# Sustaining Sámi Reindeer Management in Northern Fennoscandia

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**Abstract**
Sámi reindeer management (SRM) has a long history in Northern Fennoscandia. The Sámi have developed a culture and a land-use pattern adapted to the reindeer's requirements through an annual cycle of pasturing, calving, rutting, and other requirements. However, this order has been distorted by effects of national border establishments between Norway-Sweden (1751), Finland-Sweden (1809) and Norway-Russia (1826), complete border closures in the late 19th century followed by gradual and partial closures through the 20th century. Further, neighbouring people have, in several waves of agricultural settlements, established themselves as strong competitors for SRM land. In modern time, encroachments and conversion of land to technical and other use have been, and still is, exerting a serious pressure on land-use having potential of causing fragmentation of the pasture areas and marginalisation of this indigenous core livelihood.

Today preservation of biodiversity is considered a major challenge worldwide. In Europe much attention is connected to the species of open and semi-open landscape. There are clear indications that co-operative grazing systems (CLSs) could be important in the promotion of biodiversity. SRM is one of CLSs studied in the EU-project Landscape Development, Biodiversity and Co-operative Livestock Systems in Europe (LACOPE). However, to play this role requires that SRM be sustained as a livelihood. Accordingly, an analysis of the current variety of socio-economic and ecological adaptations of SRM in Northern Fennoscandia is interesting in a biodiversity policy context. We explore a bundle of SRM adaptations and whether different changes can contribute to the improvement of their sustainability.

## Introduction

Traditional Sámiland, Sapmi and whole Fennoscandia are very heterogeneous landscapes. Much due to the main mountain ridge (The Keel) — constituting the border area between Norway and Sweden — altitude is to a great extent ecologically equivalent to latitude. Thus, migrating from a forested valley to naked mountains is similar to a movement from tundra to taiga. Most of Sapmi is situated on the Fennoscandia bedrock shield, which is covered by glacial sediments. Moraines and rolling stone hills, forests and shrubs, mires, and numerous lakes and ponds cover much of the landscape. Finnmarksvidda and adjacent inland areas comprise a low undulating plateau of low mountains, birch-covered hills, low pine forest, and open lichen land. The reindeer belongs to the alpine and the northern boreal zone. The latter is dominated by spruce forest - when moisture is sufficient- or pines at drier and poorer ground. The alpine zone is dominated by heather, dwarf birch and willow thickets in the lower sub-zone and with grasses and snow beds in the medium subzone. A general overview of the nature geography of Fennoscandia is provided in Figure 1.

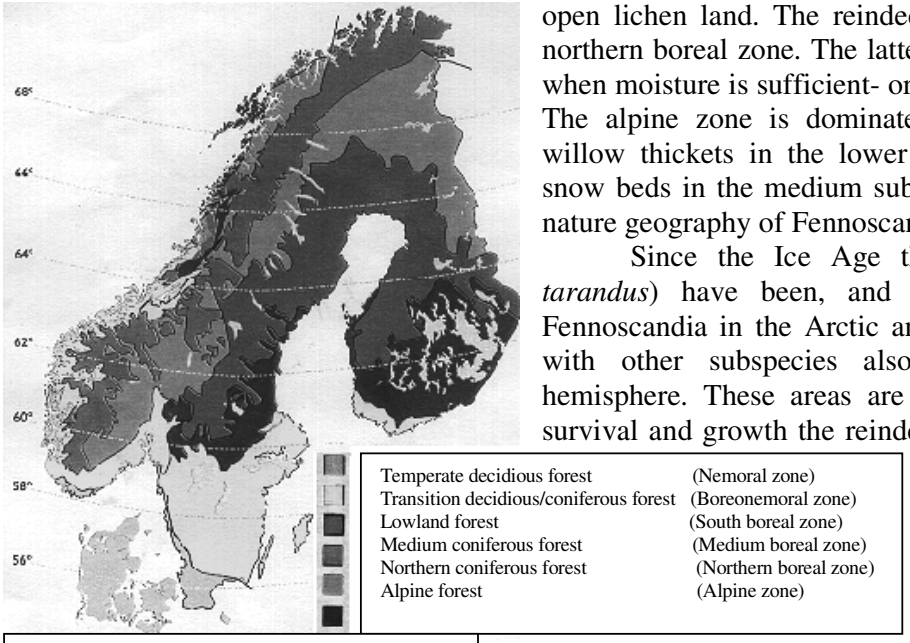


Figure 1. Nature Vegetation Regions of Fennoscandia. *Source NUB, 1977:34, cf. Gaare, 1997b.*

