The role of wild reindeer as a flagship species in new management models in Norway

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Wild reindeer are under pressure from human development projects throughout their habitat. Norway is currently making a significant move to establish a new management model based on national reindeer regions and regional management plans. A focus on wild reindeer as a flagship species allows the species to be included as a broad conservation objective in complex land-use plans. The authors surveyed a representative sample of residents in the Rondane and Setesdal regions to examine their perceptions of the current status of reindeer and how management relates to other social and development issues. Local actors and institutions, including hunters, were perceived as more responsible and suited to make decisions about reindeer population sizes and management objectives than non-local actors. There was little local consensus on the role of human impacts on wild reindeer, and residents rated local knowledge higher than scientific knowledge for management purposes. Rondane residents attached more importance to reindeer than Setesdal residents, but the latter saw reindeer as more threatened by human development. New management approaches will need to take a social-ecological perspective and recognize that the inclusion of reindeer can enhance broader conservation goals at regional, national, and international levels, but may also escalate local social conflicts.

Keywords: *flagship species, local participation, regional management, wild reindeer*

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Introduction

Wild mountain reindeer (*Rangifer tarandus tarandus*) (or caribou in North America) are the most widespread and abundant large herbivores in tundra ecosystems. Economically, culturally, and socially, the species has contributed through millennia to shaping rural mountain cultures (Andersen & Hustad 2004; Bang-Andersen 2008) and boreal regions (Burch 1972; Baskin 2000). Contemporary developments in rural areas and increasing pressure and piecemeal fragmentation of reindeer habitats have led to international recognition of the species' vulnerability (Kofinas et al. 2000; Weclaw & Hudson 2004; Vistnes & Nellemann 2008). Greater interest and awareness of the role of reindeer in arctic and alpine ecosystems, combined with rural communities' needs for economic development, have led to calls for a change in the existing management system in favour of greater involvement by stakeholders (Gunn et al. 2009). The response in Norway has been to enhance the status of wild reindeer as a flagship or umbrella species. By applying the national planning system, 10 national reindeer regions have been defined (Andersen & Hustad 2004). Some of these regions have since been merged into single units, and today seven new regions are required to implement new management plans by 2013 (St.meld. nr. 21 (2004–2005). The regional plans will cover important reindeer habitats and their zones of influence, and hence function as policy guidelines for conservation and local development. In this article we focus on rural communities in the Rondane and Setesdal reindeer regions, which are in different stages of the planning process. In Rondane an appeal was made against the draft plan and it is currently undergoing revision, whereas the Setesdal plan is in the implementation phase.

The shift from sector management to large-scale comprehensive management of reindeer habitats is a formidable challenge (Falleth et al. 2010), as there is little experience of handling the complex interactions that emerge in natural resource planning at regional level (Falleth & Hovik 2009; Hongslo & Lundberg 2012). In Norway regional plans and regional

governments are weak institutions, embedded between a strong state and strong local governments. The same can be said for voluntary intermunicipality cooperation in planning and land-use management (Falleth & Johnsen 1996, Falleth & Hovik 2009).

The new regional plans are mandated to favour conservation of a single species, while also striking a balance between preservation and utilization of the mountain regions. The complexity of the challenge is compounded by the fact that diverse stakeholder interests, land uses, and values need to be negotiated in order to achieve sufficient legitimacy (Hongslo & Lundberg 2012). Essentially, an old hierarchical management system is to be transformed into a new system in which public participation will play a much greater role. This transformation will be challenging because the population, in even small communities, usually represents several different and often competing norms, values, and interests, as well as exhibiting limited trust towards external actors (Rydin & Falleth 2006). Public trust is a prerequisite for the regional level plans to be effective, along with the ability to plan and work across municipal and county borders.

The objective of this article is to assess the role and importance of wild reindeer in the rural communities within the Rondane and Setesdal national reindeer regions. Specifically, we examine whether the reindeer populations are perceived as threatened, the perceived importance of reindeer relative to other social and development issues locally and nationally, knowledge about the current management regime, and perceptions of the role and performance of actors who can influence reindeer management. We also examine differences between the two regions, which represent different histories of wild reindeer management. The findings are discussed in relation to main trends in the management of wild reindeer, both regarding conservation of important habitats in regional plans and the established management of the reindeer population.

Area and population management of a flagship species

Wild reindeer are a common species in the southern Norwegian mountain ranges. By contrast, semi-domesticated reindeer are mainly linked to indigenous pastoralism (Tyler et al. 2007) in the central and northern parts of Norway. There is some overlap between domestic reindeer herding and the wild reindeer habitats in some areas, such as Jotunheimen–Breheimen. In the central parts of southern Norway, semi-domestic reindeer are managed by non-Saami herding groups (Jotunheimen tamreinlag, Lom tamreinlag, and Fram tamreinlag), whereas they are herded by indigenous Saami people in the areas north of Røros as well as in the Femundsmarka area to the south of Røros. Reindeer are familiar to the general public, despite having a largely secluded existence in remote mountain areas. Direct observation of wild reindeer is difficult, but most residents in local communities recognize the species and its behaviour (Andersen & Gundersen 2011). The reindeer is a relatively shy animal, and its behaviour is less spectacular than, for example, that of the large carnivores. Reindeer live in large herds and are not usually characterized as a charismatic species, which is often a criterion for flagship species. However, there are examples of less charismatic species such as snakes and insects that are classified as flagship species as long as their novelty interest influences public opinion (Bowen-Jones & Entwistle 2002). Charisma is a subjective assessment, and perceptions of wild reindeer vary, depending on individual environmental orientations[1] and perceptions of meat quality, attractiveness, and revenue generation (Bråtå 2005).

Historically, Norwegian wild reindeer were grouped into two or three large populations with seasonal migrations along well-established movement corridors (Skogland 1986). Currently, large-scale seasonal movements are not practised, and instead 23 separate populations of wild reindeer inhabit distinct ranges. The current habitats are severely

fragmented due to human settlements, roads and railways, hydropower development, second homes and tourism resorts, and various agricultural and pastoral activities (Nellemann et al. 2003; Bevanger & Jordhøy 2004; Panzacchi et al. 2013).

