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20 **Ecosystem services as an integrative framework: what is the potential?**

21

22 **Abstract**

23 Ecosystems approaches, and among them the ecosystem services (ES) framework, are held as
24 promising vehicles for holistic thinking which is usually taken to mean integration of society
25 and nature. The notion of ES is also seen to aid us in saying something about how and what
26 people value in nature. It is hence surprising that among a huge number of scientific works
27 couched in terms in ES, still relatively few explore the explicit engagement of such concepts
28 with stakeholders with respect to empirical issues, including integration. Motivated by a need
29 to empirically test rather than assume the integrative work of ES, we ask: what ways of using
30 the framework as a stakeholder tool are invited, and does integration unfold in practice? Our
31 evidence comes from a study of a group of stakeholders' perspectives on sustainable
32 management of sheep grazing in low alpine landscapes in the south of Norway. According to
33 the stakeholders, grazing intensity, type and spatiality cannot be understood and arrived at
34 without accounting for how grazing pressure is the result of the co-production of nature and
35 society. By way of four empirical examples, we demonstrate 1) the integrative agency ES can
36 have, 2) how ES can work to integrate despite the framework, 3) how ES can work against
37 integration, and 4) the implicit agency of ES for the co-production of sustainability and
38 grazing pressures. The study demonstrates that there are particular weaknesses in the concept
39 as an integrative device regarding the invisibility of human co-agency. Furthermore, the
40 precise methodological framing of the research is found to be crucial for whether and how
41 human co-agency is made visible through the framework, and thus how ES works as an
42 integrative framework.

43

44

45 **Keywords:** Ecosystem services, integrative framework, co-production, methodology, grazing,
46 Norway

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48

49 **1 Introduction**

50 Over the last 40 years or so, the notion of ecosystem services (ES) has established itself as
51 one of the most prominent “intellectual weapons in the environmental area” (Head 2008:373).
52 Responding to the facts that “humans are inextricably embedded in all earth surface
53 processes, and often dominate them” and that “the human role is finally being acknowledged
54 in the political arena” (ibid.), ES is seen to hold increasing promise as a framework to
55 integrate human-environment interactions and help us understand and handle “the scope,
56 complexity and uncertainty of global environmental problems” (Raymond et al. 2010:1766.
57 See also Ehrlich and Mooney 1983; Cornell 2011; Díaz et al. 2015; Fischer and Eastwood
58 2016; Carmen et al. 2017). Even though “building an integrative approach has long been
59 acknowledged as a major scientific challenge” (Stenseke and Larigauderie 2017:2) within
60 environmental management, “there remains a duality between individuals, culture and the
61 environment in many human-nature relationship frameworks, which have the potential to
62 undermine successful environmental management initiatives” (Raymond et al. 2017:2. See
63 also Head 2008; Setten et al. 2012; Fish et al. 2016).

64 Drawing on empirical evidence, we offer a much needed interrogation of how ES can work to
65 integrate – or not – across society and nature by shedding light on what it takes for integration
66 or co-production to happen and what works against it. This article hence goes beyond much
67 social science critique of ES (e.g. Fish 2011; Chan et al. 2012; Setten et al. 2012; Pascua et al.
68 2017). It does so by providing evidence from a study set within a complex debate about
69 sustainable management of sheep grazing in low alpine landscapes in the south of Norway
70 (Norwegian Agricultural Authority 2013; Setten and Austrheim 2017). Grazing studies in
71 mountain environments have demonstrated various effects on biodiversity by different animal
72 densities (e.g. Austrheim et al. 2016). There is, however, limited knowledge about individual
73 and societal choices as a basis for animal densities, and, by implication, what is considered
74 sustainable within the context of mountain grazing. Arriving at sustainable grazing pressures
75 is a complex societal issue, not least because mountain landscapes have for some time stood
76 “on the threshold of major change” due to accelerated “restructuring of the agricultural, social
77 and economic fabric of mountain areas” (Soliva et al. 2008:56). Our evidence is produced
78 through a series of workshops with stakeholders representing national level state agencies and
79 NGO’s with land management or recreational remit. This material conveys exactly how and
80 why grazing intensity, type and spatiality cannot be understood and arrived at if nature and
81 society are produced in separate boxes. Our material crucially also conveys that it matters

82 how we methodologically engaged the stakeholders throughout the workshops for co-
83 production of society and nature to happen – or not.

84

85 In this article, we ask the following question: What can ES potentially *do* as an integrative
86 tool within the context of sustainable resource management? In addressing this question, we
87 importantly also address whether making nature visible for society, in fact, makes the social
88 invisible to integration. Before we respond to this question, we want to convey in more detail
89 how we approach the ES framework, i.e. how we understand it as a potential tool for
90 integration. This is followed by an outline of the production of the empirical materials. In the
91 results section, we demonstrate the integrative agency ES can have, how ES can work to
92 integrate despite the framework, and how ES can work against integration. We also
93 demonstrate the implicit agency of ES for the co-production of sustainability and grazing
94 pressures. Before concluding, we discuss four overarching findings relevant for the integrative
95 potential of the framework.

96

97 **2 The challenges of integration and co-production**

98 When the ES framework was introduced in the early 1980s in order to raise the public's
99 awareness of the many services that ecosystems provide to humans, it was in effect an
100 argument for the protection of ecosystems (Setten et al. 2012). It was also in effect an
101 argument for 'boxing off' nature – and culture. There are signs, however, of a 'new' and
102 increasing consensus within parts of the 'ES community': humans are integral to, rather than
103 users of nature (e.g. Díaz et al. 2015, 2018; Fischer and Eastwood 2016; Pascual et al. 2017;
104 Raymond et al. 2017; Stenseke and Larigauderie 2017). What is surprising is the time taken to
105 explicitly acknowledge that it is critically important to understand ES as a larger human and
106 societal achievement, i.e. ES are not *delivered* to humans by nature, they are rather co-
107 constitutive. This would logically mean not only making nature visible to society, but also
108 making society visible in making and remaking nature in particular ways as society itself is
109 continually remade. Hence, the time is ripe for investigating the co-production of humans and
110 nature within an ES framework. As part of this, we need to explore much more systematically
111 the explicit engagement of the ES framing with stakeholders with respect to empirical issues.
112 Despite an, by now, immense body of literature concerned to explain and argue for how ES
113 help us to say something about how and what people value in nature, still relatively few

114 explore people's engagement of the concept with regard to ecosystems (yet see Fisher and
115 Brown 2014; Fischer and Eastwood 2016; Carmen et al. 2017; Stålhammar and Pedersen
116 2017), including the language with which we frame our engagements (Rydin 1999; Head
117 2008; Fish 2011; Setten et al. 2012).

