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9 Governing maximum reindeer numbers in Fennoscandia

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Introduction

Environmental governance is contested and complex, involving divergent and interacting policy, society and science perspectives (Bennett & Satterfield 2018). This chapter explores the governing challenges associated with setting the maximum permitted number of reindeer in Finland, Norway and Sweden. Reindeer herders operate with an estimated herd size (Sara et al. 2016). While herders across Fennoscandia regularly count their reindeer, recording exact numbers can be challenging: some reindeer escape the autumn round-ups, and some are lost during the winter (e.g., due to predation, traffic accidents, starvation and moving to other districts). Many of the calves born in spring are slaughtered in the autumn. Available grazing resources and weather also affect herd sizes, which fluctuate throughout and between years. However, for the past hundred years, state-based government bodies in all three countries have decided on maximum permitted numbers. Structures, processes and mechanisms for planning, implementation and evaluation of herd sizes vary. While reindeer numbers do affect the state of pastures, the governance challenge of defining and imposing a maximum number lies in questions about who should make the decisions, for what purpose and what type of knowledge upon which to ground the decision making. It is thus appropriate to examine whether and how externally defined and imposed maximum numbers may enhance the sustainability of reindeer husbandry and whether the sociocultural dimension is recognized or neglected in the ecological and economic metrics used (Heikkinen et al. 2007).

Reindeer numbers as a sensitive topic

Reindeer numbers and herd structure affect the herders' economy. The interdependence between animals and pastures forms the material basis for reindeer husbandry as a traditional, nature-based livelihood (Tahvonen et al. 2014; Pekkarinen et al. 2015). However, competition with other forms of land use has triggered local and national debates about reindeer numbers, in which different land use interests' claims, accusations, arguments and perspectives compete with those of the herders (Johnsen 2016). Sensitivity to the issues surrounding

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reindeer numbers also relates to Indigenous rights of Sámi people to the lands they have inhabited for centuries. In the case of Finland, ethnic Finns also practice reindeer herding and did so long before state intervention on northern lands (Heikkinen 2002).

Fluctuations in reindeer herd sizes have been explained by multi-facetted ecological (e.g., weather and snow conditions), political (e.g., national borders, state-based regulation and other land uses), economic (e.g., demand for reindeer meat) and social (e.g., relationships between herders, and between herders and other land users) aspects (see Pape & Löffler 2012). The customary rights of herders to use the land for their livelihood derive from their historical presence in the areas and are recognized by national laws and regulations, though these are not always implemented (Chapter 8). Moreover, herders hold key expertise and practice-based knowledge about the dynamics between pastures, reindeer and herders (Chapter 7). This knowledge is based on long-term daily experiences of herders who directly witness the socio-environmental changes affecting their livelihood. Herding practices such as herd structure, migration, pasture rotation or use of supplementary feeding have evolved in response to changes in social and environmental conditions and, in turn, have an impact on which pastures can be used, under what circumstances and to what extent (e.g., Kumpula et al. 2011). It can be argued that as both knowledge holders and rights holders, herders' perspectives should be included in decisions about the maximum number of reindeer (see Sarkki et al. 2021; Chapter 8).

From the states' perspectives, setting reindeer numbers depends on the size and ecological condition of pastures. This interdependence often lies at the heart of decision making on maximum numbers. The idea of carrying capacity of winter pastures is critical for setting reindeer numbers in most parts of Fennoscandia, usually measured by the quality and quantity of biomass of terrestrial lichens on winter pastures. Such calculations on pasture–reindeer relations are often used (especially in Norway) to inform decisions on the maximum sustainable number of reindeer. This often relies on ideas informed by the "tragedy of the commons" (Hardin 1968), reflected as a persistent narrative that, without state control, herders will increase their herd sizes to the detriment of all. However, this one-dimensional presentation of reindeer herders' rationale and simplification of the argument is questioned (e.g., Benjaminsen et al. 2015; Johnsen et al. 2015; Marin et al. 2020); issues like supplementary feeding (especially in Finland), herding practices, pasture rotation, cumulative impacts of other land uses and climate change also contribute to the pressure that a particular number of reindeer has on pastures. Consequently, there is a risk that decision makers rely mainly on reductionist views on carrying capacity, while herders' knowledge derives from practice and more complex recognition of landscape processes and interactions (Chapter 7). Herders often point out that their livelihood, culture and rights are compromised by external definitions, regulations and generalized estimates.

