute towards the “wider societal benefits of behaviour change around meat  
370 eating” (07). For two other participants it is the “environmental impacts of production” (11) which  
371 underpin food provision and provide a link to food security, as “very high input methods may be  
372 unsustainable therefore not 'secure'” (10).

373 Another characteristic of the PES-related criteria is the prominence of statements about priorities  
374 and trade-offs between the various different themes. For instance, participant 04 defined their  
375 criterion (titled ‘Food Security’) as “a trade-off between quantity, quality and diversity” (04), without  
376 specifying a generic order of prioritisation. For participant 02, quality is clearly prioritised over  
377 quantity, “because of the impact of food production on the environment” (assuming an inverse  
378 correlation between food quality and environmental impact). Referring to yet another trade-off,  
379 participant 03 commented that “in terms of food safety, food security is not about cheap food” (03),  
380 meaning that affordability is important, but not at the cost of safety. In a similar vein, participant 07  
381 talked about the “prioritisation of land use for meat production” (07) as revolving around a choice  
382 between “cheap meat or high quality more expensive meat”. All these comments were provided  
383 within definitions of PES-related criteria.

384 *Cultural Ecosystem Services (CES):* Education (and knowledge) was the most prominent theme  
385 from amongst the CES-related criteria (contained within four criterion titles and included within the  
386 key features of a further three criteria) and was generally understood as pertaining to individuals  
387 rather than organised groups or collectives. The sort of individuals envisaged by participants  
388 included the public as well as farmers, and both young people and old. For the public, this means  
389 learning about food production and land use – i.e. to help them understand “why the estate is being

390 managed in that way” (02), to give them “an understanding of human relationships with the land  
391 historically” (08), and to educate them about “food production and what good food is, so that they  
392 understand the compromises involved in producing food in different ways” (10). For farmers, it’s  
393 about providing opportunities for them to learn techniques and approaches “for future sustainable  
394 food production” (13) and “getting them to open their eyes to new ideas that are not totally based  
395 on high inputs – ideas that work for small farms and help them survive” (10). This participant also  
396 emphasised the importance of providing “opportunities for multiple family members to be  
397 employed on the land or farm business” (10), as a way to retain “the value of tacit and traditional  
398 knowledge of farmers”.

399 Another CES-related theme is health and care (in two criterion titles and the key features of another)  
400 – or the “capacity [of the option] to promote human health and social care”, such as could be  
401 provided through “social or care farming” (13). Four participants linked positive outcomes for mental  
402 and physical health with access to land for recreation, whether “virtual or real” and relating to both  
403 “local communities and general publics” (05). The health of land managers and workers was also  
404 considered by two participants, with one asking whether “those involved in the option have good  
405 mental health” (12) and the other being concerned about the ‘Lifestyle’ of those working the land  
406 “in terms of happiness, busy-ness and flexibility” (08). Two additional themes that emerged from  
407 analysing the CES-related criteria are engagement and development. The term engagement was  
408 commonly used by participants in relation to a number of other concepts that feature in the criteria,  
409 some already mentioned, including access, involvement, consultation, education, advocacy,  
410 participation, connection and community. Attempting to generalise over much of this, one  
411 participant asked, “Does the option integrate the community in its operations and objectives?” (12).  
412 The term development was used more specifically in connection to rural, particularly agricultural,  
413 communities and their reliance on a range of business services, as “every farm needs a vet, haulier,  
414 merchant and so on – the vital supporting services – and when in place they also provide  
415 employment” (03).

416 A more general characteristic of the CES-related criteria is their application at different times, by  
417 different participants, to either people as individuals or as collectives. For instance, as demonstrated  
418 above, the education, health and care-related benefits of different options were frequently framed  
419 in relation to individuals. However, the themes of engagement and development both explicitly  
420 concern people as collectives, related to each other within communities, in addition to having  
421 relevance to people as individuals.

### 422 3.2 Criteria outside conventional ES Frameworks

423 The thematic analysis of the 18 residual criteria (RES) volunteered by participants produced two top  
424 level themes and five further sub-themes: Viability (including financial, political and practical) and  
425 Desirability (including ethics and efficiency/effectiveness). Only four out of the 18 criteria reflect  
426 matters of desirability – the rest all reflecting issues of viability.

427 *Desirability:* “Land Use Intensity” emerged as a particularly important consideration for one  
428 participant, who used this criterion to enable comparison of the options in terms of how efficiently  
429 and effectively they use land, albeit that they are using it in different ways, for different purposes.  
430 For this participant, it is paramount that land is used in an efficient and effective way in order to  
431 mitigate the pressure from agricultural expansion, which is fuelling biodiversity loss; thus, whereas  
432 inefficient use of land could be a *viable* option, it is not a *desirable* one. Another matter of  
433 desirability emerged as a consideration for several of the participants (08, 10, 11 and 13). According  
434 to these four, Animal welfare, i.e. “capacity of the model to promote high level welfare of farmed

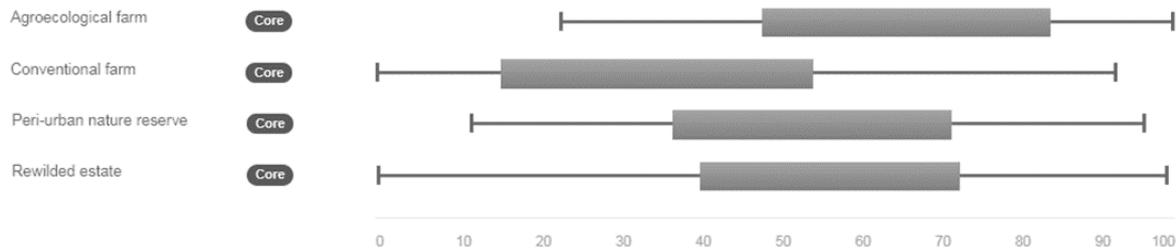
435 animals through the whole system, birth to death” (13), must be maintained above a certain level  
436 for an option to be considered desirable.

