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Adapting to climate change in Sámi reindeer herding: the nation-state as problem and solution

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> We have some knowledge about how to live in a changing environment. The term 'stability' is a foreign word in our language. Our search for adaptation strategies is therefore not connected to 'stability' in any form, but is instead focused on constant adaptation to changing conditions.
>
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Introduction

Climate change is likely to affect the Sámi regions in Norway, Sweden, Finland and Russia, with greater variability in temperature, precipitation and wind, and higher winter temperatures (ACIA, 2005; Tyler et al., 2007). These factors strongly affect snow quality and quantity, with snow quality as a crucial factor for reindeer herding. Considering their experience obtained through time and their traditional ecological knowledge, the pastoral practices of Sámi herders are inherently well suited to handle huge variations in climatic conditions. Reindeer herding and its natural environment have always been subject to large variability in weather patterns, and skilful adaptation to these past variations offers important insights on adaptation to climate change. In particular, it is crucial to recognize the importance of traditional ecological knowledge (Berkes, 2008).

The adaptation of Sámi reindeer herding to climate change is conditioned by its political and socio-economic environment (ACIA, 2005, p. 971; E. S. Reinert, 2006; Tyler et al., 2007). Important parts of the traditional adaptive strategies – the composition of herds and the flexibility to move reindeer herds between summer and winter pastures – are challenged by nation–state policies restricting herd

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diversity and mobility and by rigid regulations. Management of Sámi reindeer herding in Norway is strongly conditioned by models of agricultural husbandry, not suitable for reindeer herding (ACIA, 2005, p. 978; E. S. Reinert, 2006; Tyler et al., 2007).

This chapter discusses the role of the nation–state and systems of governance and institutions as barriers and solutions to adaptation to climate change from the point of view of Sámi reindeer herders. Climate change is likely to affect the Sámi regions. The reindeer herders' adaptation to climatic variation, embodied in traditional herding practices with diversification of risk, based on the traditional ecological knowledge of biological diversity, is the key to improved resilience and successful adaptation to climate change. A crucial factor for enhancing the adaptive capacity to climate change is to modify the incentives in Norwegian official administration of reindeer herding management.

First we discuss traditional ecological knowledge and the anthropological concept of ecological niches, in terms of reindeer herding. We then outline the recent historical background for the governance structure of reindeer herding in Norway, and argue that adjustment of the governance structures is crucial for survival of the Sámi reindeer herding culture. Reindeer herding administration in Norway is characterized by detailed and inflexible government interference, from the structure of the herd to the movement of animals. In this chapter our focus is on reindeer herding in Finnmark, the northernmost area of Norway. Recapturing key aspects of the traditional organizational form – herd diversity and cross-boundary mobility – might be necessary in order for Sámi herding culture to adapt to climate change.

Traditional ecological knowledge and ecological niches

Traditional ecological knowledge is defined as the knowledge, practice and beliefs about dynamic relationships of living beings and the environment, a knowledge which has evolved in adaptive processes and been handed down from generation to generation (Ingold, 2000; Berkes, 2008). Combining traditional and scientific knowledge about ecological systems, and their interrelationships with cultural and economic systems, is crucial for understanding the resilience capacity of ecological and social systems and for identifying factors that can enhance the potential for sustainable development and self-sufficiency (Berkes et al., 2000; Berkes, 2008). The ACIA (2005) report recognizes that traditional ecological knowledge is important in order to supplement and enrich scientific data on climate change impacts. Sámi reindeer herders are unique observers of how changing weather patterns are altering grazing possibilities for reindeer and the sustainability of reindeer herding (Tyler et al., 2007). The EALAT project of the Sámi University College, which this chapter draws upon, represents an innovative approach to including traditional ecological knowledge into studies of adaptation to climate change.

Ecological niche is a well-known concept from ecology, describing the adaptation of an organism to a particular environment. The anthropological concept of ecological niche is also used in interdisciplinary studies of ecology, geography and anthropology, introduced by geographer Carl Troll (1899–1975) who studied parts of the world with extreme climatic variations (Troll, 1931, 1966). In the Andes mountains he described 'landscape belts' (*Landschaftsgürtel*) along the mountain ranges, not only with specific agricultural and pastoral activities, but with climate-related opportunities for creating a livelihood and human settlements.