Governing maximum number of reindeer in the three countries

In Finland, the Reindeer Husbandry Act states that the Ministry of Agriculture and Forestry (MAF) shall determine the maximum reindeer number for each herding district for each ten-year period, so that "*reindeer grazing does not exceed the sustainable production capacity of winter pastures*" (Reindeer Husbandry Act 848/1990; 21 §). The quantity and quality of pastures and their relationships to reindeer numbers and grazing practices need to be examined and evaluated to inform decisions on sustainable numbers. However, it is important to include the impacts of other forms of land use when assessing the impacts of reindeer grazing on lichens (Sarkki et al. 2013; Kumpula et al. 2014). In particular, commercial forestry affects "*not only the spatial configuration and areas of different pasture patches, but also the grazing pressure at the remaining pasture sites*" (Jaakkola et al. 2013, p. 459). As the impacts of other land uses on reindeer pastures are increasingly taken into consideration, the concept of carrying capacity of winter pastures as a legal instrument to decide maximum number of reindeer is being challenged. For example, Landauer et al. (2021, p. 13) pose further questions regarding "*who has the right to decide what constitutes a desirable system state*".

In Norway, the national Reindeer Husbandry Board (RHB) sets the maximum number of reindeer for each herding district. Regulating numbers, as well as economic incentives for increasing efficiency of meat production, are key tools for ensuring the national policy objective of "a rational, market-oriented industry" (Meld. St. 32 2016–2017, p. 7). There is also an objective to preserve pastures from overgrazing, and therefore the state-regulation of reindeer numbers is informed by estimates of the pastures' "carrying capacity". However, it is a paradox that while herders are forced to reduce their herds to preserve pastures, the authorities allow mineral extraction and wind power development in the same areas (Johnsen 2016; see also Chapter 8). Some scholars and herders also argue that the use of indicators – such as carcass weights – to monitor ecological sustainability excludes the herders' experience-based knowledge about the reindeer and herd dynamics and leads to misreading Arctic landscapes (Benjaminsen et al. 2015; Johnsen et al. 2017; Marin et al. 2020).

In Sweden, the state regulates reindeer numbers at the reindeer herding district level. According to the present Swedish Reindeer Husbandry Act (SFS 1971:437), the County Administrative Boards (CABs) are responsible for determining the highest number of reindeer for each district. Unlike in Finland and Norway, processes for deciding reindeer numbers are rather rare governing interventions and the public discussion on maximum number of reindeer is less intense. The debates on "overgrazing" and "too many reindeer" on sensitive mountain (summer) pastures peaked in the 1990s, resulting, e.g., in changes in the legislation with demands for environmental consideration (Swedish Government Proposition 1995/96:226; Reindeer Husbandry Act §65a). Studies claiming overgrazing in specific areas were also contested and proved to be more of a local problem caused by limiting the natural movement of

reindeer by erecting fences (Moen & Danell 2003). This, together with research showing that reindeer grazing had no consistent negative effects on mountain vegetation (Olofsson et al. 2001), put the overgrazing issue on the back burner in Sweden. However, proposals to limit numbers keep resurfacing, while perhaps under more restricted circumstances. Accordingly, maximum numbers are treated more flexibly in Sweden, compared to Finland and Norway, typically serving as a reference rather than an absolute limit (e.g., SOU 2001:101, p.318).

Objectives

Governance approaches pertaining to maximum reindeer numbers differ between the three countries. Here, we highlight different governance challenges and opportunities in the different national contexts: herders' opportunities to participate in decision making on maximum numbers (Finland), clashes between scientific and reindeer herders' knowledge systems (Norway) and flexibility of state-based governance to define and enforce maximum numbers (Sweden).