437 *Viability:* As a term, “viability” was resonant for a number of participants. Of the four who  
438 used it in their criteria titles (and one other who used it as part of their criterion description), all  
439 were citing economic or financial matters. For instance, several participants felt that it was  
440 important to consider the options from a business perspective, either in terms of “value of outputs”  
441 against “value of inputs” (02); “productivity”, “market size” and “costs” (01); or whether there is a  
442 “basic profit-making model” underlying the individual enterprise (13). One participant was  
443 specifically concerned with the behaviour of consumers (“it is often only ABC1 groups that are able  
444 to buy direct from the producer or local butchers”), which they claimed is what “drives markets” and  
445 therefore determines viability (06). Another, whose ‘market’ is an internal one, focused on  
446 reputational benefits, or the capacity of the different options “to justify the cost of environmental  
447 services from internal budgets” by “producing good stories for customer sales purposes” and  
448 “showcasing” the company’s “interest and concern for the environment” (07). Participants were also  
449 concerned with the extent to which the options represent a “long term financially stable method of  
450 land use” (13) – or in other words, the “sustainability of the underpinning finances” in terms of a  
451 “50+ years’ consideration of where the money comes from” (03).

452 Several other aspects of broader ‘viability’ (i.e. ability of the options to survive or work successfully)  
453 were also volunteered as appraisal criteria. Political support was raised by a participant who  
454 indicated various levels of policy and politics as being relevant, including “national, international (by  
455 which I mean agro-environmental schemes), local councillor support at the ward level, planning  
456 permission, the SDNPA [South Downs National Park Authority], and other relevant statutory bodies”  
457 (Local Government). More ‘practical’ aspects of viability concern the availability of expertise – in  
458 terms of “land manager knowledge and experience” (06), or the “skills, education, staffing required”  
459 (01) – and the suitability of the options’ locations in relation to their surroundings, with respect to  
460 access and connectivity, as well as their “size, fertility and history of management” (02). In  
461 connection to the issue of expertise and linking this with the changing political landscape, one  
462 participant highlighted that “if new opportunities or different techniques or goals are to be  
463 incorporated into the system then that knowledge and learning has to come from somewhere” (06).

### 464 3.3 Exploring different viewpoints

465 **Figure 4** below shows the ‘ranks chart’ for all participants (and therefore all perspectives). It displays  
466 the ‘ranks’ (overall performance scores) for each of the core options under the complete range of  
467 criteria that were developed by all of the individual participants through their appraisal interviews.  
468 Each bar in the ranks chart below is an aggregation of the individual ranks assigned by each  
469 participant, which in turn are calculated as the sum of the scores under individual criteria, each  
470 multiplied by the normalized weighting for that criterion (Stirling and Coburn 2014). The ‘rank  
471 extrema’ (thin lines) give an impression of the full variability in the ranks assigned by different  
472 participants, whereas the ‘rank means’ (thick bars) give an impression of the distribution of  
473 participants’ ranks within the full ranges.



474

475

476 **Figure 4. Ranks chart showing the aggregate ranks for the core options, calculated using**  
 477 **pessimistic and optimistic scores assigned by all perspectives using all criteria.**

478 On the surface, this chart suggests that there is an overall ‘winner’ and an overall ‘loser’ of the MCM  
 479 exercise (the Agroecological Farm and the Conventional Farm respectively) and the other two  
 480 options are relatively close ‘runners-up’. It also shows that there is a high degree of variability  
 481 between the ranks assigned by different participants, for all four options, which indicates – as  
 482 anticipated – considerable ambiguity and/or uncertainty in relation to the options. However, it is  
 483 important not to misinterpret or overemphasise the final ranking outcomes – in particular, the  
 484 picture of ranks does not represent statistically significant preferences about land use. Rather, it  
 485 provides an indication of how the options defined within this exercise have been appraised by a  
 486 group of appraisers who were selected for their capacity to view the issues from a range of relevant  
 487 perspectives. The data therefore become more interesting when they are cut according to the  
 488 different perspectives and issues, revealing how performance of the options is understood from  
 489 those perspectives and in relation to those issues.

490 For instance, patterns of performance according to the Conservation perspective, on the one hand,  
 491 and the Farming perspective, on the other, are particularly contrasting. Under the Conservation  
 492 perspective, the Conventional Farm is universally disfavoured (there is a common ‘foe’) but there is  
 493 disagreement over which of the other options is *most* favourable, whereas under the Farming  
 494 perspective the Agroecological Farm is most favoured (a common ‘friend’), but there is  
 495 disagreement over which of the other options is *least* favourable. The contrast between  
 496 perspectives concerning remit (Local versus National) and sector (Private versus Public) is less  
 497 pronounced in both cases. A striking difference, however, between the ranks for the Local and  
 498 National perspectives is the difference of attitude towards the Conventional Farm option. The Local  
 499 scores for this option are strongly skewed to the pessimistic end of the scoring range, whereas the  
 500 National scores are skewed slightly to the optimistic end, suggesting that there may be more  
 501 sympathy towards conventional farming from the National perspective.