Since the Ice Age the reindeer (*Rangifer tarandus tarandus*) have been, and still is a dominant grazer in Fennoscandia in the Arctic and Sub-arctic zones and together with other subspecies also around the whole Northern hemisphere. These areas are harsh and marginal and for its survival and growth the reindeer is dependent on pasturing the most nutritious plants for each respective season. In spring, summer and fall grasses, herbs and leafs rich in protein, vitamins and minerals constitute

the main diet of the reindeer. The plants are most nutritious in an early growth stage. Consequently, the reindeer pasturing follows the process of snow melting and the growth of the first sprouts upwards in the landscape as the growth season proceeds.

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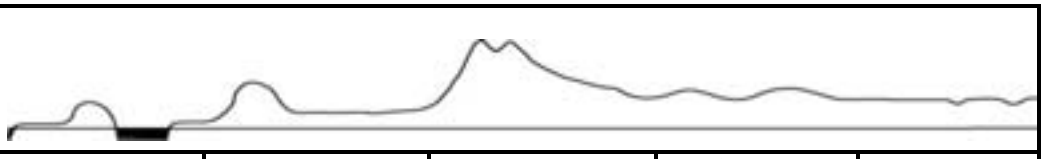
|---|---|---|---|---|---|
| **Landscape** |  | | | | |
| | Coastal zone | Fjord zone | Mountain range | Continental plateau | Continental forests |
| **Climate** | Mild winters/cool summers. Moderate annual precipitation. Moderate amounts of snow in winter | Mild winters/hot summers. High annual precipitation – much of it as winter snow | Cold winters/cold summers. High annual precipitation, heavy snow cover during winter | Cold winters/hot summers. Moderate annual precipitation and moderate to low amounts of snow in winter | Cold winters/hot summers. Low annual precipitation with small amounts of snow. Dry snow conditions. |
| **Vegetation types** | Sea shore vegetations, bogs/mires, coastal heaths, mountain vegetations with vertical distribution mainly in low- and mid-alpine belt. | Deciduous forests (birch/grey alder), Pine forests in valley floors, mires, heather vegetations, seashore marshes, mountain vegetations – low- to mid-alpine. | Mountain vegetations with vertical distribution from – low- to high-alpine belt, mountain mires, shrub vegetations, grass heaths and snowbed communities | Lichen heaths and lichen birch woodlands , grass heaths, mires and wetlands | Pine forests, mixed forests with pine/spruce and birch, mires and wetlands. Forest vegetation often rich in lichen. |
| **Grazing adaptations and treath's** | Summer and year-around grazings. In general limited agricultural activity. Roads, local industry, tourism, wind-mill parks. | Summer grazings/migration routes/calving land. Agricultural activity, forestry, settlements, roads/ infra-structure, local industry, tourism, military restrictions | Summer grazings/migration routes/calving lands. Hydro-power industry, mining, tourism, military restrictions, beast of pray | Winter, spring/fall grazings/migration routes. Tourism, protected areas, | Winter and year-around grazings. Forestry, tourism, protected areas, roads and infrastructure. |

*Figure 2. West to east cross-section summarizing the variations within the northern Fennoscandian reindeer range system. The figure summarizes the landscape formations, climate, dominating vegetation, types and pastoral adaptations and predominating disturbances in different regions.*

In the fall the animals start descending search for mushrooms and pasturing plants in forests, fens and low alpine areas. The reindeer pasture very scattered in this period, as single animals or in small groups. In September, when rutting time is approaching, the animals again gather into bigger flocks. The fall is important for rebuilding after heat and insect nuisance in summer. During the whole green vegetation period the reindeer builds up nutrient reserves for winter. During winter the main diet is lichens, which is a survival fodder rich in carbohydrates, but low in protein and minerals. The lichens are ground lichens, including several species of the genera *Cladina*, and arboreal lichens in coniferous forest. The ground lichens are covered by snow, and dug forward by the animals. In case of mighty snow cover, and even worse, ice-crust the reindeer can be obstructed from access to the lichen with starvation as a potential outcome.