We expect that supporters of new trends in area-based management of reindeer have much to learn from the experience of harvest or population management, which historically involved multiple management levels. Traditionally, wild reindeer populations have been managed by hunting, as natural predators have little or no impact on the herds. Often, this means an adaptive management process to maintain harvestable populations at a given density. The population management of wild reindeer may be seen as generally successful (Bråtå 2005), despite some minor challenges of controlling population size and health (Strand et al. 2012a). Practical management is based on cooperation between private and public sectors. Landowners are represented on wild reindeer committees (*villreinutvalg*), with responsibility for local operational management, whereas the state-run wild reindeer boards (*villreinnemd*) exercise public authority. In the past, the wild reindeer committees and the wild reindeer board have shared responsibility for inventorying reindeer populations, setting the goals for population dynamics, developing plans for attaining goals, and making proposals for annual hunting quotas.

The wild reindeer boards have enjoyed a high level of public trust (Bråtå 2003; 2005) because the reindeer is a focal species for hunting and is representative of important sociocultural history in the local community (Bang-Andersen 2008). Many local people who are interested in mountain management are well aware of the overgrazing problems associated with wild reindeer populations in the Dovrefjell area in the 1950s and in Hardangervidda in the 1980s (Skogland 1983; 1985), including the devastating long-term effects of trampling and degrading lichen heaths. Overgrazing has also been a problem for decades in many overabundant semi-domesticated reindeer herds (Ims et al. 2007). Managing reindeer

populations through hunting has been a win-win situation for avoiding the overgrazing problem and producing healthy populations adapted to the available resources combined with optimal production of meat. This is a success story built on decentralized management, delegation of power to local institutions, and integration of both scientific and traditional local knowledge (Strand et al. 2010).

In the past, a critical element in population-level management was that the management unit coincided sufficiently well with the natural range of wild reindeer in each distinct range rather than with the administrative borders of municipalities and counties (Bråtå 2005). In addition, specification of the wild reindeer units resulted in a more holistic arena that included relevant stakeholders in discussions on objectives and strategies for each reindeer population. Further, the integration of scientific knowledge and traditional local knowledge at the lowest management level was important and necessary in order to define management strategies and to involve different stakeholders (Bråtå 2005). Scientific knowledge is essential for understanding the general patterns of the reindeer populations' biology and ecology, while traditional local knowledge addresses much more specific and place-dependent problems and challenges. With a new management model gradually being put in place, a number of questions arise concerning the efficacy of large management units, whether management institutions have sufficient trust and legitimacy, and how suitable reindeer are as a flagship species intended to advance broad conservation interests while simultaneously balancing the preservation and utilization of larger mountain regions.

Study areas

The Rondane region (Fig. 1) covers a rugged mountain area and provides an important reindeer habitat surrounded by several local communities. Our study includes the northern

part of the Rondane reindeer area (1513 km^2) and Sølnkletten reindeer area (1330 km^2), which together form a joint planning unit in the development of a new regional management plan. The northern part of Rondane is encompassed by the Rondane National Park (963 km^2) and Dovre National Park (289 km^2). In 1962, Rondane was designated the first national park in Norway. Although the park is managed to minimize human impacts, it is under pressure from high levels of recreational use. Areas adjacent to the park are also part of the wider ecosystem utilized by the reindeer, but these areas are more heavily impacted by human activities. Second homes, tourism resorts, and livestock production outside the national park are important sources for human activities and utilization of resources taking place inside the park (Haukeland et al. 2011). The management of the Rondane reindeer population (a winter herd of 1600 reindeer) has been associated with major conflicts, particularly related to tourism and second-home development, road development, road access in the winter season, and livestock and agricultural activities (Jordhøy 2008a; 2008b). A large part of Rondane consists of state-owned land, to which local people have certain rights of use (e.g. hunting) in contrast to non-residents. The Sølnkletten area is more influenced by human infrastructure and includes a winter herd of c.700 reindeer (Andersen & Hustad 2004).

The Setesdal region (Fig. 1) is a rugged but smaller-scale mountainous landscape than Rondane, with elevations between 1000 m a.s.l. and 1500 m a.s.l. Setesdal–Ryfylke (6154 km^2) is the second largest wild reindeer area in Norway and contains the southernmost wild reindeer population in Europe. The original wild reindeer population has become intermixed with domestic reindeer, and the last domestic reindeer disappeared from the area in 1976 (Strand et al. 2011). A large part of the wild reindeer range has been heavily developed by hydroelectric power, including dams and regulated lakes, power lines, and gravel roads. Archaeologists have recorded signs of prehistoric activities, but these traces are threatened by energy development. Settlements based on wild reindeer subsistence have been identified

dating as far back as 9600 BC (Bang-Andersen 2008). In addition, infrastructure development has stimulated second-home development, tourism, and traffic within the wild reindeer range (Nellemann et al. 2003; Strand et al. 2011; 2012b). The municipalities in the Setesdal region have received substantial economic income from hydroelectric development. A large part of the wild reindeer range in Setesdal is privately owned, with exclusive hunting licenses for the owners.

Methods and data collection

We selected a sample of people weighted by gender and age from each of the two study regions. The samples were representative of the the municipalities that comprise the planning region, including mountain areas with wild reindeer populations in each of the regions. In the Rondane region we sampled 500 respondents from the municipalities that are comprised under the new plan, namely Dovre, Folldal, Alvdal, Sel, and Nord-Fron. In the Setesdal region we sampled 500 respondents from of the municipalities of Bykle, Valle, Sirdal, Bygland, and Kvinesdal.

Data were collected using a structured questionnaire and telephone interviews conducted by a data collection agency. The interviewer used a systematic random sampling procedure whereby the sample structure was defined by the socio-demographic structure of the population in the study regions, and then collected data until the net sample of 1000 respondents was reached. The questionnaire covered questions concerning interest in and contact with wild reindeer, attitudes toward reindeer management, perceptions of the importance and role of wild reindeer to the local communities, consumptive and non-consumptive valuation of wild reindeer, the saliency of various environmental management and community issues, perceptions of a range of actors who in some way affect the viability of wild reindeer populations, and the background characteristics of the respondents. Questions

about the management of reindeer and the role of reindeer in the mountain communities were based both on previous land-use and reindeer research in these regions as well as input from public meetings and strategic interviews (Andersen & Gundersen 2010; Strand et al. 2010; Wold & Vistad 2010).

The majority of the questions were constructed to be answered using 5- or 6-point scales with a logical direction (i.e. 1= totally disagree to 5= agree very much, 6 = do not know) which the respondent uses to score each question. We then calculated average scores and standard errors (SEs) for each question. We used the independent samples t-test procedure to look for differences in the scoring of statements between the study regions. Differences were considered statistically significant when $p < 0.05$. Data were analysed using IBM SPSS Version 20.0 software.