Background

State policies and regulations for setting a maximum number of reindeer have been influenced by many different objectives. First – especially in Finland and Norway – ecological sustainability has been and is a key objective for regulating herd sizes, operationalized by the concept of carrying capacity. However, framing the criteria for ecologically sustainable herd sizes and use of pastures are a complex and contested process (Chapter 8). Second, since the 1960s and 1970s the objective has been to rationalize reindeer husbandry across Fennoscandia. In Sweden, policies typically favoured owners of large herds and embedded herding in an economic, rather than cultural, paradigm. In Norway, the rationalization policies promoted standardized herd structures and slaughter strategies and optimal reindeer numbers (Paine 1994). In Finland, EU membership since 1995 has directed the nature of reindeer husbandry towards larger herds and more meat production. In Sweden, EU membership has had less impact, and Norway is not an EU member. Third, during the past century across Fennoscandia there has been an objective to control the potential harm caused by reindeer grazing to forestry and agriculture by regulating numbers. However, the situation has moved towards increased recognition of herders' needs and impacts of other land uses on pastures. In Finland, the state forestry enterprise Metsähallitus has improved its practices in this regard. In Sweden, consultations between forestry actors and reindeer herders have a long history but today are mainly guided by market-based governance through Forest Stewardship Council (FSC) certification. However, discrepancies between herders' concerns and other actors' views on reindeer numbers remain. Controlling numbers is still often perceived by state officials as a measure to handle conflicts between reindeer husbandry and other land uses, including forestry, urbanization, mining, predator conservation and renewable energies. Table 9.1 outlines basic information regarding the maximum number of reindeer in the three countries.

Table 9.1 Background for understanding governance of maximum numbers of reindeer in the three countries

Issue	*Finland*	*Norway*	*Sweden*
Who regulates the number of reindeer?	Ministry of Agriculture and Forestry (MAF) sets the numbers for each district and owner in ten-year intervals based on propositions from working groups established by the Ministry.	The reindeer herding districts make proposals and the Reindeer Husbandry Board decides on the maximum reindeer numbers for the districts. If the district complains, the Ministry for Agriculture and Food makes a final decision.	County Administrative Boards (CABs) are responsible for determining the highest number of reindeer for each district.
Rationale for setting maximum reindeer by state-based actors.	"Reindeer grazing should not exceed the sustainable production capacity of winter pastures" (Reindeer Husbandry Act 848/1990; 21 §).	Ecologically sustainable reindeer husbandry, which is understood as a herd size adjusted to available pastures (§60).	Has differed over time. Long-term conservation of grazing resources is the key objective (Reindeer Husbandry Act § 65a), while the impacts of other land uses on pastures are increasingly recognized as important factors to consider (1971:51; SOU 2001:101).
Methods of evaluation/ monitoring.	Inventories every ten years evaluating quantity and quality of ground and arboreal lichen ranges and extent of other land use forms; annual reindeer counts.	Annual reindeer counts and counting inspections; statistics on production.	Annual reindeer counts regulated in the Sámi Parliament ordinances (STFS 2007:2). CABs can inspect the counts.
Actors in setting the max numbers.	(In the latest process) Working group consisting of representatives of MAF, Reindeer Herders' Association, regional authorities, ENGOs, Sámi Parliament, research institute	The herding district boards propose a number; the Reindeer Husbandry Board either approves the number proposed or rejects it and decides an upper reindeer number which it believes to be more sustainable.	Routines differ between CABs in how herders and others are included. Districts are always heard. There are also formalized reindeer husbandry delegations belonging to the northern CABs where general and

(*continued*)

Table 9.1 Cont.

Issue	*Finland*	*Norway*	*Sweden*
	LUKE, state-owned forestry enterprise Metsähallitus and representative of herders.		regional issues concerning herding are discussed but inclusion in decision-making processes varies.
Herders' opportunities to participate.	In the latest process, Reindeer Herders' Association and Sámi Parliament are represented in the working group. A leader of each reindeer herding district called for hearing of the working group.	Herders participate through the reindeer herding district boards.	Herding districts are heard and can appeal decisions. Herders/herding representatives may also be appointed expert investigators in decision processes, but this not formally required and varies from case to case.
Access to state subsidies.	EU subsidies for reindeer owners with 80 or more animals.	Districts with reindeer numbers within the limit and that meet the production criteria to get access to state subsidies.	None related to reindeer numbers.
Sanctions if the maximum number is exceeded.	The regional State Administrative Agency can set a penalty to enforce a reduction in reindeer to the allowed number. Also state subsidies can be cancelled, and sometimes state-forced slaughters may be applied.	Districts with too many reindeer are not granted subsidies. Districts and individual herders can be fined, and the authorities can decide forced slaughter.	While only used occasionally, the CABs can demand reduction of reindeer numbers by issuing injunctions should numbers repeatedly exceed the set limit. They may also impose fines on the districts if demands are not followed.

