CAES-workshop

CAES-workshop	**Reindeer 2000**
CAES co-ordinators	**Ekaterina Ruth, Sweden and Päivi Soppela, Finland**
Organising committee	**B. Forbes, U. Heiskari, H. Norberg, T. Porsanger, P. Soppela, E. and W. Ruth**
Oral -	**Wednesday 20.00-22.00, Friday 09.00-18.00**
Posters -	**Monday-Thursday**

Preface and overview of presentations

Preface

The following abstracts represent presentations of key note speakers, PhD students and post-doctoral scientists who will participate in the CAES-workshop 'Reindeer 2000' in conjunction with the 10th AUC. The purpose of the workshop is to stimulate the interdisciplinary approach to studies relating to reindeer and reindeer husbandry. The research in reindeer husbandry has long been dominated by natural sciences whereas the traditions of social sciences have been week or missing. However, it is obvious that a dialogue across discipline borders and a motivated inter-disciplinary approach is necessary to understand and solve many of the current challenges within reindeer husbandry. This workshop aims to increase understanding and partnership particularly between young natural and social scientists, and to foster closer interaction across the borders, especially between the Fennoscandian countries and Russia.

The invited key note speakers will present how they envision an interdisciplinary approach to research being developed in their particular fields and disciplines. The students' presentations provide an overview of their proposed or ongoing studies. The introductions of the key note speakers and presentations of the students serve as the basis for the session where the theme'interdisciplinary' is discussed and future activities are planned. The workshop as a whole serves as an initial step and get-together for the international course 'Reindeer as a keystone species in the north: Biological, cultural and socio-economic aspects' which is due to be held in the northern Fenno-scandia and Kola peninsula in September 2000.

This workshop is organised by CAES (Circumpolar PhD network in Arctic environmental studies; http://www.urova.fi/home/arktinen/caes/), and supported by NorFa (Nordic Academy for Advanced Study).

On behalf of the organising committee Päivi Soppela

CAES key note lectures (1-4)

Abstract 167 Resolving complexity in reindeer and caribou grazing systems: The role of interdisciplinary research.
D.R. Klein.

- - - Local development program in Sami area in Russia. Indigenous knowledge and methodology.
J. Eikjok.

Abstract 168 Conflicts between reindeer-husbandry and industrial development in the East European North: The experience of interdisciplinary research. T.V. Evdokimova.

Abstract 169 Hunting/herding relationship to reindeer: some social and cultural implications.
Y. Csonka.

CAES-posters

Abstract 120 Caribou movement as a correlated random walk.
C.M. Bergman et al.

Abstract 170 Lichens as elements of reindeer pastures.
V. Elsakov.

Abstract 171 The effect of using non-traditional foods in the diet of agricultural animals.
T. Ermashova.

Abstract 134 Impact of the range expansion of the Western Arctic Caribou Herd onto traditional reindeer ranges of the Seward Peninsula, Alaska.
G.L. Finstad.

Abstract 172 Reindeer herding as a survival strategy in the north of the Russian Federation.
J.O. Habeck.

Abstract 173 The socio-economic significance of the price of reindeer meat – representation of money in the reindeer herding Sami society.
L. Heikkilä.

Abstract 174 Digestive physiology and nutrition of reindeer with special interest in winter feeding
U. Heiskari.

Abstract 14 Antler development in reindeer in relation to age and sex.
A. Hoymork et al.

Abstract 175 Environmental impacts of reindeer trails in northern Finland.
T. Kanniainen.

Abstract 176 Complementing links: the exchange between western science and traditional ecological knowledge in caribou co-management structures.
A. Kendrick.

Abstract 177 Reindeer impact upon the hydrobiological regime of the northern water bodies.
Y.S. Kuzmina.

Abstract 178 The impact of reindeer grazing on the ornitofauna of the Indiga river basin.
O.Y. Mineev.

Abstract 179 Veterinary and ecological aspects of reindeer breeding in northern Russia.
S.N. Mishenev.

Abstract 180 Physiological characteristics of reindeer in relation to nutritional status and transition from pasture to feeding.
A. Nilsson.

Abstract 181 Reindeer calf mortality as a key factor for population management and productivity in reindeer husbandry.
H. Norberg.

Abstract 182 Using geographical information systems (GIS) for reindeer range mapping.
N.A. Polezhaev.

Abstract 183 Socio-economic development and reindeer herding in northern Finnish Lapland.
T. Porsanger.

CAES-abstracts

167

Resolving complexity in reindeer and caribou grazing systems: The role of interdisciplinary research

D.R. Klein. Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK 99775, USA (ffdrk@uaf.edu).

