

Title: Mapping value plurality towards ecosystem services in the case of Norwegian wildlife management: a Q analysis

Keywords: Q method; values; carnivores; conservation; ecosystem services

Corresponding Author: Ms. Yennie Katarina Bredin, MSc

Corresponding Author's Institution: Norwegian Institute for Nature Research

First Author: Yennie Katarina Bredin, MSc

Order of Authors: Yennie Katarina Bredin, MSc; Henrik Lindhjem, Ph.D ; Jiska J van Dijk,

Ph.D; John D

Linnell, Ph.D

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Abstract:

For many deep-rooted resource conflicts where the cultural component of ecosystem services (ES) is strong, standard monetary valuation may be methodologically difficult and not always meaningful. A deeper understanding of the value plurality of key stakeholders may be called for to develop acceptable policies. We use the Q method to analyse the perceived and actual trade-offs related to Norwegian wildlife management, a source of prominent conflict in Norway. We identify and classify distinct arguments in the wildlife management debate following the ES framework, and use the Q method to explore extant/prominent narratives characterizing stakeholders' perceptions of the importance of arguments about biodiversity and ES. Finally, we reflect on whether and to what extent the Q method can contribute to our understanding of resource conflicts, underlying values, and ES trade-offs. Three clear narratives appeared: Pro-sheep grazing (cultural), pro-carnivore conservation (intrinsic) and a middle position emphasising recreational hunting (utilitarian). Despite considerable disagreement among narratives, the Q analysis also revealed areas of common ground useful for developing acceptable policies. Given the inherent complexity of socio-ecological systems, it is useful to draw from a diverse toolbox of methods, including the Q method for ES analysis.

Highlights:

- The cultural component is important for ecosystem services from Norwegian wildlife management
- The Q method may be useful for analysing deep-rooted ecosystem service conflicts.
- Respondents grouped into three narratives; cultural, intrinsic and utilitarian
- There was common ground, but issues related to sheep and wolves were divisive

Key words: Q method, values, carnivores, conservation, ecosystem services.

1. Introduction

There is currently great interest among academics and policy-makers in assessing the diverse values of biodiversity and ecosystem services (ES). The Millennium Ecosystem Assessment (MEA) (2005) and the Economics of Biodiversity and Ecosystem Services (TEEB) initiative, started a process of “recognizing and demonstrating” the potential (economic) value of ecosystem service benefits (Kumar, 2010). The next step was seen to be the design of policies that can “capture” such values in decision-making (TEEB, 2010). However, for many ES conflicts this process may not be straightforward. Firstly, there are often deep-rooted conflicts over rights and resources, a situation that does not lend itself to standard monetary valuation of costs and benefits (Spash, 2013). In such situations, there is a need for a deeper understanding of the value plurality underlying the different positions of various stakeholders (Martin-Lopez et al., 2014). Secondly, while economists may be good at defining an environmental conflict and analyse it theoretically, relatively less emphasis is traditionally put on investigating how implementation of policies among affected stakeholders may succeed (Barry and Proops, 1999). For this, a much better understanding of stakeholder positions, the values underpinning these, and their relation to ES is required.

One of the most prominent conflicts in ES and biodiversity management in Norway (and Scandinavia) is the conflict over the way wildlife and wildlands should be managed. In Norway, only a small part of the land area (5%) has been converted to agricultural land. The remaining area is about equally divided into forest and alpine tundra. The forests are intensively exploited for timber production and exploited for hunting. The main game species in forested areas are moose (*Alces alces*), red deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*). Most forest areas are also used for free-grazing (without fencing or shepherding) of domestic sheep. Conflicts exist between these activities, with wild ungulates involved in vehicle collisions, as well as damaging forests and crops (Kjøstvedt et al., 1998; Olausson and Skonhøft, 2011). A

higher degree of controversy still has emerged in the last 25-30 years as large carnivores have been allowed to begin a recovery (e.g. Linnell et al., 2010). The return of the wolf (*Canis lupus*), Eurasian lynx (*Lynx lynx*), wolverine (*Gulo gulo*) and brown bear (*Ursus arctos*) to this multi-use ecosystem has sparked a wide range of conflicts. These include renewed depredation on livestock (Kaczensky 1999), real and perceived competition with hunters for shared prey (Melis et al., 2010), and a diversity of social conflicts where large carnivores have become symbols for a diversity of wider conflicts (Skogen and Krange, 2003). Discussions over large carnivore management involve a wide range of stakeholders at local, national and even international levels. Additionally, the institutions to govern decision making with large carnivores are highly political in nature and have undergone constant evolution from being centralized to being decentralized in recent years. Ex post facto compensation is paid for livestock killed by carnivores and both lethal control and hunting are heavily used to limit the numbers and distribution of large carnivores, which is regulated through a strict zoning policy (Linnell et al., 2005b). The different species groups combined (sheep, wild ungulates, large carnivores) are important components of a wide range of diverse ES that are valued and experienced in very different ways by stakeholders at different scales. The conflicts run much deeper than just a matter of distribution of market-based costs and benefits. It is more based on normative issues, touching on the extent to which the Norwegian landscape is viewed primarily as an arena for recreation, the production of timber or meat (both domestic and wild), or for the conservation of wildlife and biodiversity (Skogen et al., 2006). Hence, numerous arguments (economic, social, ethical and philosophical) are used to form and support opinions among stakeholders.

Classic environmental valuation studies, for example using stated preference methods such as contingent valuation, to value the public benefits of wildlife conservation often run into methodological problems, since conservation is often seen as a public good or service for some (typically urban populations) and "a bad" or disservice for others (typically rural populations)

(Bohara et al., 2001; Bostedt, 1999). Furthermore, a more fundamental problem is that the trade-offs people are asked to make in stated preference surveys, for example, may not be meaningful in situations where ecosystem complexity is high and a plurality of values and underlying motives are involved (i.e. incommensurability, multiple dimensions) (Frame and O'Connor, 2011; Iniesta-Arandia et al., 2014). For ES with a strong cultural component, standard economic valuation may be particularly challenging (Barrena et al., 2014; Chan et al., 2012; Daniel et al., 2012).