Three case studies: Examples of different governance practices

Latest process to set maximum permitted number of reindeer in Finland

During the 1980s, reindeer numbers exceeded the maximum allowed in several districts. This was mainly due to favourable winters, but also due to changes in herding practices (calf-slaughter, supplementary feeding and treating parasites).

All these changes led to smaller than typical annual reindeer losses. The deteriorating conditions of the lichen pastures, however, raised more and more concerns, especially when some northern districts simultaneously experienced high reindeer losses due to harsh winters in the late 1980s. In addition, market disturbances and a deteriorating image and demand for reindeer meat due to the 1986 Chernobyl nuclear accident resulted in "too many" reindeer. This led to decreasing numbers of slaughtered reindeer and an increase in herd size. However, despite these complexities, a general conclusion of the reindeer husbandry authorities and researchers at that time was that winter pastures could not sustain the then high number of reindeer. This resulted in a reduction of the maximum number by 25,000 to 203,700 in 2000. In 1990–1991, the set maximum was 228,900, and in the same year the actual number reached 259,611.

In 2018, after keeping the maximum numbers unchanged for 20 years (2000–2020), the MAF started a process to determine the maximum numbers for the years 2020–2030 and set up a working group to prepare a proposal. The 13 members of the reindeer numbers working group (including permanent experts and secretaries) consisted of members of the Reindeer Herders' Association and the Sámi Parliament, and a leader of one Sámi reindeer herding district. Other permanent members were a reindeer researcher from the Natural Resources Institute (LUKE) and members of The Finnish Association for Nature Conservation, Metsähallitus, and The Central Union of Agricultural Producers and Forest Owners (MTK). During the working process, leaders of each reindeer herding district (54 in total) were invited to present their own herding system, suggest a suitable maximum number for their district and give other feedback.

The MAF decided, in accordance with the working group's recommendations, that the maximum number of reindeer in each district basically remains the same as before, but the allowed maximum number of reindeer owned by a single herder be increased to 500. This maximum number for one herder is already in use in the 20 northernmost districts (specific reindeer herding area including Sámi Homeland) but is now applied to all reindeer herding districts. In addition, districts were asked to prepare Pasture Management Plans for the next period, 2022–2030, aimed at reducing grazing pressure on winter pastures.

The final recommendations of the working group were based on scientific and herders' knowledge. However, the justification for the proposal was mainly based on scientific input about winter pastures. The reason for focusing on the state of winter pastures is based on the Reindeer Husbandry Act. However, a synthesis produced by a research group led by LUKE and funded by the MAF shows that it is problematic to regulate maximum reindeer numbers purely on carrying capacity of winter pastures. Both scientists and herders emphasized that the issue is much more complex than simple carrying capacity for at least three reasons: (1) there is no simple shared idea of carrying capacity (sustainable production capacity of winter pastures); (2) following the law would

result in absurd situations (especially in southern districts with widespread supplementary feeding); (3) the law does not recognize the effects of other land uses on winter pastures (and thus is in conflict with laws covering reindeer husbandry). Furthermore, herders were not against "empirical, objective and unbiased" scientific information, and appreciated scientific knowledge (even economic-ecological modelling). However, even though herders were heard in the process, we highlight the need to recognize and include herders' knowledge more fully when specifying reindeer numbers. This is because the economic and social factors of reindeer herding, as well as the effects of other land uses on pastures, need to be considered, along with the status of pastures during other seasons (Pekkarinen et al. 2015). In conclusion, the interactions between different land uses, predation, climate change and herding practices (e.g., supplementary feeding) point to complex relationships between reindeer numbers and pasture conditions, bringing into question the use of reductionist logic to determine appropriate numbers.

