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Adapting to Climate Change in 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

Johan Mathis Turi, Chairman of International Centre for Reindeer Husbandry (ICR),
Tromsø, UN Environmental Day, June 2007.

This paper discusses the role of nation-states and their systems of governance as sources of barriers and solutions to adaptation to climate change from the point of view of Saami reindeer herders. The Saami, inhabiting the northernmost areas of Fennoscandia, is one of more than twenty ethnic groups in the circumpolar Arctic that base their traditional living on reindeer herding.

Climate change is likely to affect the Saami regions severely, with winter temperatures predicted to increase by up to 7 centigrade. Temperature, however, is just one of many interacting variables affecting reindeer herding. Precipitation and wind also affect snow quality and quantity, where the type of snow (quality) rather than the quantity of snow is the most crucial one. We argue, however, that the pastoral practices of the Saami herders are inherently better suited to handle huge natural variation in climatic conditions than most other cultures. Indeed, the core of their pastoral practices and herding knowledge is skillful adaptation to unusually frequent and rapid change and variability. Reindeer herding and its natural environment have always been subject to huge variations – many of them of a cyclical nature – and these past variations offer clues to how permanent changes in the existing cyclical trends may be successfully coped with.

This paper argues that the key to handle permanent changes successfully is that herders themselves have sufficient degrees of freedom to act. Considering the similarities in herding practices in the four nation-states between which Saami culture is now divided – Norway, Sweden, Finland, and Russia – the systems of governance are surprisingly different. Indeed, the very definition of what is required to be defined as an ethnic Saami is very different in the three Nordic countries. We argue that timely adjustments modifying the structures of governance will be key to the survival of the Saami reindeer herding culture. Since the differences in governance regimes – and the need to change national governance structures – are so central to our argument, we spend some time tracing the origins of these systems.

The paper starts by introducing the perspective of ecological economics – as contrasted with environmental economics – as the basis for our analysis. Then we discuss the geographical and climatic basis for reindeer herd-

ing, based on the theories of geographer Carl Troll and anthropologist John Murra. We continue by briefly describing how the Saami and other by then marginal ethnicities were integrated into the European nation-states during the late 1700s, and how the present systems of governance have their roots in different nation-building experiences. Further we briefly describe the existing cyclicity upon which future climatic change will be superimposed.

The next part of the paper looks at the governance structure of reindeer herding in Norway, Finland, and the Yamal region of Russia, comparing the different regimes to the historical experience of past regulatory regimes. It is argued that recapturing key aspects of the traditional organizational form – herd diversity and international mobility – is necessary in order to enable Saami herding culture to survive the present climatic trends. From this point of view the Russian form of governance allows for a large degree of the kind of herders' self-determination that would be needed. Norway, on the other hand, represents a case of extremely detailed and inflexible government interference in many aspects of reindeer herding, from the structure of the herd to the movement of animals. Finally we summarize the four main variables that in our view will determine the ability for Saami reindeer to adapt to climatic change. In order to succeed, however, considerable changes to existing governance regimes are required, re-establishing the degrees of freedom that the herders will need to cope in the short term and to adapt in the long term.

1. Perspectives from Ecological Economics.

This section introduces some perspectives from ecological economics, a relatively new approach to the intertwined relationships between economic activities and their ecological impacts. In contrast to environmental economics, that addresses environmental problems within the framework of standard mainstream economics, ecological economics transcends the neo-classical framework and takes into account ecological constraints, acknowledges ethical values, stakeholder interests, and rights of indigenous people, and recognizes that strong uncertainties of the climate change impacts require precautionary approaches.

As discussed in the ACIA report (2005), the adaptation of Saami reindeer herding to climate change is conditioned by its political and socio-economic environment (ACIA 2005, p. 971; 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 now challenged by nation-state policies restricting herd diversity and mobility across the nation-state borders.

Climate change impacts dramatically affect the conditions for reindeer herding and the well-being of the Saami and other indigenous people of the Arctic. Given the strong uncertainty about future climate change impacts in the Arctic, the irreversibility of these impacts, and the intertwined nature of the cultural and ecological values of the Arctic regions, we argue that standard economic valuation and risk management need to be supplemented with perspectives from ecological economics, with its broader approach to environmental uncertainties, ethical values and conflicts of interest. As we shall get back to in section 2 of the paper, this ecological approach also integrates perspectives from the now unfortunately marginalised science of geography.

1.1. Values, uncertainty, and ecological economics.

Ecological economics explicitly recognizes that nature is the basis for life, and that valuation of nature requires valuation methods beyond monetary valuation and cost-benefit analysis (Costanza 1989, 2001; Norgaard 1994; O'Neill 1993, 1996, 2007). A loss of nature quality cannot necessarily be compensated by a gain in other values (Martinez-Alier, Munda and O'Neill 1998). In contrast, standard mainstream economics – upon which environmental economics is based – considers nature as a “good” similar to other (produced) goods, and no particular value priority is given to nature as the basis for life-sustaining processes. Ecological economics recognizes that economy and ecology are derived from the same Greek word, *oikos*, meaning house, our home on planet Earth, and a sustainable economic household management must take into account the ecological limits of the Earth.

In environmental economics, some environmental problems are represented as externalities, external to the responsibility of the economic decision-maker, indicating that some prices are too low, relative to the environmental damage. Ecological economics draws attention to the problem that the concept of externality may not be sufficient to capture the extent of the environmental problem. Spash (2002) refers to the institutional economist K.W. Kapp (1950) who criticized the concept of externality as not taking into account that ‘the pushing of damages onto others and avoiding the associated costs is to be expected as a normal and prevalent activity of the successful economic agent’ (Kapp quoted in Spash 2002, p. 5).

Although ‘trade-offs’ always have to be made, it can be argued that the standard economic approach of ‘opportunity cost’, assuming that there is a perfect trade-off between the value of nature and other values, neglects the incommensurability between produced goods and essential nature qualities. Ecological economics approaches the valuation of nature in terms of the qualities it expresses (Aslaksen and Myhr 2007). O'Neill, Holland and Light

(2007) argue for the spatio-temporal particularity of nature: The cultural context, history, and location of a particular place in nature matter for this value, giving that place an inherent quality. In its emphasis on context, history, institutions and ethics, ecological economics brings back core themes from the historical schools of economics that were highly influential, particularly in Continental Europe, up until World War II.

Nature qualities and the cultural values embedded in that place in nature must be understood and valued through their representation of a particular place at a particular time. The place and time where they belong give nature and culture their distinct value, a value that cannot be replaced. The cultural values of Saami reindeer herding, in the past and the present, are intertwined with the nature values of the tundra landscape, and the values that need to be preserved must be understood in terms of the spatio-temporal particularity they represent.

In ecological economics, the focus on uncertainties in valuation and complexities in ethics leads to a broader approach to environmental risk and value, emphasizing the process of knowledge generation and value assessment (Funtowicz and Ravetz 1991, 1994). The approach to uncertainty in ecological economics involves a distinction between weak and strong uncertainty. Weak uncertainty refers to the lack of knowledge about future events which can be characterized in terms of risk and probabilities. Strong uncertainty refers to a lack of knowledge about the future which involves ignorance: future possible outcomes may be unknown, in which case attributing probabilities to unknown states may be meaningless (Spash 2002). Other approaches than standard methods of risk analysis are needed, involving precautionary perspectives, in order to strengthen dialogue between stakeholders and secure the role of less powerful stakeholders (Kymlicka 1995, Martinez-Alier 2002, Munda 2004, Vatn 2005). Precautionary perspectives encompass several aspects in order to enhance the potential for sustainable development: development of processes for acknowledgement of uncertainties, facilitation of stakeholder participation, recognition of ethical values, taking into account the traditional ecological knowledge of indigenous people of the Arctic. Cooperation between indigenous people across the Arctic represents an emerging institutional framework for a stronger voice.

Combining traditional and scientific knowledge about nature is an important part of understanding the resilience capacity of ecological and social systems, enhancing the potential for sustainable development and self-sufficiency. Economic activities in the Arctic pose considerable risk to the vulnerable nature and have the potential to alter the Arctic environment considerably (Ford et al. 2006). The challenge is to develop sustainable eco-

conomic activities, ensuring that new economic activity benefits indigenous and other local people (Duhaime, Rasmussen and Comtois 1998).

Some of the differences between ecological economics and standard mainstream economics, as discussed above, are briefly summarized in Figure 1.