In this study we take up the challenge raised by ecological economists such as Barry and Proops (1999) and Swedeen (2006) to analyse resource conflicts more in depth using the Q method, a tool for discourse analysis (Addams and Proops, 2000; Brown, 1980; Webler et al., 2009). Although the topic of wildlife management and ES lends itself well to the use of the Q method, such applications are still rare and the study is the first of its kind in Norway (Chamberlain et al., 2012; Mattson et al., 2006; Rastogi et al., 2013). Thus, in this Q study, we make the links between the different arguments used in the Norwegian wildlife management debate, and the underlying values (monetary and non-monetary) and the full range of ES categories using the Common International Classification of Ecosystem Services (CICES)¹. Specifically, we address two main questions: (1) What are the positions (narratives) that characterize stakeholders' perceptions of the importance of arguments about biodiversity and ES associated with wildlife management?; and (2) To what extent can applying the Q methodology contribute to our understanding of the resource conflict, the underlying values, and ES trade-offs?

2. Method, data collection and analysis

2.1 Q methodology

¹ <http://cices.eu/>

Q methodology is a form of discourse analysis that originates from the field of psychology and which has been adopted in a range of fields (Baker and et al, 2006; Barry and Proops, 1999; Curry et al., 2013; Davies and Hodge, 2012; Davies and Hodge, 2007; Swedeen, 2006). It combines both quantitative and qualitative data through statistical analysis to explore different opinions that exist about a topic. Q methodology does not allow for generalizations about the representativeness of different opinions within a larger population (which is an aim of general population surveys). It does however, give insights into the range of opinions that exist about some topic within a sample population, and how those opinions differ and converge. As such, the Q method lends itself well to study the importance of ES and associated values across stakeholder groups within the Norwegian wildlife management debate and to capture the nuances in opinions. This may be valuable when searching for common ground for the implementation of acceptable and feasible policy options, and as a basis for stakeholder (Cuppen et al., 2010) and deliberative processes (Walton, 2013), or the use of decision-support tools such as multi-criteria decision analysis (Swedeen, 2006).

A Q study typically involves several steps. The two most critical steps to secure a good quality in study design include the selection of Q statements (Q-set) and participants (P-set). The Q-set commonly derives from a so-called concourse of statements and a good Q-set is broad in scope to cover all the different aspects, both positive and negative, of the topic under review. In addition, the Q statements should be intelligible and allow for differing interpretations by the participants. Similarly, while it is a prerequisite in Q methodology that the participants must be knowledgeable about the topic of the study, the P-set should aim to be inclusive of different stakeholders.

2.2 Identification of stakeholders

To identify key stakeholders for the analysis, we conducted literature reviews, internet and news searches, and consulted experts. We chose the most relevant organisations considering their relative importance and interests. The organisations represented the interests of farmers, hunters, forest owners, nature and carnivore management, animal welfare and nature conservation, tourism, and sheep farming. We selected informants based on their functions and relative importance within the organisations, thus reflecting their knowledge about the topics and the area of this study. We contacted informants primarily through e-mail, and when they were willing to participate in the study, we performed interviews personally². We limited our study to representatives from the organisations' national level bodies and from regional divisions from South-eastern Norway. South-eastern Norway is the only part of Norway where wolves, bears and lynx occur together, and the area of most intensive forestry and game management (roe deer and moose) with widespread sheep farming, and contains sharp gradients from urban to rural areas, thus providing the widest diversity of stakeholder views within a shared ecosystem.

2.3 Statements that reflect ecosystem services and underlying values

Based on an extensive search of printed and internet resources and our own accumulated experience of the conflicts we identified 40 Q statements representing key arguments or value statements about the management of sheep, moose, roe deer, wolf, lynx and bear, in South-eastern Norway³. We first sampled as many statements as possible aiming to cover all aspects

² Due to our confidentiality agreements we will not further specify who the informants were or where they came from.

³ We deliberately excluded red deer, wolverine and semi-domestic reindeer management issues to reduce the complexity of the study and keep it more focused on the prevailing conditions within the south-eastern boreal forest area of Norway.

related to our focus species. We then merged similar statements for each species, thus keeping the diversity in aspects for each species. Next, we omitted those statements that covered similar issues. Finally, we selected the 40 Q statements that best covered a diversity in positive and negative aspects for each species, while keeping a balance in the number of statements per species. , Using expert judgement, each statement was classified as primarily belonging to the different ES categories of provisioning, regulation/maintenance, or cultural, according to the CICES classification system (see Table 1). CICES system is the currently most developed continuation from MEA (2005). Not all our statements fitted easily into service categories, so we added an “other” category. Classifying the statements allowed us to examine the relationships between biodiversity and ES within the wildlife debate, and showed that arguments referring to cultural services were relatively more common (N=20). Of these, 16 statements referred to arguments about the “physical and intellectual interactions with biota, ecosystems, and land- / seascapes”, and four statements referred to arguments about the “spiritual, symbolic and other interactions with biota, ecosystems, and land- / seascapes”. Under the remaining service categories 10 Q statements represented arguments about regulation / maintenance services, (“maintenance of physical, chemical, biological conditions”), seven Q statements represented arguments for provisioning services (“nutrition” or “materials”), and three Q statements did not exactly fit within any CICES category.

[Place table 1 here]

Observations can also be made in relation to the number of statements regarding the different types of species and ES classification in Table 1:

- Sheep were mostly associated with statements categorised under provisioning (4 of 9 statements) and cultural (3 of 9 statements) services.