Norway: Models and indicators for 'rationalizing' reindeer herding

For more than a century, Norwegian government officials have been concerned about "too many reindeer" and "too many herders", especially in West Finnmark, their largest reindeer herding region. In the official view, too many reindeer will lead to overgrazing and degradation of the tundra, and too many herders will jeopardize the economic viability of reindeer husbandry in the north (LMD 2018). This understanding has its background in the rationalization programme introduced in the 1970s with the objective of transforming Sámi reindeer husbandry into a more economically efficient industry (Paine 1994).

To achieve more effective decision making, the Reindeer Husbandry Act of 2007 gives more responsibility to herders in assessing the number of reindeer that could graze the herding districts' pastures and, in cases where the herd sizes are too large, developing reduction plans. In 2008, the Ministry of Agriculture and Food (LMD) established a working group with the mandate to develop criteria and norms for determining sustainable reindeer numbers. The group, which consisted of herders, scientists and government officials, defined indicators that were 'simple, objective and verifiable', such as carcass weights and meat production volumes. In addition, the group described more subjective indicators based on traditional knowledge of the reindeer's well-being, such as the morphology of the antlers and body and the quality of the coat (LMD 2008a). However, in the final *Guidelines for setting ecologically sustainable reindeer numbers*, no traditional knowledge indicators were included (LMD 2008b).

During 2009 and 2010, the herding districts developed proposals for maximum reindeer numbers and reduction plans. The proposals were submitted to the national RHB, which made final decisions on maximum numbers. The first four proposals were approved at the end of 2010, but the LMD overruled the decisions of the RHB and argued that the proposed maximum reindeer numbers would not ensure sustainable herding practices (Johnsen 2016).

The national reindeer husbandry administration developed new guidelines, and the RHB used these to specify new maximum herd sizes. The herding districts were not aware of the new guidelines, but they observed that the new numbers were not consistent with the criteria and norms identified by the working group. As a consequence of the new level, the herding districts in West Finnmark had to reduce their herds by an average of approximately 30%, a reduction twice as large as that originally proposed by the herding districts (Johnsen 2016).

The final decisions on maximum numbers emphasized mathematical models for calculating correlations between reindeer meat production, animal numbers and densities of reindeer. However, these are models based on simplified and generalized versions of reality and do not include the herders' complex, situated and local knowledge of reindeer and pastures, and may even undermine it. The models do not take local differences such as herding practices, geography and disturbances (e.g., predators or human activities) into account.

Sweden: maximum number of reindeer as a flexible governance tool

In Sweden, the process of deciding the highest number of reindeer remains largely unclear. Decisions should be informed by the ecological status of pastures, consideration of 'other interests' and land users, as well as animal welfare (§15, prop. 1971, p. 51; prop. 1992/93:32, SOU 2001, p. 101). Grazing inventories (at district level) alongside previously documented numbers of reindeer (actual presence and historically determined) are recognized as carrying particular weight. However, updated grazing inventories are often lacking and the methods for inventorying are contested. Furthermore, how 'consideration of other interests' (§15) should actually affect decisions about maximum number of reindeer is unclear in several respects: first, what interests this actually refers to (e.g., those not regulated through other legislation such as forestry) and second, to what degree and how different types of consideration are to be weighed against one another (e.g., SOU 2001; Brännström 2017). The consideration criteria, therefore, seem to carry less weight in practice compared to other criteria when determining reindeer numbers. While it is natural to think of limits to reindeer numbers as a restricting governing instrument, it could potentially function as an instrument to *protect* herding districts vis-à-vis encroachment from other actors and interests. For example, the Swedish legislation specifies that the maximum numbers must not be compromised or lowered as a consequence of the actions of competing land users (see, e.g., the §21 in the Forestry Act). That is, felling trees or developing a mine is not considered sufficient reason to reduce numbers. The potential strength as active protection, however, remains untested. The argument has never been used effectively to stop extensive forest felling (SOU 2001, p. 101; Brännström 2017) and other actors, such as mining companies, seem completely unaware of this logic and have openly suggested reducing reindeer numbers as an "adaptation" to proposed mining interventions (Raitio et al. 2020).