Figure 1. Perspectives from ecological economics

Topic	Standard economics	Ecological economics
Compare value of nature and other values	Values are commensurable Nature has no particular priority over other goods Opportunity cost	Nature is the basis for life Value of nature qualities may be incommensurable with other values Valuation of nature requires methods beyond monetary valuation
Ethics	Preferences	Multiple approaches to ethics Value plurality
Nature and culture in context	Externality	Value of nature and culture are intertwined Traditional ecological knowledge (TEK)
Relationship of humans and nature	Instrumental value of nature	Spatio-temporal particularity of nature
Motivation	Self-interest	Responsible self-interest
Interests	Aggregate interests	Stakeholder interests Power issues
Future	Economic growth	Sustainable development
Uncertainty	Risk management Probability assessment Weak uncertainty	Precaution Case-by-case evaluation Strong uncertainty

1.2. Traditional ecological knowledge

Ecological economics, with emphasis on ethics, plural values and precautionary perspectives, highlights that traditional ecological knowledge (TEK) should be taken into account and appropriately acknowledged. 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 (Berkes 1999, Ingold 2000, Selin 2003). In the Arctic, traditional ecological knowledge about animal migrations, ice patterns, vegetation and weather is important in order to supplement and enrich scientific data on climate change impacts (ACIA 2005). Combining traditional and scientific knowledge about ecology is considered an impor-

tant part of understanding the resilience capacity of ecological and social systems and identifying factors that can enhance it (Berkes 1999, Berkes, Colding and Folke 2000, Gadgil, Olsson, Berkes and Folke 2003).

Climate change impacts on the texture of snow and ice are important determinants of the access of reindeer to food (Tyler et al. 2007). Saami reindeer herders are unique observers of how changing winter weather patterns are altering the grazing possibilities for reindeer. The texture of snow and ice is an important determinant of the access of reindeer to food. In reindeer herding, "reading" nature is the ongoing process of observing and evaluating grazing pastures and weather conditions, the texture of snow and ice, wind directions, the sequence of changes in nature, all factors which determine access to pastures and the behaviour of the reindeer herd (Heikkilä 2006). The EALAT project of the Saami University College represents an important and innovative approach to integrating traditional ecological knowledge into studies of adaptation to climate change.

Traditional ecological knowledge is embodied in practices and stories (narratives) that provide a systematic outline of the information relevant to particular habitats, ecosystems and landscapes (Helander and Mustonen 2004). Stories about the land and their detailed and systematic descriptions of changes in the environment are valuable input in the process of analysing scenarios of climate change impacts. To ensure sustainable resource management, it is crucial to integrate scientific knowledge and policy recommendations with indigenous knowledge of weather patterns, seasonal changes, migration of reindeer, growth of plants, and traditional uses of land.

Taking traditional ecological knowledge into account reminds us that there are multiple ways of knowing about the world, and that the categories of knowledge may not be as well-defined as suggested by modern science. Indigenous Arctic worldviews are characterized by their holistic nature, which means that they are not easily compartmentalized into spiritual, cultural, economic, social, or other components. A quote from Popper reminds us of the potential value of multiple perspectives on knowledge:

'I am inclined to think that scientific discovery is impossible without faith in ideas which are of a purely speculative kind, and sometimes quite hazy; a faith which is completely unwarranted from the point of view of science, and which, to that extent, is 'metaphysical' (Popper quoted in Loasby 1976, p. 27).

Awareness of traditional ecological knowledge encourages participatory, community-based resource management systems that allow diverse approaches to knowledge, practices and beliefs to become visible.

Traditional ecological knowledge emphasizes the importance of the relationship between human beings and nature, a viewpoint that overlaps with ecological economics.

1.3. The precautionary principle

The precautionary principle has been suggested as an approach to handle situations with large environmental uncertainty and potentially irreversible consequences. The purpose of the precautionary principle is to provide guidelines for evaluating new technologies, new economic activities, or new public policies, in situations with strong uncertainty about environmental hazards. A report by UNESCO (2005) suggests the following definition: "When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm."

As a particular illustration of the precautionary principle, we suggest the framework in a report from the European Environmental Agency (EEA 2001) that has re-examined the histories of a number of previous environmental problems in terms of the precautionary principle: They emphasize the "late lessons" for precaution that can be drawn from previous environmental problems, where "early warnings" of harm were available, but not heeded. Based on experiences from the past, the report suggests guidelines for precautionary strategies that will enhance the potential for sustainability and self-sufficiency (Box 1).

Box 1. "Late lessons from early warnings"

1. *Acknowledge and respond to ignorance, as well as uncertainty and risk, in technology appraisal and public policy-making*
2. *Provide adequate long-term environmental and health monitoring and research into early warnings*
3. *Identify and work to reduce "blind spots" and gaps in scientific knowledge*
4. *Identify and reduce interdisciplinary obstacles to learning*
5. *Ensure that real world conditions are adequately accounted for in regulatory appraisal*
6. *Systematically scrutinize the claimed justifications and benefits alongside the potential risks*
7. *Evaluate a range of alternative options for meeting needs alongside the option under appraisal, and promote more robust, diverse and adaptable technologies so as to minimize the costs of surprises and maximize the benefits of innovation*
8. *Ensure use of "lay" and local knowledge as well as relevant specialist expertise in the appraisal*
9. *Take full account of the assumptions and values of different social groups*
10. *Maintain the regulatory independence of interested parties while retaining an inclusive approach to information and opinion gathering*
11. *Identify and reduce institutional obstacles to learning and action*
12. *Avoid "paralysis by analysis" by acting to reduce potential harm when there are reasonable grounds for concern*

Source: EEA (2001).

Application of this framework to studies of climate change adaptation of Saami reindeer herding is the topic of our ongoing research. In the present paper we briefly outline some points for future research based on previous case studies of Saami reindeer herding (ACIA 2005, 978; Reinert 2006, Tyler et al. 2007). The purpose of this approach is to develop a more disaggregated knowledge basis in order to make visible the contested values, power issues, and conflicts of interest.

An important point in the framework suggested by "Late lessons from early warnings" is that public policies need to be evaluated in terms of real world conditions. As reindeer herding is strongly impacted by climate change, a precautionary approach needs to evaluate to what extent the nation-state policy measures are in accordance with strategies of adaptation. To enhance the adaptive capacity and self-sufficiency of Saami reindeer herding, stakeholder participation is crucial, and traditional ecological knowledge should be taken into account. In Saami reindeer herding in Norway, man-

agement of herd size and composition, as well as the killing of reindeer and processing of meat, is influenced by models of agricultural husbandry, hardly suitable for reindeer herding (ACIA 2005, 978; Reinert 2006, Tyler et al. 2007). The influence of the nation-state policies may strongly increase the vulnerability of reindeer herding to climate change impacts, and it is important to reconsider management practices and policies to see how strategies of adaptation to climate change can be improved.

Precautionary approaches require the development of processes for acknowledgement of uncertainties, facilitation of stakeholder participation, recognition of ethical values, and taking into account the traditional ecological knowledge of the Saami reindeer herding practices and other indigenous people of the Arctic. Combining traditional and scientific knowledge about nature is an important part of understanding the resilience capacity of ecological and social systems, enhancing the potential for sustainable development.

2. Reindeer Herding as a Mode of Production.

2.1. Carl Troll and the human geography of extreme climates.

German geographer Carl Troll (1899-1975) specialised in the studies of the parts of the world with the most extreme climatic variations – among them high mountains in the tropics – and their effects on human habitation (Troll 1931 & 1966). Troll coined the term ‘landscape ecology’ in 1939. He noted that the two most developed societies in pre-Columbian America had originated in two similar but geographically separated areas, in the highlands of Mexico and the Andes. He found ‘landscape belts’ (*Landschaftsgürtel*) along the mountain ranges, and tied each belt not only to specific agricultural and pastoral activities, but also to climate-related opportunities for creating a livelihood and therefore for human settlements.

Extreme fluctuations in temperature characterising the high Andes – ‘winter every night and summer every day’ – created the conditions that made freeze-drying possible. Troll drew comparisons between the high mountains in the tropics and the subarctic regions – those of the Saami reindeer herders – where frequent freezing and thawing (*Frostwechselhäufigkeit*) was one of the common elements. In a somewhat contradictory way, the most extreme climates 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 to migrate between such niches at relatively short distances, and in terms of temperature changes inside each niche, daily and annually. As we shall see later, Humankind’s main strategy to cope with and adapt to climatic extremes is an answer in tune

with Nature's own challenges: maximising variety in each potato field and each animal herd reduces risk through principles that are similar to an insurance policy. It is worth noting that these are principles alien to the practices underlying modern agricultural production. We shall later argue that the basic foundation for a successful system of reindeer herding governance – particularly under climatic change – is the understanding of diversity and cyclicity, rather than stability, as the key feature of both natural environment and the herders' response.