502 This specific contrast is echoed in qualitative accounts of ‘food security’ provided by participants,  
 503 wherein different geographical scales emerge as drivers of the different perspectives. For instance,  
 504 for one participant in the Local perspective (12), considering food security means asking whether the  
 505 option supplies “the local community”, whereas for participants in the National perspective (03),  
 506 food security means “self-sufficiency of the UK” and “global societal systems” (01). Likewise,  
 507 contradictory accounts of biodiversity highlight another polarising issue. Whereas, for participant 04  
 508 (Conservation perspective), “genetic diversity is not a level of detail that is relevant here”, for  
 509 participant 13, biodiversity is framed in terms of the “extent to which the model has the capacity for  
 510 diversity of herbivores and other land uses to support biodiversity, including agro-biodiversity, in  
 511 terms of genetic diversity and traditional practices, for enhanced resilience”. In contrast to the  
 512 previous account, this framing is particularly sympathetic to agroecological practices, which enhance

513 biodiversity on farmed land and consider the whole farm system, including different breeds of  
514 domestic species, as relevant to biodiversity conservation.

## 515 4 Discussion

516 Our research shows that selected stakeholders – surrounding the management of large herbivores  
517 on sites in the South East of England that span the land sparing-sharing spectrum – incorporate  
518 elements of SRES, PES and CES in their framings of performance. Taken alone, this finding  
519 strengthens arguments advocating for ES approaches to be used in the assessment of agricultural  
520 systems (Crossman et al. 2012; Maes et al. 2013; The Economics of Ecosystems and Biodiversity  
521 (TEEB) 2018). However, looking in more detail at the most prominent themes to emerge from a  
522 thoroughgoing thematic analysis of the empirical data associated with the 49 ES-related criteria  
523 (titles, key features and descriptions), the findings reveal a more challenging picture.

524 As demonstrated in section 3.1 above, within SRES, the most prominent themes relate to  
525 biodiversity (in terms of habitats and species) and soils. Given the set-up of the MCM exercise, which  
526 included the phrase ‘enhancing biodiversity’ within the overarching goal, it is unsurprising that  
527 biodiversity features as a theme. However, the predominance of this theme is worthy of note, as is  
528 the prominence of soil as a theme and the fact that other SRES-related themes – for instance  
529 relating to air quality, climate regulation, control of pests and diseases, erosion control, pollination,  
530 water regulation, nutrient cycling, and so on – did not emerge more clearly (many only featured  
531 tangentially, in connection to biodiversity or soil). These findings offer challenges to conventional ES  
532 frameworks, as neither biodiversity nor soil (as construed by the participants) are clearly defined  
533 within them. Instead, soil cuts across conventional SRES subcategories, whereas biodiversity seems  
534 to sit semi-invisibly behind them, concealing a raft of complex, non-linear relationships (Haines-  
535 Young and Potschin 2010). Therefore, conventional ES frameworks may fall short of assessing SRES-  
536 related aspects of land use and management options that incorporate agroecological practices,  
537 within which both biodiversity and soil take on particular significance and specific meanings that are  
538 not well aligned with subcategories of SRES.

539 Turning now to PES, the most prominent themes relate to food provision – in terms of both the  
540 intrinsic values relating to the quality, quantity and variety of food provided and the extrinsic or  
541 relational values of that food, such as its affordability, the security and sustainability of its supply,  
542 and the contexts of its consumption – almost to the exclusion of any other outputs (e.g. fuel, fibre,  
543 freshwater, medicines and so on). This in itself is unsurprising as the set-up of the MCM exercise  
544 included the phrase ‘enhancing [...] food security’ within the overarching goal. Nonetheless, a  
545 striking characteristic of the criteria definitions relating to food, which goes beyond the scope of  
546 conventional ES frameworks to account for, is the prominence of statements about priorities and  
547 trade-offs between the various different themes. What this clearly reflects is the inextricability – or  
548 indeed ‘embeddedness’ (Sonnino and Marsden 2005) – of the values that can be derived from PES  
549 and the contexts in which they are produced and consumed – in terms of contextual differences  
550 between different options or sites, aspects of the competitive environment and elasticity  
551 surrounding them, and varying contexts of food consumption. In light of this, and the fact that all of  
552 these considerations about intrinsic and extrinsic values must be prioritised in practice by  
553 landowners and managers themselves on a site-by-site basis, conventional ES frameworks – which  
554 provide no method of prioritisation – cannot offer a comprehensive solution for assessing land use  
555 and management options if agroecological practices are taken into account.

556 Regarding CES, the most prominent themes relate to education, health and care, with engagement  
557 and development also featuring prominently. Within these themes a wide range of other issues are

558 represented, spanning most of the subcategories of CES used within conventional ES frameworks.  
559 Moreover, a striking contrast between and within the various CES-related themes, which is  
560 challenging to conventional ES frameworks, concerns their application to either people as individuals  
561 or as collectives (see section 3.1). This ambiguity is challenging to conventional ES frameworks  
562 because it makes the various subcategories of CES extremely difficult to compare or reconcile with  
563 each other, as they relate simultaneously to different scales and locations – including landowners  
564 and managers themselves, their family members as individuals, individual members of the public,  
565 individual members of local communities, local communities as collectives, consumers and citizens  
566 as collectives, and so on. We therefore suggest that applying these categories in the context of  
567 agroecological practices demands particular sensitivity – in contrast, for instance, to conventional  
568 agricultural options which are not typically community-oriented in the same ways or to the same  
569 degree (Whatmore, Stassart et al. 2003, Renting, Schermer et al. 2012). Though some literature has  
570 begun to explore this and other issues relating to the assessment of CES (Bryce, Irvine et al. 2016,  
571 Fish, Church et al. 2016, Fish, Church et al. 2016, Tratalos, Haines-Young et al. 2016, Chen, de Vries  
572 et al. 2019), little work has adopted a structured, participatory approach, allowing stakeholders and  
573 participants to identify their own framings of the problem (Stirling 2006, Stirling 2010, Bernues,  
574 Tello-Garcia et al. 2016, Schmidt, Walz et al. 2017), nor has attention been directed to addressing  
575 this in the context of agroecological practices.