Pasture choice and land use pattern vary through the year from forest and valley to mountain and tundra within the different seasonal areas. The reindeer requirements of different pasture areas imply a land demanding and extensive pasture form. The operation of reindeer requires adaptation to the reindeer needs of different pasture qualities through the year as well as animal needs of foraging calm. In all work with the reindeer it is essential to work with nature in relation to pasture needs, animal behaviour, topography, weather and conditions of passage. Topographical barriers as lakes, rivers and valleys constitute natural

borders governing animal movements within and between pasture areas. Figure 2 provides a cross-section of Sapmi (Scandinavia) with the Norwegian Sea/ the Polar Sea in East and North and the Bothnian Sea in the East (and South). The main migration direction of Sapmi is thus between the coast and along the major river valleys in direction from (North) West towards (South) East.

The mountain ridge, constituting the Norwegian-Swedish Border Mountains, the Keel (Kjølen) as well as the Finnmark coastal mountains, has nutritious and easy weathering Cambric-Silurian bedrock, providing rich soils and vegetation creating meadows sand snow beds are the best summer pastures. The inland East of the mountains lies on poor acidic bedrock. The undulating tundra constitutes a mosaic of lichen heather, twig heather and bogs. In the continental tundra and pine forests the snow cover is light and dry an easily accessible for reindeer. Low alpine areas, often as land tongues East of the mountain ridge, provide calving areas in the spring and also fall pastures.

The area is characterized by a sharp gradient in climate and grazing conditions, created by the high mountains. Their western slopes and summits are strongly influenced by the wet Atlantic climate. Precipitation is high and comes primarily as snow in winter. These conditions create vegetation where dwarf shrubs, mosses and grasses predominate. Reindeer can graze the western habitats in summer but in winter, the reindeer have no access to the vegetation, due to the thick snow cover. Moreover, this kind of vegetation provides little winter food anyway, because grasses and forbs wither and woody plants are inedible for reindeer. Grazing and trampling normally leads to increased abundance of grasses and forbs in these areas, creating the possibility for positive feedbacks between grazing and productivity.

Entirely different conditions prevail on the leeward slopes of the mountains and on the extensive Precambrian plateau east of the mountain chain. Here, climate is dry and precipitation comes primarily as rain in summer. Winters are cold and snow cover is thin. The climate favors terricolous lichens, which absorb rainwater and fog with their spongy thalli before the water has reached the ground. Extensive lichen heaths, providing lots of winter food for reindeer if properly used, thus characterize the area. The thin, powdery snow typical for the area makes winter grazing easy. However, the lichens are extremely brittle during dry summer days. Thus, even low numbers of reindeer can destroy the lichen cover if they are present in the area under summer conditions. The area is also characterized by intense mosquito plague, which makes the problem worse. To keep mosquitoes away from their noses, reindeer move continuously search for exposed, windy places, which often leads them to the sparse pine dominated upland forests in the southern part of the area and to tundra hills in the north. Both mobility and habitat selection thus tend to increase the damage on lichen grounds.

**Biodiversity and grazing**

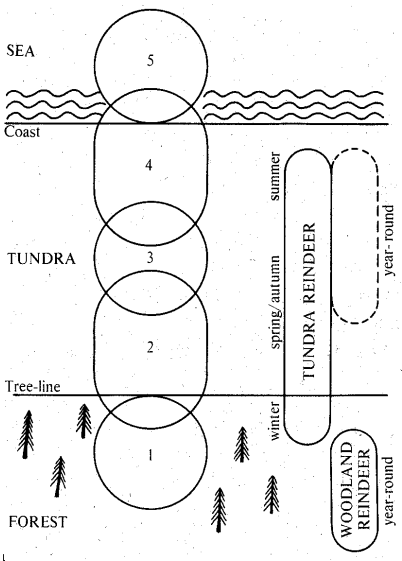
In general terms the tundra remains tundra regardless of reindeer grazing. However, there is quite a broad zone, which can be closed birch forest without grazing, half-open when grazed moderately and a kind of ’birch savanna’ (open and tundra-like, with birches just in spots inaccessible to grazers) if grazed intensely. This zone is about 300 m wide vertically, embracing e.g. a large part of Seiland, so it is not a minor part of the landscape (see Oksanen et al. 1995). With narrow definition of habitat, all habitat types change a good deal if not grazed at all. As some of the grazing is due to lemmings and voles, grazing would not disappear if reindeer were removed, but a comparison of both sides along a reindeer fence suffices to show that habitats change when grazed or left ungrazed by reindeer. Intense grazing contributes to maintain what Zimov (1995) calls the ’steppe stage’ of the tundra (more palatable graminoids, less mosses, less ericoids [in Fennoscandia] and/or unpalatable

tussock graminoids [in Beringia]. (See Olafsson at al. 2001, Olafsson & Oksanen 2002, Olafsson et al 2004).