118 When setting out to investigate the purported strength of ES as a tool for integration and
119 communication, we hence acknowledge "the pervasive influence of language" (Rydin
120 1999:467) when analyzing environmental or any other policy-making. "To analyse policy is,
121 therefore, to analyse communication and argument, language and discourse" (ibid.), i.e. the
122 'discursive environment' matters. There are two sets of literatures, which inform our analysis.

123 The first set of literature argues convincingly that it is valid and necessary to integrate the
124 'doing' or agency of concepts and language in decision-making (Rydin 1999; Head 2008,
125 2012; Fish 2011). Concepts, such as ES, are not surface representations, let alone semantics,
126 they rather help us to take a stand in the world through naming experiences, claiming truths
127 and creating realities: "It is precisely because the language of ecosystem services is non-
128 conventional that it allows new thoughts and connections to be made" (Fish 2011:676). In
129 short, language generates ideas and realities. The terminology by which we frame human-
130 nature relations are thus fundamental to what different framings can do, both conceptually and
131 empirically. Consequently, we need to recognize that "sustainable development is socially and
132 discursively constructed" (Rydin 1999:467), yet must be put into practice by actors in order
133 to have any societal impact. The crux in recognizing the agency of language is to build on this
134 insight and address and identify what "the critical and normative implications" (ibid.) are for
135 ES as an integrative framework.

136 The second and related set of literature revolves around the aforementioned integration across
137 nature and culture as a purported strength of ES (e.g. Sukhdev et al. 2014; Pascual et al. 2017;
138 van Riper et al. 2017). Whether ES works to integrate is, however, subject to ongoing
139 controversy. Numerous critiques have pointed to the fact that the framework consists of
140 weakly linked building blocks or 'boxes', working to fragment and overlook rather than
141 integrate (e.g. Setten et al. 2011; Fish et al. 2016; Fisher and Eastwood 2016). Yet ES
142 proponents continue to argue that to combat ecosystem degradation and loss of biodiversity,
143 nature must be made visible in the (economic) choices we make (e.g. Robertson 2006; NOU
144 2013:10; Sukhdev et al. 2014).

145

146 The assumption that nature – and culture – *can* be boxed off, is evident in well-known
147 metaphors such as ‘human impact’ (e.g. Head 2008), and the ‘transformation’ or ‘alteration’
148 of the planet by humans (e.g. Vitousek et al. 1997). These are firmly based on “the
149 assumption that the social and the natural are pre-existing categories prior to their interaction
150 with one another” (Head 2008:375). The more recent notion of ‘social-ecological systems’
151 (e.g. Ostrom 2009), aims to integrate ecology and society by acknowledging that humans are
152 pervasive to ecosystems, yet re-produces the assumption of separate systems (Head 2008).
153 And “In mainstream ecosystem services conceptualizations, humans tend to become overtly
154 involved at the end of the chain” (Fischer and Eastwood 2016:42), thus highlighting that the
155 emphasis the Millennium Ecosystem Assessment puts on making *nature* visible to society
156 (MEA 2005) still largely dominates ES thinking. In essence, this means making *nature* visible
157 to integration practices, which logically ought to make culture or peoples’ engagement within
158 ecosystems equally visible. This is, however, a more hard-won achievement.

159

160 We have only recently begun to observe attempts to think in terms of co-production and co-
161 agency, i.e. making human agency explicitly visible alongside nonhuman agency. This is
162 evidenced through recent appeals to the social and humanistic sciences to engage in assessing
163 nature’s contributions to people’s quality of life (Stenseke and Larigauderie 2017; Díaz et al.
164 2018). Attempts relevant for the integrative potential of ES mainly come from two rather
165 different quarters. First, there are a set of closely allied conceptualisations of human-nature
166 relationships to ES: e.g. Muhar et al. (2017) develop a model for integration of ‘socio-cultural
167 concepts of nature’ into frameworks of interaction between social and cultural systems; van
168 Riper et al. (2017:234) argue for the need to recognize “that complexity is imperative to
169 understanding social-ecological change ...” in the valuation of ES; And the UN’s
170 Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) is now framing
171 its work through the notion of ‘nature’s contributions to people’, i.e. “all the contributions,
172 both positive and negative, of living nature (diversity of organisms, ecosystems, and their
173 associated ecological and evolutionary processes) to people’s quality of life” (Díaz et al.
174 2018:270). While all these, in different ways, make advances in framing human-nature
175 relationships within the context of ES, they neither through their terminology nor their
176 explanations, convincingly convey that society and nature are co-constitutive. Adding
177 complexity and contextual contingency is not enough, as they still end up re-producing the
178 assumption that there are pre-existing ‘systems’ and that they hence can be separated.

179

180 A second and different set of ‘co-productive’ literatures take exactly the concept of agency,
181 “both human and otherwise” (Head 2008:373), as its starting-point, and makes conceptual
182 space for the co-agency and co-production of nature and culture. In many social sciences,
183 there has been growing acknowledgment “that ‘[a]gency is a relational effect generated by ...
184 interacting components whose activity is constituted in the networks of which they form a
185 part” (Whatmore 1999:28, cited in Castree 2002:121 See also Head 2012). In effect, we need
186 to understand nature and culture “in terms of associations rather than separations” (Castree
187 2002:118), i.e. as entangled rather than discrete. All things, including nature and humans, “are
188 only definable *in relation to* other things” (ibid., emphasis in original). This is no simple
189 achievement and we concur with Fischer and Eastwood (2016:43) when they hold that co-
190 production as “interactions between people and ecological systems that result in ecosystem
191 services” have only occasionally – “and usually in passing and referring to cultural services”
192 – been subject to attention (e.g. Chan et al. 2012; 2016, see also Head 2008; Raymond et al.
193 2017). So, instead of adding humans to nature “at the end of the chain” (Fischer and
194 Eastwood 2016:42), we insist that ‘both sides’ are considered from the start so we can make
195 visible their co-constitution accordingly (Setten et al. 2012. See also Head 2008). This insight
196 is surprisingly little reflected in ES frameworks research, let alone empirically demonstrated.
197 If we accept, then, that “ecosystem services are not produced ready-made by ecosystems”
198 (Fischer and Eastwood 2016:41) we need to investigate what is made in/visible when we
199 enroll ES concepts in the world.