576 Looking across, within and between SRES, PES and CES, divergent perspectives (in particular  
577 between conservation and farming) can be identified, underlining the fact that values and interests  
578 differ within and across stakeholder groups and illustrating the utility of MCM in ascertaining those  
579 differences. These perspectives revealed divergent framings of certain issues (e.g. food security in  
580 relation to multiple geographical scales and biodiversity in relation to multiple ‘biological scales’,  
581 including genetic diversity, species diversity and habitat diversity), with varied relevance for the  
582 different options (e.g. agroecological practices tend to be oriented towards local communities  
583 whereas conventional farming tends to be oriented towards national and global markets; genetic  
584 diversity of livestock is highly valued within agroecological practices but less so within conservation,  
585 where the focus tends to be on species and habitat diversity). The implication of these findings for  
586 the use of ES frameworks in assessing land use and management options is that care must be taken  
587 to ensure that assumptions (e.g. whether contribution to food security is sought at the local,  
588 national or global level and whether biodiversity is sought at the genetic, species or habitat level) are  
589 made explicit.

590 Our findings also point towards other stakeholder considerations that fall outside of conventional  
591 ES-focussed studies, as well as more integrated forms of ES assessment (e.g. Dendoncker et al.  
592 2018). These considerations were found to focus on aspects of viability and desirability of particular  
593 options – both of which illustrate the context-specificity of performance within multi-level policy  
594 regimes and ecological and socio-cultural contexts. In particular, the three ‘Viability’ sub-themes –  
595 financial, political and practical – are all very rooted in the national and local context in which the  
596 particular land manager is operating. This relates not only to the biophysical environment but also  
597 the socio-cultural and policy environment. For instance, as shown in section 3. 2, participants’ main  
598 concerns relating to viability are: How profitable is the option? Is there enough money to support  
599 land managers and workers now, and for investing in the future? Where is the money coming from?  
600 And, how sustainable are the finances over generations? Hence, broader aspects of viability of  
601 concern to participants relate to the landscape of political support for the option, the availability of  
602 expertise required for making a success of it, and the suitability of the option in relation to the  
603 characteristics of specific sites. This emphasis on context-sensitivity highlights the importance of  
604 localised considerations to decision-makers – especially those working at sub-national levels.

605 To our knowledge, previous ES studies of re-wilding in the UK have not incorporated viability  
606 considerations. Likewise, ES-led studies looking at different types of farming have not – to our  
607 knowledge – explicitly dealt with financial, political and practical viability issues, even though these  
608 may have been taken into account in studies of agro-ecological farming that have not incorporated  
609 ES measures (Laughton 2017). This represents a disjuncture in the literature that this study  
610 highlights and – to some extent – begins to bridge. However, it is difficult to imagine how ES  
611 frameworks might be extended to be generalizable across these issues.

## 612 5 Conclusions

613 Land-sharing and land-sparing practices, such as those surrounding the management of large  
614 herbivores in the South East of England, are understood in different ways, from different  
615 perspectives. Through exploring how their relationships to the delivery of ES vary under differing  
616 views, we have opened up land use policy and research to include a wider set of considerations than  
617 previously attended to. This has helped to move the discussion forward by re-emphasising the  
618 limitations of conventional – as well as more integrated – ES frameworks and suggesting a direction  
619 for future scholarship.

620 Taken overall, our findings have uncovered a lack of sensitivity of conventional ES frameworks to the  
621 specific concerns, priorities and ambiguities of agroecological practices; an inability to encompass  
622 multiple scales and localities; and limitations to incorporating localised considerations. Even if they  
623 do not allocate a monetary value to ecosystem services (thus falling short of creating Polanyian  
624 ‘fictitious commodities’), ES approaches still ‘disembed’ natural processes from their local contexts.  
625 Therefore, in order to re-embed the kinds of data gathered by ES-based assessments of land use  
626 policy, we suggest more attention is paid to an additional set of stakeholders’ considerations which  
627 focus on viability and desirability, lie outside of traditional ES categories, and rest on biophysical,  
628 socio-cultural and political-economic (e.g. policy) conditions. This presents opportunities for  
629 incorporating such context-specificities into mapping approaches that aim to broaden out  
630 perspectives and present open, plural and conditional (Stirling 2008, 2010) advice to policy and  
631 practice. Thus, we believe that further development of the MCM tool – as well as other approaches  
632 that aim to broaden out perspectives and present open, plural and conditional advice to policy and  
633 practice (Stirling 2008, 2010) – could enable a more deeply embedded approach to appraising ES at  
634 local levels. , and that there is much scope for experimenting with these kinds of broad and open  
635 deliberative-analytic approaches (Ely et al. 2014) as the UK develops its land use policy following the  
636 UK’s departure from the EU.