Troll compared the high mountains in the tropics and the subarctic regions of the Sámi reindeer herds, where frequent freezing and thawing (*Frostwechselhäufigkeit*) was a common element. The most extreme climate zones of the planet are made inhabitable by the extreme variations – in terms of 'windows of opportunity' – that Nature presents to human beings, both in terms of ecological niches in which different plants and animals thrive, in terms of the possibility of migrating between such niches at relatively short distances, and in terms of temperature changes inside each niche, daily and annually. Humankind's main strategy to cope with and adapt to climatic extremes is in tune with Nature's own answer: maximizing variety in each Andean potato field and each Sámi reindeer herd reduces risk through principles similar to that of an insurance policy. These are principles alien to the practices underlying modern agricultural production. The basic foundation for a successful system of reindeer herding governance – particularly under climatic change – is the understanding of diversity and cyclicality, rather than stability, as the key feature of both the natural environment and the herders' response.

In the subarctic regions, the difference in snow quality is a key element of diversity, and topography is an important component determining how snow is distributed over an area. Winter grazing areas are determined by the time of the year and snow conditions (Sara, 2001, p. 46). In choosing grazing areas, the Sámi herders' first concern is what is called *guohtun* (the possibility for the reindeer to get to their food, i.e. grazing conditions through snow). Understanding and ability to handle changes in snow conditions are of vital importance for sustainable Sámi reindeer herding.

Troll's theories were further developed by anthropologist John Murra (1916–2006) in the context of the Andean cultures (Murra, 1975, 2002). In the Andes, Murra found a 'vertical archipelago' of micro-climates – ecological niches – and explained the pre-Columbian Andean cultures as based on sequential utilization of crops and animals found at these different ecological levels (*pisos ecológicos*). Reindeer herding can be understood in the context of Murra's 'archipelago' of ecological niches, but niches that are more horizontal than vertical. Herding is based on the sequential usufruct of a multitude of such ecological niches, moving the animals over large distances in annual cycles in order to find optimal grazing, ranging

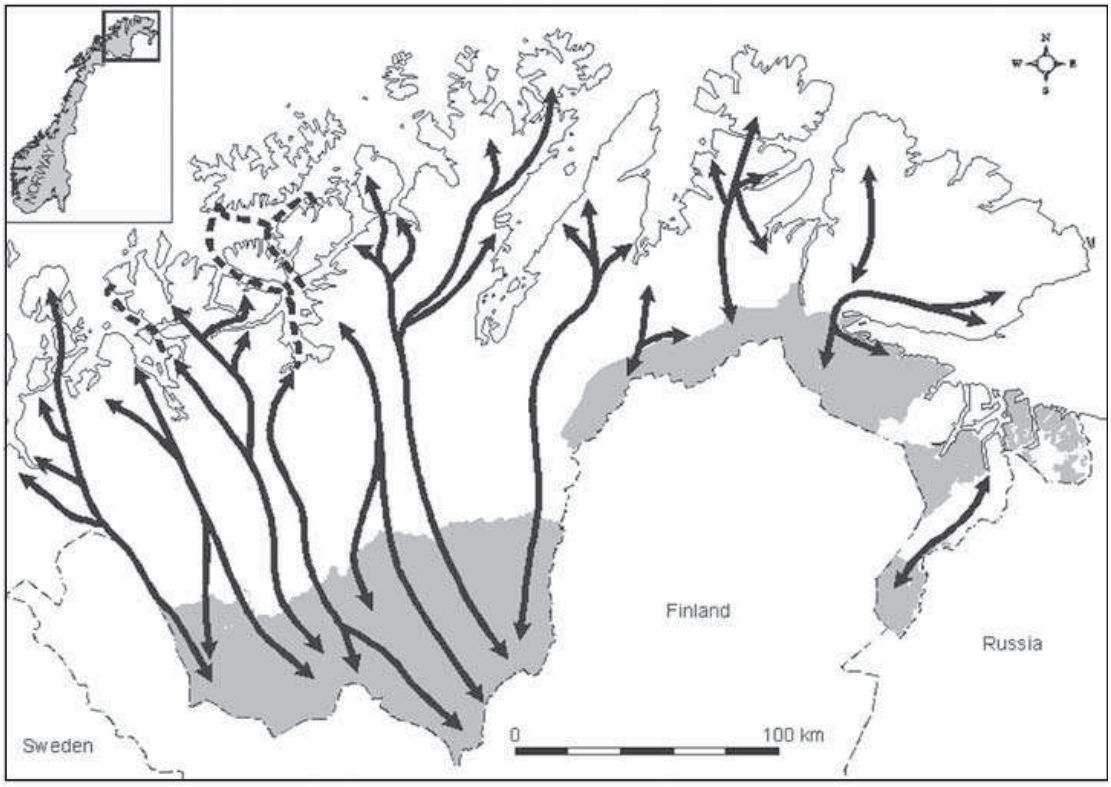

Figure 26.1 Reindeer herders' migratory pattern in Finnmark, Norway. (Source: Tyler et al., 2007.)

from the coast in summer to the inland areas with accessible snowpack in winter. The eight seasons of the reindeer herders – compared to the four in temperate climates – are but one reflection of the complexity of the system. Inside the niches controlled by the herders, there are also micro-niches that are used by the reindeer themselves. Dark-coloured animals – those that might suffer most from insects – find their way to the last patches of snow in summer, where insects are scarce. The annual treks normally cover several hundred kilometres and permanent human settlements and slaughtering facilities are often found at the passage points between summer and winter pastures.