- Moose were associated with statements under all ES categories, but most were related to cultural services (5 of 8 statements).
- Roe deer were mostly associated with statements within regulatory / maintenance services (6 of 7 statements).
- The statements about lynx were evenly divided between regulatory / maintenance (4 of 9 statements) and cultural services (4 of 9 statements).
- Wolves were mostly mentioned under cultural services (6 of 12 statements), but were also associated with the other service categories (and “other”).
- Statements about bears were classified mostly under cultural services (6 of 10 statements).
- “Carnivores” in general were mentioned in seven statements divided among all categories.

Hence, there is a great diversity of values and services underlying the conflict, and the cultural value component is strong.

2.4 Study design and data analysis

To secure a statistically sound analysis we adhered to Webler et al. (2009) who recommend that the ratio the P-set to Q-set should not exceed 2/3. We interviewed 26 informants selected from the eight key stakeholder groups, with 2-4 informants from each⁴. We conducted the interviews in person between May and July 2013. First, we asked informants to sort the 40 Q statements according to how well they represented their own thoughts within a pyramid-shaped matrix (i.e. perform a Q sort; ordering of statements). The matrix conformed to a quasi-normal distribution and a scale running from disagree most (-5) to agree most (+5). Informants had to accommodate

⁴From the 26 interviews, one Q sort was removed as the informant decided to withdraw from the study, thus 25 Q sorts were included in the analysis.

all 40 Q statement cards within the matrix. Thus, informants had to weight all statements relative to each other, according to their own opinions. After the sorting exercise, informants were encouraged to explain their reasons, thus revealing their subjective opinions on these topics. This information was later qualitatively analysed and combined with a quantitative Q sort analysis to describe the range of extant opinions (narratives)⁵.

To analyse the Q sort data from the interviews we used the PQmethod software⁶. This software allows for two alternative methods of analysis; either through a principal components analysis (PCA) or a centroid factor analysis (CENT). We performed a PCA since this option considers both commonality and specificity among Q sorts (Webler et al., 2009). We rotated the factors using the Varimax algorithm and an automatic flagging of sorts, to minimize subjective interference in the analysis. After the quantitative Q sort analysis was completed, we combined the statistical analyses with the follow-up discussions to explore the interpretability of narratives across possible solutions (e.g. for two, three, four, and five factors). Thus, we found that three factors worked best to coherently describe as much as possible of the variation in opinions across the Q sorts. During the subsequent description of narratives, we combined the statistical analysis with the qualitative data through a constant comparison. At this stage, we went back to correct for the flagging of Q sort 8⁷, which was highly associated both with factors 1 and 3, placing it within narrative 3 where it fit best. Once verified, we compared the narratives to identify more important value arguments (i.e. arguments that attracted stronger agreements/disagreements) within each narrative as well as similarities and differences among

⁵ The informants were thereafter contacted again, through email, and given the opportunity to comment on the resulting narratives. Their feedback was subsequently considered for the final presentation of the narratives.

⁶ Freely available from: <http://schmolck.userweb.mwn.de/qmethod/index.htm>

⁷ The stakeholder verified this during the feedback stage. Appendix A shows the defining sorts for factors 1, 2, and 3.

narratives. To complete the narrative analysis and to uncover patterns in affiliations among stakeholders we explored the assemblages of different key stakeholders that grouped into the different narratives.

3. Results and analysis

3.1 Statements, ecosystem services and main narratives

Based on the 40 Q statements in Table 1, three narratives emerged from the Q analysis. We typified these as N1 “*Intrinsic*”, N2 “*Cultural*”, and N3 “*Utilitarian*”. Together they explained 64% of the total variance among the 25 Q sorts and comprised the opinions of 23 individuals. Two individuals did not agree with any narrative. There was relatively low correlation between narratives N1 and N2 (0.0155), and between N1 and N3 (-0.1697), indicating that they were distinctly different. The correlation between narratives N2 and N3 was higher (0.6295). Table 2 summarises, in brief, the main value and policy orientations of the three narratives. While N1 emphasizes intrinsic or existence values connected with the cultural service of carnivore conservation, N2 is more focused on the cultural heritage values related to continued sheep grazing practices and food production. Finally, N3 advocates a more extractive use / utilitarian value perspective.

[Place table 2 here]

Figure 1 represents the idealized Q sorts, i.e. the orderings of the 40 value statements (represented by the respective statement numbers 1-40, Table 1) as they would appear for persons who fully agree with narratives N1, N2 or N3. Negative Q sort values (Q-SV) indicate disagreement with value statements and positive Q-SV indicate agreement with value statements. The stronger the agreement or disagreement with a particular statement, the more important the value statements was to the particular stakeholder group. In total, 25 Q statements were relatively more important within one, or more, of the three narratives (i.e. Q statements

with Q-SV of -5, -4, +4, or +5, Fig.1). Across narratives, stakeholders disagreed on 16 of the 25 relatively more important Q statements while they agreed on nine of the relatively more important Q statements. The Venn diagram in Figure 2 show that the three stakeholder groups, to a varying degree, agreed on totally 15 of the 40 Q statements (c.f. Table A in appendix). Although six of these consensus statements were not first priority within any narrative (Fig.1; Fig.2) they still provide common ground across narratives. Figure 1 and 2 hence illustrates that the stakeholder groups agreed on some issues, potentially providing a solid basis for conflict resolution with regard to incompatible issues across stakeholder groups.

[Place figure 1 here]

[Place figure 2 here]

We now provide a more detailed analysis of the narratives. Numbers in square brackets refer to the specific Q statements (Table 1). Direct citations from the interviews are within quotation marks.

3.2 Intrinsic narrative

Narrative N1 favoured carnivore conservation, focused on intrinsic or existence values, and comprised the opinions of nine people coming from organisations that worked with animal welfare and nature conservation, tourism, or nature and carnivore management. More important Q statements within N1 (i.e. Q statements with Q-SV of -5, -4, +4, or +5) were mostly associated with pest control, existence, and bequest services (Figure 1; Table 1). Thus, the right of bears, wolves and lynx to live in Norwegian nature [5] and “their intrinsic values” were fundamental and these stakeholders favoured increased carnivore populations [18] with larger distributions and strict nature conservation.