637 Whilst this paper presents evidence based on a small sample size, with associated limits to the  
638 number and diversity of perspectives sought, we believe that it makes an important contribution to  
639 scholarly debates about land use policy. We therefore suggest that further work research could be  
640 undertaken to broaden the increase the range of perspectives that are included within interviews  
641 and scale up sample size, enabling more fine-grained distinctions (e.g. within the “farming”  
642 perspective). In particular, an exploration of the perspectives of farmers and other land managers  
643 operating at multiple geographic scales would be important. Additionally, broadening core options  
644 to include intensive agriculture could also yield important and interesting insights. Given the  
645 attention being paid to local decision-making around the implementation of the ELMS and the  
646 landscape level at which ES are best understood, and the fact that the MCM tool itself is not  
647 currently able to combine different options together in a portfolio approach (e.g. appraising a  
648 combination of land use measures used on different parts of a single estate, or a combination of

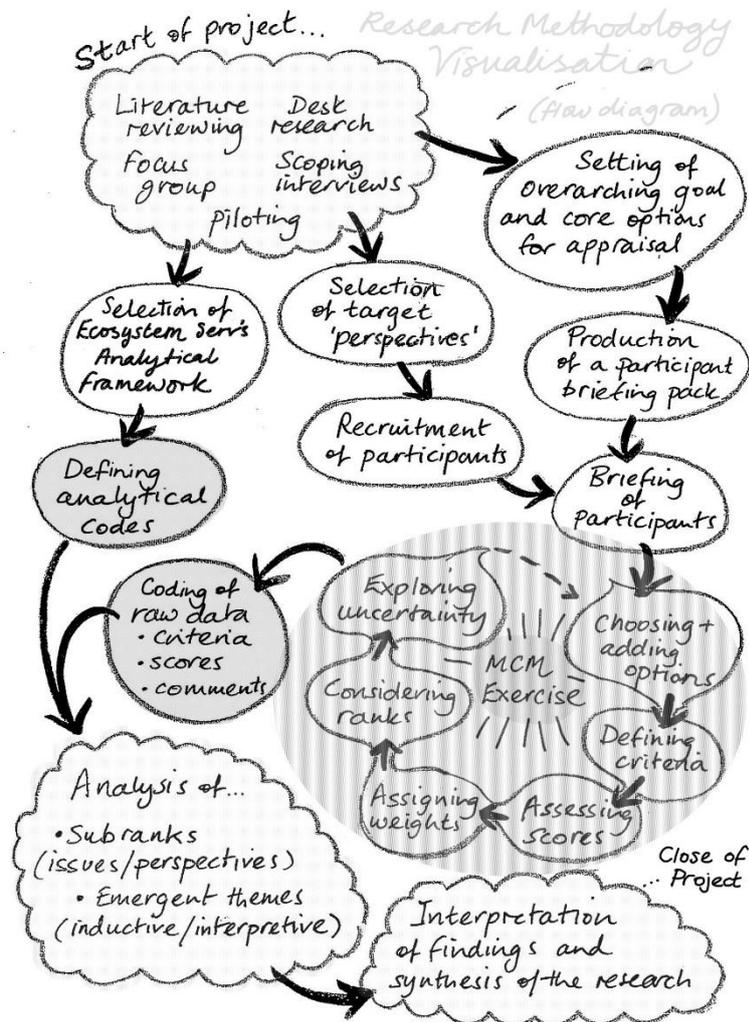
649 land use measures adopted by different land managers, for example in a local farm cluster), this  
650 presents one possibility for how the MCM tool could be developed into the future.

## Appendix A

<b>I.D.</b>	<b>ORGANISATION TYPE</b>	<b>PROFESSIONAL ROLE TYPE</b>	<b>LAND USE</b>	<b>RELATION TO PROPERTY</b>	<b>REMIT</b>	<b>SECTOR</b>
<b>01</b>	National government body	Agri-Environmental Officer	N/A	N/A	National	Public Sector
<b>02</b>	Local authority	Conservation Manager	Conservation	Landowner	Local	Public Sector
<b>03</b>	Trade union	Regional Adviser	Farming	N/A	National	Trade Association
<b>04</b>	Local AONB	Conservation Manager	Conservation	N/A	Local	Voluntary Sector
<b>05</b>	Charitable trust	Wildlife Advisor	Conservation	Landowner	National	Voluntary Sector
<b>06</b>	Charitable trust	Agriculture and Grazing Specialist	Conservation	Landowner	National	Voluntary Sector
<b>07</b>	Utility company	Environmental Officer	Conservation	Landowner	N/A	Corporate
<b>08</b>	Land agency	Rural Surveyor	Farming	Estate Agent	N/A	Corporate
<b>09</b>	Community farm	Farm Director	Farming	Tenant	Local	Voluntary Sector
<b>10</b>	Family farm (Weald)	Tenant Farmer	Farming	Tenant	Local	Independent
<b>11</b>	Agricultural estate	Estate owner and director	Rewilding	Landowner	N/A	Independent
<b>12</b>	Family farm (Downland)	Tenant Farmer	Farming	Tenant	Local	Independent
<b>13</b>	University	Environmental Lawyer	N/A	N/A	N/A	Academic

## Appendix B

Methodological design, illustrating the use of MCM analysis (based on Coburn and Stirling 2019) within the wider participatory social appraisal exercise.