Results

Perceptions of the status of reindeer populations

The respondents were asked about the current status of the reindeer populations in their region and their adaption to available habitats. A total of 55% of the respondents thought the population levels were sufficiently large and well adapted to the utilized habitat. By contrast, 30% thought the reindeer populations were vulnerable and threatened by the development of mountain areas. Only 8% were of the opinion that populations were too large and that the reindeer acted as a barrier to further development or other aspects of the environment (Table 1).

We found large differences between Setesdal and Rondane regarding perceptions of the current reindeer population status (Table 1). In the Setesdal sample, 42% were of the opinion that the wild reindeer population was threatened by development in mountain areas, while only 18% shared this opinion in the Rondane region. With regard to whether the

population sizes were well adjusted to the available habitat, only 38% of the Setesdal respondents agreed, while 72% of the respondents from the Rondane region supported the statement.

The general perceptions of the historical development within reindeer populations summarized in Table 2 show that the respondents are divided into two groups; those who believed that the size of the reindeer populations had reduced in the utilized area due to infrastructure development (39%), and those who believed the reindeer populations had not been affected by infrastructure development (40%). Only 13% believed the reindeer populations had increased its inhabited area. In Setesdal, 50% of the respondents claimed that the populations had a reduced living area, while only 28% in the Rondane region thought this was the case. In the Rondane region 52% believed that the wild reindeer populations had not been affected by infrastructure development, while only 27% in Setesdal held this belief. There is a distinct contrast between the two regions on this issue, with almost opposite patterns in Rondane and Setesdal. However, considering the history of infrastructure development in each region, this difference is not unexpected.

Ranking of local public sectors

One objective of our study was to identify how the rural communities ranked reindeer management against other issues of public management in their local community. We asked the respondents to indicate the 3 most important areas in a list of 10 policy areas (Table 3). The two most important sectors were schools and education, and public health and care for elders. Immigration, and taxes and fees were considered least important. The management of wild reindeer was rated 6th out of the 10 policy areas. However, there are some important differences between the two study regions. In Rondane, the ranking of policy areas was

identical to the overall pattern, while in Setesdal, tourism was considered more important than the local (municipal) mountain board, and almost equally important as reindeer management.

There were significant differences between the two regions regarding the importance of the 'local management board' (*fjellstyret*) (an extensive decision-making authority over land-use and harvesting issues in much of Norway's protected areas) and 'wild reindeer management' (Table 3). Respondents from Rondane attached more importance to the management board than respondents from Setesdal ($t = 3.45$, $df = 971$, $p = 0.001$). The same pattern was found for wild reindeer management ($t = 2.80$, $df = 987$, $p = 0.005$).

Ranking of national environmental issues

To put local perceptions into perspective, we asked the respondents what they thought were the three most important national environmental policy issues (Table 4). The two issues ranked highest were the reduction of environmental toxicants in food, and the pollution of water and air. Loss of biodiversity was ranked as the third most important issue, followed by management of national parks and protected areas. Invasive species were scored as the least important issue. Management of wild reindeer, management of large carnivores, and controlling development in mountain areas received almost similar scores (3.83–3.86), roughly in the middle of the score range in all cases.

The Rondane region reflects the pattern of the overall sample. Rondane respondents ranked pollution of air and water slightly higher (i.e. more important) than reducing environmental toxicants in food, and they ranked management of national parks and protected areas slightly higher than loss of biodiversity. In Setesdal, the only exception from the general pattern was that 'controlling mountain development' was seen as more important than management of large carnivores. Carnivore management was the only issue that differed

significantly between the two regions ($t = 1.967$, $df = 983$, $p = 0.049$), as more importance was attached to it by Rondane residents than by Setesdal residents (Table 4).

Perceptions of stakeholder roles and responsibilities

Perceptions of the legitimacy and efficacy of institutions and actors are an important element of public trust and may be an indication of how local participation in natural resource management works. We asked the respondents to express to what extent they thought a range of actors had a positive or negative influence on the reindeer and their habitat (Table 5). Local residents were ranked highest in terms of positive influence, followed by hunters and researchers respectively. The three most negatively ranked groups were local business, tourists, and non-local cabin owners. In Rondane, hunters were considered to have more positive impact than local inhabitants in general. The municipality administration and farmers were also ranked higher than researchers. In Setesdal, researchers were ranked higher than hunters (Table 5).

We found significant differences between the areas regarding perceived impact from different stakeholder groups. Hunters were considered to have significantly more positive impact in the Rondane region than in the Setesdal region ($t = 5.69$, $df = 990$, $p = 0.001$). Researchers were considered to have significantly less positive impact in Rondane than in Setesdal ($t = -2.60$, $df = 976$, $p = 0.009$).

Following the ranking, the respondents were asked to state to what extent they thought the stakeholder groups took their responsibilities seriously and acted accordingly (Table 6). In this case too, local inhabitants were ranked first, followed by hunters and researchers respectively. Local business, tourists, and non-local cabin owners were seen to act least responsibly. In the Rondane region, hunters ranked higher than local inhabitants, and the municipality administration ranked above researchers. In Setesdal, researchers were ranked

almost equally as high as local inhabitants, whereas hunters were ranked sixth. The Ministry of the Environment ranked third, higher than the municipality administration, farmers, and hunters (Table 6). There was no change from the general picture of the four stakeholder groups with lowest scores. We found three significant differences between the study regions. Local inhabitants ($t = 2.46$, $df = 973$, $p = 0.014$), hunters ($t = 6.84$, $df = 977$, $p = 0.001$), and non-local cabin owners ($t = 2.15$, $df = 982$, $p = 0.032$) all had higher average scores in Rondane than in Setesdal (Table 6).

Attitudes toward decision making

The new regional management plans will raise issues about decision-making responsibilities. On this topic we asked the respondents to indicate to what extent they agreed that various actors should make decisions about the appropriate size of reindeer populations as well as decisions on how to utilize reindeer for different purposes such as hunting, tourism experiences, and conservation (Table 7).

Local residents with relevant practical experience, such as farmers, landowners, and hunters, received the most support (i.e. they had the highest score amongst the stakeholder groups). The wild reindeer board was ranked second. Local residents (all residents in a community regardless of their occupation or interest) were ranked equal to the municipality administration. Researchers, national management institutions, and environmentalists respectively scored 3.4, 3.2, and 2.7, while there was considerable resistance to international institutions such as the European Union and the United Nations. Responses from the Rondane region followed the general pattern, while in Setesdal the municipality administration and researchers were ranked higher than local inhabitants (Table 7). There was a significant difference between study areas in the scoring for local inhabitants ($t = 3.91$, $df = 991$, $p =$

0.001) and local inhabitants with practical/management experience (t = 2.28, df = 992, p = 0.023), where the Rondane region scored higher than the Setesdal region.