The plant target species are rare arctic-alpine plants which grow on calcareous soils. Their distribution (and rarity) is connected to the occurrence of these soils above the timberline. Grazing-caused erosion creates more habitat for rarities by spreading the lime and nutrient-rich material of the dolomite rocks to wider areas. Furthermore, these plants rely on local disturbances for successful reproduction. Grazing is a major source of disturbance and might therefore necessary for plant reproduction. Moreover, the rarities tend to be small, and even species with relatively tall inflorescences (such as *Armeria scabra, Ranunculus sulphuraeus, Arnica angustifolia*) have most of their leaves close to the ground and are thus vulnerable to competition. By keeping taller plants (=superior competitors) like *Trollius europaeus* and *Geranium sylvaticum* in low densities, grazing extends the potential habitat of the rarities to lower altitudes (where they could otherwise only grow on lock faces, loose scree and other naturally stressful or disturbed habitats). The wider habitat amplitude created by grazing influences metapopulation dynamics: more suitable habitat means lower risk of local extinction plus shorter dispersal distances and higher propagule production, increasing the recolonization rate of habitat patches, from where a local population has gone extinct (Fülling & al. 2004).

**Adaptations of Sámi reindeer management**

This landscape can, however, be utilized by different pastoral adaptations, cf. Figure 3 which provides a general circum polar pattern providing the ecological zones not taking into consideration elevation.




*Reindeer subsistence cycles*: (1) a year-round woodland adaptation, (2) a forest- tundra adaptation, (3) an exclusive tundra adaptation, (4) a coast-tundra adaptation and (5) maritime settlements. Possible pastoral adaptations are depicted on the right-hand-side of the figure.

*Figure 3. (Sub)Arctic subsistence cycles.* Source: Ingold, 1980:13

In our LACOPE study area we have defined the current adaptations (a) *full migration*, (b) *year-around-adaptation* and (c) *shortened migration.* (a)The full migration adaptation is based on two annual migrations of several hundred kilometres between two geographically distinctly different summer and winter pasture areas. In the figure the full migration is called tundra reindeer. It is based on a long migration between the Keel Mountains and Eastern coniferous forests (Sweden) or Western coastal mountains and inland tundra (Finnmark). (b) The year-around adaptation, based on short migrations within the same local area, has two variants: Western *coastal* variant and Eastern *woodland* variant. In the coastal variant (Norway) the reindeer find winter fodder in snow free areas near the sea or suboseanic lichen pastures West of the mountain ridge. In the woodland variant (Sweden and Finland) the summer pastures are mire areas within the woodland region. (c)The shortened migration adaptation is an in-between compromise of the (a) and (b) extremes. It includes a variant with use of tundra or low alpine areas for summer pastures.

**Pasture problems**

Broadly we may distinguish between two sets of forage problems; those having *external* and *internal* reasons respectively. As for the external part, historically agricultural settlements

from non-Sámi intruders have played a major role in displacing reindeer herders from their traditional land.

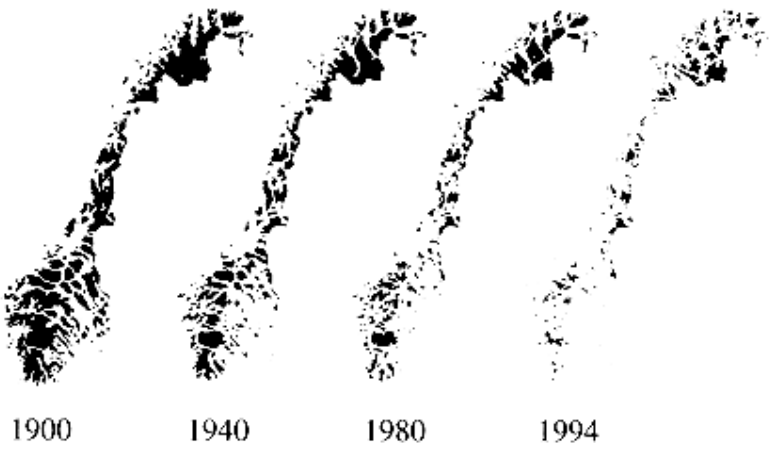



*Figure 4.Fragmentation. Land area more than 5km from roads. Source: GRID-Arendal (1996) in Norwegian Reindeer Husbandry Administration (1998).*