200

201 **3 The study and its methods**

202 *3.1 A study of stakeholder preferences concerning the management of sustainable sheep* 203 *grazing in low alpine landscapes in the south of Norway*

204 Grazing studies have demonstrated how mountain biodiversity and ES are affected by various
205 sheep densities, i.e. the number of sheep per square unit, and research is showing that
206 moderate to low grazing have positive impact on numerous ES, while trade-offs are more
207 apparent when grazing pressure is high (e.g. Austrheim et al. 2016). There is hence a fairly
208 solid knowledge base concerning the ecological dynamism in the mountains. Much less
209 knowledge exists about individual and societal preferences that underpin animal densities: the
210 number of sheep that annually are grazing in the mountains – where and at what times – is the
211 result of choices that eventually are taken by sheep farmers within differing political,

212 financial, social and ecological contexts (Setten and Austrheim 2017). Sheep densities can
213 hence not be isolated as a purely ecological concern, i.e. as biomass or a set carrying capacity.
214 The ‘correct’ or optimal sustainable grazing level must rather be seen as conditioned by value
215 choices that are spatially and temporally contingent. That grazing needs to be considered
216 within a wider societal context, not only for food production, but also regarding woodland
217 encroachment, cultural landscapes, biodiversity and cultural heritage more widely, is
218 increasingly recognised (Norwegian Agricultural Authority 2013). It is against this empirical
219 background that we set out to interrogate what the ES framework can do as an integrative tool
220 for these wider societal concerns.

221 *3.2 Data production*

222 We conducted three interrelated workshops, taking place in Trondheim (October 17-18 2012),
223 Grimsdalen (September 17-19 2013), and Oslo respectively (January 30-31 2014). The
224 participating stakeholders were identified due to expertise in the field representing statutory
225 bodies charged with environmental mandates, as well as interest organisations having stakes
226 in policy formulation and governance relating to the management of mountain landscapes. In
227 total 18 people representing 12 stakeholder institutions and organisations participated in the
228 workshops. (Table 1).

229 Table 1 (Around here) Stakeholders participating in the workshops¹

230 We brought these stakeholders together through a multi-stage participatory, in-depth
231 discussion process, which in essence “involves stakeholders communicating and sharing their
232 perspectives and experiences on a decision issue and therefore enables more informed and
233 creative responses to management problems and opportunities” (Fish et al. 2011:30). Due to
234 the complex and contested nature of mountain grazing, we needed participatory techniques for
235 sustained deliberation and reflection that could aid in building trust, “integrating diverse
236 values, improving public participation, facilitating critical dialogue, and increasing legitimacy
237 of results” (Pascua et al. 2017:5). Critical to the design of the workshops was making time
238 and space for sustained communication where participants could “confer, ponder, exchange
239 evidence, reflect on matters of mutual interest, negotiate and attempt to persuade each other”
240 (Fish et al. 2011:14. See also Burgess et al. 1988; Raymond et al. 2013; Carmen et al. 2017;
241 Reed and Abernethy 2018) on matters relating to ES and grazing practices. We hence used the

¹ Each institutional stakeholder has been attributed a number [1]-[18] in the presentation of the empirical material in Section 3. No stakeholder represented more than one institution/organization.

242 ES framework as a conceptual tool for communication among the stakeholders in order for
243 them to do the integration or co-production – or not.

244

245 Each workshop was designed around one key question, accompanied by sub-questions and
246 deliberative techniques. The first workshop addressed the question of which mountain
247 landscape do we envision in 2030. Two objectives were set: to develop scenarios describing
248 how the stakeholders envision the nature of the Norwegian mountains in 2030, and to
249 deliberate over how different activities and ideologies compete with or affect grazing
250 practices. Because the ES framework was chosen a priori as an approach, the framework was
251 elaborated to the stakeholders in relation to alpine sheep grazing specifically, including
252 contextualized examples from each ES category² along with what research tells us about how
253 different grazing densities affect and are affected by ES. Two scenarios were developed based
254 on an open analysis of the driving forces that the stakeholders identified and which are likely
255 to affect future grazing practices. Developing the scenarios was fundamental to the process as
256 a whole as they were a result of a common pool of knowledges and experiences held by the
257 stakeholders.

258 At the second workshop, the stakeholders worked with the question of which mountain
259 landscape do we wish for. Drawing on the scenarios, we aimed for a normative description of
260 a future oriented and sustainable grazing regime that the group as a whole could support. So,
261 while the first workshop was oriented towards ‘external’ forces, the second workshop focused
262 on preferences concerning sustainable grazing regimes that were ‘internal’ to the group. We
263 wanted them specifically to identify which ES are produced by the two scenarios, and which
264 factors might potentially affect these ES.

265 At the final workshop, the key question raised concerned how to develop sustainable grazing
266 management in the mountains. The stakeholders were focusing on developing goals for such
267 management, including debating the nature of carrying capacity as well as sustainability.

268 A large number and wide spectrum of group, sub-group and individual exercises, with
269 different objectives, were integral to the workshops. The details of a number of these are
270 conveyed in the Results section. Each workshop was introduced by project as well as invited
271 researchers, managers and farmers in order to provide up-dated insights on relevant topics,

² Supporting, regulating, provisioning and cultural services respectively.

272 including changes in land use practices within the context of wider societal changes,
273 ecological effects of grazing, experiences from organized grazing in the mountains, and sheep
274 grazing as value choice. During the second workshop, we also went into the field with a sheep
275 farmer. These activities were fundamental not only for arriving at a deeper understanding of
276 the complexities of mountain grazing, but importantly also for the group dynamic as they
277 provided the stakeholders with a common set of references to draw on when deliberating
278 (Fish et al. 2011).

279 *3.3 Data analysis*

280 The successive workshops were audio-recorded with the consent of the participants, and
281 transcribed verbatim. The empirical material was subject to an initial exploration where key
282 themes were identified, providing evidence for the integrative potential of ES. Using NVivo
283 11 software for qualitative analysis enabled us to further identify how exactly this potential
284 works or not, depending on the exercises employed within the framework of our deliberative
285 approach.

286

287 **4 Results**

288 If ES framings are to serve any kind of co-productive function – and it seems to be
289 fundamental if implicit that they should – then definitions ought to start by defining ES as the
290 benefits humans gain from their place, role and interaction *within* ecosystems. To that end we
291 will demonstrate how the stakeholders talked humans and non-humans in and out of the
292 ‘system’ in various ways. More specifically, we ask what ways of using the framework as a
293 stakeholder tool are invited, and does integration unfold in practice? We use three examples
294 of how ES is co-produced by demonstrating: 1) how ES works to integrate, 2) how ES works
295 to integrate despite the framework, and 3) how ES works against integration. This is followed
296 by an example of a wider discussion about sustainability in order to further shed light on co-
297 production.