The stakeholders behind N1 felt that eradicating free-living, large carnivores would deprive all future generations of the opportunity to experience these animals in nature [14], i.e. clear

reference to existence and bequest value. Norway's commitment to numerous international agreements [6] was considered important: "to achieve improvements, all countries must take their part of the responsibility and Norway cannot sneak away."

In general, stakeholders behind N1 did not regard hunting (especially moose) as important for cultural heritage [35]. Instead, they valued large carnivores for the maintenance and regulatory services they provide. Thus, lynx were considered as ecologically important for controlling the roe deer populations [21] and stakeholders strongly opposed keeping the lynx population low to reduce the competition with hunters [25] or reducing roe deer because they were a problem for gardeners [7]. Similarly, stakeholders did not consider wolves as more burdensome than valuable to society [32], but as central for restoring the ecological balance [15]. They did not think that a larger wolf population would have large negative consequences for moose hunting [34]. In particular, stakeholders were sceptical that increased bear hunting would lead to greater safety for people and domestic animals that lived in areas with carnivores [37]. On the contrary, increased bear hunting "could lead to more wounded bears" and associated "risky encounters". Furthermore, "the bear density in Norway is low" and "mostly it is about transient animals" so allowing for "more hunting might not really help".

Although "it could be discussed what is natural", and they realised that "many people probably would experience sheep as a natural element in Norwegian nature", the stakeholders behind N1 opposed the idea that sheep provided important cultural (heritage) services [4]. Instead they argued that sheep husbandry practices "had changed over time", and that "Norwegian sheep keeping had never been more intense than during the last 60 years". They did not think it important to facilitate traditional sheep grazing to enable future generations to experience sheep farming [17]. Instead, they requested both more reflections about sheep keeping practices, which they viewed as problematic [33], and they reflected over the "loaded label" of traditional practices. "I believe this has to do with something that isn't discussed much at all, namely

whether or not it is OK to let sheep lose in the wildlands [with little supervision or protection]”, one informant said.

Contrary to the other narratives, the stakeholders behind N1 did not think, “predators were the problem”. Disagreeing that sheep farming, and viable carnivore populations could not coexist [20], they strongly opposed the idea that wolf and bear conservation was a threat to traditional farming and a living countryside, i.e. the cultural heritage aspect strongly associated with the provisioning service of farming under N2 [26]. “Mostly there are economic reasons for people to quit sheep farming but, for many, the depredation by large carnivores is the last straw. I believe that the sheep farmers need to change their husbandry, for which they get much too little help or support.” Thus, “carnivore conservation per se” was not considered a threat, but “bad sheep husbandry” was, and the “wider society” was considered “obliged to care for the local society and farmers”.

3.3 Cultural narrative

Narrative N2 (cultural) focused on cultural landscape values and food security, i.e. the cultural and provisioning aspects of traditional farming are closely related within this group. The seven stakeholders that fell within this narrative came from organisations that worked with farmers, tourism, and nature and carnivore management. The more important statements within narrative N2 (Figure 1; Table 1) were mostly associated with pest control, symbolic, physical use of land-/seascapes in different environmental settings, and cultural heritage services. The stakeholders behind narrative N2 viewed humans as ecosystem engineers and favoured strict carnivore or sheep grazing zones. They also wanted compensation for sheep farmers who must abandon their livelihood because of the strict carnivore zone-policy, as well as to give permission to sheep farmers within carnivore-free zones to kill carnivores that entered those zones.

To the stakeholders behind N2, sheep had long been a natural element in Norwegian wildlands [4]. They saw today's sheep farming practices as an important cultural service, which was "crucial for keeping the cultural landscapes [grazing dependent] open" and important for hundreds of species that "depend on grazing animals" as well keeping the treeline below its climatic limit [31]. Thus, they considered it important to facilitate traditional sheep grazing [17] "with regard to future generations and the cultural landscapes" although "some interventions or changes [might be needed]". Stakeholders behind N2 did not think that traditional sheep farming incurred larger costs than benefits for the wider society [13]. Instead, many talked about the significance of provisioning services, the "importance of food security" and of how "letting sheep graze in the wildlands [was] a good way of producing food". Because, even if many sheep were lost while grazing in the wildlands, unrelated to carnivores, this was acceptable [33] since "part of all populations [...] die through the course of a season/a year [...] from sickness, accidents, drowning, etc. [...]. However, losses caused from bad husbandry and bad animal welfare are not acceptable".

While statement [27] (about conflicting political priorities and political signals) was difficult to accommodate within the CICES framework, "the political targets" [for the size and distribution of carnivore populations] was an issue of great concern and frustration within N2, which "no doubt creates conflicts." "Politicians want livestock in all of Norway and lynx, bear and wolves in some areas. It is cowardly of them to say 'Yes please, we want both'. They should have learned and said that 'in those areas where we should have carnivores, sheep farming will not be continued' and remove the subsidies for meat production." Furthermore, current carnivore policy has left room for diverse interpretations, which has led to "tensions between sheep farming and carnivore managers and different management practices in different counties. [...]" It is demanding for us that work with management to interpret the carnivore policy [...and] this

creates frustration both for managers, sheep farmers, and those that work for animal welfare.” Thus, the people behind N2 demanded clearer policies and greater political decisiveness. Yet, they thought that the population target for lynx was “large enough” and that the population targets for wolf and bear were an “acceptable compromise” since Norway would have to cooperate with Sweden to successfully secure viable wolf-, and bear populations in the long term [18]. Stakeholders also agreed that people should tolerate bear, wolf and lynx [5] and that knowledge about wolves, bears and lynx would give people security and make them more likely to avoid unwanted encounters with large carnivores, or to encounter them if desired [30]. Most stakeholders appreciated the experiential value of large carnivores and thought that it would be a positive experience for life to see a wild bear in nature [11] even if it obviously would depend on the nature of the encounter.