Knowledge of reindeer management

Knowledge of the management system regarding reindeer was a salient part of our respondents' attitudes toward management objectives, land-use options, and stakeholders. We asked the respondents how well they knew the different elements of the current reindeer management model (Table 8). In general, their level of knowledge was not particularly high. On the whole, the respondents knew more about the size and distribution of the reindeer population than they did about the management structure, although the difference was not great. Their knowledge of the different levels of management authorities was almost similar to how much they knew about the regional wild reindeer board. They knew least about the Norwegian Information Center for Wild Reindeer(Norsk villreinseter), which has offices in each of the study regions, at Skinnarbu in Tinn Municipality and at Hjerkinn in Dovre Municipality. Furthermore, the 23 regional and 10 national management areas, the regional level management plans, and the older county-level management plans were not well known. Residents in the Rondane region were slightly more knowledgeable about the current management regime than residents in the Setesdal region. Rondane residents scored significantly higher on knowledge of the management authorities and their different levels (t = 2.86, df = 995, p = 0.004), the regional and national management areas for wild reindeer (t = 4,58, df = 991, p = 0.001), the Norwegian Wild Reindeer Foundation (t = 10,11, df = 988, p = 0.001), the size and range-use of the wild reindeer population in the area (t = 3.42, df = 977, p = 0.001), and the wild reindeer board (Table 8). The only non-significant item was knowledge of the regional (county-level) management plan for each of the management areas for wild reindeer.

Discussion

The implementation of a new reindeer management regime implies a marked shift in planning from expert-based decisions and bureaucracy towards the political arena and increased public involvement. Hence, the attitudes, interests, and votes of residents in reindeer regions will become increasingly important because the new management plans inevitably will be arenas of negotiation among multiple stakeholders.

The community residents expressed strong support for local inhabitants and hunters as actors with a positive influence on the reindeer and their habitat, implying that they have less impact on wild reindeer populations than other actors and institutions, that they act responsibly, and that they are better suited than other stakeholders to make decisions about population sizes and how to utilize the species. In contrast, local businesses, tourists, and non-local cabin owners were thought to have the largest negative impact on the wild reindeer populations, to behave less responsibly, and to be less suited to making decisions about reindeer management.

The general perception was that the reindeer populations were in reasonably good condition, and that they were not seriously displacing other land-use interests. There was more divergence on the question of whether or not human development had impacted reindeer populations. Scientific knowledge represented by researchers and environmental agencies tended to be valued less than traditional knowledge provided by local residents. A critical review of wild reindeer management in Norway (Bråtå 2005) concluded that while the objectives for population management often were precisely quantified in plans, this was not the case for area-based management. The new management model will necessarily involve more actors, be a continual arena for negotiation, and be more adaptive. Traditional and local knowledge will play an important part in defining new goals, but by necessity this will require increased communication and negotiation between those with scientific knowledge and those

with local knowledge. Within the general picture there are some noteworthy differences between the two study regions that are linked to different development paths. Setesdal and Rondane represent two divergent and opposite situations for wild reindeer due to the origin of their respective populations, human development in the wild reindeer ranges, and the importance of wild reindeer for the local economy and policy. In general, respondents from the Rondane area showed stronger support for reindeer management and thought local management and wild reindeer management were more important compared to respondents from Setesdal. Wild reindeer in Setesdal originate from domestic reindeer herds (Strand et al. 2011), the reindeer range is heavily developed by infrastructure, and wild reindeer play a lesser role in the local economy and policy due to income from hydropower development. Consequently, the respondents from Setesdal considered the wild reindeer population to be more threatened than was the case in Rondane, they valued research knowledge to a higher extent, and thought that the municipality should play a lesser role in reindeer management. The fact that researchers were valued more highly in Setesdal than in Rondane may be attributed to the massive infrastructure development in Setesdal and the need in the mountain ecosystem for scientific knowledge for initiating restoration measurements in a heavily human-altered landscape. Large state-controlled energy corporations have exploited the hydropower potential extensively in the Setesdal region. In the Rondane region, national interests have focused more on land conservation and wildlife protection. These differences may have influenced the municipalities in different ways, also indicating that municipalities in the Rondane region play a more vital role in sustainable wild reindeer management.

A further distinction between the two regions is that there are proportionally more hunters in the Rondane area and the importance of hunting in the local cultures and traditions varies between in the two regions. Unlike in Setesdal, the wild reindeer in Rondane are not considered to have originated from domestic stocks (Røed et al. 2008), but rather are

descendants of the original wild populations, and hunting and trapping are considered to have been a part of the local culture in the Rondane region throughout human history (Skogland 1986, Jordhøy 2008c). With strong roots in history, wild reindeer conservation was a key objective in the designation of Rondane as Norway's first national park in 1962 (Bråtå 2003). Since the 1980s, reindeer conservation has frequently been used as an argument for reducing human impacts on the fringes of the national park (Jordhøy 2008a; 2008b; Nellemann et al. 2010).

Reindeer as flagship species and conservation agent

A flagship species is usually a charismatic large vertebrate that can be used to anchor a conservation campaign because it arouses public interest and sympathy (Simberloff 1998). Often flagship species perform a strategic socio-economic role rather than an ecological one, and can lend support to broader conservation objectives without competing with them (Walpole & Leader-Williams 2002). Typically, a flagship species will be most effective if it resonates with local values and if it is linked to the protection of cultural symbols and cultural identity (Bowen-Jones & Entwistle 2002). There are several reasons why wild reindeer are suitable as a flagship species at local level. First, our study shows a generally positive perception of reindeer among respondents from the local communities. Wild reindeer management was valued higher than tourism. This ranking can be attributed to the historical and cultural significance of the species locally. Human interaction with wild reindeer has occurred for 8000–10,000 years, and was a prerequisite for the first settlements in the Holocene (Bang-Andersen 2008). During the Viking Period and early Middle Ages, reindeer were hunted using large-scale pitfalls, which were systems of fences that led animals into traps or lakes. Caches of stone that served to hide waiting hunters are still visible in many places within the wild reindeer range (Jordhøy 2008a; 2008b). The opportunity to hunt wild

reindeer is still highly important for the local inhabitants, who enjoy privileged hunting rights. While hunting was formerly a key to survival in a demanding environment, currently it is a recreational activity providing both consumptive and, non-consumptive experiences, it contributes to cultural identity, and it serves as a management tool for maintaining healthy reindeer populations (Bye 2009; Flø 2012).