298

299 *4.1 The integrative potential of ES*

300 On the second day of the first workshop, the stakeholders were asked to individually and in
301 writing offer a definition of ES as well as an account of what they see as the benefits of the

302 framing. Relating to the latter, there were variations in how aligned they were to mainstream
303 definitions (e.g. Fisher and Eastwood 2016) and variations in the extent to which they
304 constructed such concepts in integrative ways. Some initially pointed out that ES as a term is
305 alienating, being too much a tool for economic calculations of incalculable values. In their
306 written statements most of the stakeholders did, however, feel that ES framings had utility or
307 held promise of utility in terms of integrating perspectives, for example, being
308 “multidisciplinary” [7], aiding attempts “to come to a common understanding” [5], and
309 providing an “overview of cultural/social/ecological effects” [8]. Some emphasise the
310 gathering of natural and cultural dimensions under one conceptual roof, e.g. “The term can be
311 an umbrella term for the goods that nature and cultural landscapes provide” [1]; “Creating a
312 common understanding of resources available, and how to use them” [7]. Some are thus
313 clearly looking to ES to serve a connecting function, and indeed making connections visible
314 by invoking an integrative vision for what ES framings can do: e.g. “to see the connection” in
315 order to achieve “a sustainable society” [8], and to create “heightened awareness about the
316 value of ecosystems/nature for our survival and quality of life” [3].

317

318 Interestingly, when asked for *their own* definition of ES, most stakeholders invoked a
319 conception based on an externalised and self-standing nature. Table 2 gives an overview of
320 how the majority of the participants placed people at the end of a linear process, very much in
321 line with mainstream ES conceptualisations (e.g. Fischer and Eastwood 2016). There are
322 some important nuances in their conceptions though: there is human agency tied up in the
323 term ‘production’, but within the ES context ‘production’ most often works to obscure the
324 actual human agency (Robertson 2006). Further, ‘natural values’ can easily be taken to mean
325 human-nature interactions, value judgements being a human trait, but human agency is in fact
326 made invisible. The overall emphasis was thus on what people are *given* from nature rather
327 than from the interaction with and co-production of nature. Only one stakeholder put
328 humans/culture at the heart of the definition, while another made space for a notion of
329 services being co-produced. It is worth noting, however, that the latter mentioned humans and
330 ecosystems as sides of a coin, and in that sense separated them.

331 This exercise demonstrates an integrational potential of ES as a concept for dealing with a
332 large number of perspectives at once. The methodological approach, i.e. the workshop
333 including a variety of exercises, is central to making this happen. It was pointed out by the
334 stakeholders that developing scenarios, engaging in plenary discussions and being challenged

335 conceptually represent “exciting work methodology” [3], offer “new perspectives” and
336 knowledge [8], catalyse new ways of thinking, working and “problem solving” [10], and
337 “through participating, I influence the results which affect other stakeholders. I contribute to
338 defining what might happen” [6]. In sum, and as one of the stakeholders held, that gathering
339 stakeholders across interests and competences provided “greater insight into the driving forces
340 that have significance for mountain management” [2].

341 Table 2 (Around here) Illustrations of positioning of nature and humans in stakeholders’
342 definitions of ecosystem services.³

343

344 *4.2 ES integrates despite the framework*

345 An exercise during the second workshop revolved around the stakeholders’ landscape
346 preferences. A series of three manipulated photographs of a mountain landscape was core to
347 the exercise. The pictures were in essence showing a landscape that was gradually losing its
348 overt cultural imprint in order to prompt discussion of ES related to different grazing
349 pressures: high, moderate and low pressures/no grazing respectively. The pictures included
350 different levels of birch and shrub encroachment and different numbers of buildings needed
351 for summer farming, yet no humans or animals. Based on the information given by the
352 facilitator – “The pictures show a part of a landscape under the climatic tree-line,
353 approximately 900 m.a.s.l. The landscape lies within 15 % of the land mass which will
354 develop towards a more forested landscape if grazing pressure is reduced” – the stakeholders
355 were asked to provide arguments for why they preferred one landscape before the other. They
356 worked individually with the pictures, gave their preferences and arguments in writing, and
357 engaged in a common discussion. Out of 12 stakeholders, 6 preferred the landscape with high
358 grazing pressure whereas 5 preferred moderate pressure, yet stating that they could equally
359 have chosen the other. One refused to prioritize arguing that “nature should be as it is, it’s not
360 up to humans to choose” [5]. Importantly, given that the stakeholders interpreted the
361 landscape as a summer farming landscape, they would *look for* culture in the pictures. The
362 picture showing low grazing pressure/no grazing, was unsurprisingly ignored because it
363 contradicts what the landscape is *intended* to be.

³ There are 11 responses as one of the stakeholders left the workshop before undertaking this exercise.

364 In terms of ES' integrational work, the stakeholders' concerns can usefully be understood
365 along two interconnected lines of arguments: 1) what is made explicitly visible in the pictures,
366 and 2) what it takes to produce what is made visible. Both concern the in/visibility of human
367 agency.

368 Preferences for what is made visible were often argued along aesthetical lines: "aesthetically
369 beautiful ... gives contrasts and variation" [2] and "it's the landscape I prefer aesthetically
370 and experience-wise" [12]. These visual characteristics cannot, however, be understood apart
371 from what produce them. A prerequisite for what can literally be seen in the pictures is the
372 existence of other landscapes, i.e. what is not seen: "This mountain farming landscape
373 represents a part of a larger landscape where the degree of use will vary and give larger
374 variations in habitats/biotopes/ecological niches" [4]. A concern for heterogeneity was
375 emphasized by all stakeholders, very much echoing an overall concern for nature diversity
376 and human-nature co-production: "resources are used for grazing" [3], "the buildings
377 demonstrate that the land is used ... and the grazing pressure appears to hold the
378 encroachment back" [1]. The larger societal effects of the co-production are also pointed at:
379 "reduces the need for food import – gives both food security and (probably) reductions in
380 CO2 emissions" [2], "contributes to securing knowledge about agriculture ... and keeping
381 traditions alive" [6], the landscape represents "values for visitors to meet animals in the
382 mountains, including understanding where food comes from" [2], and "mountain grazing is in
383 many ways a prerequisite for the upkeep of agriculture" [6] and, by implication, "a scattered
384 settlement pattern, quality of life and cultural diversity" [2].