In the subarctic regions, different 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 2001:46). In choosing the areas, the 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 Sami reindeer herding.

The highest population density in pre-Columbian America was probably found in the Andes, which at first sight may appear to have the most hostile climate, with a density of up to 50 times that of the fertile prairies of North America. The extreme *Frostwechselhäufigkeit* created the conditions for the freeze-drying technologies used in the pre-Columbian Andes and indirectly determined the location of human settlements. Even today the big cities in the Andes – from Quito in Ecuador to Cuzco in Peru and La Paz in Bolivia – are located over 2.800 metres above sea level, where the climate allowed the freeze-drying method used by the Incas to produce their food staple dried meat (*charqui*) and in the two latter areas also freeze-dried potatoes (*chuño*). The freeze-drying technology was extremely efficient. Archaeologists have boiled freeze-dried potatoes found in pre-Columbian tombs and found them still edible.

Troll's insights and theories linking specific climatic zones to human methods of production and consequently human settlements were further developed by Rumanian-American anthropologist John Murra (1916-2006) in the context of the Andean cultures. In the Andes Murra found a 'vertical archipelago' of micro-climates – of 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 ecologicos*). Early Spanish lawyers who attempted to understand land ownership in the Andes found no ownership, but instead a system of sequential usufruct of geographically scattered regions. These ecological niches rose in altitude from fishing in the Pacific, via cotton-growing in the coastal valleys, fruit in higher valleys, the cultivation with irrigation of corn and even higher up potatoes, and at the very top the local crop *quinoa* and the herding of llamas.

We argue that reindeer herding can best 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 from the coast in summer to the inland areas with accessible snow-pack 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 suffering most from insects – find their way to the last patches of snow in summer, where insects are scarce. The annual treks can be up to 2.000 km. 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 pasture all year round and are typically moved between coastal summer pastures and inland winter pastures (Figure 2). The pattern of migration 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. Troll's *Frostwechselhäufigkeit* – the frequency of thawing and re-freezing – during winter progressively increases in both the density and the hardness of the snowpack, thus making 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 is high; inland, however, conditions are colder, drier and temperatures more stable, creating favourable grazing conditions (i.e. snow conditions) – *buorre guohtun* – for the animals.

In herders' phraseology the concept of *guohtun* is only used in connection with snow, i.e. the condition of the snow and the amount of snow. 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 a lot of energy to reach their food.

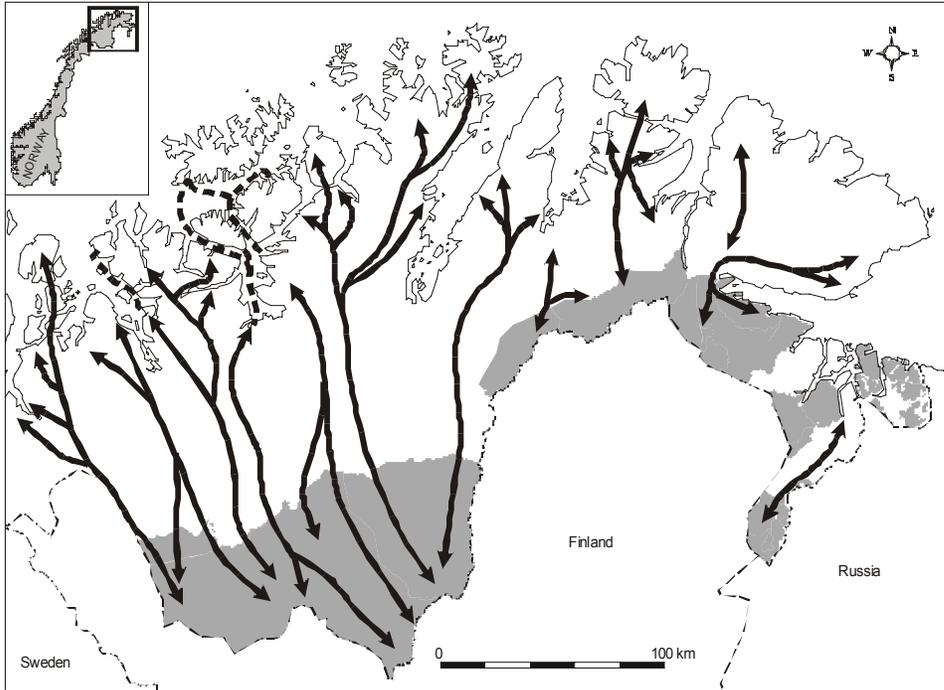


Figure 2. Reindeer herders' migratory pattern in Finmark, Norway.

2.2. 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, pointing to a strong arrow of causality running from society's mode of subsistence to its institutions. Similar modes of subsistence develop similar institutions (E. Reinert 2007). The utilization of a myriad of climatic niches created by climatic diversity forces both cultures into long annual treks. Both societies are organised in extended family groups, the *ayllu* in the Andes and the *siida* of the Saami. In 19th century Sweden, the *siida* was the object of government taxation – it was recognised as being a de facto corporation. In some areas the reindeer herders shift economic organisation twice a year – the summer *siida* consists of different people than the winter *siida*.

As other pre-capitalist societies the Andean and the Saami cultures knew no property rights, but developed a complex system of sequential usufruct of land. This system can best be compared with time-sharing in modern holiday villages: property rights in effect mean exclusive rights for a well-defined and limited period of time. This is not to suggest that the climatic similarities will always have the same effects in both societies. The same

Frostwechselhäufigkeit – frequent freezing and thawing – that makes freeze-drying possible in the Andes, endangers the reindeer in the coastal areas in winter because of its effect on hardening the snowpack. One important effect of global warming is that the area with high *Frostwechselhäufigkeit* is extending further and 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 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 natural warmth of the earth changes the hard ice-snow into grainy snow.

The mechanisms developed both in the Andes and by the Saami reindeer herders in order to reduce unpredictable climatic risks are based on the principle of early insurance policies, on diversity. To reduce the risk of early long-distance trading ownership was spread among many ships. Insurance schemes was a sophistication of this system which developed when it became too cumbersome to manage ships with, say, 40 owners each controlling 2.5 per cent of the company. This is not an issue in a reindeer herd on in a potato field, where all animals or all potatoes belong to the same *ayllu* or *siida*. Even close to our present day in the Andes, an illiterate farmer would know more than one hundred varieties of potatoes by name, and grow up to forty of them on the same plot of land every year. One potato variety would survive severe frost in the growing season, another extreme draught, etc. Although not maximising the yield in a ‘normal’ year, a diversity of varieties insured survival under virtually any circumstance. Andean potato fields exemplify the precautionary principle of ecological economics, as do the traditional composition of a reindeer herd.

In reindeer herding the challenges posed by unpredictable climate variation are met through herders’ finely tuned skills in exploiting options presented by the presence of a myriad of ecological niches, in other words diversity of the landscape, but also through 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, moreover, 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 (Oskal 2000, Magga 2005). The Saami concept of a ‘beautiful’ herd of reindeer (*čáppa eallu geallu eallu*) incorporates, therefore, a diversity which is the antithesis of the homogeneity observed in a pure bred herd of livestock (monoculture)

developed by selection to suit the requirements of modern, high yielding agricultural ruminant production systems.

The traditional diversity of the structure of reindeer herds reflects a coping strategy aimed at reducing their vulnerability to the consequences of unfavourable – and unpredictable – conditions (e.g. Nilsen 1998, 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). Large numbers of large males were required for traction and to help keep the herd gathered and the general level of activity of the females low: in modern jargon, they contributed to increasing net energy gain in the herd. The males’ weight and strength, moreover, enable them to break crusted snow and ice, opening the snow pack and providing access to the plants beneath to the benefit of themselves and - incidentally – of the smaller females and calves. 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).

Extreme fluctuations and unpredictability of the climate are the normal state of affairs both in the high mountain areas of the tropics and in the sub-arctic, borderline cases of where it is possible for human beings to carve out a living. When global warming adds to the already extreme weather conditions it appears to be wise to understand and strengthen the very efficient coping mechanisms that have made survival possible for centuries already.