The CABs have the opportunity to enforce maximum numbers by issuing injunctions (*föreläggande*) or fines, should the total number of reindeer within a district repeatedly exceed the limit (§15), but this is only rarely used. For example, in Västerbotten county, only one injunction has been issued since their introduction in 1993 (pers. comm. with CAB official). However, there are large differences over time and regions and the use of injunctions may vary between CABs.

As a recent example, in 2017, Västerbotten county determined new maximum numbers for its seven herding districts. The formal maximum numbers had remained constant for over 70 years (since 1945–1946, set by the so-called Lapp administration). Changes were suggested in 1966 after surveying the status of reindeer grazing areas but were not implemented. The discussion resurfaced again in the 1990s after herd sizes increased.

It was not, however, until 2002 when Västerbotten CAB formally decided to revisit the maximum numbers. A so-called reindeer number group was established, consisting of active herders and elders from some of the herding districts concerned. After consulting the herding districts, the group recommended increasing the maximum numbers for all districts except for one, based largely on the herders' own assessment of available pastures and strategies (Idivuoma 2015). However, due to uncertainties regarding administrative borders and overlapping pastures between districts, the proposal was overruled by the administrative court in 2003, demanding that borders were first settled. The CAB, in the meantime, made an interim decision to go with the highest number of suggested reindeer for each district (whether based on the old ordinance from 1945 or the suggestion by the reindeer number group). The borders were finally settled in 2015 after responsibility for determining them had been transferred from the CABs to the Sámi parliament in 2007 and after another round of appeals (one district had, e.g., not been able to participate fully in the process).

In the meantime, a special investigator, a knowledgeable herder from a different region, was appointed by the CAB to provide input for determining new reindeer numbers (Idivuoma 2015). The new investigation generally took the earlier reindeer number group's suggestion at face value and suggested maintaining or increasing maximum numbers, with one exception. The newly settled borders meant that one district lost important winter pastures, which resulted in a recommendation to substantially reduce the maximum numbers there. The CAB's decision, based on the inquiry's recommendations, was again appealed by two of the districts (both arguing that the districts, not the CAB, should have the decision-making power over numbers). The appeals were turned down and the new limits finally came into force in 2017, 15 years after the process was initiated.

This example, despite regional variations, demonstrates some general characteristics. First, the tool in itself is used infrequently and can involve a lengthy bureaucratic process. Second, the process can be undertaken in different ways with varying degrees of participation and recognition of the district's views

and practice-based expertise. It *can* be quite inclusive, as this example suggests, but this is not required and, therefore, rather depends on the CAB in question. Third, while the legal basis for determining maximum numbers comes across as hierarchical and controlling, the actual praxis seems to allow more flexibility and recognizes uncertainties in the legal history, resulting in perceived difficulties in determining fixed limits. The authorities thus approach it as a reference value rather than an absolute limit (SOU 2001). If neighbouring districts or other land users complain, intervention may be warranted. Finally, the example demonstrates how reindeer numbers strongly depend on other factors, in this case, borders and access to winter pastures. Together, this explains why many CABs hesitate about the degree to which the governing tool can actually be used and enforced.

Discussion

Though the cases presented above do not allow a robust comparison of specific aspects, they each highlight themes relevant for the governance of reindeer numbers: (i) participation of herders in decision making, (ii) unequal treatment of herders' practice-based knowledge and knowledge relying on optimization and rationalization using simplified scientific models and indicators and (iii) flexibility of governance.

Participation

In Finland, the suggestion was made 30 years ago (MAF 1988) to decentralize governance and give more decision-making power to the herding districts. However, even today, issues of participation are contested. It is likely that this is due to tensions between the fear by some decision makers and scientists of overgrazing and increased recognition that external factors also impact pasture conditions. The Norwegian case illustrates that even when herders were represented in the working group, there was no guarantee of inclusive and transparent decision making. The case from Sweden illustrates that herders can be involved as experts, owners *and* facilitators of knowledge coproduction, which is quite different from Norway's use of mathematical models of carrying capacity. Nevertheless, in all countries, the perception is that reindeer numbers have to be controlled externally.