After years of accumulation of knowledge on specific aspects of reindeer and caribou grazing systems, both by the indigenous peoples dependent on reindeer and caribou and through research activities, our understanding of these systems has been greatly expanded. In North America, the primary focus of government-sponsored research has been on the population dynamics of caribou and how changes in rates of recruitment and mortality influence population fluctuations. Predation, primarily by wolves and bears, has been shown to be a major population limiting factor. Little research, however, has been directed at understanding the complex biology of the predators. Traditional knowledge of caribou grazing systems held by the indigenous subsistence hunters who have been dependent upon them has dealt primarily with seasonality of movement patterns, behavior of the caribou as it influences hunter success, and recognition of long term variations in abundance and availability of caribou. In contrast, in Eurasia a much greater effort has been extended over a long period of time to understand the ecology of the vegetation of both domestic and wild reindeer grazing lands. The accumulation of knowledge about forage productivity, its seasonal availability, and response to grazing pressure has been essential for successful reindeer husbandry and has evolved with the indigenous cultures that have been dependent upon it. However, there have been changes in the patterns of use of the land by both domestic and wild reindeer, largely in the latter half of this century, brought about by the intensified influences of western cultural contact on the indigenous peoples of the North and on the land. These changes, both in the human cultures and in how reindeer use the land, have generated a need for additional and more complex knowledge of the relationships of humans to the reindeer and of the reindeer to the land. Although humans have long understood that caribou and reindeer grazing systems were complex in contrast to most other systems of herbivory, details of that complexity have not been well understood. There is now a need for increased efforts by biologists and social scientists, working closely with the indigenous peoples, to increase our understanding of the complex and changing relationships that exist between the humans, the reindeer and caribou, and the vegetation that are the principal components of these northern grazing systems.

168

Conflicts between reindeer-husbandry and industrial development in the East European North: The experience of interdisciplinary research

T.V. Evdokimova. Institute of Biology, Komi Science Center, Ural Division of Russian Academy of Science, Kommunisticheskaya St., 28, Syktyvkar, 167610 Russia (evdokimova@ib.ksc.komi.ru).

The territory of the Bolshezemelskaya tundra is located in the East European north of Russia. The northern part of this territory is located in the Nenets Autonomous District of the Arkhangelsk Region, and the southern portion in the Komi Republic. For almost two centuries, the tundra and forest-tundra landscapes have been in use as reindeer pastures by reindeer herdsmen of the Nenets and Komi-Izhma ethnic groups. Over the last century, more than 230,000 domesticated reindeer have regularly grazed here. Prior to industrial development of the area, decreases in the number of reindeer resulted mainly from natural-climatic factors and epizooites. Additional critical ecological situations were brought about by the removal of pastures from active use due to overgrazing. The overgrazing is partly related to conflicts between Nenets and Komi reindeer herdsmen: each group claims traditional rights to the land and therefore priority over the use of the same pastures. In the mid-1950s, the Bolshezemelskaya tundra became an object of geological surveys, and in the 1970s, the energy industry began oil and gas extraction. The development of oil and gas production affected the ecology of certain areas of reindeer pastures making them unsuitable for reindeer-grazing and limiting grazing in the surrounding areas. The result is a situation in which multiple factors contribute to the decline in the quantity and quality of available pastures. At present, the effect of the main natural and anthropogenic factors on the ecological situation of reindeer pastures has been studied rather well. The main relationships determining changes in productivity of vegetation cover and in the overall quality of grazing ranges have been established. Today, however, many new factors have demonstrated a practical necessity to assess the risk of the emergence of critical ecological situations in the reindeer pastures. These include: revision of the legal bases on territories traditionally occupied by indigenous peoples; transformation and reorganization of reindeer breeding organizations and farms; revision

of the borders of pastures used by different farms; changes in oil and gas production; and global climatic changes. We propose to conduct an interdisciplinary assessment on the basis of combined analysis of changes in the pasture landscape structure and assessment of correlation of grazing effects, the ethnic context for these changes, industrial effects, productivity of the vegetation cover, and quality of grazing ranges. Critical ecological situations are viewed as having negative ecological consequences limiting the reindeer breeding development.

169
Hunting/herding relationship to reindeer: some social and cultural implications
Y. Csonka. Prehistory Department, University of Neuchâtel, Ave. DuPeyrou 7, CH-2000 Neuchâtel, Switzerland. (ycsonka@vtx.ch).

As a hunted species, reindeer figure prominently in the diet of many peoples since Upper Palaeolithic times tens of thousands of years ago. Its potential to provide most human subsistence requirements has contributed to make it a popular prey. The domestication of reindeer appeared much more recently, and in the regions where it is now prevalent, herding did not become intensive until one or two centuries ago. Should we acknowledge the opposition between hunting and pastoralism, well publicized by proponents of an evolutionary scheme which considers herding a revolutionary first stage in food production? Or are there any specific social and cultural patterns linked to the reliance on the exploitation of reindeer, whatever its manner, which would allow to speak of " reindeer peoples " as a meaningful ethnographic category? Reindeer exploitation is about the only case where we may compare hunting and pastoral economies based on (by and large) the same animal in the same environment : for several decades, social scientists have explored this unique opportunity to find nuanced answers to these questions. Distinguishing between ecological, technical and sociocultural processes. We shall review and evaluate some results of these investigations, in the realms of food procurement, organization of work, redistribution, social and political organization, and emic representations.