The keyword best characterizing the transformation of natural landscapes in Sámi reindeer management areas as in the citation is *fragmentation*. A good illustration of that is the time series map of Norway, cf. Figure 4, showing the gradual reduction of area 5 km or more from roads during the 20th century. We may conjecture that this development pattern broadly corresponds to the general trend for Sámi reindeer management areas. The reason is that after the industrial revolution gradually more land has been irreversibly transformed from natural state to development, technical and industrial use. This transformation has increased speed by time, particularly after World War II, including railways, roads, mines, hydroelectric power regulation, modern forestry (particularly in Sweden and Finland), and modern tourism development. The effects can be characterized as e.g.:

> *"The more the land is cut up and criss-crossed by the railway and road networks, and the more grazing lands are cut up into an uneven patchwork by the timber industry, the more difficult it becomes to stabilize the reindeer's movement* (Beach 1981:52):"

It is self-evident that this process must heavily increase the external pressure on reindeer management, with roads providing access to "the wilderness" for a series of disturbing activity. Beach's main point in the quotation above is that fragmentation destabilizes the reindeer's movement. One implication is that *it becomes more and more difficult to follow the naturally given annual migration cycle*. Modifications or extra use of technology becomes necessary.

One example, several herder districts in Norway, have legal rights, codified in the 1972 bilateral pasture convention, to winter pastures in the Swedish inland woods. Due to encroachments by hydroelectric power regulations many rivers cannot safely be used as migration routes. Further large-scale clear-cutting forestry removes old forest being the source of arboreal lichens, making artificial forage necessary. In practice, migration has to be conducted by trucks, at a high extra cost.

*The ultimate effect of fragmentation is marginalization of nature-based, including indigenous, livelihoods.* Thus the trend tends to be that either such types of livelihoods cannot be sustained at all, or the running cost will reduce its potential as a subsistence base for many people. Thus the trend tends to be that either such types of livelihoods cannot be sustained at all, or the running cost will reduce its potential as a subsistence base for many people. A report from United Nations development program (UNEP, 2001) indicates that in a number of

decades the sum-effect of all encroachments and disturbances tends to be so serious that to continue reindeer management may be difficult. This development has wide implications in a property rights perspective. Reindeer management has during the latest part of the 20th century established rights of compensation for encroachments. That is, the formal property rights are clearly stronger than in older times. However, as other indigenous peoples, the Sámi viewpoint is clear: Money cannot compensate the loss of land. The problem is that the long-term effect of encroachments and disturbances is undermining existing property rights, i.e. the property rights the Sámi herders have to their traditional land is too weak in practice.

The main internal problem is the danger of *overgrazing*. This danger is clearly greatest for the lichen pastures of winter, than for the green pastures used most of the year. The reason is that lichen pastures are far more vulnerable than green pastures, as lichens are fragile for trampling and also slow growing with an annual growth rate at about 10 % (cf. Gaare, 1999). Serious overgrazing may require up to 20-30 years of recovery time. On the contrary, green pastures can stand much heavier pasture utilization, though changes in vegetation to more productive and pasture tolerant species, e.g. from heather species to grass species, can be promoted (Olofsson, 2001). Moreover, mat-forming lichens will have their highest production level at an intermediate grazing intensity of winter pasturing. Accordingly, some rotation in winter pasture use between years is a favourable strategy, which also is a natural strategy for the animals (Skogland, 1993).

Historically the total herd size development of Sweden is a good example of a general basic pattern of herd pasture adaptation. Through the 20th century the total herd size has followed cycles with flattened tops and bottoms with 20 to 30 years between the tops with amplitudes around 30 % (SSR & al. 1999:16). This pattern can be explained by a combination of natural and social science explanations. The first sign of serious overgrazing is lowered birth and calf-survival rates. Second, a heavy grazing pressure depletes reserves for bad years due to between years climatic variability and the impact and frequency of bad years will increase with an overall impact of limiting stock before ultimate carrying capacity is reached. Third, the natural response of the animals when inadequate pasturage is to disperse in search for food, which makes it increasingly difficult for the herder to govern animals' movements, also limiting herd growth (Beach, 1981:46-48, Ingold 1976:31-32). Accordingly, there certainly are mechanisms that work to limit herd growth and keep the number of reindeer below ecological carrying capacity.