385 The exercise demonstrated that the stakeholders were attempting to correct the abstracting
386 agency, i.e. 'people-last', of the ES framing. They contextualized and reinstated a society-
387 nature relationality in two ways; within and beyond the pictures. The ES framing hence
388 facilitated co-production, not because of the framework but rather despite of it because the
389 stakeholders re-connected the 'boxes' by making culture visible. In essence, the framework
390 worked as something to argue with or react to, rather than agree with.

391

392 *4.3 ES working against integration*

393 Also at the second workshop, stakeholders engaged in an experimental exercise inspired by
394 research dealing with ES trade-offs (e.g. Rodriguez et al. 2006; Briner et al. 2014). Making

395 trade-offs (visible) implies losing one quality or aspect of something in return for gaining
396 another. What at the outset, then, is integrational or co-produced is in fact disintegrational.
397 This was demonstrated through a ‘ranking’ of ES relating to Norwegian mountains in general
398 and in Grimsdalen, where the workshop was held, in particular. The researchers introduced
399 and explained the principles of the ranking, which was undertaken individually and based on a
400 spreadsheet provided by the researchers, where the four ES categories of supporting,
401 regulating, provisioning and cultural services were given, along with contextualized
402 examples. The spreadsheet also included what might be seen as disservices such as bacteria
403 and erosion. In total, 24 services were included, and the stakeholders were given 100 points to
404 distribute across the preferred services. The exercise was hence given ingredients of the ES
405 framing and how different ES interrelate. The project researchers were prompting
406 stakeholders to make links between services in ways the stakeholders saw important for the
407 purpose of identifying values in Norwegian mountains.

408 The exercise caused a lot of stir, head-shaking and questioning, and as one of the stakeholders
409 stated, it was “messy” [3]. He was further and bluntly claiming that it was

410 “Nonsense” [3]

411 “Why?” [researcher]

412 “... it didn’t work for me” [3].

413 Some of the stakeholders even hesitated to hand their spreadsheets over to the researchers:

414 “I’ll take your spreadsheet” [researcher]

415 “Yes, if you get something out of it. ... Are we writing our name on it?” [3]

416 “Yes” [researcher]

417 “No, I can’t be bothered. What’s the point? ... why is it interesting?” [16].

418 Reasons for these reactions might be that the purpose of ranking was poorly explained, that
419 the spreadsheet contained too many factors, which made it impossible to rank services, and
420 that some services are beyond the idea of services itself, and hence ranking. Reflecting the
421 latter, one of the stakeholders held: “Impossible exercise. Cannot weigh essential services
422 against each other” [5]. This was echoed by another stakeholder, saying that “to me, the basic
423 processes are essential for nature, hence I cannot weigh them against each other” [2]. These

424 stakeholders are saying very clearly that the exercise was, in fact, very useful, yet in
425 unexpected ways. By resisting the exercise, the stakeholders demonstrated the co-productive
426 agency of the ES framing, i.e. because the stakeholders resisted the invitation to separate and
427 make trade-offs visible, they did integrational work.

428

429 *4.4 The implicit agency of ES for the co-production of sustainability and grazing pressures*

430 The integrational agency of ES also came to be visible through the stakeholders' deliberations
431 over 'sustainability' as idea and tool with consequences for grazing and mountain landscapes.
432 We framed a discussion about sustainability within the 'classic' definition of sustainable
433 development as given by the World Commission on Environment and Development:
434 "Development which meets the needs of the present without compromising the ability of
435 future generations to meet their needs" (Dresner 2008:70). The interlinked notions of
436 sustainability and grazing pressures ran through all workshops, yet were explicitly focused on
437 during the second and third workshops. Compared to the exercises described above, ES is
438 more implicit because the stakeholders were allowed to discuss freely, but the discussions
439 were still positioned within the overall ES framing as the stakeholders kept referring to the
440 framework.

441 In a plenary discussion at the second day of the second workshop, and following a SWOT
442 analysis concerning opportunities for and threats against mountain grazing, the stakeholders
443 started to challenge each other over the meaning of sustainability. They quickly ran into a
444 discussion structured along a human-nature 'schism', i.e. whether humans are part of the
445 notion of sustainable development or not:

446 "What is sustainable for mountain nature is probably that nature takes its course
447 without human impact" [2]

448 "Yes, I agree" [3]

449 "But then you place humans outside the notion of sustainable development" [2]

450 "Yes" [3]

451 "But, I think that's utopia, ... , if you can't chop firewood at your cabin, you'll freeze
452 to death if you're not allowed to make an impact on the ecosystem" [11]

453 “That’s not what I said” [3]

454 “Yes, it was” [11]

455 “..., sustainability, ..., as a concept it’s indisputably related to humans, so if you talk
456 about mountains without human impact in every sense of the word, then you talk
457 about ecology” [4].

458 When the stakeholders in plenary, later the same day, deliberated more systematically over
459 the notion of ‘sustainable mountain grazing’, including what is not sustainable mountain
460 grazing, they continued to argue along similar lines. However, ‘sustainable grazing’ took the
461 stakeholders into a more complex discussion where issues relating to spatial and temporal
462 dimensions of grazing, carrying capacity, grazing pressures, breeds and other herbivores came
463 to the fore: “For mountain grazing to be sustainable, these nuances need to be acknowledged”
464 [7]. In effect, the stakeholders were arguing for a spatialized culture-nature divide: “... that
465 not all areas will be subject to moderate grazing pressure, not all areas subject to high
466 pressure, there must be differences according to knowledge” [7]. They were delineating
467 different alpine areas into spaces of culture where sheep numbers are increased, and spaces of
468 nature with low or no grazing. By implication they, again, talked humans in and out of nature-
469 culture relations through arguing for grazing regimes that in some places are socially
470 sustainable, yet to a lesser degree ecologically sustainable, and vice versa. In both cases
471 humans are made visible through the fact that either solution is a choice made by humans.
472 Hence, and however framed, there is co-production:

473 “What is sustainable and geographically dependent and which nature types we find in
474 different places and which grazing animals we have and other animals, it’s dependent
475 on where in the country you are and which goals you have...” [7].