Herds of mixed age and sex, varying in size from 100 to 10 000 animals, are maintained on natural pastures all year round and are typically moved between coastal summer pastures and inland winter pastures (Figure 26.1). The pattern of migration, from time immemorial, is clearly an adaptation to climatic conditions. Feeding conditions for reindeer in winter are chiefly a function of the availability of forage through snow, so the quality of the snowpack becomes a crucial variable. Weather variability with thawing and refreezing – during winter progressively increasing both the density and the hardness of the snowpack – makes it difficult for the animals to dig down to the plants beneath. Such conditions occur frequently at the coast, where winters are mild and precipitation high. Inland, however, conditions

are colder, drier and temperatures have been more stable, creating favourable grazing conditions (i.e. snow conditions) – *buorre guohtun* – for the animals.

In herders' terminology the concept of *guohtun* is only used in connection with snow, i.e. the condition of the snow and the amount of snow (Magga, 2006). The term does not refer to grazing as such, to the availability of moss, lichen or plants etc. The herders' term *buorre guohtun* conveys how easy it is for the reindeer to dig through the snow in order to reach their food. If it is easy for the animals to reach the food through the snow, one says there is *buorre* (good) *guohtun*. This means that the snow is dry and grainy, and that the snow cover is not very thick. Under such conditions the reindeer do not have to use a lot of energy in order to get to their food. *Heajas* (bad) *guohtun* means that it is difficult for the animals to get to their food. The snow is hard and there are layers of ice both near the ground and at higher levels in the covering snow, and the animals will consequently use much energy to reach their food. Norwegian authorities have tended not to understand that feeding problems are often a result of lack of access to food through the snowpack, a problem which is overcome by the return of spring, rather than a permanent problem of 'overgrazing'. This is but one example of the lack of awareness of herders' traditional ecological knowledge.

One important possible effect of climate change is that the area with high *Frostwechselhäufigkeit* is extending further inland. If the ground surface of an area free from snow freezes in autumn, while wet, this produces *botneskárta* – an icy cover that will block access to vegetation until spring. Faced with this condition, reindeer herders say it is best to sell as many reindeer as possible: this means a winter catastrophe. This condition will not change until springtime comes and the hard ice-snow becomes grainy snow.

Institutions and risk-reduction mechanisms under extreme climatic risks

A comparative study of institutions in the Andes and among the reindeer herders exhibits many similarities (E. S. Reinert, 2007). The utilization of climatic niches created by climatic diversity forces both cultures into long annual treks. Both societies are organized in extended family groups, the *ayllu* in the Andes and the *siida* of the Sámi. The mechanisms developed both by the Andean potato farmers and the Sámi reindeer herders in order to reduce unpredictable climatic risks are based on the principle of insurance policies, on diversity. Even close to the present day in the Andes, farmers would grow up to 40 varieties of potatoes every year. One potato variety would survive severe frost in the growing season, another extreme drought, etc. Although not maximizing the yield in a 'normal' year, a diversity of varieties ensured survival under virtually any circumstance (Murra, 1975, 2002). Both the variety of the Andean potato fields and the traditional composition of a

reindeer herd exemplify the diversity called for by a precautionary principle. When climate change adds to the already extreme weather conditions, it appears wise to understand and strengthen the very efficient coping mechanisms that have made survival possible for centuries.

In reindeer herding the challenges posed by unpredictable climate variation are met through herders' finely tuned skills in exploiting the options presented by the presence of a myriad of ecological niches, in other words, by the diversity of the landscape and the diversity of their herds. As one herder puts it:

> The more landscape types one has – that is, alternatives with which to meet different situations – the more secure reindeer pastoralism will be over a longer period of time. Contrariwise, in a uniform landscape without alternatives, one is left helpless when faced with natural changes (within a season, between years) (Mikkel Nils Sara quoted in Paine, 1992).