Wild reindeer habitats are found in high mountain areas that are often valuable for the conservation of other species (Skogland 1994). A significant part of the mountain ranges is already protected, mainly because of the presence of wild reindeer. Consequently, wild reindeer may also satisfy the criteria of umbrella or keystone species for large tracts of relatively undisturbed mountain areas (Caro & O'Doherty 1999). However, at the local scale, this may be a controversial position, since our respondents were divided on the question of whether earlier development has had negative effects on the wild reindeer populations. More than half of the respondents indicated that they saw wild reindeer as a robust species, capable of inhabiting landscapes with different levels of human impact. Such observations may be a significant source of conflicts in the future, as a large part of the local inhabitants see less problem with further development of mountain areas than do, for example, researchers and environmental agencies at different levels.

Management implications

Area-based management is more complex than population management due to the multiple and often diverging interests between different stakeholders on different scales. As a facet of broader land-use management issues in the Norwegian mountain regions, future management will be required to increase the integration of local and scientific knowledge (Raymond et al. 2010). The response of the wild reindeer populations to human impacts has been the subject of research for some considerable time (e.g. Nellemann et al. 2010), but their long-term

resilience is not well known. The main areal conflicts between wild reindeer management and local development concern overlapping land use with tourism, second-home development, and activities related to traditional outfield grazing (Strand et al. 2010). These factors have mainly local effects on wild reindeer populations, and time has shown that national development of transportation systems and hydroelectric power has had crucial functional effects on the original populations (Strand et al. 2010). This constitutes a social-ecological system that will require increased stakeholder participation and willingness on the part of stakeholders to negotiate and learn from each other (Jones-Walters & Cil 2011; Berkes & Turner 2006).

Questions of public trust, legitimacy of management models, and who are best suited to make decisions will increase with the new plans. Residents in the study regions generally held external actors such as state agencies and international organizations in low esteem. Criticizing conservation organizations and environmental agencies can be a way of enhancing social or cultural capital and status in communities (Skogen & Krange 2003; Flø 2012). However, there are many reasons for the weak local confidence in regional, national, and international environmental authorities. External institutions often have a limited impact on local communities in terms of benefits from infrastructure and resource development (Strand et al. 2010).

The preservation-versus-utilization discourse on wild reindeer is often contentious. One reason is that opposing stakeholders use different arguments for the need for protection. Local residents wish to protect their hunting traditions as an important part of their social and cultural values, and conservation agencies are motivated by national and international preservationist policies that see the wild reindeer as a threatened species. This is particularly important and challenging, as current political strategies aim at increasing the commercial exploitation of mountain areas while simultaneously preserving suitable wild reindeer

habitats. The major trend is that area management is moving into a more goal-oriented strategy compared to earlier regulation-oriented management approaches. As the concept of protected areas within wild reindeer range also is shifting from 'total protection' to 'sustainable use' (Kaltenborn et al. 2011), improved understanding of reindeer ecology and responses to anthropogenic disturbance is urgently needed to support sustainable and more flexible area management strategies. The findings from the present study suggest that that local-level management has the necessary legitimacy and trust to voice the values of the local communities.

There are many different sources of change within wild reindeer management in relation to the dichotomies of land preservation and land utilization. Area management includes measures that to some extent regulate, redirect, or otherwise restrict human activity and development within wild reindeer areas. This requires governance through objectives based on knowledge, participation, and continual monitoring and adjustment. A reasonable strategy in future-based management could be to describe the main problems in focal areas, set a goal for further development, and create a plan for further data collection to test achievements of management means within the focal area (Strand et al. 2010). Planning and management would then concentrate on core issues that can be linked to fundamental community dynamics that drive conservation conflicts. Effective area-based management across larger regions will require more compromises and consensus on land-use issues within and among municipalities than the communities are used to.

Conclusions

The findings of this study indicate that wild reindeer in Southern Norway meet some of the criteria of a flagship species, such as being linked to local history and culture, and being perceived as symbolizing wise use of the environment. However, the reindeer is also a fairly

elusive and shy animal that is often difficult to observe, and vernacular knowledge suggests it is not considered particularly charismatic or scenic. It is valued locally, nationally, and internationally, and this has led to major policy actions. Currently, reindeer have the potential to function as a conservation agent for land-use management across mountain areas.

There is national and international agreement that wild reindeer need protection. However, wild reindeer conservation through area-based management clearly also has the potential to escalate land-use conflicts, particularly in relation to tourism, second-home development, and agro-pastoral activities. Current development of large-scale regional plans have led to antagonism towards conservation agencies among local inhabitants, and an increase in conflict levels can be expected as new plans are implemented. This will especially be the case if a new management model appears to be unpredictable, inconsistent, and does not sufficiently incorporate different forms of knowledge. Conflicts and lack of legitimacy can to some extent be abated by including traditional local knowledge in the area-based management of wild reindeer to a greater degree and also creating a better forum for stakeholder involvement.

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References

Andersen, O. & Gundersen, V. 2010. *Ferdsel og bruk av Rondane: Etterundersøkelse blant besøkende sommeren 2009*. NINA-Rapport 599. Norsk institutt for naturforskning, Trondheim.

Andersen, R. & Hustad, H. (eds.) 2004. *Villrein og samfunn: En veiledning til bevaring og bruk av Europas siste villreinfjell.* NINA Temahefte 27. Norsk institutt for naturforskning, Trondheim.

Bang-Andersen, S. 2008. Prehistoric reindeer hunting in the southern Norwegian highlands. Grimaldi, S. & Perrin, T. (eds.) *Mountain Environments in Prehistoric Europe: Settlement and Mobility Strategies from the Palaeolithic to the Early Bronze Age*,pp. 63-70 Archaeopress, Oxford.

Baskin, L.M. 2000. Reindeer husbandry/hunting in Russia in the past, present and future. *Polar Research* 19, 23–29.

Berkes, F. & Turner, N.J. 2006. Knowledge, learning and the evolution of conservation practice for social-ecological system resilience. *Human Ecology* 34, 479–494.

Bevanger, K. & Jordhøy, P. 2004. *Reindeer – The Mountain Nomad*. Naturforlaget, Oslo.

Bowen-Jones, E. & Entwistle, A. 2002. Identifying appropriate flagship species: The importance of culture and local contexts. *Oryx* 36, 189–195.