120
Caribou movement as a correlated random walk. *C.M. Bergman, J.A. Schaefer, S. Luttich & R. Otto* (cbergman@uoguelph.ca).

170
Lichens as elements of reindeer pastures
V. Elsakov. Biology Institute, Komi Science Centre, RAS, Syktyvkar, Russia (elsakov@hotmail.com).

Questions connected with the feeding of reindeer in natural pastures are important for detailed investigations of the biology and ecology of reindeer. These include the organization of ecotopes that comprise the pastures and the migration of elements within tundra trophic chains. Lichens are the most important and informative components for the monitoring of pasture conditions. This is due to: (1) the slow growth rates of their thalli; and (2) the sensitivity of structural and functional parameters of their symbiosis to different anthropogenic and natural influences. Moreover, some species of lichens are capable of fixing atmospheric nitrogen and can accumulate significant quantities of certain heavy metals and other elements, thereby transferring these elements to reindeer when ingested. The adaptive plasticity of the lichen species prevalent in reindeer pastures is partly due to the high level of species variability. I will collect data pertaining to lichen morphological and anatomical peculiarity, in addition to the composition of lichen substances and electrophoretical spectres of certain enzymes. Then I shall determine the most important factors influencing the variability and biology of select pasture lichens. Ecological factors are most importent factors for the development of vegetation in the tundra zone. Knowledge of the factors that determine the speed of restoration and development of pasture vegetation is very important. Toward this aim we have begun to employ remote sensing techniques with the use of satellite images.

171
The effect of using non-traditional foods in the diet of agricultural animals
T. Ermashova. Faculty of Agriculture, Department of Genetics, Petrozavodsk Public University, Petrozavodsk, Russia (gubernia@karelia.ru, For: Ermashova)

In recent years we have begun to use non-traditional foods to expand and enrich the diets of cattle, pigs, poultry and other agricultural animals in Russia. These include forest resources and seaweed. This past year I have established some experiments on the use of *Fucus crupper*, a species of seaweed that provides animals and poultry with a wide choice of biologically active substances, many of which are not present in the usual

commercially available foods. Nor are they found in any terrestrial plants. In terms of food, seaweed can be roughly equated with cereals. There are 0.35-0.45 of feeding units, 82% of dried substance, 7% of wet protein, and 57% of nitrogen-free extracts per one kilogram of *F. crupper*. In addition, the general content of amino acids is 84% from albumen, which consists of all critical amino acids. The proportional content of mineral substances is also very rich, especially iodine and bromine, and a wide spectrum of vitamins. Seaweed has yet another useful feature: when consumed with other foods it improves digestion of the other components of the diet. The fodder form of *F. crupper* is made from seaweeds which grow in the White Sea and other northern seas. However, modern technology also allows us to reproduce seaweed at the same location of it is to be used. It is a rich and ecologically pure northern product.

134

Impact of the range expansion of the Western Arctic Caribou Herd onto traditional reindeer ranges of the Seward Peninsula, Alaska. *G.L. Finstad* (fnglf@uaf.edu).

172

Reindeer herding as a survival strategy in the north of the Russian Federation

J.O. Habeck. Department of Social Anthropology, University of Manchester, United Kingdom (jeoh2@cus.cam.ac.uk).

At present I am conducting field research for both the TUNDRA project and my PhD dissertation in the surroundings of Usinsk, Inta and Vorkuta (Republic of Komi, Russia) and on select reindeer pastures in the Nenets and Yamalo-Nenets Districts. Within the framework of the TUNDRA project, I am examining how local inhabitants perceive their environment and how climate change impinges upon their livelihood. I am also inquiring regarding their perceptions of environmental pollution, over-grazing and over-fishing. For my PhD dissertation, I will examine current ecological, economic and social problems of the reindeer herders and their families. One of the preliminary results of my research: although oil and gas extraction does have a negative impact on reindeer husbandry in this region, the overall economic situation and several social problems, e.g. the decreasing number of people who want to work in the tundra, should be considered as the predominant threats to reindeer husbandry.

173

The socio-economic significance of the price of reindeer meat – representation of money in the reindeer herding Sami society

L. Heikkilä. Department of Sociology, University of Lapland, P. O. Box 122, FIN-96101 Rovaniemi, Finland (lydia.heikkila@kolumbus.fi).