Reindeer herders have traditionally maintained high levels of phenotypic diversity in their herds with respect, for example, to the age, sex, size, colour and temperament of their animals (N. Oskal, 2000; Magga, 2006). The Sámi concept of a 'beautiful' herd of reindeer (*čáppa eallu geallu eallu*) incorporates, therefore, a diversity which is the antithesis of the monoculture of homogeneity observed in a pure-bred herd of livestock developed by selection to suit the requirements of modern, high-yielding agricultural ruminant production systems.

The traditional diversity of the structure of the reindeer herds reflects a coping strategy aimed at reducing their vulnerability to the consequences of unfavourable – and unpredictable – conditions (for example Nilsen, 1998; A. I. Oskal, 1999). In this way apparently 'non-productive' animals have particular roles, which contribute to the productivity of the herd as a whole. For example, in the 1960s reindeer herds in Finnmark typically comprised between 25% and 50% adult males, many of which were castrated (Paine, 1994). Castrates were required for traction and to keep the herd gathered. They may also have lowered the general level of activity of the females, hence contributing to increased net energy gain in the herd. Modern agronomists have considered adult males unproductive and today few herds in Finnmark comprise more than 10% large bulls, but variation is large (Nilsen, 1998). With more temperature variability and difficult grazing conditions in winter, castrated male reindeer play a crucial role in breaking the ice cover, enabling the smaller animals to graze. The lack of herd diversity is a considerable threat to sustainability and adaptation to climate change.

Cyclicality and change

The climate in the Arctic is neither stable nor predictable. Great variability in weather patterns and the need for constant adaptation is the rule rather than the

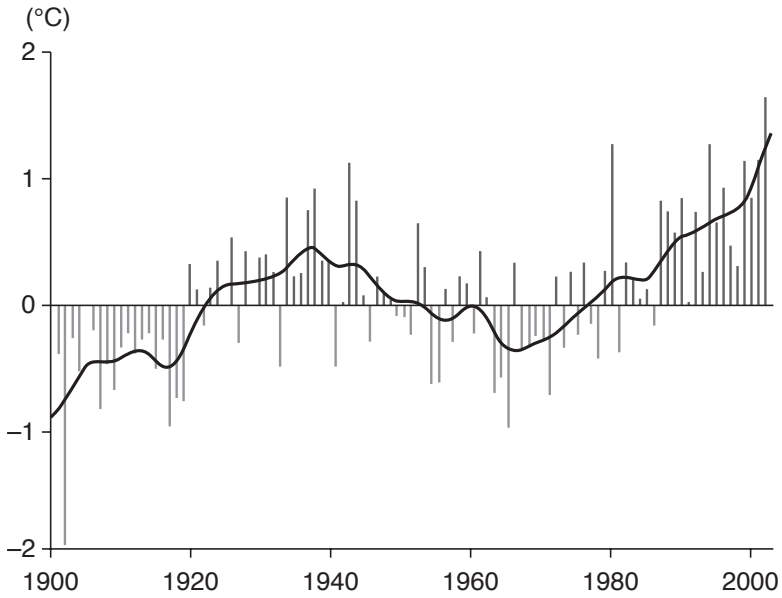

Figure 26.2 Cyclical behaviour of temperatures in the Arctic in the twentieth century: annual average change in near-surface air temperature from stations on land relative to the average for 1961–1990, for the region between 60° and 90° N. (Source: ACIA, 2005, p. 3.)

exception in Sámi reindeer herding. 'One year is not the next year's brother', goes a Sámi saying.

The study of climatic cycles in the Arctic goes back to Norwegian polar researcher Fridtjof Nansen (Nansen, 1926). Figure 26.2 shows the historic development from 1900 in average air temperatures in the Arctic. Today is not the first time the Arctic has seen rapid temperature change. Similar patterns were evident during the 1920s and 1930s. There are still reindeer herders alive who have knowledge about how reindeer husbandry coped and adapted in the past, knowledge that can be crucial to face a future with increasing climate change.

Historical records indicate large variations in the number of reindeer. Figure 26.3 shows the number of reindeer in Sweden from 1900 to 2000, displaying a distinctly cyclical variability. Between 1978 and 1998 the annual number of reindeer slaughtered in Norway, Sweden and Finland tripled, and then fell back again almost to the previous level. Despite very different governance regimes in the three countries, the production curves rise and fall in a remarkably parallel fashion (E. S. Reinert, 2002, p. 39).