3. The Herders and the Nation-State.

3. 1. Europe in an age of diversity: ‘reverse orientalism’ and ‘noble’ ethnic minorities.

Today we are used to Western cultures being largely ethnocentric, and also to the creation of mostly negative stereotypes about ‘the others’ as exemplified by Edward Said’s 1979 book, *Orientalism: Western Conceptions of the Orient*. In Norway, Sweden and Finland the Saami have long been subject to ethnic stereotyping, to Said’s ‘orientalism’ with some national variations. It is of particular importance that ‘Saami orientalism’ has penetrated the governance system of reindeer herding to a very different degree in the three nation-states. The balance between ‘orientalism’ and professionalism in the treatment of ethnic minorities will, in our view, determine the degree to which Saami reindeer herders will be able to cope with global warming.

In this section we argue that the kind of essentially negative stereotyping of non-European cultures that Said describes as ‘orientalism’ has not

always been the norm. In fact Europe's view of foreign cultures changed dramatically in the latter part of the 18th century, a change that also profoundly affected Saami reindeer herding.

The thirst for knowledge during the Renaissance brought with it a view that celebrated the diversity of human cultures as sophisticated users of their respective natural environments. Culture was to a large extent seen a product of the context provided by the natural environment. Early books on natural and political geography, as Giovanni Botero's *Relazioni Universali* (originally published in 1596) list *Lappia* (today's *Sapmi*) as an independent nation on par with Norway and Sweden. In his work Botero (1544-1617) uses a full page (Botero 1622: 97) packed with lines of text to describe the Saami nation, which he calls both *Lappia* and *Lapponia*, stating that this state 'borders with Norway'. He describes the Saami skills in archery and admires their construction of boats without the use of nails.

As always Botero bases his analysis on the relationship between nature and culture. 'Instead of horses, Nature has given the Saami the reindeer'¹. He tries to describe the reindeer, size of a mule, skin as a donkey, and antlers similar to those of a deer, but with fewer branches'. Botero then admiringly describes the great distances, 50 *miglia*, that the Saami can travel with their reindeer sleighs in 24 hours.

Part of this admiration for the variety of God's creation was what we call 'reverse orientalism'. Non-European cultures were often used as utopias that showed the Europeans alternative ways to organise society. The admiration for the Chinese was common (Wolf 1750), but also for the Andean Inca Empire (Justi 1762). In Sweden – at the time an important political and also intellectual power in Europe – this reverse orientalism extended to the Saami. Carl von Linné or Carolus Linnaeus (1707-1778) – one of the most influential Swedish intellectuals of the time – clearly held the Renaissance view of the Saami as noble. In an age where German cameralism was the type of economics applied in Sweden, Linnaeus describes the Saami as 'the ideal cameralists', and one of his best known portraits shows him in traditional Saami dress (Aslaksen 2007).

'They have been at continuous war with the Norwegians', Botero reports on the nation Lapponia², and informs us that they now have had to accept paying taxes to Norway, which are paid in animal skins. As late as in the middle of the 19th century the Northernmost part of Norway, Finnmark, was labelled 'a colony' in official Norwegian documents.

¹ 'In vece di cavalli, la natura gli ha dato il rangifero..'

² 'Hanno guerreggiato lungamente co i Noruegi' he says in his old-fashioned language.

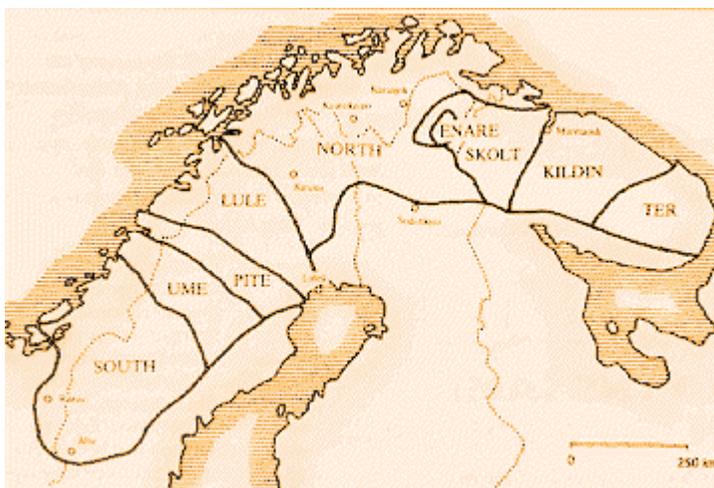


Figure 3. Saami languages and nation-state borders.

Similarly to what later happened in Africa, when *Sapmi* or *Lappia* was absorbed into the modern nation-states this was done in a way that cut across traditional ethnic areas. Figure 3 shows how the dotted lines marking the borders (from left to right) of Norway, Sweden, Finland, and Russia cut across the Saami linguistic groups that also represented the traditional migratory range of the herders. Comparing figure 3 and figure 2, which shows the present-day migratory patterns of herders in Finnmark, renders the idea of the traditional importance of 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, Sweden, Finland and Russia, the traditional free movement of the Saami reindeer herders between these nations was maintained (codified in *Lappecodicilen* of 1751). In this way the organizational units of the Saami herders – the *siida* – came to represent an early case of transnational corporations. 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 a long time. As late as in the summer of 2007 Swedish reindeer herders came to summer pastures in Norway using the 1751 *Lappecodicil* as their legal basis.

In the same way as the Jews in many parts of Europe (Israel 1989), the Saami lived in a ‘republic apart’ moving freely within the Scandinavian kingdoms and tsarist Russia (of which Finland was a part until 1917).

3.2. 1770s and the end of 'republics apart'.

From the start of European colonization the property rights of the aboriginal groups being colonized was not questioned from a legal point of view: "*the Indians were true owners (of land) both from the public and the private standpoint*" (Vittoria, 1532, quoted in Riseth & Gundersen 2004). This view slowly came to change, and central to the change was natural rights philosopher John Locke (1632-1704) (Oskal 1995 and 1999). While he maintained *private property as a basic human right*, he also argued that *indigenous peoples and nomads do not have property rights to pasture lands* (Oskal, 1999).

These legal considerations were part of a broader political change where the earlier view of 'a noble savage', as exemplified by Botero's writings, was changed into a view of an 'ignoble savage'. Ronald Meek's 1976 book 'Social Science and the Ignoble Savage' records this as a watershed event in the development of the social sciences: the development of classical economics has its roots in the Enlightenment stage theories that defined human progress from hunting and gathering to nomadism and then to sedentary agriculture, and then finally – in Adam Smith's system – to *The Age of Commerce* (see Reinert 2000 for a discussion of stage theories). The practical consequence of this was, among other things, separating aboriginal economic activities as 'inferior' to European agriculture. This had immense consequences for European attitudes, above all towards other ethnic groups, and served as a justification for colonialism.

As part and parcel of this same trend, the phenomenon that we have labeled 'reverse orientalism' – using foreign cultures as stereotypes to be imitated – turned into the opposite phenomenon. Ethnic stereotypes came to be used in a mainly negative way, what Said justifiably calls 'orientalism'. In Finland today Saami orientalism includes a standard picture of a drunken Saami waving a bottle. The action movie on the 1852 Kautokeino Revolt (see below), to be released in early 2008, in a very orientalist fashion emphasizes Saami alcohol abuse instead of their loss of pasture, which may have precipitated the drinking problems in the first place. Saami orientalism in Norway also takes on more subtle and insidious forms to which we shall return later.

The changes towards the indigenous population built up after Locke's writings. The Jews were faced with similar problems as other ethnic groups like the Saami. In many European countries the Jewish communities had functioned as 'republics apart' with a large degree of self-management, also in legal affairs. During the 1700s this largely came to an end (Israel 1989). In spite of this change obviously being gradual, it is remarkable how the 1770s mark a qualitative turning point in the European nations' relationship to their

ethnic minorities. The Jesuits taught the American Indians in their own language and taught them art, music, and book printing, and in Asia they represented our 'reverse orientalism' by holding up the merits of Confucianism to the Europeans and translating his work into European languages. In 1773 the Jesuits were suppressed in all Catholic countries. The drafts of the Constitution of the United States referred to the 'Indian nations'; by the time the Constitution was approved in 1776 these had been reduced to 'Indian tribes'. In Norway, the *Seminarium Lapponicum* in Trondheim that taught priests to preach in the Saami languages was closed in 1774, and a long period of 'Norwegianification' followed until the present day. The world view that had produced the legal framework for the Saami reindeer herder – the 1751 *Lappecodicilen* – was dead and buried in the 1770s.