In the latest third of the 20th century these mechanisms have been seriously challenged by the strong force of *a revolution in herding and transportation technology*, i.e. animal and human muscle power have to a considerable degree been replaced by snowmobiles, ATVs, cars, trailers and to some extent also helicopters. One side of this is a drastic decrease in man-animal contact, but another is *an explosion in cost level*. Parallel to this was a process of integration of the herders into the surrounding society, which also implied a modern cost level for housing and a whole range of private and family activities. Accordingly, herder families could hardly resist being a part of the monetary based society. Moreover, the cost problem associated with new herding technology is to some extent also a *treadmill effect* (Riseth, 2000). The treadmill imposes everyone to follow the level of herding technology as the most advanced user not to loose in the competition for land and animals. Thus, the treadmill increases the minimum necessary herd size for everyone and creates a trend of shredding herders increasingly reducing reindeer management's potential as subsistence base, as also fragmentation does. In addition to external income as wage labor and subsidies there are, in principle, two distinct options: *herd increase* and *productivity increase* (herd structuring[1]). The first option is unproblematic as far as there is excess pasture, but will imply overgrazing

[1] including calf- slaughter

when deficit pasture resources. Herd structuring has the potential of increasing the output of meat per animal in the spring herd from 7-8 kg up to about 20 kg, with minor monetary costs. Most of this potential is realized in practice, i.e., in South Sámi reindeer management. However, in the LACOPE study area the productivity increase have so far been rather limited. Part of the explanation seems to be that influential groups of herders have been in the position to implement the other option, herd increase. Let us consider a bit the necessary requirements for this option and step back to the fundamentals.

From the general description (above) it is obvious that pasture in all seasons is essential for all reindeer management. The basic challenge is to avoid bottlenecks. In particular, it is fundamental to have a good balance between the main seasons, i.e. summer and winter pastures. In the case of *winter pasture limitation*[2] the resources set an absolute limit for the number of animals that can survive the winter, while the opposite case *summer pasture limitation* promotes relatively large but low-productive herds as winter survival is relatively high but the animals gets insufficient pasturage in summer to utilize fully their growth potential. There are indications that the pasture balance situation has major influence on contemporary herders choice set. This needs to be investigated systematically, but it is interesting to note that for Sweden the general picture seem to be that there are not major problems of overgrazing (SSR & al., 1999, Moen & Danell, 2003) while there are reports of clear overgrazing problems, both in Finland and Finnmark[3]

Let us briefly consider these general pictures. As for Sweden the reports focus the situation of summer pastures. However, in Sweden the extension of Sámi rights to winter pastures are currently under inquiry within a specific committee, and the situation at least seems to be that the winter pastures are more at stake than summer pastures. The hypothesis that reindeer management in Sweden generally is winter pasture limited could explain the conclusions stated above. In Finnmark, an increasing overgrazing first of fall, and later winter, lichen pastures have developed during the 1980s and 1990s (Johansen & Karlsen, 1998, 2002, Riseth 2000). The overgrazing is connected to a rise in herd size to a historically new level about the double level of earlier tops (Riseth, 2001). This may be explained by the combined situation of summer pasture limitation and insufficient natural or institutional borders (Riseth & al., 2004, cf. Riseth, 2000). More specific, the most expanding, both in herd size and extension of winter pasture area, siida-groups seem to be among those having the best opportunities of expansion due to landscape openness. The general pattern in Finland is that the vast majority of the pasture districts have a lower standing biomass of ground lichens than considered necessary for recovery. This can mainly be explained by overgrazing, but to some extent also by the use of off-road vehicles (Colpaert &al., 2003). In addition arboreal lichens are considerably reduced due to forestry practices. Herd size levels in Finland increased during from the mid-1970s to about 1990 to nearly the double level of the 1960s. The rise can be explained by a combination of favourable weather and snow conditions and changes in management practice, including supplementary feeding (Kumpula, 2001). We may state as a main pattern that contemporary reindeer management in Finland is free-coupled from the natural winter pasture limitation and sustain its current herd size on supplementary feeding. Accordingly, it seems that dependence on supplementary feeding and pressure from competing land-use prevents lowered reindeer densities and recovery of pastures (op.cit.:15).