By mitigating the negative effects of environmental variability, the skills of the herders create a protective cushion that minimizes the effect of this variability. A downward cycle in the number of reindeer may be triggered by a climatic shock to the herds so big that the herders are not able to compensate. Such events are characterized as *nealgedálv* ('the year when the reindeer starved') (Eira et al., 2008). The coping mechanisms involved in cushioning against variability are of the same

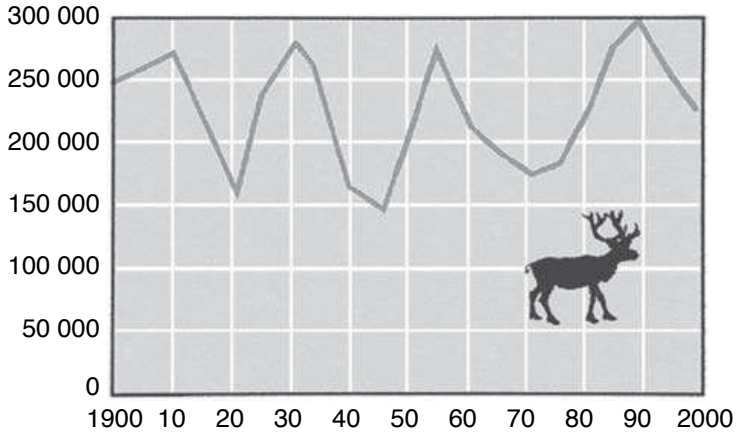

Figure 26.3 Cyclical movement of number of reindeer in Sweden, 1900–2000. (Source: Statistics Sweden, 2001.)

kind that will be needed in order to understand, cope and adjust to permanent change. The experiences from the cyclical patterns must be part of the analysis of adaptation to climate change. The relationships that create cyclicality in the number of reindeer are highly complex, and one of the goals of the EALAT project is to investigate the factors involved and their internal relationships.

Reindeer herding and the nation–state

Early books on natural and political geography, as Giovanni Botero's *Relazioni Universali* (originally published in 1596), list the Sámi regions of Lappia, today's *Sápmi,* as an independent nation on a par with Norway and Sweden. When *Sápmi* or *Lappia* later was absorbed into the modern nation–states, this was done in a way that cut across traditional ethnic areas. Figure 26.4 shows how the dotted lines marking the borders (from left to right) of Norway, Sweden, Finland and Russia cut across the areas of the Sámi linguistic groups that also represented the traditional migratory range of the herders. Comparing Figure 26.4 and Figure 26.1, which shows the present-day migratory patterns of herders in Finnmark, renders the idea of the importance of the traditional migration across present nation–state border, *within* the domains of the linguistic groups.

Initially, even when Lappia later was absorbed inside the borders of Norway and Sweden (at the time also including the Grand Duchy of Finland), the traditional free movement of the Sámi reindeer herders in Northern Fenno-Scandia was maintained and codified in *Lappecodicilen* of 1751. In this way the organizational units of the Sámi herders – the *siida* – were preserved across national borders. Their sequential usufruct of land continued across national boundaries – and indeed their whole economic system – continued unaffected by the consolidation of the nation–states for