Burch, E.S. 1972. The caribou/wild reindeer as a human resource. *American Antiquity* 37, 339–368.

Bråtå, H.O. 2003b. The Norwegian system for wild reindeer management – major development since the 19th century. *Rangifer* 14, 29–36.

Bråtå, H.O. 2005. *Kriterier for en bærekraftig villreinforvaltning – et samfunnsvitenskapelig perspektiv på forvaltning av bestander og arealer*. ØF Rapport 13. Østlandsforskning, Lillehammer.

Bye, L.M. 2009. ‘How to be a rural man’: Young men’s performances and negotiations of rural masculinities. *Journal of Rural Studies* 25, 278–288.

Caro, T.M. & O’Doherty, G. 1999. On the use of surrogate species in conservation biology *Conservation Biology* 13, 805–814.

Falleth, E. & Johnsen, V. 1996. *Samordning eller retorikk: Evaluering av fylkesplanene 1996–1999*. NIBR Report 1996:20. NIBR, Oslo.

Falleth, E. & Hovik, S. 2009. Local government and nature conservation in Norway: Decentralization as a strategy in environmental policy. *Local Environment* 14, 221–231.

Falleth, E., Hanssen, G.S. & Saglie, I.L. 2010. Challenges to democracy in a market oriented urban planning in Norway. *European Planning Studies* 18, 737–754.

Flø, B.E. 2012. Kjøt, kjensle og kameratskap – om reglar, normer og kulturell danning. Bringslid, M.B. (ed.) *Bygdeutviklingas paradoks*, 275–303. Scandinavian Academic Press, Oslo.

Gunn, A., Russell, D., White, R.G. & Kofinas, G. 2009. Facing a future of change: Wild migratory caribou and reindeer. *Arctic* 62, iii–vi.

Haukeland, J.V., Daugstad, K. & Vistad, O.I. 2011. Harmony or conflict? A focus group study on traditional use and tourism development in and around Rondane and Jotunheimen National Parks in Norway. *Scandinavian Journal of Hospitality and Tourism* 11, Supplement 1, 13–37.

Hongslo, E. & Lundberg, A.K. 2012. Regional planlegging i villreinområder – arealplanlegging som nytt virkemiddel? *Kart og Plan* 72, 255–265.

Ims, R.A., Yoccoz, N.G., Bråthen, A.K., Fauchald, P., Tveraa, T. & Hausner, V. 2007. Can reindeer overabundance cause a trophic cascade? *Ecosystems* 10, 607–622.

Jones-Walters, L. & Cil, A. 2011. Biodiversity and stakeholder participation. *Journal for Nature Conservation* 19, 327–329.

Jordhøy, P. (ed.) 2008a. *Villreinen i Rondane–Sølnkletten: Status og leveområde*. Report 339. Norsk institutt for naturforskning, Trondheim.

Jordhøy, P. 2008b. *Problematikk ikring ferdsel og villrein i Rondane*. Report 331. Norsk institutt for naturforskning, Trondheim.

Jordhøy, P. 2008c. Ancient wild reindeer pitfall trapping systems as indicators for former migration patterns and habitat use in the Dovre region, southern Norway. *Rangifer* 28, 79–87.

Kaltenborn, B.P., Hongslo, E., Gundersen, S. & Andersen, O. 'Public perceptions of planning objectives for regional level management of wild reindeer in Norway', In press: *Journal of Environmental Management and Planning.*

Kaltenborn, B.P., Qvenild, M. & Nellemann, C. 2011. Local governance of national parks: The perception of tourism operators in Dovre–Sunndalsfjella National Park, Norway. *Norsk Geografisk Tidsskrift–Norwegian Journal of Geography* 65, 83–92.

Kofinas, G., Osherenko, G., Klein, D. & Forbes, B. 2000. Research planning in the face of change: The human role in reindeer/caribou systems. *Polar Research* 19, 3–21.

Nellemann, C., Vistnes, I., Jordhøy, P., Strand, O. & Newton, A. 2003. Progressive impact of piecemeal infrastructure development on wild reindeer. *Biological Conservation* 113, 307–317.

Nellemann, C., Vistnes, I., Jordhøy, P., Støen, O.G., Kaltenborn, B.P., Hanssen, F. & Helgesen, R. 2010. Effects of recreational cabins, trails and their removal for restoration of reindeer winter ranges. *Restoration Ecology* 18, 873–881.

Panzacchi, M., Van Moorter, B., Jordhøy, P. & Strand, O. 2013. Learning from the past to predict the future: Using archeological findings and GPS data to quantify reindeer sensitivity to anthropogenic disturbance in Norway. *Landscape Ecology* 28, 847–859.

Raymond, C.M., Fazey, I., Reed, M.S., Stringer, L.C., Robinson, G.M. & Evely, A.C. 2010. Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management* 91, 1766–1777.

Røed, K.H., Flagstad, Ø., Nieminen, M., Holand, Ø., Dwyer, M.J., Røv, N. & Vilá, C. 2008. Genetic analyses reveal independent domestication origins of Eurasian reindeer. *Proceedings of the Royal Society Biological Sciences* 275, 1849–1855.

Rydin, Y. & Falleth, E. (eds.) 2006. *Network and Institutions in Natural Resources Management*. Edward Elgar, Cheltenham.

Simberloff, D. 1998. Flagships, umbrellas, and keystones: Is single-species management passé in the landscape era? *Biological Conservation* 83, 247–257.

Skogen, K. & Krange, O. 2003. A wolf at the gate: The anti-carnivore alliance and the symbolic construction of community. *Sociologia Ruralis* 43, 309–325.

Skogland, T. 1983. The effects of density-dependent resource-limitation on size of wild reindeer. *Oecologia* 60, 156–168.

Skogland, T. 1985. The effects of density dependent resource limitations on the demography of wild reindeer. *Journal of Animal Ecology* 54, 359–374.

Skogland, T. 1986. Density dependent food limitation and maximal production in wild reindeer herds. *Journal of Wildlife Management* 50, 314–319.

Skogland, T. 1994. *Villrein: Fra urinnvåner til miljøbarometer*. Teknologisk forlag, Oslo.

St.meld. nr. 21 (2004–2005). *Regjeringens miljøvernpolitikk og rikets miljøtilstand*. Miljøverndepartementet, Oslo.

Strand, O., Gundersen, V., Panzacchi, M., Andersen, O., Falldorf, T., Andersen, R., Van Moorter, B., Jordhøy, P. & Fangel, K. 2010. *Ferdsel i villreinens leveområder*. NINA Rapport 551. Norsk institutt for naturforskning, Trondheim.