The most devastating effects of this change to the 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, by initiative from the Norwegian administrator in Finnmark, the border between Norway and tsarist Russia was closed to the herders. This meant breaking off the main artery of the annual migration of the herders, seriously undermining the carrying capacity of herding in terms of number of animals and humans that could make a living from herding. As a consequence a serious revolt broke out in Kautokeino, leaving several dead. Herders' access to some of their key ecological niches had been blocked, greatly reducing the carrying capacity of the Finnmark herding system. As a result, hundreds of Saami families migrated to the United States and Canada, some of them taking reindeer with them across the ocean, and to Sweden.

The 1852 Kautokeino revolt had undertones of a 'theology of liberation' created by Swedish priest Lars Levi Læstadius (1800-1861) among the Saami people. Læstadius fought 'orientalism' by codifying Saami mythology and showed it not to be 'primitive' as previously thought. As the Jesuits did with the Chinese belief system, Læstadius made the belief system of the Saami accessible to the West.

In 1905 Norway broke out of the union with Sweden. Again the new borders were established in such a way that they broke up the traditional *siida* arrangements, e.g. locking the Swedish herders out from their traditional summer pastures on the coast of Norway as the Norwegian herders had previously been locked out from the huge pine forests of Finland. The new political borders severely limited the geographical niches available to the herders. The normal reaction to very mild winters with increasing *Frostwechselhäufigkeit*, limiting the access to pasture through snow, would have been to move further inland to colder conditions, in the case of the herders in Finnmark, into the forests of present-day Finland.

Using the Troll-Murra framework, we can observe that about the same time another extreme climatic niche in Europe experienced a problem similar to that of the Kautokeino Saami. The highest village in Europe inhabited all year round is Juf, at 2,126 meters above sea level, in the valley and municipality of Avers, Canton Grisons (Graubünden), in Switzerland. The comparative advantage of the valley is extremely lush cattle pastures in the summer. For centuries the most important natural trading routes were not to the rest of Switzerland, but across the mountains and into Italy, where cattle were brought to market in the fall. Like in Finnmark between Norway, Sweden and Russia, in this roadless area the border between Italy and Switzerland had been open to local trade and migration. However, when the new Swiss Federal constitution of 1848 moved the collection of customs duties from the cantonal to the federal level the traditional way of living of the inhabitants in the Avers Valley was suddenly defined as smuggling (Stoffel 1938).

Such consolidation of nation-state power is clearly a source of potential violence, as in Kautokeino in 1852. A war with about 100 dead, in November 1847, is the closest Switzerland ever has been to a civil war. The winners established the 1848 constitution. In international political history the peaceful breakup between Sweden and Norway in 1905 is a glowing example of peaceful resolutions of political conflicts. However, from the point of view of the reindeer herders the economic separation of Norway and Sweden has not been finally resolved to this very day (Berg 1994, Lae 2003). In 2007 bilateral negotiations on herding rights were still taking place between Norway and Sweden. As a young nation in 1905, Norway strongly demanded that all cross-border reindeer activities had to cease, and Swedish Saami could no longer take their animals to summer pasture in Norway.

This brings up an issue of some importance to reindeer governance today, i.e. the different attitudes found in 'empires' vs. in 'nation-states'. In empires like Russia, and like Sweden in the 1700s, the parallel existence of several ethnic groups is normal. The tsar was also the tsar of the Saami and of many other ethnic minorities; ethnic diversity per se presents no threat to an empire.³ Sweden had established universities to serve the non-Swedish ethnic groups of their empire, in Estonia in 1632 and in Finland in 1640, still solidly in the 'pre-orientalist' period of European history. But we would argue that some old imperial heritage persists. Not that Swedish pol-

³ Estonia, gaining independence from Imperial Russia in 1918, displays the shift from tolerant 'imperial' attitudes towards its ethnic minorities (Swedes and Jews) towards those more typical of a mono-ethnic nation state during the 1920s. The Norwegian Constitution prohibited the entry of Jews into the country until 1851, and of Jesuits until 1956.

icy towards the Saami is particularly benevolent, but it differs greatly from Norwegian policy by being more marked by neglect than by active attempts to reform and eradicate ethnic differences and practices, which has been the hallmark of Norwegian policy. 'We have never thought we could manage reindeer herding more efficiently than the Saami themselves', a Swedish Ministry of Agriculture official stated to one of the authors a few years ago. As we shall see, this statement marks a distance to Norwegian practice. The ethnically 'foreign' as a threat to national identity permeates the Norwegian governance system for reindeer herding to this very day – and as we shall argue later – the Russian governance system still seems to carry with it the empire's greater tolerance for ethnic diversity.

4. Cyclicity and Change.

Climatic change in the Arctic does not start from a level playing field, but from a very rugged one. 'One year is not the next year's brother', goes a Saami saying. The study of climatic cycles in the Arctic goes back to Norwegian polar researcher Fridtjof Nansen (Nansen 1926).

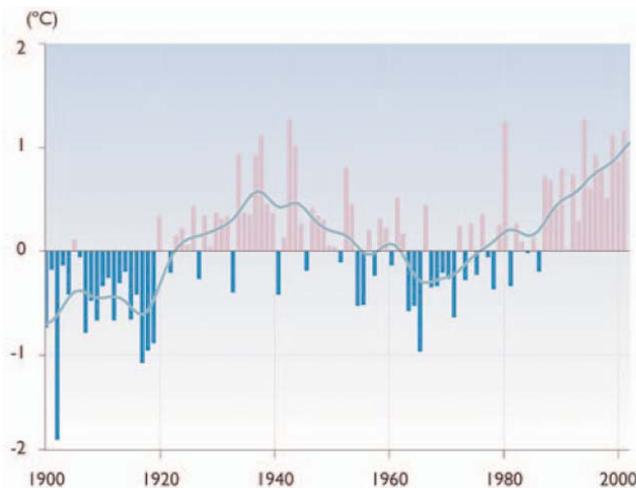


Figure 4. Cyclical behaviour of temperatures in the Arctic, 20th century.

The figure shows historic changes in average air temperatures in the Arctic (annual average change in near surface air temperature from stations on land relative to the average for 1961-1990, for the region from 60°N. (ACIA, 2005)). Today is not the first time the Arctic has seen rapid temperature change. The same pattern was evident around the 1920s. There are still reindeer herders alive who have knowledge about how reindeer husbandry adapted before, knowledge that can be crucial to face the future.

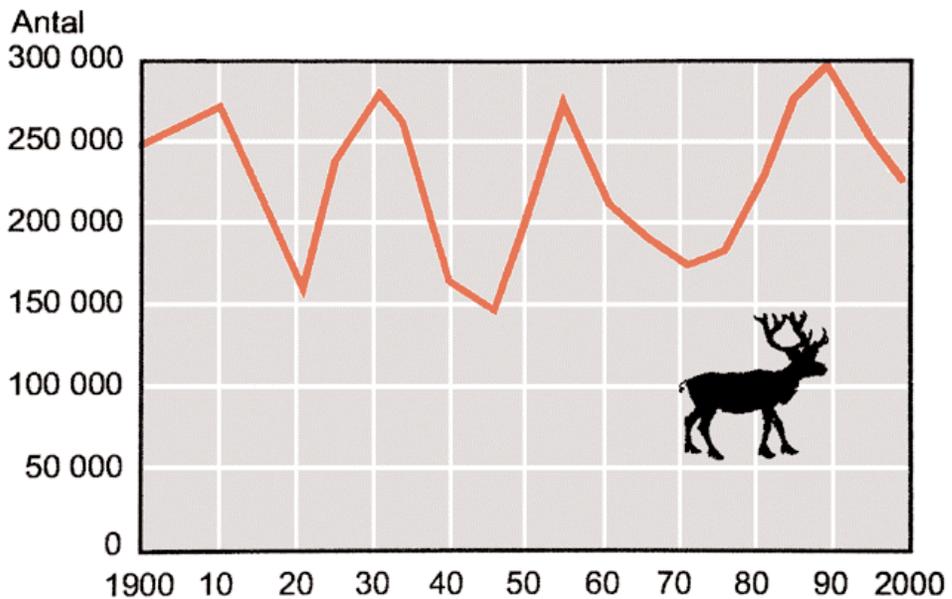


Figure 5. Cyclical movement of number of reindeer in Sweden, 1900-2000.