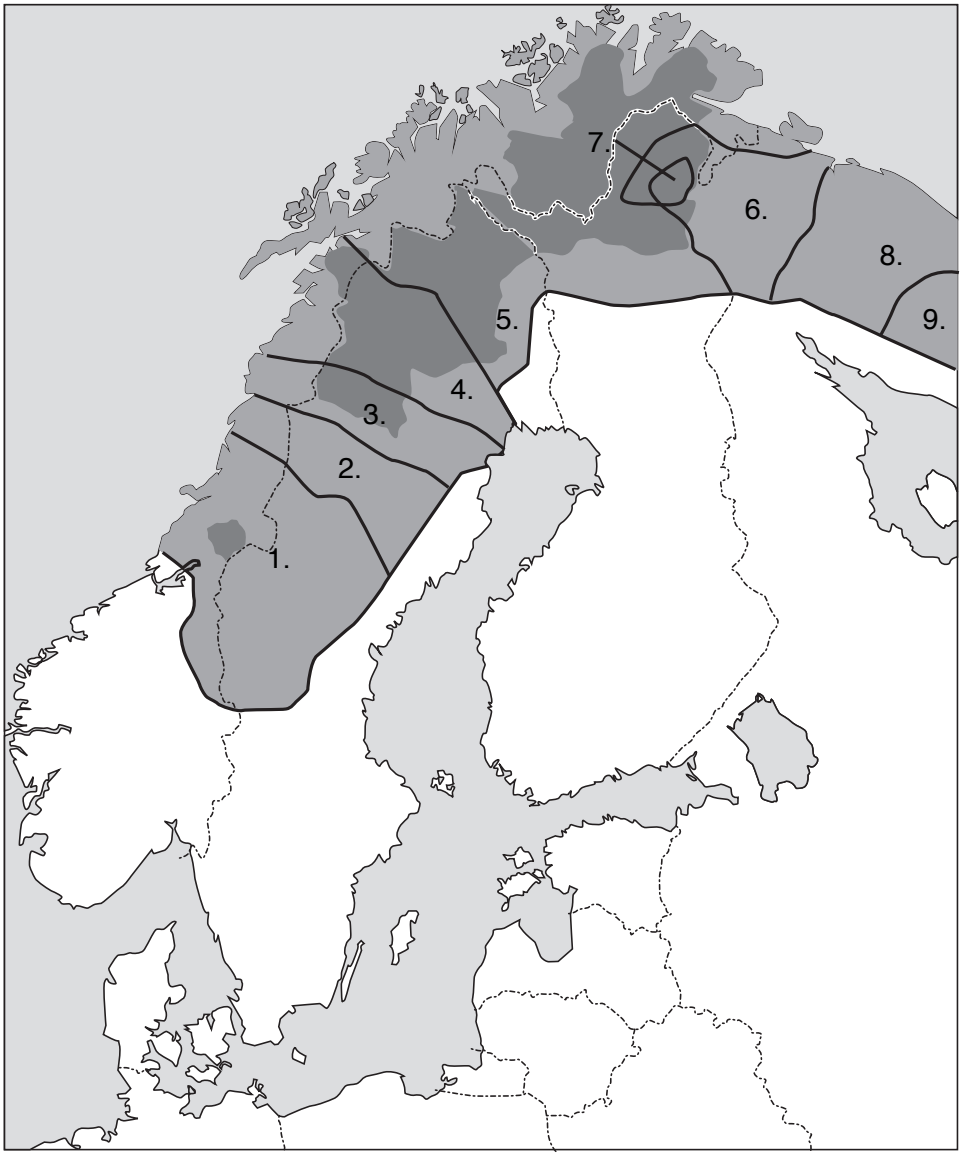

Figure 26.4 Sámi languages and nation–state borders. Geographical distribution of the Sámi languages: 1, Southern Sámi; 2, Ume Sámi; 3, Pite Sámi; 4, Lule Sámi; 5, Northern Sámi; 6, Skolt Sámi; 7, Inari Sámi; 8, Kildin Sámi; 9, Ter Sámi. Darkened area represents municipalities that recognize Sámi as an official language. (Source: Wikipedia, 2008.)

a long time (N. Oskal, 1999). Between 1809 and 1917 the Grand Duchy of Finland was part of Russia.

The most devastating effects on the reindeer herders' economy did not take place until 1852. The border between Russia/Finland and Norway had been drawn in 1826, but the free movement of reindeer and herders continued. In 1852 the border between Norway and Russia/Finland was closed to the herders. Herders' access to some of their key ecological niches was blocked, breaking off the main artery of the annual migration of the herders, seriously undermining the carrying capacity

of the Finnmark herding system in terms of number of animals and humans that could make a living from herding (Bull et al., 2001; Pedersen, 2006).

Reindeer herding governance on the nation-state level in Norway

We now turn to look more closely at the governance of reindeer herding in Norway. Our analysis reveals a somewhat surprising mismatch between the achievements of Norwegian legislation to protect Sámi rights, and the rigid agricultural models and modes of control still prevailing in reindeer herding management.

After the long history of forced assimilation – 'Norwegianization' – came to an end, Norway has made considerable progress in achieving rights for the Sámi people (Norges Offentlige Utredninger, 1984, p. 18; 2007, p. 13). The two central international conventions on Sámi rights are the 1966 UN Convention on Civil and Political Rights and the 1989 International Labour Organization (ILO) Convention 169 on indigenous and tribal peoples, ratified by Norway respectively in 1972 and 1990 (neither Sweden nor Finland have ratified the ILO convention). Sámi rights in Norway were further strengthened by inclusion of para. 110a in the Constitution in 1988 and in the Human Rights Law in 1990. Central to these rights is the recognition that the material basis of the Sámi culture must be secured, strengthening the Sámi rights to the pastures for reindeer herding. Although a detailed analysis of the legislative changes is beyond the scope of this chapter, our study shows there is still a distinct discrepancy between the rights secured through extensive national and international legislation and the practices of the reindeer management authorities. These are recounted in E. S. Reinert (2006) in more detail, and briefly reported below.