Under N2 moose hunting was viewed as an important constituent of cultural heritage [35]. Whereas stakeholders agreed that moose caused many traffic collisions [29], they disagreed that moose management was too intensive [12] and advocated increased and reformed hunting quotas to reduce moose numbers. They disagreed with keeping lynx populations low to favour roe deer hunters [25] or gardeners [7]. They did not see roe deer as a pest.

3.4 Utilitarian narrative

Narrative N3 focused on utilitarian values and extractive uses of the Norwegian wildlands. The seven stakeholders that fell within the utilitarian narrative worked within organisations for hunters, political reform regarding carnivore management, or forest owners. The N3 stakeholders viewed humans as stewards of nature and they favoured the present population targets for lynx and bear, and the present closely managed populations for moose and roe deer. They did not favour Norwegian wolf populations. The more important statements within narrative N3 (Figure 1; Table 1) were mostly associated with pest control, education, physical use of land-/seascapes in different environmental settings, and cultural services.

Hunting was considered as both an important (positive) cultural and provisioning service. Also for this group, the two ES were closely intertwined. “Regardless of what you hunt, hunting is a positive experience. It is incredibly social...” Thus, the stakeholders valued roe deer hunting for the many positive experiences that it provided [2]. They also showed a keen interest in moose hunting, which was economically important to some Norwegian landowners [16] and important for cultural heritage [35] and Norwegian rural life.

Despite their enthusiasm for hunting stakeholders thought “We should not open up for roe deer hunting because of some gardeners”. In fact, they thought that many gardeners actually experienced roe deer positively [7]. In addition to the cultural services of observing roe deer, roe deer were considered an important prey for carnivores, i.e. providing maintenance services, [38], in particular for lynx. Although lynx were understood to kill healthy roe deer [8], stakeholders disagreed that lynx were ecologically important for roe deer population control [21] since “climate has more to say for how the roe deer populations fluctuate” than lynx. Similarly, wolves were not deemed central for restoring the ecological balance [15]. Instead, stakeholders saw wolves as a disservice provider, a burden to society [32], a competitor for provisioning services, and a threat to hunting dogs and cultural services associated with hunting. They thought that a larger wolf population would have large negative consequences for moose hunting [34]. They disagreed that wolves could improve human development towards a better understanding of nature, self-understanding, or an increased quality of life [36]. Instead, one stakeholder noted, “The wolf issue easily becomes very stigmatising and is easily used to categorize people. [Therefore] it probably doesn’t contribute so much to a more holistic understanding of nature.”

In general, the stakeholders agreed with the population targets for lynx, wolves and bears, which they deemed sufficient to secure viable populations in the long term [18]. However, they wanted “to establish population target[s] for the Nordic countries”. Moreover, most of the stakeholders

thought that it would have been a positive life experience to see a wild, Norwegian bear [11]. “For us hunters, who many perceive of as being anti-carnivores, it would be an even greater experience to see a wild bear. I see nothing contradictory in the fact that some people can be against the carnivore policies and still have a positive experience from seeing large carnivores”, one of them said. However, the origin of the wolf was highly problematic (Linnell et al., 2005a). Because “the wolf is of Russian/Finnish origin and at the edge of its range”, the stakeholders disagreed that Norway had “an obligation to conserve wolves” [6].

Another issue that was touched upon was social responsibility. The general feeling was that illegal hunting existed but was not a threat to the population targets in general [39]. “The great threat is that people do not respect the laws but take liberties, which degrades social morals. When large carnivores become symbols of hegemony the alarm should sound. We have plenty of biologists but we lack psychologists. Illegal hunting is a threat to the management but not for the population's development.” To N3, sheep were a natural element in Norwegian wildlands and a cultural service provider [4].

3.5 Overlap across narratives (Fig.2)

Across narratives, the stakeholders agreed that it was positive to know that lynx existed in Norwegian forests. Many stakeholders also expressed a wish to encounter lynx, or spoke enthusiastically about encounters that they had experienced. Stakeholders agreed that while the chance of bear attacks was low, the risk should not be ignored. Similarly, stakeholders agreed that bears could not be held responsible for killing more sheep than they eat, or for killing sheep in a brutal way because “nature in general is brutal” and the “bears are not at fault”. Rather some stakeholders would hold policy responsible for livestock losses due to carnivore depredation (e.g. due to an ineffective zoning policy c.f. N2). Indeed, stakeholders regarded the policy as inconsistent and wished for clearer directives and more resolute decision-making.

Hence, all parties considered clarifying policy directives and making them more predictable, beneficial (even if some would disagree with the policy itself).

Stakeholders did not believe that large roe deer populations increased the risks of contracting tick-borne diseases. They agreed not to diminish roe deer populations because these were a pest to many gardeners and agreed that roe deer were an important prey, in particular for the lynx. The stakeholders furthermore agreed that the large moose population caused many traffic collisions, and high personal- and material damages. Hence, moose and roe deer management is an area where ES trade-offs do not cause critical discord among the stakeholders.