476 Co-production, and the agency of humans and animals, was hence demonstrated through
477 different, yet interlinked issues running through all workshops: the thorny relationship
478 between grazing animals and predator numbers and spatialities are caught up in farming
479 practices and predator politics: Participation in agriculture and the financial conditions under
480 which agriculture is practiced are fundamental to the intensity and spatiality of resource use in
481 the mountains: Changes in breed characteristics and composition not only hinge on
482 individual’s skills and expertise but also on co-operation and community; I.e. there are social
483 capital requirements of differing grazing regimes. Also the tree-line is a matter of co-agency:

484 the tree-line is artificially held down through grazing, but ES does not allow for that agency to
485 become visible because of its focus on making nature visible. We can hence safely argue that
486 ES allows for discussions which are value laden and which encourages stakeholders to think
487 and explain co-productively. Hence, and before discussing the potentially integrational
488 agency of ES more broadly, we end these examples with a statement that one of the
489 stakeholders made in a plenary discussion at the final workshop. The statement aptly
490 summarizes a fundamental challenge, not only of the ES framework, but more broadly, i.e.
491 how to develop what Head (2008) termed the ‘useful weapons’ in the environmental area:

492 “... we also need to maintain resilient ecosystems ... it’s a question of how to
493 integrate humans into this ... I simply don’t understand that if you want people to
494 inhabit this planet, how it is possible to exclude humans” [16].

495

496 **5 Discussion**

497 The ES framework has been criticized for being weak on connecting the ‘boxes’ (e.g. Setten
498 et al. 2012), and that in the efforts to make nature visible, an invisibility or even forgetting, of
499 human agency is generally invited. The “‘non-human’ iconography” (Macnaghten 2003:73)
500 which we hold to still dominate much ES thinking is hence a paradox at a time when humans
501 pervade earth ecosystems. Motivated by a need to interrogate rather than assume the
502 integrative work of ES, we have been asking: what ways of using the ES framework as a
503 stakeholder tool are invited, and how does co-production unfold in practice? In the analytical
504 process, we have identified four overarching themes that inform our response to these
505 questions.

506 First, when used as a conceptual and communicative tool, i.e. as something to think with and
507 argue against, ES allow room for stakeholders to do the connecting in ways that *they* see are
508 important. The framework appears, then, to have facilitated integrative and contextualized
509 discussions on alpine grazing management: ES represents an accessible way to allow
510 stakeholders from predominantly ‘nature’ and ‘culture’ angles to debate the balancing,
511 synergizing and trading off of various ecosystem contributions. Fish’s (2011) claim that the
512 non-conventional language of ES is generative of new ideas, hence resonates with our
513 findings. The ES framework also, and importantly, makes certain culturally and socially
514 situated aspects and values visible to environmental decision-making, including to natural

515 scientists. This resonates with what IPBES only recently has acknowledged, namely that
516 “Providing space for context-specific perspectives recognizes that there are multiple ways of
517 understanding and categorizing relationships between people and nature ...” (Díaz et al.
518 2018:272). It is evident that the stakeholders think, talk and deliberate with reference to
519 challenges that are specific to Norway, yet not isolating the Norwegian mountains from an
520 international political and social reality. Our material demonstrates, then, that ES invites
521 connections across space and scale to be made when used as a communicative device, and that
522 these connections reflect much needed situated understandings and perspectives of the
523 stakeholders (see also Flint et al. 2013). When ES are engaged by stakeholders, context-
524 specific and culturally complex issues can become part of the ‘weaponry’ needed within the
525 environmental area, rather than a predictable and undertheorized set of ‘cultural ecosystem
526 services’ (Fish 2011). Space is thus potentially created for qualitative social science research
527 on the co-production of ES (e.g. Díaz et al. 2018).

528 Secondly, this empirical application also demonstrates weaknesses in the concept as an
529 integrative device. Engaging the ES framework to address the issue of sustainable alpine
530 grazing highlights that human co-agency is where the ES framework is particularly weak as
531 an integrative tool. This is evidenced by repeated instances when stakeholders try to, and
532 indeed do, write and speak various forms of co-agency back in. The most striking, and
533 unexpected, illustration of co-production was when the stakeholders resisted to make trade-
534 offs visible. The stakeholder consensus built over three workshops hence suggests that
535 Norwegian alpine grazing ES are most threatened by a *lack* of human co-agency. Co-agency
536 is what keeps the tree-line down and it is the lack of a few key co-agencies of humans-and-
537 sheep that threatens the optimal balance the stakeholders identified between key ES,
538 especially between biodiversity, food production, rural incomes and aesthetics and amenity
539 (Setten and Austrheim 2017). We hence concur with Macnaghten (2003:80): “The
540 environment is commonly experienced, not simply as a set of physical issues, but tangled up
541 as part of social life. People come to the issues through particular things that matter to them.
542 ... the environment becomes meaningful when it engages social life, ...”. In essence, as there
543 is substantial human involvement in most ES, ES are not delivered ready-made by ecosystems
544 (Fischer and Eastwood 2016). ES *are* the entanglements.

545 Third, a key finding is that it makes a difference *how* we engage ES methodologically as
546 different techniques and exercises and ways of mobilizing ES had different effects on its
547 integrative agency. What ES do and can do is hence also a methodological issue, and we

548 concur with e.g. Carmen et al. (2017) and Raymond et al. (2017) that researching ES cannot
549 be isolated from project methods. However, simply bringing stakeholders together will not
550 teach us whether and how ES holds any integrational potential: "... deliberate and attentive
551 engagement" by stakeholders is required (Reed and Abernethy 2018:52). Different layers of
552 methods, with different and interlinked agency, are thus crucial for whether ES works to
553 integrate or not. Understanding the complex dynamics of sheep grazing require a broad set of
554 methodological tools – ranging from conceptually challenging exercises to field visits – in
555 order to develop new knowledge that reflects societal choices and values. There is in effect
556 methodological contingency with consequences for understanding causation, for developing
557 explanatory frameworks and for thinking in terms of agency and relations (Head 2008).

558 Finally, if ES is to work integratively it needs to make visible that different grazing pressures
559 are only the result of the co-agency of humans with sheep. We are, however, aware that our
560 choice of stakeholders might skew our findings. I.e. would the integrative capacity of ES have
561 worked better if we had looked at more situated (and local) examples of mountain grazing?
562 I.e. would integration be enhanced by being able to talk in specifics? Again, Macnaghten's
563 (2003:81) findings on how people engage with the environment, offers clues: when people
564 engage with the environment, "... the depiction of 'the environment' as a set of issues, global
565 in scope and physical in origin, is a configuration that remains detached and abstracted from
566 everyday life". We assert that these questions must always be considered when mobilizing ES
567 conceptualisations. We also assert that such questions cannot be fully answered without
568 applying an ES approach to stakeholders in specific contexts.