In 1978, a new reindeer herding law was introduced in Norway. The principles of this legislation were, typically for the time, based on a strong faith in mass production and industrial agriculture, attitudes prevalent in the Norwegian Ministry of Agriculture (Lenvik, 1988, 1990). The Lenvik studies which informed this legislation were undertaken on particular areas only, in the southern reindeer districts in Norway, where annual meat production is stable, not showing the variability found further north. Moreover, the agricultural models for livestock feeding were not translatable to reindeer grazing on natural pastures. In particular, while the agricultural model does not attribute much value to an old wether, the situation is quite different in reindeer herding, where the castrated male reindeer (known by the herders as 'the gentlemen of the tundra') play an important role in breaking the ice so that the smaller animals may graze.

The 1978 reindeer herding law introduced an element of common pastures, without roots in previous Sámi legal tradition (where pastures traditionally were

managed by the *siida*). Not surprisingly the reindeer herders themselves call the 1978 law the 'barnyard law', following which reindeer herds have increasingly been managed – almost exclusively – to maximize annual meat production, thereby seriously increasing the vulnerability of the herds. Thus the centrally-imposed management regime paid little attention to the traditional regulation of the use of pastures and to the role of natural cycles of production. The use of common pastures contributed to fuelling an official perception of 'overgrazing' recalling the classical 'tragedy of the commons' situation (Hardin, 1968). Herders were simultaneously accused of maximizing profits, by exploiting common resources for individual benefit, and of maximizing herd sizes. Either way, the policy conclusion was the same: too many reindeer.

As a consequence, the Norwegian Parliament (*Stortinget*) defined a non-revisable maximum number of reindeer in Finnmark, which warrants 'forced slaughtering' of reindeer by the Ministry of Agriculture. Officially, a year resulting in a large number of reindeer is a call for alarm, since according to governmental analysis heightened conditions of (re)production are interpreted as a threat to the 'sustainability' (statically defined) of the lichen the reindeer feed on, rather than as a natural cyclical change within a wider pattern of sustainability. This view has recently been challenged by a Sámi study of reindeer numbers in relation to ecological and traditional notions of sustainability (Joks et al., 2006).

The official consensus in Norway during the widely publicized crisis in reindeer herding in the late 1990s was that it was due to herder irresponsibility. During the 1990s Sámi reindeer herding was subjected to a fixed pricing regime. The volume of production was halved, with similar consequences to herders' income (E. S. Reinert, 2006). Other pieces of legislation, both national and international, contributed to further changes in the management of reindeer herds. Sanitary regulations enforced within the European Economic Area meant that the Norwegian Sámi lost control over the elements in the value chain where profits are made, in particular slaughtering and marketing (H. Reinert, 2007). In 2002 an estimated 80% of all reindeer in Sweden and Finland were slaughtered in establishments owned by the herders themselves. In Norway this number was around 20%, a striking difference from the neighbouring countries (E. S. Reinert, 2002). The herders lost control not only over a key stage in their productive cycle, but also an important aspect of herding culture to a monopsony (purchasing monopoly) controlled by non-Sámi economic interests. This economic regime also severely reduced the options to market reindeer meat in the luxury food market segment (Jensen, 1999), nationally and internationally, thus reducing herders' profitability even further (E. S. Reinert, 2006; H. Reinert, 2007).

In other words, the 1978 law denied Sámi reindeer herders access to key elements in the value chain. Individual purchasers were replaced by a system of

'target price' established through negotiations with the government. An important part of this regime of herding administration was a policy of equalization, whereby large reindeer owners through forced slaughter had to significantly reduce the size of their herds. At the same time, numerous new economically weak herding units with small herds were established (E. S. Reinert, 2006). This policy model from agriculture has attempted to reform Sámi reindeer herding to conform to monoculture practices of modern agriculture and to Fordist mass production (E. S. Reinert, 2006). A key goal in this policy has been to level out the natural cycles of production. Traditional ecological knowledge was not recognized as integral to sustainable reindeer management practice: 'It is as if everything we know has no value', a university-educated female herder pointed out (E. S. Reinert, 2006).

The detrimental effects of the 1978 law on Sámi reindeer herding in Norway have slowly been recognized, and it was supplanted by a new law in 2007 with the purpose of amending several of the unfortunate consequences of the 1978 law (Norges Offentlige Utredninger, 2001, p. 35). It remains to be seen how the new law will influence the practice of the reindeer herding administration and hence the sustainability of reindeer herding. As one reindeer herder put it: 'Before, we were used to work with an unpredictable nature, now we also have to work with an unpredictable government administration' (E. S. Reinert, 2006). Nevertheless, additional challenges remain to a more sustainable herding of reindeer, for example, the proposal that reindeer management should not be overseen by the Ministry of Agriculture (Norges Offentlige Utredninger, 2001, p. 35). It will be a formidable challenge to modify the structure of reindeer herding management and bring the governance practices in line with the improvements in legislation for Sámi rights obtained through the past 25 years; to secure the material basis for survival and continuation of Sámi culture; and to build adaptive capacity based on traditional ecological knowledge.