Knowledge systems

Decision making for rationalizing reindeer husbandry often prioritizes natural science knowledge over reindeer herders' practice- and experience-based knowledge. In Norway's decision making, scientific knowledge is considered objective and superior to the herders' knowledge, which is seen as subjective and biased (Benjaminsen et al. 2015; Johnsen et al. 2017; Marin et al. 2020). In Finland, the legal focus on carrying capacity of winter pastures requires scientific

inventories quantifying their state, especially the condition of lichen grounds. The resulting natural science knowledge has a strong role in discussions about reindeer numbers. However, this is problematic as considerable areas with terrestrial or arboreal lichen have been lost, mainly due to activities like forestry, in most districts, and there is extensive supplementary feeding. Furthermore, recently it has become increasingly clear that defining a single constant 'optimal' maximum number of reindeer is very difficult due to ecological, but also economic, sociocultural and other contextual complexities. This realization has focused increased attention on herders' knowledge to inform the discussions. In the Swedish case, the herders' expertise and knowledge system was given a major role in determining new numbers. However, herders still complain that decision-making power lies in the hands of the CABs and not the districts themselves.

Formal recognition by state-based actors of other actors' impacts on grazing conditions varies between countries. In Finland, such recognition is increasing, in Norway the authorities are starting to acknowledge the need to protect reindeer pastures from encroachment, and in Sweden the formal recognition of influence of other land users on pasture condition is strong, yet tools to deal with this in practice are still lacking.

Flexibility

The cases demonstrate both different degrees of rigidity in governing approaches and opportunities for increased flexibility by strengthening aspects of self-governance. Borders, between countries and herding districts, are of central importance in understanding how reindeer numbers are directly and indirectly decided, and enacted. Drawing and closing national borders have been central in the governing of reindeer husbandry since the late 1800s (Lantto 2000). In the Swedish case, while maximum numbers were considered more flexibly than elsewhere, the perceived need and act of defining fixed borders turned out to be the single most important factor affecting the actual 'flexibility' of maximum numbers. In Finland, it was proposed that reindeer densities could be higher in areas with significant meat production, where the number of reindeer owners compared to the number of reindeer is large and where an increase in reindeer numbers does not compromise carrying capacity. Also in Finland, the proposed Pasture Management Plans are a solution to ensure sustainability in a context where the maximum number of reindeer was not changed compared to the previous numbers, over a 10-year time frame. Herders can choose between two out of five options to enhance sustainable use of pastures: (1) reduce the number of reindeer by 7% from the maximum, (2) early slaughter to reduce pressure on winter pastures, (3) further enhancing pasture rotation practices, (4) summer grazing practices to enhance biodiversity values and (5) increasing collaboration between separate herding districts. In Norway, a key issue concerning flexibility is how the indicators and norms used for setting maximum reindeer numbers are the same irrespective of where the district is located in the country and the types of pastures/ecosystems present.

Table 9.2 Key questions on governing the maximum number of reindeer

- How can participation and flexibility be enhanced in decision making concerning reindeer numbers?
- How can herders' experience-based knowledge and Sámi worldviews be included in the governance of reindeer numbers?
- Is there a need to change laws governing maximum numbers of reindeer to increase flexibility to adapt to changing situations and to enhance opportunities for participation of reindeer herders?
- What are the alternatives to the idea of carrying capacity of (winter) pastures upon which to ground decisions about maximum number of reindeer?
- How can scientific knowledge and herders' knowledge be integrated in a mutually constructive way for developing integrated knowledge systems leading to balanced decisions on maximum number of reindeer?
- How do seasonal migration, pasture rotation, use of supplementary feeding and timing of slaughter affect grazing pressures and thereby need to inform decisions on maximum number of reindeer?
- How can impacts of other land users on pasture condition and availability be recognized when defining maximum number of reindeer?

Conclusion

Our analysis and comparison of the cases highlight issues regarding setting maximum reindeer numbers by state-based governance. In particular, further research is needed on how to enhance participation and flexibility, and to find effective ways to integrate herders' knowledge systems into state-based governance. Importantly, more holistic landscape approaches are needed, taking multiple actors, pressures and alternatives into account. Accordingly, we have formulated a number of questions (Table 9.2) that we advise all involved to consider before embarking on new policy processes determining reindeer numbers.

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