569

570 **6 Implications and conclusions**

571 Through this research, we have interrogated the integrative and co-productive potential of the
572 ES framework. To allow us to say something about whether and how ES hold such potential,
573 we have engaged the ES framing with stakeholders within the context of sustainable sheep
574 grazing in low-alpine mountains in Norway. Our work thus responds to calls for more
575 sustained empirical, and by implication, contextually situated engagement with the
576 framework. Among the most significant contributions from this research is that ES can be
577 made more conceptually and empirically meaningful – and useful – if we are prepared to take
578 the co-production of humans and nature seriously. In consequence, if we want to know and
579 understand something about the consequences of stakeholders' value choices for what ES can

580 do, more privilege needs to be given to knowledge produced through qualitative
581 methodologies that allow for such value choices to be documented and debated. Finally, we
582 see these insights as a start on systematic and empirically grounded work on the integrative
583 capacity of ES framings, underscoring the need to pursue their methodological application as
584 a key frontier for ES development.

585

586

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595

596 **References**

597 Asner, G.P., Elmore, A.J., Olander, L.P. et al. 2004. Grazing systems, ecosystem responses,
598 and global change. *Annual Review of Environment and Resources* 29:261-299.

599 Austrheim, G., Speed, J., Evju, M. et al. 2016. Synergies and trade-offs between ecosystem
600 services in and alpine ecosystem grazed by sheep – an experimental approach. *Basic and*
601 *Applied Ecology* 17:596-608.

602 Barnaud, C., Antona, M. 2014. Deconstructing ecosystem services: uncertainties and
603 controversies around a socially constructed concept. *Geoforum* 56:113-123.

604 Briner, S., Huber, R., Bebi, P. et.al. 2013. Trade-offs between ecosystem services in a
605 mountain region. *Ecology and Society* 18:35, [http://dx.doi.org/10.5751/](http://dx.doi.org/10.5751/ES-05576-180335)
606 [ES-05576-180335](http://dx.doi.org/10.5751/ES-05576-180335).

607

608 Burgess, J., Limb, M., Harrison, C.M. 1988. Exploring environmental values through the
609 medium of small groups: 1. Theory and practice. *Environment and Planning A* 20:309-326.
610

611 Carmen, E., Watt, A., Carvalho, L. et al. 2017. Knowledge needs for the operationalisation of
612 the concept of ecosystem services. *Ecosystem Services*
613 <https://doi.org/10.1016/j.ecoser.2017.10.012>

614 Castree, N. 2002. False antitheses? Marxism, nature and actor-networks. *Antipode* 34:111-
615 114.

616 Chan, K.M.A., Satterfield, T., Goldstein, J. 2012. Rethinking ecosystem services to better
617 address and navigate cultural values. *Ecological Economics* 74:8-18.

618 Chan, K.M.A., Balvanera, P., Benessaiah, K. et al. 2016. Why protect nature? Rethinking
619 values and the environment. *PNAS* 113:1462-1465.

620 Cornell, S. 2011. The rise and rise of ecosystem services: Is ‘value’ the best bridging concept
621 between society and the natural world? *Procedia Environmental Sciences* 6:88-95.

622 Díaz, S., Demissew, S., Carabias, J. et al. 2015. The IPBES conceptual framework –
623 connecting nature and people. *Current Opinion in Environmental Sustainability* 14:1-16.

624 Díaz, S., Pascual, U., Stenseke, M. et al. 2018. Assessing nature’s contributions to people.
625 Recognizing culture, and diverse sources of knowledge, can improve assessments. *Science*
626 359, 6373:270-272.

627 Dresner, S. 2008. *The Principles of Sustainability*. 2nd ed. Earthscan, London.

628 Ehrlich, P.R., Mooney, H.A. 1983. Extinction, substitution, and ecosystem services.
629 *BioScience* 33:248-254.

630 Fish, R. 2011. Environmental decision making and an ecosystems approach: Some challenges
631 from the perspective of social science. *Progress in Physical Geography* 35:671-680.

632 Fish, R., Burgess, J., Chilvers, J. et al. 2011. *Participatory and deliberative techniques to*
633 *embed and ecosystem services approach into decision making: an introductory guide*. Defra
634 (Project Code: NR0124), London.

635 Fish, R., Church, A., Winter, M. 2016. Conceptualising cultural ecosystem services: A novel
636 framework for research and critical engagement. *Ecosystem Services*,
637 <http://dx.doi.org/10.1016/j.ecoser.2016.09.002>

638 Fisher, J.A., Brown, K. 2014. Ecosystem services concepts and approaches in conservation:
639 Just a rhetorical tool? *Ecological Economics* 108:257-265.

640 Fischer, A., Eastwood, A. 2016. Coproduction of ecosystem services as human-nature
641 interactions – An analytical framework. *Land Use Policy* 52:41-50.

642 Flint, C.G., Kunze, I., Muhar, A. et al. 2013. Exploring empirical typologies of human-nature
643 relationships and linkages to the ecosystem services concept. *Landscape and Urban Planning*
644 120:208-217.

645 Head, L. 2008. Is the concept of human impacts past its use-by date? *The Holocene* 18:373-
646 377.

647 Head, L. 2012. Conceptualising the human in cultural landscapes and resilience thinking.
648 Plieninger, T., Bieling, C. (Eds.) *Resilience and the Cultural Landscape: Understanding and*
649 *Managing Change in Human-shaped Environments*. Cambridge: Cambridge University Press,
650 65-79.

651 Macnaghten, P. 2003. Embodying the environment in everyday life practices. *The*
652 *Sociological Review* 51:63-84.

653 Millennium Ecosystem Assessment [MEA]. 2005. *Ecosystems and human well-being:*
654 *synthesis*. Island Press, Washington, DC.

655 Norwegian Agricultural Authority [Statens landbruksforvaltning] 2013. *Sluttrapport*
656 *Nasjonalt Beiteprosjekt 2009-2012* [Final report. National grazing project 2009-2012]. SLF
657 rapport 2013, 14:1-50. Oslo.

658 NOU 2013:10. 2013. *Naturens goder – om verdier av økosystemtjenester* [Nature's goods –
659 on the values of ecosystem services]. Norges Offentlige Utredninger, Departmentenes
660 servicesenter, Informasjonsforvaltning, Oslo.

661 Ostrom, E. 2009. A general framework for analyzing sustainability of social-ecological
662 systems. *Science* 325:419-422.

663 Pascua, P., McMillen, H., Ticktin, T. et al. 2017. Beyond services: A process and framework
664 to incorporate cultural, genealogical, place-based, and indigenous relationships in ecosystem
665 service assessment. *Ecosystem Services* 26B:465-475.