Some are calling for the traditional ecological knowledge of Sámi reindeer herders to be recognized and included in animal welfare legislation. There is fear that Sámi reindeer herders might lose their right to castrate male reindeer using their traditional knowledge and insights. As mentioned earlier, these animals provide vital support for the herds. Without them the vulnerability of the herds is increased, both as regards predatory animals, animals welfare, and reduced access to food through ice-covered pastures. Norway's National Committee for Ethics in Science and Technology (NENT) developed ethical guidelines, in effect giving support to the Sámi by recommending natural scientists to integrate and respect alternative sources of knowledge such as traditional knowledge. Recently, Vladimir Etylin from a reindeer herding family in Chukotka, Eastern Siberia, said in this respect:

'Being an indigenous representative and having been born on the tundra myself, I consider a ban on castration as a serious threat to all reindeer husbandry. […] Castrated males do have their own place in the herd's structure too. Humans would not have been able to domesticate reindeer without castration. It is one of the corner stones of the domestication process. […]Without castrations it is not possible to build up a controllable reindeer herd. Geldings have many functions in a reindeer herd. The first one is that they are the calmest animals of a herd. Which means that a reindeer herd with castrates quiets down easily. For example: In Chukotka it is impossible to survive without crushing ice during a so-called black ice period, when everything gets covered with a layer of ice. When this happens only castrates are strong enough to break such ice. […] Reindeer cows follow after them and eat the fodder left over (Etylin, 2007).

Although the basis for Sámi legal rights is much stronger in Norway than in the other Nordic countries, a comparison of the practices of reindeer herding management in Norway, Sweden, Finland and Russia reveals striking differences, with important lessons for adaptive capacity for climate change. For example, in Russia, reindeer herders on the Yamal peninsula, organized in so-called brigades, have been allowed strong autonomy within their pasture areas. Within the borders of the pasture allocated to the municipal enterprise there are no formal limitations on flexible use of land, allowing brigades to 'trade snow' with neighbouring brigades, and even respond to severe climatic conditions, such as frozen pastures, by using seasonal pastures off season. An example is the winter of 2003/04 when rain in January caused locked pastures in the winter pastures south of the Yamal-Nenets Autonomous Okrog when some brigades responded to this by turning back towards summer pastures, other responded by not migrating as deeply into the winter pastures as they normally would (E. I. Turi, 2008).

The ability to self-organize according to their traditional knowledge is an important factor in strengthening reindeer herders' resilience to changes. The general secretary of World Reindeer Herders' Association stated that 'Nothing is liable to arouse more disturbances within reindeer husbandry than encroachments on its internal organization' (J. M. Turi, 2002, p. 71). Without a fluent and flexible organization reindeer pastoralists would lose the source of their greatest adaptive capacity. Institutional settings where reindeer pastoralists' traditional organization is restricted – as in Norway – represent a serious institutional constraint on adaptation.

Conclusion: building adaptive capacity for climate change

The crucial factor in adaptation to climate change is to improve ecological, cultural and economic resilience, through building adaptive capacity. To summarize, this chapter suggests four main elements for increasing the capacity of reindeer herding to adapt to climate change.

(1) Restructure herds to decrease vulnerability to climatic change. A *čáppa eallu* ('beautiful' herd of reindeer) is highly diversified, unlike a herd of livestock developed to suit the requirements of a modern, high-yielding agricultural production system. Modify government incentives that work against herd diversity. Include traditional ecological knowledge to enhance diversity, flexibility and adaptive capacity. Recognize that the complexity inherent in the reindeer herding and its traditional management is precisely the key to successful adaptation to the complexity presented by the uncertainties of climate change.
(2) Re-establish Fenno-Scandinavian reindeer herding across nation–state boundaries, allowing the *siida* to regain its transboundary character, through political processes involving the Sámi organizations in the countries in question.
(3) Limit the increasing permanent loss of ecological niches available to the herders, due to pastoral land being used for other purposes, including new infrastructure. This point differs from point 2 which refers to ecological niches that do exist, but are blocked from herders' use by national or international rules and regulations, whereas point 3 refers to ecological niches being permanently destroyed.
(4) Improve the economic basis of the reindeer herders by giving them back access and ownership to the most profitable activities in the value chain: slaughtering and marketing. A solid economic base will better enable herders to absorb the costs associated with climatic change.

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