Source: Statistics Sweden.

The relationships that create cyclicity are highly complex, and one of the goals of the EALAT project is to investigate the factors involved and their internal relationships. It seems that a downward cycle may be triggered by a climatic shock to the herds, like in the winter of 1931 when reportedly all calves in Finnmark perished. For the purposes of this paper it is sufficient to note that both the variables and the coping mechanisms involved in cyclical change are of the same kind that will be needed in order to understand and adjust to permanent change. The experiences from the cyclical patterns must be part of the analysis.

5. Comparative reindeer governance on the nation-state level.

In his 1962 book *'On the Theory of Social Change. How Economic Growth Begins'* MIT economics professor Everett Einar Hagen (1906-1992), points to cultural values as important for development. As the academic debate on economic development is currently moving away from a period focusing on 'institutions' towards 'culture', his work is likely to be studied once again. One of Hagen's variables explaining innovation and growth, and their absence, is traditional children's fairytales that create life-long attitudes. In old Norwegian fairytales one hero is an unorthodox young man, Askeladden, whose closeness and kindness to nature, even to old witches, in the end bring him the princess and half the kingdom. Some Slavic fairytales include similarly enterprising young men but with a different ending:

little Pjotr understands that the elderly were right after all. These are clearly different culturally-based messages as to the benefits of being unorthodox and innovative.

After World War II modern children's literature has, to a large extent, taken over the role previously held by fairytales. However, in Sweden, Finland and Norway the most popular authors of children's books in the post-war period – Lindgren, Jansson and Egner respectively – communicated surprisingly different values to the coming generations. The authors themselves were all products of the same generation, having experienced the difficult 1930s, and the post WW II period, and all became famous enough to have their children's stories celebrated with museums or theme parks.

In the stories of Swedish author Astrid Lindgren (1907-2002) the children tend to be right and the authorities wrong. In the case of *Pippi Longstockings* both the policeman and the authorities in charge of protecting children are 'villains'. In *Rastus and the Vagabond*, Rastus, another orphan, teams up with a tramp, and the authorities are again the crooks. The overly zealous and incompetent Constable Bergkvist clearly merits Rastus' term 'blockhead'. In *Karlsson-on the-Roof* we meet another shady figure, and Karlsson's lack of morals are corrected by the young hero *Lillebror*. In Lindgren's books the reader is generally left doubting whether adults are reformable or indeed hopeless cases. Fearing that Karlsson might lead children to disobey authority and to mistrust and fear babysitters, the book was banned in some libraries and schools in North America.

The Moomin books by Finland's Tove Jansson (1914-2001) present us with fictional animal-like characters with very human strengths and weaknesses. Here the common-sense Moomin mother represents a healthy and caring antidote to her husband's high-flown ideas and ambitions. As with Lindgren, authorities tend to be nerds: the Hemulens – a species apart – as policemen, orphanage aunties, or park guards. The only likable authority is a benevolent despot who appears in one book.

The books by Norwegian Thorbjørn Egner (1912-1990), who also edited school textbooks for a generation, send very different messages than those of his two Nordic colleagues. The main plot in Egner's two classics *The Singing Town* (or *When the robbers came to Cardamom Town*), peopled by human beings, and *Climbing Mouse and Other Animals in the Hunchback Wood*, peopled by animals, are that characters with behavior deviating from the established are reformed through the good intentions of others. The norms that come to prevail are modeled on individuals who, without a trace of doubt, define themselves to be the perfect role models for the rest of the world to follow.

The three Cardamom Town robbers are successfully rehabilitated by Aunt Sophie and Constable Bastian, the authority. Aunt Sophie's singing lament is that if the rest of the world would just behave as she does, it would be a perfect place. The town is ruled by Constable Bastian's Cardamom Law: *'You shall never bother others. You shall be both fair and kind. And whatever else you do, I shall not mind'*. An admirably clear and simple substitute to the Ten Commandments and legal systems.

In Egner's idyllic Hunchback wood Morty Forest Mouse is the person who declares that the world would be a perfect place if just everyone behaved like him. The main problem in the forest is that it is also inhabited by a carnivore, the fox. One of the main plots is the rehabilitation of this fox. To the applause of the rest of the forest, but somewhat *contra naturam*, the fox is cajoled by the majority into becoming a vegetarian. In contrast with Lindgren's work, with Egner 'bad' behavior is eminently curable and also solves social problems. In contrast to Lindgren's world, Egner's code of behavior appears in context with a minimum of diversity. Utopia is achieved though good intentions, and the role model is oneself. In a world where cultural diversity has become the norm this sounds like a formula for an 'orientalist' world view. It becomes clear how Egner's utopia was valid only in the context of an ethnically extremely homogeneous post-WW II period in Norway.

Why these digressions into the admittedly slippery slope of national stereotyping? In order to offer an explanation, even an excuse, for Norway's exceedingly 'orientalist' reindeer herding governance structure. After serving as a consultant to the reindeer herders in the annual negotiations with the government, the corresponding author of this paper (Reinert) received financing from the Reindeer Herding Research Fund (RUF) in order to make a comparative study of national reindeer herding governance in Norway, Sweden and Finland. Everett E. Hagen and his theories that appeared to be of direct relevance to explaining the huge differences between Sweden and Finland on the one hand – with degrees of autonomy and self-management – and the reformist model with detailed supervision and intervention in Norway. Norwegian reindeer herding governance has all the elements of an Egnerian utopia, including the ambition to modify nature, applied in a situation where different contexts make such an approach doomed to fail. And the point when the failure will be evident is likely to be too late, because the lessons from early warnings have not been adhered to.

Since the late 1970s Norway's Ministry of Agriculture has attempted to reform Saami reindeer herding to conform to monoculture practices of modern agriculture and to Fordist mass production (Reinert 2006). A key goal in this policy has been to avoid – to level out – the natural cycles of production. One unfortunate coincidence – such things happen more easily in small

countries – is that the only bureaucrat with a Ph. D. in reindeer herding (from the agricultural university in the far South) had studied herding in the Southern regions, where nature's cycles are much less pronounced and the culture much more 'Norwegianised'. This created an Egnerian reform program that materialized as a noticeable 'orientalist' attitude from the Norwegian government towards the Saami herders during the annual negotiations. The vast majority are from the far North. 'It is as if everything we know has no value', a university-educated female herder correctly pointed out.

As is clear from Figure 5 cyclicity is a fact of life with reindeer as with lemmings. The Norwegian herders were subjected to a pricing regime that kept prices fixed during the 1990s while volume of production was halved. This halved the income of the herders (Reinert 2006). Cyclicity of production is officially seen as man-made, as a result of 'overpasturing' and 'underpasturing' (Ims & Kosmo 2001 : 14-15). In official documents climatic variations are not discussed other than as random events causing occasional 'crises' in an otherwise stable environment. The general consensus in Norway during the widely publicized crisis in reindeer herding in the late 1990s was that it was due to herder irresponsibility. However, two lines of partly contradictory arguments were found in the public debate. One argument is the classical 'tragedy of the commons' argument (Hardin 1968): individual herders maximize their profits based on unregulated common grounds. A lack of capitalist property rights and of strong central state management would therefore lead to the physical destruction of Northern Norway through overgrazing. The other argument is based on the opposite assumption, that reindeer herders are *not* profit maximizers, but rather maximize the size of their herds. In both types of arguments – whether herders maximize profits or fail to maximize profits – too little attention is paid both to the strong traditional regime regulating the use of pastures and to the role of natural cycles of production. In the Ministry of Agriculture the two types of economic crisis – those created at the peaks and the troughs in figure 5 – both bring forward the same gut reaction: too many reindeer. Whatever the source or type of crisis, the remedy and policy response is always the same.

The official interpretation of cyclicity in the Ministry of Agriculture as a result of 'overpasturing' and 'underpasturing' suffers from some logical flaws. How does one explain the fact that sustainability and herd sizes after the 1999 crisis subsequently returned to previous levels at an unprecedented speed, doubling the volume and value of production of Norwegian reindeer meat in three years from 1999 to 2002? The last period that saw a doubling of production was from 1978 to 1987, a period of nine years rather than three years. This suggests an increased resilience of the habitat precisely during a period when crisis-maximization regarding the habitat

emanated from the Ministry of Agriculture. Does this sudden increase in the number of animals mean that the mechanisms causing 'the tragedy of the commons' are subject to cyclical fashions among the herders, so that the pastures recover in periods when herders are less profit-maximizers (or respectively no longer maximize the size of their herds)? How would one otherwise explain the sudden and explosive recovery of 'sustainability'?