4. Discussion and conclusions

The conflict over the Norwegian wildlife management is deep-rooted. Knowing the areas of agreement and disagreement between the values (and not just the monetary values) of different stakeholder groups may be important for the development of acceptable management policies and for successful implementation of these policies (Raymond et al., 2013). Therefore, we used Q methodology to explore how key stakeholders' values, associated with ES and biodiversity within the Norwegian wildlife management debate, differed and converged. From the stakeholder responses, it became clear that the three groups associated with the main narratives N1 ("*Intrinsic*"), N2 ("*Cultural*"), and N3 ("*Utilitarian*") favoured different management regimes and resulting wildland types, providing different services. The stakeholder views on the roles of humans in these landscapes differed. Within N1, humans were a disturbance that negatively affected the wilderness, its intrinsic value and the cultural services associated with wilderness conservation. On the other hand, within N2 and N3, human influence was positive and necessary. Within N2, humans were ecosystem engineers that have evolved together with the landscapes that they shape, thus creating niches and habitats that promote higher biodiversity, and cultural and provisioning ES, especially as represented by traditional sheep husbandry and life styles. Within N3, humans were stewards that provided the necessary

management of wildlife populations, through hunting, to secure the delivery of utilitarian and provisioning ES. The stakeholders' views on appropriate management policy thus differed accordingly. Notably stakeholders disagreed on the issues that related to wolf and sheep management. Yet they agreed that today's policy regarding wolf and sheep management practices were unsatisfactory. They also agreed that government wavering is negative, i.e. a clearer direction and spatial prioritisation is better than muddling through to try to please everyone.

Whereas previous sociological research has identified the symbolism attached to the wolf by various stakeholders (Skogen et al., 2006), our study indicates that sheep, and especially sheep husbandry, may also be emerging as a highly symbolic issue. From the way people explained their choices it was clear from the application of the Q method that many statements, even those that primarily were about provisioning services (for example traditional farming), were seen to have an important cultural service component, especially related to heritage and tradition. Hence, it is not easy to categorise and delineate ES categories, and associated monetary and non-monetary values, in practice in a resource conflict like this. In addition, some ES (especially associated with wolves and sheep) were clearly considered a positive service to some and a negative service (disservice) to others. In contrast, issues related to the management of large ungulates and even lynx management did not appear to be associated with critical disagreements. This indicates that there are areas of agreement between the diverse stakeholders where it should be possible to find room for engagement as a precursor to moving onto more complex and divisive issues. Applying the Q method can provide a more in-depth understanding of the resource conflict and the diversity of arguments and values underlying the ES and biodiversity management problem. In addition, it can, as we have attempted to demonstrate, provide a better basis for sorting out which services and values are in (strong) conflict, and where trade-offs are critical and difficult to navigate in designing policies. In such cases,

standard economic policies that for example rely on compensation or incentives may not work because they do not address the underlying, deep-rooted value conflicts and equity issues (Madden and McQuinn, 2014; Pascual et al., 2010). Furthermore, areas of common ground or relatively less disagreement may be identified, where service trade-offs are either non-existent or possibly less important (than perceived a priori) to stakeholders. Such areas may be more suitable for monetary instruments.

Although the Q method may be useful to analyse ES and biodiversity conservation it does not, by design, allow for generalizations within larger populations. However, if the arguments in the debate are well covered and represented, as we think we achieved, the Q method will provide a good overview of the range of narratives within the debate. In our study, we could possibly have tried to cover additional stakeholder groups (e.g. researchers, tourism professionals) and arguments, additionally, followed up the Q-analysis with more questions to understand the sources of disagreements in depth. However, it is always a consideration where to draw the line in terms of scope and depth. Through a thorough preparation phase, we believe we managed to cover the most important issues in the Q analysis. To explore further how to bridge the gaps between the stakeholders positions identified in this study, it may be useful to draw on interesting parallels to conflict avoidance practices in the USA and other European countries where carnivores are returning. In conclusion, given the inherent complexity of socio-ecological systems such as this, it is useful to draw from a diverse toolbox of methods, including applications of the Q method for ES analysis, to move towards better ES management outcomes.

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Table 1: Q statements about sheep, moose, roe deer, lynx, wolf and bear, that represent key arguments in the Norwegian carnivore debate, organised in accordance with the CICES categories.⁸

Main ES categories	Main output or process types	Biological or material outputs and biophysical and cultural processes	Statement number	Q statement
Provisioning	Nutrition	Reared animals and their outputs	9	Norwegian lamb meat is an ecological product
			13	Traditional Norwegian sheep farming incurs larger costs than benefits for Norwegian society
			26	Wolf and bear conservation is a threat to traditional farming and a living countryside
			28	Bears kill more sheep than they eat, and they often kill in a brutal way
			33	Even without carnivores an unacceptable high number of sheep die as a consequence of the traditional Norwegian sheep grazing practices
	Wild animals and their outputs	19	Moose meat is an ecological product	
	Materials	Fibres and other materials	40	A large moose population causes great problems and economic losses for forest owners through their selective grazing of the forest
Regulation / Maintenance	Maintenance of physical, chemical, biological conditions	Pest control	7	Roe deer is a plague to many gardeners and therefore the populations must be diminished
		Maintaining nursery populations and habitats	8	Lynx mostly predate on sick and weak roe deer
			15	The wolf is central to restoring the ecological balance in Norwegian nature
			18	The Norwegian population targets for lynx, wolf and bear are too low to secure viable populations in the long-term and must therefore be increased
			20	Sheep farming and viable carnivore populations cannot coexist
			21	Lynx fill an ecologically important function by keeping the roe deer populations down
			23	Norwegian wolf will be able to contribute to a stronger and healthier moose population, with larger and healthier animals
			25	The lynx population ought to be kept low so as not to compete with hunters for roe deer
			38	The roe deer is an important prey for Norwegian carnivores
		Disease control	24	Large roe deer populations increase the risks of contracting tick-borne diseases
Cultural	Physical and intellectual interactions with biota, ecosystems, and land- / seascapes.	Experiential use of plants, animals and in different environmental settings	1	Large carnivores in the Norwegian wild-lands may enable/provide the basis for profitable ecotourism
			11	To see a wild, Norwegian bear in nature is a positive experience for life
			22	The chance of being attacked by a bear, when one is out in the forest, is so low that it can be ignored
			29	The large Norwegian moose population causes many traffic collisions, which result in substantial personal- and material

⁸ Note that a Q statement could be about more than one species and be associated with more than one ES category.

We have assigned statements to what we considered their primary ES category after consulting colleagues working within the ES field.