Strand, O., Panzacchi, M., Jordhøy, P., Van Moorter, B., Andersen, R. & Bay, L.A. 2011. *Villreinens bruk av Setesdalsheiene*. NINA Rapport 694. Norsk institutt for naturforskning, Trondheim.

Strand, O., Nilsen, E.B., Solberg, E.J. & Linnell J.D.C. 2012a. Can management regulate the population size of wild reindeer (*Rangifer tarandus*) through harvest? *Canadian Journal of Zoology* 90, 163–171.

Strand, O., Andersen, R., Jordhøy, P. & Panzacchi, M. 2012b. GPS-prosjektet i Setesdalsområdene. *Villreinen* 2012, 8–13.

Tyler, N.J.C., Turi, J.M., Sundset, M.A., Strøm Bull, K., Sara, M.N., Reinert, E. Oskal, N., Nellemann, C., McCarthy, J.J., Mathiesen, S.D., Martello, M.L., Magga, O.H., Hovelsrud, G.K., Hanssen-Bauer, I., Eira, I.M.G. & Corell, R.W. 2007. Saami reindeer pastoralism under climate change: Applying a generalized framework for vulnerability studies to a sub-arctic social-ecological system. *Global Environmental Change* 17, 191–206.

Vistnes, I. & Nellemann, C. 2008. The matter of spatial and temporal scales: A review of reindeer and caribou response to human activity. *Polar Biology* 31, 399–407.

Walpole, M.J. & Leader-Williams, N. 2002. Tourism and flagship species in conservation. *Biodiversity and Conservation* 11, 543–547.

Weclaw, P. & Hudson, R. J. 2004. Simulation of conservation and management of woodland caribou. *Ecological Modelling* 177, 75–94.

Wold, L.C. & Vistad, O.I. 2010. *Bruk av scenariogrupper ved utarbeidelse av regionalplan for Rondane-området*. NINA Rapport 641. Norsk institutt for naturforskning, Trondheim.

Figure caption

Fig. 1. Location of the study areas, the Rondane and Setesdal regions, in Southern Norway

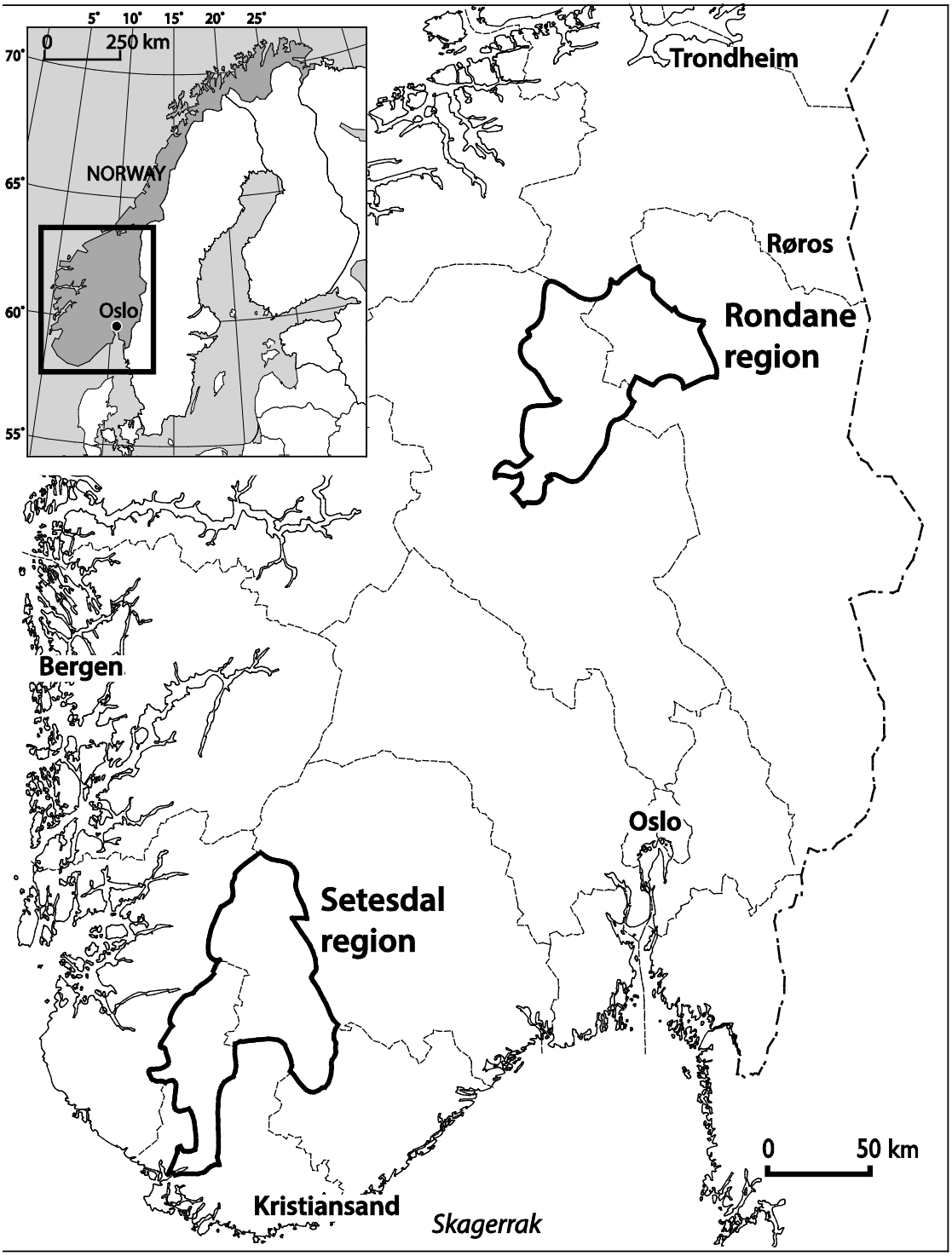

Table 1. Perception of current status for wild reindeer populations in two regions of Norway. Numbers in per cent for the whole sample (Total, N=1000), and split for the Setesdal (n=500) and Rondane regions (n=500)

	Total	Setesdal	Rondane
Populations are vulnerable and threatened by development in the mountain region.	30.1	42.2	18.0
Populations have appropriate size and are well adjusted to their environment.	55.1	38.4	71.9
There are too many reindeer and they displace other environmental and development interests.	8.0	8.8	7.2
Not sure/Do not know	6.8	10.6	3.0