## References

- Alcamo, J., Thompson, J., Alexander, A., Antoniadou, A., Delabre, I., Dolley, J., Marshall, F., Menton, M., Middleton, J., and J.P.W. Scharlemann (2020) Analysing interactions among the sustainable development goals: findings and emerging issues from local and global studies, *Sustainability Science* 15(6): 1561-1572.
- Batáry, P., Dicks, L. V., Kleijn, D., & Sutherland, W. J. (2015). The role of agri-environment schemes in conservation and environmental management. *Conservation Biology*, 29(4), 1006-1016.
- Bateman, I. J., Harwood, A. R., Mace, G. M., Watson, R. T., Abson, D. J., Andrews, B., ... & Termansen, M. (2013). "Bringing ecosystem services into economic decision-making: land use in the United Kingdom". *Science*, 341(6141), 45-50.
- Bateman, I. J., A. R. Harwood, G. M. Mace, R. T. Watson, D. J. Abson, B. Andrews, A. Binner, A. Baveye, P. C., Baveye, J. & J. Gowdy (2016) Soil "Ecosystem" Services and Natural Capital: Critical Appraisal of Research on Uncertain Ground, *Frontiers in Environmental Science* 4: 41.

- Baylis, K., Peplow, S., Rausser, G., & L. Simon (2008) Agri-environmental policies in the EU and United States: A comparison, Ecological Economics 65(4): 753-764.
- Bernues, A., E. Tello-Garcia, T. Rodriguez-Ortega, R. Ripoll-Bosch and I. Casasus (2016). "Agricultural practices, ecosystem services and sustainability in High Nature Value farmland: Unraveling the perceptions of farmers and nonfarmers." Land Use Policy 59: 130-142.
- Bonnieux, F., Dupraz, P. & Latouche, K. (2006) Experience with Agri-Environmental Schemes in EU and Non-EU Members [Technical Report], Dijon: Institut National de Recherche Agronomique.
- Boyatzis, R. E. (1998). Transforming Qualitative Information: Thematic Analysis and Code Development. Thousand Oaks, California, Sage.
- Bryce, R., K. N. Irvine, A. Church, R. Fish, S. Ranger and J. O. Kenter (2016). "Subjective well-being indicators for large-scale assessment of cultural ecosystem services." Ecosystem Services 21, Part B: 258-269.
- J.J. Candel, L. Pereira (2017) "Towards integrated food policy: main challenges and steps ahead", Environmental Science & Policy, 73, pp. 89-92., ISSN 1462-9011.
- Chen, X., S. de Vries, T. Assmuth, J. Dick, T. Hermans, O. Hertel, A. Jensen, L. Jones, S. Kabisch, T. Lanki, I. Lehmann, L. Maskell, L. Norton and S. Reis (2019). "Research challenges for cultural ecosystem services and public health in (peri-)urban environments." Science of The Total Environment 651: 2118-2129.
- Compassion In World Farming (2019) UK Factory Farming Map (<https://www.ciwf.org.uk/factory-farm-map/>). URL accessed 14/08/2019. Godalming, UK, Compassion in World Farming.
- Committee on Climate Change (2019). Net Zero - Technical Report. London, Committee on Climate Change (CCC).
- Coburn J., Stirling A. (2019) "Multicriteria Mapping as a Problem Structuring Method for Project Front-Ending". In: Bell G., Pagano R., Warwick J., Sato C. (eds) Problem Structuring Approaches for the Management of Projects. Palgrave Macmillan, Cham.
- Crossman, N.D., B. Burkhard, N. Stoyan (2012) Quantifying and mapping ecosystem services. Int J Biodiversity Sci Ecosys Serv Manag 8: 1–4.
- Crowe, B. H. Day, S. Dugdale, C. Fezzi, J. Foden, D. Hadley, R. Haines-Young, M. Hulme, A. Kontoleon, A. A. Lovett, P. Munday, U. Pascual, J. Paterson, G. Perino, A. Sen, G. Siriwardena, D. van Soest and M. Termansen (2013). "Bringing Ecosystem Services into Economic Decision-Making: Land Use in the United Kingdom." Science 341(6141): 45-50.
- Defra (2013). The Farm Business Survey 2011/12. Rural Business Research. Cambridge, Crown Copyright.
- Defra (2018). Agriculture Bill: Analysis and Economic Rationales for Government Intervention. Defra Evidence and Analysis Paper No. 7. London.
- Defra (2018). A Green Future: Our 25 Year Plan to Improve the Environment, HM Government London.
- Defra (2018). Health and harmony: The future for food, farming and the environment in a green Brexit. London.
- Dendoncker, N., F. Boeraeve, E. Crouzat, M. Dufrêne, A. König, and C. Barnaud (2018). "How can integrated valuation of ecosystem services help understanding and steering agroecological transitions?" Ecology and Society 23(1):12.
- Fairhead, J., M. Leach, & I. Scoones (2012) "Green Grabbing: a new appropriation of nature?", Journal of Peasant Studies, 39:2, 237-261