In fact, at closer scrutiny, what passes as 'scientific analysis' from the Ministry of Agriculture may equally well be seen as incomplete and opinionated fragments of analysis lacking internal consistency.⁴ Systematically fed with this far from scientific and far from complete analysis, the Norwegian Parliament (*Stortinget*) has defined a static maximum number of reindeer in Finnmark. Based on this, the Ministry of Agriculture planned 'forced slaughtering' of reindeer. The logic applied in reindeer herding thus runs contrary to the logic otherwise applied in nature's production. A bumper year in other crops – from wheat to fruit and berries – is a call for celebration. In reindeer herding a bumper crop is exclusively a call for alarm. This is because in the static governmental analysis good conditions of production are exclusively interpreted as a threat to 'sustainability' (statically defined once and for all) of the reindeer moss, rather than as a natural cyclical change in the same sustainability.

In 1976 the planned economy reached reindeer herding with a bang. In practice this meant that the Saami herders were alienated from the key elements in the value chain: from slaughtering and marketing. An eyewitness who was present at the time tells of how men in white coats from the meat cooperative moved in on the slaughtering spaces around Røros to take over the slaughter traditionally performed by the herders themselves. The purchasers, who traditionally gathered around these areas and constituted the existing market of reindeer herding, disappeared and were replaced by a 'target price' established through negotiations with the government. An important part of the new regime of herding was a policy of equalization, whereby large reindeer owners through forced slaughter were forced to significantly reduce the size of their herds. At the same time, numerous new economically weak herding units with small herds were established. In this way, reindeer herding lost the most resourceful herders (Reinert 2006).

⁴ In the sphere of biology, an unlikely but very serious disagreement exists between the government and the herders themselves as to what reindeer actually eat. While the official line is that reindeer hardly survive without reindeer moss (*Cladonia* sp.), the herders themselves – backed by some researchers – are of the opinion that present government policy is based on an exaggerated view of the importance of reindeer moss in the animals' nutrition. Reindeer inhabiting the Northern archipelago of Svalbard (Spitsbergen) for an estimated 40.000 years have had no access to reindeer moss at all. This is a key issue because an important political pressure towards 'forced slaughtering' of reindeer is essentially based on an effort to save reindeer moss.

Reindeer herders themselves call the 1976 law the “barnyard law”, a highly apt name. From now on, reindeer herding was to be governed by the same scientific Fordist principles according to which agriculture was managed, where the industrialised agriculture in Central Europe was the standard against which reindeer herding was held up and judged.

Herding policies of the Ministry of Agriculture were largely governed by the theoretical works of Dag Lenvik, initially employed in the Reindeer Herding Administration and subsequently responsible for reindeer herding in the Ministry of Agriculture. His was the logic of modern agricultural practices as taught in Norway at the Agricultural University at Ås. It is not our purpose here to criticize individuals, but Lenvik represented an approach that was highly typical of the entire culture in the Ministry of Agriculture, a culture that in our view is still strongly marked by the Fordist faith in mass production.

Lenvik’s publications show to what degree herding is being forced into the mass production philosophy of ‘modern’ agriculture (Lenvik 1988, 1990). ‘Within normal sheep rearing, meat production based on old uncastrated rams is unthinkable. No sheep farmer would use the winter feed – the marginal factor – on a herd of rams that produce less meat than the ewes can produce through the yield of lambs. Today, the line of thinking should be the same in reindeer herding. Male animals that are superfluous from the point of view of procreation occupy grazing grounds that could alternatively be employed for cows... A herd of male animals larger than what is necessary for good insemination results should in that case be based on factors other than meat production... such as tourism or special management techniques’ (Lenvik 1990: 31-32)

In this central article Lenvik makes no mention whatsoever of environmental or climatic variations, except when he *excludes* these as a factor that can explain differences in the development of herding between Finnmark and Trøndelag: ‘This is not due to predators or other natural circumstances’ (ibid.:34). Lenvik conducted his investigations in the southern reindeer districts, with much less climatic variation and much less problems with predators. Lenvik does not in his ‘barnyard model’ consider the importance of male animals in the herd. A herd with few bulls is far more ‘nervous’ and more exposed to predators than a traditional herd. Bulls, particularly the castrates or ‘the gentlemen of the tundra’, also play an important role in digging up food for calves and cows. The older bulls are the ones that start the mating season, and they are important to keep predators at bay. Some local herders today claim that he was not aware that the district he was studying received many bulls from the neighbouring district Essand on the Swedish side of the border, others point out considerable problems with the weighing methods.

With this sort of research, a series of conflicts arose between the Administration and the herders concerning the organisation of reindeer meat production. Here Saami knowledge and theoretical knowledge from the Agricultural University at Ås clashed, and over the course of more than a decade the Saami understanding of their own meat production was completely trampled. The Egnerian reform model in Norwegian reindeer herding leads the administration to produce a large quantity of highly detailed and constantly changing regulations, compared to the 'self-management model' in Swedish and Finnish reindeer herding. As one of the herders put it: 'Before, we were used to work with an unpredictable nature, now we also have to work with an unpredictable government administration'. The frequent changes of the rules of the game – intended to fine-tune what the Ministry saw as the ideal plan – made rule-and-regulation-based entrepreneurship the most profitable form of Saami entrepreneurship. The price level was given by the monopsony to which most herders had to sell their animals, the leeway left for entrepreneurship became maximizing profits by being as obedient to the ever-changing government rules as possible.

Another classic in the knowledge wars between the Agricultural University at Ås and Saami knowledge is the question of the role of large cows in meat production. Lenvik shows a clear relationship between the weight of cows and their reproductive capacity (1988, table 4). Herders have insisted all along that the cows grew large because they did not have a calf the first year, and that large cows are *less* fertile and not, as Lenvik claimed, more fertile. After the Ministry of Agriculture has spent decades actively trying to influence herd composition according to Lenvik's principles, it now appears – as far as we understand it – that the herders were right all along. Large cows are on the average less fertile than small ones.

The traditional knowledge of herding was to be gradually replaced by 'science'. 'In 1976-77 one had to resort to opinionating about many central issues during the negotiations concerning reindeer herding and the Reindeer Herding Act. Today, twelve years later, the subjects of biology, ecology, production theory, economics and politics are far more developed for herding. 'Opinions' can thus largely be replaced by expertise' (Lenvik 1990:34). The Reindeer Herding Administration was also going to be the institution that would ensure that reindeer herding in practice conformed to the new orthodoxy. Through very frequent changes in the regulations, which were often inaccessible to the herders, the administration could reward herders who followed the correct path – for example in herd composition and calf slaughter – and punish those who didn't. The bitterness is greatest precisely among those herders who had the greatest potential as independent business operators.

Through government regulation, also sanitary regulations, the Norwegian Saami have lost control over the elements in the value chain where profits are made, 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 the same figure was around 20% (Reinert 2002). The herders have lost control not only over a key stage in their productive cycle, but also an important aspect of herding culture.

For many years Norwegian policy has run contrary to the principles on which both Swedish and Finnish reindeer policy – and general European agricultural policy – are based. Normally subsidies and support would be given to herds large enough to provide a reasonable income. Norway has always had an upper limit of animals beyond which no support is given, in Sweden and Finland the opposite is the case; a minimum limit of animals is required to achieve support. Contrary to their Norwegian colleagues, reindeer herders in Sweden and Finland have a large degree of self-management. Most of the work carried out in Norway by the Reindeer Administration – the prolonged arm of the Ministry of Agriculture – is in Sweden and Finland left to the herders' own organizations. Aside from an entrenched practice that contains strong elements of 'orientalism' – of what Paine (1977) in the context of the Canadian Arctic called 'welfare colonialism' – few objective reasons seem to exist as to why Norwegian herders should not be given the same degree of autonomy.