Table 2. Perception of the historical trends for wild reindeer in two regions of Norway. Numbers in per cent for the whole sample (Total, N=1000), and split for the Setesdal (n=500) and Rondane regions (n=500)

	Total	Setesdal	Rondane
The population has reduced distribution due to development in the mountains.	38.5	49.5	27.5
The population has not been measurably affected by development.	39.5	27.0	52.0
The population has increased its range	13.1	11.6	14.6
Not sure/Do not know	8.9	11.8	5.9

Table 3. Respondents' scoring of key policy issues in the rural community they live in. Mean scores and standard errors (S.E.). Response format: 1: Absolutely no importance, 2: Of little importance, 3: Neither important nor unimportant, 4: Of some importance, 5: Of great importance. 'Don't know' category excluded from analysis. (Total, N=1000; Rondane, n=500; Setesdal, n=500)

	Total		Rondane		Setesdal	
	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.
Education	4.42	.026	4.41	.036	4.43	.037
Healthcare and welfare	4.36	.029	4.34	.041	4.39	.040
Economic development	4.06	.029	4.08	.041	4.05	.042
Municipality management of protected areas	3.99	.031	4.03	.043	3.94	.045
Transportation	3.92	.032	3.90	.045	3.94	.045
Wild reindeer management	3.76	.033	3.85	.045	3.67	.048
Local management board	3.69	.032	3.79	.043	3.57	.048
Tourism	3.69	.032	3.74	.041	3.64	.048
Taxes and fees	3.57	.034	3.62	.046	3.52	.049
Immigration	3.06	.038	3.02	.053	3.11	.053

Table 4. Ranking of key environmental issues on the national level. Mean scores and standard errors (S.E.). Response format: 1: Absolutely no importance, 2: Of little importance, 3: Neither important nor unimportant, 4: Of some importance, 5: Of great importance. 'Don't know' category excluded from analysis. (Total, N=1000; Rondane, n=500; Setesdal, n=500)

	Total		Rondane		Setesdal	
	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.
Environmental toxicants in food	4.20	.034	4.16	.049	4.25	.048
Pollution of water and air	4.18	.033	4.17	.047	4.19	.046
Loss of biodiverity	3.98	.034	3.98	.048	3.97	.049
Management of national parks and protected areas	3.97	.033	4.01	.043	3.93	.049
Reindeer management	3.86	.032	3.92	.043	3.81	.046
Management of large carnivores	3.84	.037	3.91	.049	3.77	.055
Control of mountain development	3.83	.034	3.84	.048	3.81	.048
Invasive species	3.54	.041	3.56	.055	3.52	.061

Table 5. Perceived stakeholder influence on reindeer and their habitats. Mean scores and standard errors (S.E.). Response format: 1: Very negative influence, 2: Somewhat negative influence, 3: Neither negative nor positive influence, 4: Somewhat positive influence, 5: Very positive influence. 'Don't know' category excluded from analysis. (Total, N=1000; Rondane, n=500; Setesdal, n=500)

	Total		Rondane		Setesdal	
	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.
Local inhabitants	3.64	.032	3.63	.045	3.65	.045
Hunters	3.51	.034	3.70	.044	3.32	.051
Researchers	3.43	.039	3.33	.056	3.53	.054
Municipality	3.42	.029	3.44	.040	3.41	.042
Farmers	3.39	.035	3.38	.047	3.41	.051
Ministry of the Environment	3.27	.042	3.23	.058	3.30	.061
County Governor	3.12	.038	3.12	.052	3.12	.057
Local business	2.88	.034	2.92	.049	2.84	.047
Tourists	2.77	.034	2.76	.046	2.78	.052
Non-local cabin owners	2.62	.033	2.66	.044	2.59	.050

Table 6. Perceptions of stakeholder performance. Mean scores and standard errors (S.E.)., Response format: 1: Not at all, to a limited extent, 3: To a certain extent, 4: To a large extent, 5: To a very large extent. 'Don't know' category excluded from analysis. (Total, N=1000; Rondane, n=500; Setesdal, n=500).

	Total		Rondane		Setesdal	
	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.
Local inhabitants	3.63	.033	3.71	.045	3.55	.048
Hunters	3.52	.034	3.74	.043	3.29	.049
Researchers	3.49	.038	3.45	.054	3.54	.053
Municipality	3.43	.030	3.46	.042	3.39	.042
Ministry of the Environment	3.43	.041	3.45	.056	3.41	.059
Farmers	3.35	.034	3.36	.048	3.35	.048
County Governor	3.21	.038	3.25	.052	3.17	.054
Local business	2.81	.033	2.84	.048	2.78	.046
Tourists	2.59	.033	2.64	.046	2.54	.048
Non-local cabin owners	2.50	.032	2.57	.046	2.43	.045

Table 7. Attitudes toward who should make decisions about reindeer management objectives. Mean scores and standard error. Response format: 1: Absolutely disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree. 'Don't know' category excluded from analysis. (Total, N=1000; Rondane, n=500; Setesdal, n=500).

	Total		Rondane		Setesdal	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Local inhabitants with practical/management experience	4.03	.031	4.10	.042	3.96	.047
Wild reindeer board	3.80	.035	3.83	.047	3.77	.051
All local inhabitants	3.53	.038	3.68	.051	3.38	.056
Municipality administration	3.52	.033	3.55	.047	3.48	.045
Researchers	3.37	.038	3.34	.054	3.41	.055
National governance	3.17	.040	3.18	.056	3.16	.058
Environmentalist	2.74	.041	2.68	.054	2.79	.060
International authorities (e.g. EU or FN)	1.94	.036	1.91	.051	1.96	.052

Table 8. Knowledge about current reindeer management regime. Mean scores and standard errors (S.E.). Response format: 1: Have never heard about it, 2: Poor, 3: Fairly poor, 4: Fairly good, 5: Very good. 'Don't know' category excluded from analysis. (Total, N=1000; Rondane, n=500; Setesdal, n=500).

	Total		Rondane		Setesdal	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Size and distribution of the wild reindeer population in the area	3.54	.048	3.70	.065	3.38	.069
Different levels of management authorities	3.32	.043	3.44	.060	3.20	.063
Wild reindeer board	3.31	.047	3.51	.062	3.11	.069
County level management plans for Rondane and Setesdal	3.25	.048	3.26	.064	3.24	.071
Regional and national management areas for wild reindeer	3.16	.044	3.36	.060	2.96	.062
Norwegian Information Center for Wild Reindeer	2.74	.050	3.22	.073	2.26	.062