- Fish, R., A. Church, C. Willis, M. Winter, J. A. Tratalos, R. Haines-Young and M. Potschin (2016). "Making space for cultural ecosystem services: Insights from a study of the UK nature improvement initiative." Ecosystem Services **21, Part B**: 329-343.
- Fish, R., A. Church and M. Winter (2016). "Conceptualising cultural ecosystem services: A novel framework for research and critical engagement." Ecosystem Services **21, Part B**: 208-217.
- Fischer, J. , B. Brosi, G. C. Daily, P. R. Ehrlich, R. Goldman, J. Goldstein, D. B. Lindenmayer, A. D. Manning, H. A. Mooney, L. Pejchar, J. Ranganathan, H. Tallis (2008), Should agricultural policies encourage land sparing or wildlife-friendly farming? Frontiers in Ecology and the Environment, **6**: 380-385.
- Fu, B., L. Zhang, Z. Xu, Y. Zhao, Y. Wei, D. Skinner (2015) Ecosystem services in changing land use, Journal of Soils and Sediments **15**: 833–843
- Fu, B. J., C. H. Su, Y. P. Wei, I. R. Willett, Y. H. Lü and G. H. Liu (2011). "Double counting in ecosystem services valuation: causes and countermeasures." Ecological Research **26**(1): 1-14.
- Garnett, T. (2008). Cooking up a storm: Food, greenhouse gas emissions and our changing climate. Surrey, Food Climate Research Network.
- Garnett, T. (2009). "Livestock-related greenhouse gas emissions: impacts and options for policy makers." Environmental Science & Policy **12**: 491-530.
- Garnett, T. (2015). Gut feelings and possible tomorrows: (where) does animal farming fit? Food Climate Research Network, University of Oxford, Oxford UK.
- Garnett, T., C. Godde, A. Muller, E. Rööös, P. Smith, I. De Boer, E. zu Ermgassen, M. Herrero, C. Van Middelaar and C. Schader (2017). Grazed and confused?: Ruminating on cattle, grazing systems, methane, nitrous oxide, the soil carbon sequestration question-and what it all means for greenhouse gas emissions, Food Climate Research Network.
- Glamann, J., J. Hanspach, D. J. Abson, N. Collier and J. Fischer (2017). "The intersection of food security and biodiversity conservation: a review." Regional Environmental Change **17**(5): 1303-1313.
- Green, R.E., S. J. Cornell, J. P. Scharlemann, A. Balmford (2005). Farming and the fate of wild nature. Science, **307** (5709): 550-555.
- Haines-Young, R. and M. Potschin (2008). England's Terrestrial Ecosystem Services and the Rationale for an Ecosystem Approach. Full Technical Report. London, DEFRA.
- Haines-Young, R. and M. Potschin (2010). The links between biodiversity, ecosystem services and human well-being. Ecosystem Ecology: a new synthesis. D. G. Raffaelli and C. L. J. Frid. Cambridge, UK, Cambridge University Press: 110-139.
- Hasan, S. S., L. Zhen, M. G. Miah, T. Ahamed and A. Samie (2020). "Impact of land use change on ecosystem services: A review." Environmental Development **34**: 100527.
- Heyl, K, Döring, T, Garske, B, Stubenrauch, J, Ekardt, F. (2021) The Common Agricultural Policy beyond 2020: A critical review in light of global environmental goals, RECIEL **30**: 95– 106.
- Kremen, C. (2015) Reframing the land-sparing/land-sharing debate for biodiversity conservation. Ann. N.Y. Acad. Sci., **1355**: 52-76.
- Lang, T. and M. Heasman (2004). Food wars: the global battle for mouths, minds and markets. London, Earthscan/James & James.
- Lang, T. and G. Rayner (2012). "Ecological public health: the 21st century's big idea? An essay by Tim Lang and Geof Rayner." BMJ **345**: 5466.

- Laughton, R. (2017) A Matter Of Scale: A study of the productivity, financial viability and multifunctional benefits of small farms (20 ha and less), Coventry: Landworkers Alliance and the Centre for Agroecology, Water and Resilience (CAWR)
- Leach, M., A. C. Stirling and I. Scoones (2010). Dynamic sustainabilities: technology, environment, social justice. London, Routledge.
- Levidow, L. (2015). "European transitions towards a corporate-environmental food regime: Agroecological incorporation or contestation?" Journal of Rural Studies **40**: 76-89.
- Linstead, C., T. Barker, E. Maltby, P. Kumar, Mortimer, A. M. Plater, M. Wood (2008). Reviewing Targets and Indicators for the Ecosystem Approach. Final Report. University of Liverpool, Institute for Sustainable Water, Integrated Management and Ecosystem Research (SWIMMER).
- Loos, J. and H. von Wehrden (2018). "Beyond Biodiversity Conservation: Land Sharing Constitutes Sustainable Agriculture in European Cultural Landscapes." Sustainability **10** (5).
- Lorimer, J., C. Sandom, P. Jepson, C. Doughty, M. Barua and K. J. Kirby (2015). "Rewilding: Science, practice, and politics." Annual Review of Environment and Resources **40**: 39-62.
- MacMillan, T. and R. Durrant (2009). Livestock consumption and climate change: a framework for dialogue. Brighton, Food Ethics Council.
- Maes, J., A. Teller, M. Erhard, C. Liqueste, L. Braat, P. Berry, B. Egoh, P. Puydarrieux, C. Fiorina, F. Santos, M. L. Paracchini (2013) Mapping and Assessment of Ecosystems and their Services. An analytical framework for ecosystem assessments under action 5 of the EU Biodiversity Strategy to 2020. Publications Office, European Union, Luxembourg.
- Maskell, L. C., A. Crowe, M. J. Dunbar, B. Emmett, P. Henrys, A. M. Keith, L. R. Norton, P. Scholefield, D. B. Clark, I. C. Simpson, S. M. Smart (2013), Exploring the ecological constraints to multiple ecosystem service delivery and biodiversity. J Appl Ecol, **50**: 561-571.
- Melathopoulos, A. P. and A. M. Stoner (2015). "Critique and transformation: On the hypothetical nature of ecosystem service value and its neo-Marxist, liberal and pragmatist criticisms." Ecological Economics **117**: 173-181.
- Millenium Ecosystem Assessment (2005). Ecosystems and Human Well-Being: Synthesis. Washington DC, Island Press.
- National Audit Office (2019). Early review of the new farming programme: Report by the Comptroller and Auditor General. London, National Audit Office.
- Polanyi, K. (1944) The great transformation. New York: Rinehart & Company.
- Ribeiro, D. and M. Šmid Hribar (2019). "Assessment of land-use changes and their impacts on ecosystem services in two Slovenian rural landscapes." Acta Geographica Slovenica **59**(2).
- Renting, H., M. Schermer, A. Rossi (2012). "Building Food Democracy: Exploring Civic Food Networks and Newly Emerging Forms of Food Citizenship." International Journal of Sociology of Agriculture and Food **19** (3) (Special Issue on Civic Food Networks): 289-307.
- Reyers, B., P. J. O'Farrell, R. M. Cowling, B. N. Egoh, D. C. Le Maitre, J. H. J. Vlok (2009) Ecosystem services, land-cover change, and stakeholders: finding a sustainable foothold for a semiarid biodiversity hotspot. Ecology and Society **14** (1): 38
- Schmidt, K., A. Walz, B. Martín-López and R. Sachse (2017). "Testing socio-cultural valuation methods of ecosystem services to explain land use preferences." Ecosystem Services **26, Part A**: 270-288.
- Sonnino, R. and T. Marsden (2005). "Beyond the divide: rethinking relationships between alternative and conventional food networks in Europe." Journal of Economic Geography **6**(2): 181-199.