666 Pascual, U., Balvanera, P, Díaz, S. et al. 2017. Valuing nature's contribution to people: the
667 IPBES approach. *Current Opinion in Environmental Sustainability* 26:7-16.

668 Raymond, C.M., Fazey, I., Reed, M.S. et al. 2010. Integrating local and scientific knowledge
669 for environmental management. *Journal of Environmental Management* 91:1766-1777.

670 Raymond, C., Singh, G.G., Benessaiah, K. et al. 2013. Ecosystem services and beyond: using
671 multiple metaphors to understand human-environment relationships. *BioScience* 63:536-546.

672 Raymond, C., Giusti, M., Barthel, S. 2017. An embodied perspective on the co-production of
673 ecosystem services: toward embodied ecosystems. *Journal of Environmental Planning and*
674 *Management* 1-22.

675 Reed, M., Abernethy, P. 2018. Facilitating co-production of transdisciplinary knowledge for
676 sustainability: working with Canadian Biosphere Reserve practitioners. *Society and Natural*
677 *Resources* 31:39-56.

678 Robertson, M.M. 2006. The nature that capital can see: science, state, and market in the
679 commodification of ecosystem services. *Environment and Planning D: Society and Space*
680 24:367-387.

681 Rodriguez, J.P., Beard, T.D., Bennett, E.M. et al. 2006. Trade-offs across space, time and
682 ecosystem services. *Ecology and Society*, <http://www.ecologyandsociety.org/vol11/iss1/art28/>

683 Rydin, Y. 1999. Can we talk ourselves into sustainability? The role of discourse in the
684 environmental policy process. *Environmental Values* 8:467-484.

685 Setten, G., Austrheim, G. 2017. Bærekraftig beiting i fjellet: Hvilke prinsipper legger sentrale
686 interessegrupper til grunn for å balansere mellom ressursbruk og ressursgrunnlag?
687 [Sustainable mountain grazing: which principles for balancing resource use with resource
688 base are held by key stakeholders?] *Tidsskriftet Utmark* 2:
689 <https://brage.bibsys.no/xmlui/handle/11250/2468114>

690 Setten, G., Stenseke, M., Moen, J. 2012. Ecosystem services and landscape management:
691 three challenges and one plea. *International Journal of Biodiversity Science, Ecosystem*
692 *Services and Management* 8:305-312.

693 Soliva, R., Rønningen, K., Bella, I. et al. 2008. Envisioning upland futures: stakeholder
694 responses to scenarios for Europe's mountain landscapes. *Journal of Rural Studies* 24:56-71.

695 Speed, J.D.M., Austrheim, G., Hester, A.J. et al. 2010. Experimental evidence for herbivore
696 limitation of the treeline. *Ecology* 91:3414-3420.

697 Stenseke, M., Larigauderie, A. 2017. The role, importance and challenges of social sciences
698 and humanities in the work of the intergovernmental science-policy platform on biodiversity
699 and ecosystem services. *Innovation: The European Journal of Social Science Research*,
700 <http://dx.doi.org/10.1080/13511610.2017.1398076>
701

702 Stålhammar, S., Pedersen, E. 2017. Recreational cultural ecosystem services: How do people
703 describe the value? *Ecosystem Services* 26:1-9.
704

705 Sukhdev P., Wittmer, H., Miller, D. 2014. The economics of ecosystems and biodiversity
706 (TEEB): Challenges and responses. Helm, D., Hepburn, C. (Eds.) *Nature in the Balance: The*
707 *Economics of Biodiversity*. Oxford: Oxford University Press, 135-152.
708

709 van Riper, C.J., Landon, A.C., Kidd, S. et al. 2017. Incorporating sociocultural phenomena
710 into ecosystem-service valuation: the importance of critical pluralism. *BioScience* 67:233-244.
711

712 Vitousek, P.M., Mooney, H.A., Lubchenco, J. et al. 1997. Human domination of Earth's
713 ecosystems. *Science* 277:494-499.
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718 Table 1. Stakeholders participating in the workshops⁴

719

Stakeholders	Participants invited from each stakeholder	Total number of participants from each stakeholder
Sheep and Goat Association	1	2
Norwegian Trekking Association	1	1
National Farmers' Union	1	2
Norwegian Environment Agency	2 ⁵	3
Norwegian Agricultural Authority	1	1
The Norwegian state-owned land and forest enterprise	1	1
Friends of the Earth-Norway	1	1
Directorate for Cultural Heritage	1	2
Norwegian Smallholders' Union	1	2
<i>Friluftslivets Fellesorganisasjon</i> (Umbrella organisation for outdoor recreation interests)	1	1
Norwegian Cabin Owner's Association	1	1
Norwegian Association for Mountain Boards represented by Ringebru Mountain Board	1	1
Total number of participants ⁶	12	18

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⁴ Each institutional stakeholder has been attributed a number [1]-[18] in the presentation of the empirical material in Section 3. No stakeholder represented more than one institution/organization.

⁵ In order to cover the breadth of the Agency's mandate, two representatives were invited to participate.

⁶ The difference between the total number of invitees and participants is due to the fact that some participants were re-placed throughout the project. Changes in work situation and leave of absence were causes for these re-placements.

725 Table 2. Illustrations of positioning of nature and humans in stakeholders' definitions of
 726 ecosystem services

Externalised nature	Humans first (anthropocentric)	Hybrid
ES cover available resources in nature by way of grazing, minerals, wood products, outdoor recreation. [7]	A conscious and systematic mapping of societal values/effects of nature's diversity. [11]	An overview of cultural/social/ecological effects. [8]
Concrete services that we get from the ecosystem/nature by way of food, energy, clean water, experiences, identity. [3]		The services humans get from nature. It might be a quiet place to walk, a place to pick cloudberries, safe and clean water, food. The concept can also work the other way around – the services we can do for the ecosystem. E.g. not sweep-clean logging in order to accommodate mono-culture or emptying a lake for fish. [10]
ES are the basis for all life and humans given us from nature, and is based on a diverse and well-functioning nature. [5]		
Renewable resources provided by nature, e.g. grass which can be used to produce mutton and beef, game and fish which can be harvested from an excessive production, a stable climate, experiences, food. [6]		
Nature's usefulness to humans. [2]		
Deliverables to society from nature and nature based businesses. [12]		
Production done by nature, and the basis for production of goods and services from an anthropocentric point of view. [4]		
Goods offered by an ecosystem: biodiversity, experiences, production of food [1]		

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