Main ES categories	Main output or process types	Biological or material outputs and biophysical and cultural processes	Statement number	Q statement	
				damages every year	
			30	Knowledge about wolf, bear and lynx give people security and enables them to avoid unwanted encounters with large carnivores	
			37	Increased bear hunting will generate greater safety for people and domestic animals that live in areas with carnivores	
		Physical use in different environmental settings	2	Roe deer hunting provides many positive experiences	
			16	Moose hunting is economically important to Norwegian landowners	
			34	A larger Norwegian wolf population, than the one we have today, would have large negative consequences for Norwegian moose hunting	
		Bequest	6	Norway must ensure that Norwegian populations of wolf, lynx and bear be conserved for the future, because Norway has committed to do this through numerous international agreements	
			14	To eradicate free-living, large carnivores in Norway means that we deprive all future generations of the opportunity to experience these animals in Norwegian nature	
			17	It is important to facilitate traditional sheep grazing so that future generations may experience Norwegian sheep farming the way it is today	
		Heritage, cultural	4	Sheep have long been a natural element in the Norwegian wild-lands	
			31	Today's sheep farming practices contribute to securing rare species and valuable cultural landscapes	
			35	Moose hunting is an important constituent of our Norwegian cultural heritage	
		Educational	36	That there are wolves in Norway contributes to human development towards a better understanding of nature, self-understanding, and an increased quality of life	
		Spiritual, symbolic and other interactions	Existence	3	It is a joy to know that there is lynx in Norwegian forests
				5	Bear, wolf and lynx have a right to live in Norwegian nature
				32	The wolf is more of a burden to the Norwegian society than it is of value
			Symbolic	12	Norwegian moose management is so intensive that the king of the forest has become like a domesticated animal
Other		10	Wolves can kill people, even if that rarely happens		
		27	Conflicting political guidance creates unnecessary tensions between sheep farming and carnivore management		
		39	Illegal hunting of lynx, wolf and bear are a threat to the government's current management of population trends for these animals		

Table 2 Summary of value and policy orientations amongst the three narratives identified in south-eastern Norway 2013.

Narrative groups	Value orientation	Policy orientation
Intrinsic (N1)	Intrinsic/existence values, carnivore focused (Humans as a disturbance in nature)	Favour increased carnivore populations with larger distributions and strict nature conservation, i.e. limited human influence
Cultural (N2)	Focus on cultural heritage values associated with cultural landscapes and food security (Humans as ecosystem engineers)	Favour strict limitations on carnivore distribution to separate sheep and carnivores, with farms inside carnivore zones being bought out and strict control of carnivores outside their zones
Utilitarian (N3)	Utilitarian values / extractive use focused (Humans as stewards)	Favour status quo except for wolves, i.e. stay at existing population targets for lynx and bear, and highly managed populations for moose and roe deer (hunted species).

Source: Adapted from Davis and Hodge (2012)

Q sort values (Q-SV)										
-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
N1 Intrinsic										
25	7[^]	4	9	19	24^{^^}	23	38[^]	21	15	18
26	34	17	13	8	10	40	29[^]	33	14	5
32	37	20	31	16	22^{^^}	1	30	3^{^^}	11	6
		12		28[^]	35	27^{^^}	39			
				2						
				36						
N2 Cultural										
13	25	15	8	10	14	6	9	19	5	4
7[^]	33	21	23	22^{^^}	28[^]	16	38[^]	27[^]	29[^]	17
18	12	36	24^{^^}	37	34	26	40	35	30	31
		1		20	39	3^{^^}	11			
				2						
				32						
N3 Utilitarian										
8	7[^]	21	13	25	9	19	27^{^^}	38[^]	4	35
15	39	23	24^{^^}	26	40	5	29[^]	10	34	2
18	36	6	1	28[^]	17	14	3^{^^}	16	11	32
		12		33	30	22^{^^}	20			
				31						
				37						

Figure 1: Relative importance and sorting of the 40 Q statements for narratives N1 Intrinsic, N2 Cultural, and N3 Utilitarian. The 40 Q statements are represented by their respective statement numbers, 1-40 (Table 1). The 12 most important value statements within each narrative (Q-SV of -5, -4, +4, or +5), are highlighted in grey. There was agreement across narratives on 15 Q statements, marked in **bold**. Q statements for which the agreement across narratives was significant (i.e. “non-significant difference”) are marked [^] for $p < .01$, and ^{^^} for $p < .05$.