These considerations are brief statements on main and over-all tendencies not giving concessions to regional and local variation providing a far more many-facetted pattern. Nevertheless, they may provide a basis for continued research, both locally, regionally and not least comparative approaches.

[2] lack of winter pastures , e.g. winter pastures being the limiting factor
[3] Norway

**Potential problems within the adaptations**

In addition to the general problems discussed here, the different adaptations within the LACOPE study area have to some extent their specific complexes of problems being variants of the general pattern. Let us consider each of the adaptations from this point of view.

The full migration adaptation is characterized with the long migrations between winter land in East and summer land in West and also the variant that best utilize the potential of the natural forage resources. The main problem for this variant seems to be its low intensive uses of large areas, in particular the areas in-between. Parts of these areas are used only for short time each year; some may only be used in bad years when there are specific problems on more intensively used areas. Much of these areas also fall into the sub-alpine forest zone or the low-alpine zone being popular for other types of land-use including recreational use as tourism, hunting, fishing, private cottages etc. The valleys also are traffic arteries and the main rivers and watercourses in Sweden and Finland are often utilized for hydro-electrical power. Winter pastures in the forests of both these countries are also often considerably reduced by the impact of forestry. In addition to this, a new challenge on summer pastures in the mountain ridge seem to be wind-power plants, which also is "clean" power and accordingly very popular. In sum, the main challenge within the full migration adaptation seems to be the ability to defend the necessary land towards external disturbances and encroachments.

Another problem within this adaptation is that the impact of the sedentarization process within the reindeer management society has established an increasing division between herd and family. The herders are mainly men whilst woman and children in school age live mainly in one settlement, often in the fall area and come for visits by the herd when needed or possible. This situation may give origin both to social and cultural problems. E.g. the women are often the mediators, and their presence can contribute to resolve internal conflicts. Further, it is more difficult for children to develop the cultural and practical competence of herding life and work by being geographically distant from the herd large parts of the year.

The year-around adaptation does not avoid the problem of encroachments and disturbances, but the districts' more concentrated and rounded geometric shape and the constant herder presence make the defence of established property rights. However, the relatively small areas may make the impact of tourists, hunters, etc. more serious if conflicts are not solved in beforehand. Another potential problem is related to this is it is that these areas are the most vulnerable for the effects of bad or unfavourable weather; due to the uniformity of the area reserve areas are often very limited or non-existent. This is of course worst for the coastal variant than the continental, which is more stable, however, climate change also have a negative impact on that.

The shortened migration adaptation may have elements of problems from both main options, but have as a specific problem that the natural potential is not fully utilized, e.g. for some of the Swedish districts that instead of using the best summer pastures on Norwegian islands and peninsulas have to utilize the second best option, drier areas in the inland, which naturally would belong to the fall pasture zone. This is a variant of the pasture balance problem introduced above, i.e. summer pasture limitation, which can contribute to large but low-productive herds.

**Possible solutions**

Supplementary feeding may seem as an excellent technical solution of winter pasture overgrazing problems, but as we may learn from the Finland situation, this option can be a trap, even a double trap. Firstly, regular supplementary moves the reindeer out of its ecological niche as picky feeder of scattered resources and into the niche of e.g. sheep, being

a much better utilizer of concentrated foods. Secondly, it is a cost trap making reindeer managers even more dependent of subsidies than before.

Summarizing the general problems we could trace much of origins back to (1) the encroachment/disturbance problem and (2) the pasture balance problem. If these problems were reduced, the magnitude of overgrazing problems also might be scaled down/ brought under better control. Both these problems have external reasons; (1) depend on the property rights situation and the general development of society's technical infrastructure while (2) in addition to nature conditions depend on national borders, border closures and bilateral conventions.

**Conclusion**

The magnitude of the contemporary problems seems considerable and not easy to solve, at least not in the short run. As for the property rights problem, there seem to be possible tracks for resolving them. On local level, the Sámi *verdde*-relation, which means co-operation between a herder family and a peasant or farmer family, and is well functioning at least many places in Sweden and Finland should be supported and developed to prevent conflicts and enhance co-operation. On society level, the international rights of indigenous people should be used to strengthen the property rights of reindeer management. As for the pasture balance problem, some of this might be reduced by reorganization of some of the trans-national reindeer management. However, this is a very demanding task involving three nation states and also the vested interests of herding districts that have adapted to the current pattern for several decades.

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