In terms of herders' autonomy the Norwegian system represents an extreme case of detailed government regulation and intervention. This requires a big bureaucracy, around 50 employees of the 'Reindeer herding administration' (*Reindriftsforvaltningen*) in Alta supervise around 500 reindeer herding units. Additionally a group of people in the Ministry of Agriculture in Oslo work on reindeer herding. In Finland, with more reindeer than Norway, the tasks performed by *Reindriftsforvaltningen* have been farmed out to an organization run by the herders themselves (Paliskuntain yhdistys/ Renbeteslagsföreningen) in Rovaniemi. Their activities are guided by an annual letter with guidelines from the Ministry of Agriculture. In contrast to the Finnish system with a high degree of self-management, the Norwegian model carries similarities to the 'nanny state' described by Paine (1977) as the system governing the ethnic groups inhabiting the Canadian Arctic. The Norwegian government appears to be the last government not to include traditional knowledge as an input into scientific knowledge about the production systems of ethnic minorities. This is the official line from Norway's Ministry of Agriculture in international Polar Year Meetings, and also evident in the draft for a new law on reindeer herding.

Somewhat unexpectedly, perhaps, Russian reindeer herders on the Yamal Peninsula seem to enjoy greater degrees of freedom than their Nordic counterparts. During the Soviet era, the tolerance of ethnic minorities that we have identified as typical for empires, continued. The many ethnic groups in the North had their own offices in the Duma. In Yamal, the organisational group corresponding to the Saami *sida* is the *stoi-bushe*⁵. This traditional organisation of the work-community allows for the necessary flexibility to respond to climatic variations, and is therefore an important factor in ensuring adaptability. 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 has stated that "Nothing is liable to arouse more disturbances within reindeer husbandry than encroachments on its internal organisation" (JM Turi, 2002:71). Without a fluent and flexible organisation reindeer pastoralists would lose the source of their greatest adaptive capacity. Institutional settings where reindeer pastoralist's traditional organisation is restricted – as in Norway – represent a serious institutional constraint on adaptation.

In Yamal, reindeer herders are mainly organised in so-called *Brigades*, belonging to Municipal Enterprises. In the Yamal Peninsula there are four municipal enterprises, of which the Yamalsky Enterprise represents one. The Yarsalinsky enterprise consists of 21 brigades with varying number of members (including women, children and elders the total number of members in a brigade is normally close to 50). The municipal enterprises own reindeer and employ herders to manage the herd, and their wives to manage the household duties. In Yamal, however, a considerable proportion of reindeer are private. This leaves an organisation of the Brigade as a work-community herding their own private reindeer as well as herding the state-owned reindeer.

Yet it is evident that the core principles of the organisation of the brigade correlate with the traditional way of organising reindeer pastoralism. The brigades are organised work communities built on the main principles of the original *stoi-bushe*. The present brigade system in Yamal also enjoys the benefits of the adaptive capacities of the *stoi-bushe*.

This results from the fact that the Brigades have been allowed relative 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,

⁵ The discussion of the Yamal reindeer herders is based on El Turi (forthcoming 2008)

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 where rain in January caused locked pastures in the winter pastures south of the Yamal Peninsula. 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.

This type of response is a tactical manoeuvre known by other reindeer pastoralists as well. Similar conditions led to the same response in Sámi areas during the winter of 1917/18 (NJC Tyler et al. 2006) However, institutional constraints in the Sámi areas make such responses difficult nowadays, particularly in Norway.

Herd structuring is another key variable in adjusting to climatic change, and where the governing policies of the nation-state are very different. Traditionally reindeer herds in Finnmark typically consisted of as many as 40% adult males. Large numbers of large males were required for traction; they acted as focal points, helped keep the herd together and reduced the general level of activity of the females: in modern jargon, the males contributed to energy conservation within the herd. Such herds also have much smaller losses to predatory animals which in many areas kill a considerable percentage of young calves every year. The first description of castration of reindeer was reported by Linnaeus (1732).

Soon the Norwegian parliament will decide on a new law for animal welfare, where Saami reindeer herders might lose their rights to castrate male reindeer using their traditional knowledge and insights. Its implication might be increased vulnerability to warming of reindeer pastures and decreased animal welfare when availability of food is poor. In future the new animal welfare law in Norway can easily force Saami reindeer herders to break the law. Recently Norway's National Committee for Ethics in Science and Technology (NENT) developed ethical guidelines for science and technology, in effect giving support to the Saami by recommending natural scientists to integrate and respect alternative sources of knowledge such as traditional knowledge.

Recently, Vladimir Ethylen 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. We look at reindeer as part of a herd. Such a herd is by itself a living organism where everyone has its own place, both reindeer cows, calves, reproductive

male. 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. I have studied this theme with special care and have come to the conclusion that this problem is a very serious one. All my sympathy to Norwegian reindeer herders who have faced these problems because of 'greens'. We should in fact fight for our right to castrate. Once at a time when reindeer were still wild, human beings probably noticed that the one animal attacked the other one in order to turn this animal into a castrate. By the way, if I am not mistaken this issue is in Saami language associated with an action accomplished with one's teeth. With us there exists such a method of castrating with one's teeth too. Some of our reindeer herders can still do this with their teeth. 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. Reproductive oxen are first to die because of lack of food. Calves die very quickly too. But castrates are the strongest animals and they manage to break such ice. Reindeer cows follow after them and eat the fodder left over. Also in this way castrates play a very important role. When there is a lot of snow, they are the first ones to dig the snow away. After that they are chased away and then the reindeer cows can eat". From <http://www.reindeerportal.org>

The reduced heterogeneity of herds represents a reversal of the traditional approach; its consequences, in terms of the performance of the animals, remain largely unknown. The pattern of dispersion of female-dominated herds over the landscape is said to be different. The consequences of reduced heterogeneity in terms of changes in the vulnerability of the herding system to environmental change remain still unknown. Traditional knowledge of structuring the herd according to sex, age and behaviour is one way herders prepare for variability and change in climate conditions.

6. Conclusion: Climatic change: coping and adjustment mechanisms.

Aboriginal production systems in extreme, highly variable, and unpredictable climates are based on the sequential utilization of often large numbers of ecological or climatic niches (Murra, 1975). Human survival under such extreme climatic conditions is based on flexibility and the distribution of risk through diversity. Reindeer herders maintain high levels of phenotypic diversity in their herds with respect, for example, to the age, sex, size, colour and temperament of their animals. A *čáppa eallu* (beautiful herd of reindeer) is therefore highly diversified, and, in this respect, is the antithesis of a pure bred herd of livestock of the kind developed by careful selection to suit the requirements of a modern, high yielding agricultural ruminant production system. We argue that maintaining and re-creating necessary degrees of freedom is the key to successful adaptation to climatic change.

The paper suggests four ways to increase the capacity of reindeer to cope with (short term) and adjust to (long term) a changing climate:

1) Restructuring herds in a way that decreases vulnerability to adverse climatic conditions (e.g. pastures 'locked' by ice, and predatory animals). Traditionally the structure of the reindeer herds was managed in order to create a robust herd able to withstand climatic adversity and predatory animals. This was achieved e.g. through a large share of male castrates. In recent years herds have been managed almost exclusively with the view to maximizing annual meat production, thereby seriously increasing the vulnerability of the herds. In Norway present government incentives work *against* diversity.

2) Re-establishing Fenno-Scandic reindeer herding as the multinational enterprise it was until the mid-19th century, allowing the *siida* to regain its transnational character. This means opening up for the normal rule of free movement of people and goods with the European Economic Area also to apply to pasturing reindeer, as was the case until the mid 19th century. Such an agreement would have to be negotiated in a process also heavily involving the Saami organizations in the countries in question.

3). Limiting the increasing permanent loss of ecological niches available to the herders, due to pastoral land being used for other purposes, including new infrastructure. Point 3 differs from point 2 in that point 2 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 ecologic niches being permanently destroyed.

4). Making sure the herders have a solid economic base, which will enable them to absorb the costs associated with climatic change. Reindeer meat

is a luxury item fulfilling all the criteria for health food, low fat and high nutritional value, meeting all the qualifications for successful marketing in our 'dream society' (Jensen 1999). In Norway, however, government interference through a variety of regulations affecting the industry (E. Reinert 2006, H. Reinert 2007) has reduced the herders' previous profitability. The most profitable activities in the value chain bringing reindeer meat to the customers – slaughtering and marketing – have, through government intervention and regulations, been secured by non-Saami. In this way the Saami herders have to a considerable extent been economically reduced to a colonial status of raw material producers, left out of the high value added parts of the business.

Because they operate in such a great number of different ecological niches, the Saami herders are inherently better suited to handle permanent variation in climatic conditions than most other cultures. Compared to an Australian cotton grower, for example, a large number of options are available to the herders through which they may counteract and circumvent the negative effects of climatic change. The less encouraging part of this story, however, is that the herding governance systems imposed by nation-states have tended to reduce the very degrees of freedom that would make successful adaptation possible.

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