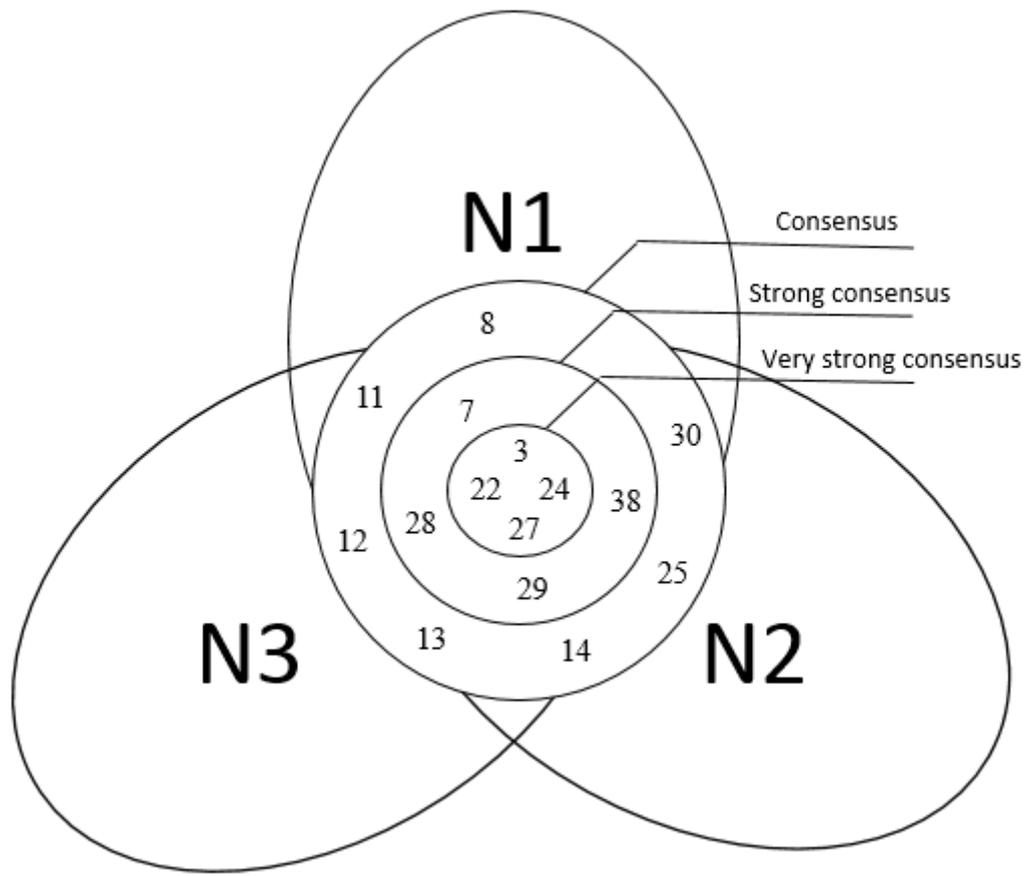


Figure 2: Venn diagram showing the 15 Q statements, for which there was agreement (consensus) across the narratives N1 Intrinsic, N2 Cultural, and N3 Utilitarian. The 15 Q statements are represented by their statement numbers (Table 1). The Q statements for which the agreement across narratives was significant (i.e. “non-significant difference”) are labelled “Strong consensus” for $p < .01$, and “Very strong consensus” for $p < .05$.

6. Appendix

Table A: Q statements organised in accordance with CICES. Narrative Q-sort values (Q-SV), z-scores, distinguishing statements and consensus (agreement) are shown for the three narratives. The Q-SV and z-scores describe the statements' relative importance within the narratives. Q-SV run from "disagree most" (-5) to "agree most" (5). Z-scores have standardized mean and standard deviation values and allow for direct comparisons of scores for the same statements across narratives. More important topics within the narratives are indicated by higher or lower Q-SV and z-scores. Distinguishing statements, unique views, are indicated next to the particular z-scores for each of the narratives. Topics for which there were high levels of agreement among the narratives are shown in the right most column; agreement (Non- significant differences)

Main category of ES	Main types of output or process	Statement #	Narrative Q-sort values and z-scores						Agreement	
			N1	N2	N3					
Provisioning	Nutrition	9	-2	-0.859**	2	0.735**	0	-0.098**		
		13	-2	-0.517	-	-2.100**	-2	-0.877		
					5					
		26	-5	-1.613**	1	0.349	-1	-0.150		
		28	-1	-0.169	0	0.303	-1	-0.180	^^	
				4						
			19	-1	-0.237**	3	0.907	1	0.549	
	Materials	40	1	0.449	2	0.783	0	-0.065*		
			7	-4	-1.511	-	-1.538	-4	-1.460	^^
						5				
Regulation / Maintenance	Maintenance of physical, chemical, biological conditions	8	-1	-0.418	-	-0.833	-5	-1.558**		
					2					
		15	4	1.107**	-	-1.269**	-5	-2.090**		
					3					
		18	5	1.673**	-	-1.691	-5	-1.591		
					5					
		20	-3	-1.130**	-	-0.219**	2	0.727**		
					1					
		21	3	0.818**	-	-0.912	-3	-0.993		
					3					
		23	1	0.358**	-	-0.562**	-3	-1.381**		
					2					
		25	-5	-1.740	-	-1.336	-1	-0.220**		
					4					
		38	2	0.731	2	0.509	3	0.864	^^	
		24	0	-0.025	-	-0.634	-2	-0.347	^	
					2					
Cultural	Physical and intellectual interactions	1	1	0.475**	-	-0.399	-2	-0.677		
					2					
		11	4	1.351	2	0.607**	4	1.347		
		22	0	0.264	-	-0.096	1	0.482	^	
					1					
		29	2	0.714	4	1.095	2	0.746	^^	
		30	2	0.699	4	1.108	0	0.217		
		37	-4	-1.432	-	-0.155	0	0.256		
					1					
		2	0	0.037	0	-0.064	5	1.486**		
		16	-1	-0.096*	1	0.400	3	0.829		
		34	-4	-1.563**	0	0.156**	4	1.012**		

	6	5	1.672**	1	0.458**	-3	-1.209**	
	14	4	1.214**	0	0.270	1	0.569	
	17	-3	-1.005**	5	1.641**	0	0.248**	
	4	-3	-0.927**	5	1.425	4	1.193	
	31	-2	-0.713**	5	2.061**	0	0.387**	
	35	0	-0.004**	3	0.941	5	1.432	
	36	0	0.189**	-	-1.263	-4	-1.427	
				3				
Spiritual,	3	3	0.905	1	0.399	2	0.687	^
symbolic and	5	5	1.569*	4	0.969	1	0.676	
other	32	-5	-1.837**	0	-0.051**	5	1.454**	
interactions	12	-2	-0.567	-	-1.447	-2	-0.976	
				4				
Other	10	0	0.036	-1	-0.158	3	0.957**	
	27	1	0.412	3	0.959	2	0.768	^
	39	2	0.606	0	0.125	-4	-1.387**	

Notes: Asterisks indicate distinguishing statements for narrative; * indicate statements that were significantly different at $p < .05$, and ** indicate statements that were significantly different at $p < .01$. Circumflexes indicate agreement among the narratives; ^ indicate statements for which there was non-significant difference at $p < .01$, and ^^ indicate statements for which there was non-significant difference at $p < .05$.