Steinfeld, H., P. Gerber, T. Wassenaar, V. Castel, M. Rosales, C. De Haan (2006). Livestock's Long Shadow: Environmental issues and options. Food and Agriculture Organisation of the United Nations, Rome.

Stirling, A. (2006). "Analysis, participation and power: justification and closure in participatory multi-criteria analysis." Land Use Policy **23** (1): 95-107.

Stirling, A. (2008). "'Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology." Science, Technology, & Human Values **33** (2): 262-294.

Stirling, A. (2010). "Keep it complex." Nature **468**: 1029.

Stirling, A. and J. Coburn (2014). Multicriteria Mapping Manual. Brighton: SPRU, University of Sussex.

Stirling, A. and S. Mayer (1999). Rethinking risk: a pilot multi-criteria mapping of a genetically modified crop in agricultural systems in the UK. Falmer, Science Policy Research Unit, University of Sussex.

Stirling, A. and S. Mayer (2001). "A Novel Approach to the Appraisal of Technological Risk: A Multicriteria Mapping Study of a Genetically Modified Crop." Environment and Planning C: Government and Policy **19** (4): 529-555.

Svenning, J.-C., P. B. Pedersen, C. J. Donlan, R. Ejrnæs, S. Faurby, M. Galetti, D. M. Hansen, B. Sandel, C. J. Sandom and J. W. Terborgh (2016). "Science for a wilder Anthropocene: Synthesis and future directions for trophic rewilding research." Proceedings of the National Academy of Sciences **113**(4): 898-906.

The Economics of Ecosystems and Biodiversity (TEEB) (2018). Measuring what matters in agriculture and food systems: a synthesis of the results and recommendations of TEEB for Agriculture and Food's Scientific and Economic Foundations report. Geneva: UN Environment.

Tratalos, J. A., R. Haines-Young, M. Potschin, R. Fish and A. Church (2016). "Cultural ecosystem services in the UK: Lessons o designing indicators to inform management and policy." Ecological Indicators **61**: 63-73.

Turnpenny, J., D. Russel and A. Jordan (2014). "The Challenge of Embedding an Ecosystem Services Approach: Patterns of Knowledge Utilisation in Public Policy Appraisal." Environment and Planning C: Government and Policy **32** (2): 247-262.

United Nations (2015) Transforming Our World: The 2030 Agenda for Sustainable Development, Resolution adopted by the General Assembly on 25 September 2015

Whatmore, S., P. Stassart and H. Renting (2003). "What's alternative about alternative food networks?" Environment and Planning A: Economy and Space **35** (3): 389-391.

Willett, W., J. Rockström, B. Loken, M. Springmann, T. Lang, S. Vermeulen, T. Garnett, D. Tilman, F. DeClerck, A. Wood, M. Jonell, M. Clark, L. J. Gordon, J. Fanzo, C. Hawkes, R. Zurayk, J. A. Rivera, W. De Vries, L. Majele Sibanda, A. Afshin, A. Chaudhary, M. Herrero, R. Agustina, F. Branca, A. Lartey, S. Fan, B. Crona, E. Fox, V. Bignet, M. Troell, T. Lindahl, S. Singh, S. E. Cornell, K. Srinath Reddy, S. Narain, S. Nishtar, C. J. L. Murray (2019). "Food in the Anthropocene: the EAT Lancet Commission on healthy diets from sustainable food systems." The Lancet **393** (10170): 447-492.

Wittman, H., Chappell, M.J., Abson, D.J., Bezner Kerr, R., Blesh, J., Hanspach, J., Perfecto, I., & Fischer, J. (2017) "A social–ecological perspective on harmonizing food security and biodiversity conservation". Regional Environmental Change **17**, 1291–1301. <https://doi.org/10.1007/s10113-016-1045-9>.

Xiao, Y., S. Yi, Z. Tang (2018) A Spatially Explicit Multi-Criteria Analysis Method on Solving Spatial Heterogeneity Problems for Flood Hazard Assessment. Water Resources Management **32** (10) 3317–3335.