My current research studies the impact of the welfare-state system on the reindeer-herding, nomadic Sami society, in Finland after the 1950´s. This research (PhD thesis) is part of the Canadian research project 'Sustainable development in the Arctic — conditions for food security', managed by University of Laval, Quebec. My research theme belongs to the section 'Socio-economic development and well-being in northernmost Europe — Current conditions and future dimensions of human environmental interactions in the northern ecosystem'. The central issues, in the theoretical framework of my thesis, are connected with the integration of a nomadic society into the modern society and the nation state. In particular, it is a question of an adaptation process of the nomadic society into sedentary life, from self-subsistence economy to market economy. I am studying the processes that have taken place with the implementation of the social categories of the welfare state into the reindeer-herding, nomadic Sami society. On one hand, it is a question of diverging and conflicting underlying values characteristic to these two cultures (e.g. equality/equity). On the other hand, it is a question of the practical outcome of the methods used for applying the means of the welfare-state society into these circumstances. The focus of the research is on the ways the integration process has influenced the traditional forms of reindeer herding and how the transition into monetary economy has changed the reindeer-herding Sami society. Reindeer herding is understood in the wide context. For example, the implications are recognised through the entire societal life, including the status of women, elders, etc. I will address the questions: how do people allocate their time and money nowadays, how do they look at their basic responsibilities and how do they think about their future. My approach is to study the large entities related to the subject, and to bring forth new analytical understanding of the structural transition processes that have taken place in the local societies in the Arctic.

174
Digestive physiology and nutrition of reindeer with special interest in winter feeding
U. Heiskari. Finnish Game and Fisheries Research Institute, Reindeer Research Station, FIN-99910 Kaamanen, Finland (ulla.heiskari@rktl.fi).

The supplementary winter feeding of reindeer has become a common practice in Finland and Sweden and emergency feeding is also needed in Norway during winters with poor grazing conditions. The feeds used most often are dry hay and silage. These are more fibrous and less digestible than the natural winter diet of reindeer, which is dominated by lichens with abundant, highly digestible carbohydrates. I have been involved in research projects which include: winter feeding experiments with different fodder resources for reindeer; anatomy of the digestive tract of growing and adult reindeer; wintertime undernutrition of reindeer and the transition of reindeer from winter pasture to supplemental winter feeding. These studies have provoked a deeper interest in the digestive function of reindeer, in order to find suitable feeds, new fodder recources and feeding regimes for the winter feeding of reindeer. My future research will apply the nylon-bag technique, which is widely used in domestic ruminant nutrition research, to study the degradation of different foods and individual nutrients in the rumen of reindeer. In addition, studies to investigate the lower-gut digestion of foods with the intestinal-bag method, often called the mobile-bag method, will help to understand the total gut digestion of reindeer.

14
Antler development in reindeer in relation to age and sex. *A. Høymørk & E. Reimers.*

175
Environmental impacts of reindeer trails in northern Finland
T. Kanniainen. Department of Geography, University of Oulu, FIN-90401 Oulu, Finland (tkanniai@mail.student.oulu.fi).

Reindeer management is an important activity in northern Fennoscandia. There are concerns regarding environmental problems caused by reindeer grazing. The interrelations between reindeer density and environmental conditions in Finland are the main topic in this study. In particular, the study focuses on the relationship between reindeer trails and reindeer density. Reindeer management can be viewed as very old, traditional northern source of livelihood. The reindeer trails are thus the marks of the northern way of living. This study also tries to arouse discussion and appreciation of the reindeer trails as a part of the Finnish national landscape. In practice, the study is an experiment to evaluate different kinds of methods. The amount and quality of reindeer trails and vegetation types were evaluated by observations collected while walking throughout the ten study areas in northern Finland along the given lines. The lines were triangular for statistical reasons. The study areas were also photographed from aeroplane, because the reindeer trails are too small to be seen by more remote sensing-methods. Statistical analyses are ongoing. The study will be finished by spring 2000.

176
Complementing links: the exchange between western science and traditional ecological knowledge in caribou co-management structures
A. Kendrick. Natural Resources Institute, University of Manitoba, Winnipeg, Canada (kendrickanne@hotmail.com).
My research examines the effectiveness of knowledge exchange within co-management structures which attempt to create bridges between western scientific knowledge and traditional ecological knowledge (TEK). Berkes' (1999) characterization of TEK as an historically and culturally rooted knowledge-practice-belief complex is adopted. The research work poses the question: Where attempts have been made to create a dialogue between western science and TEK, what is the actual success of this cross-cultural exchange? The project specifically examines co-management institutions for caribou in northern Canada. Research focuses on the mechanisms which create links between the two bodies of knowledge. It is hypothesized that caribou co-management represents a potential for western resource science and TEK to complement forces to create alternative resource management systems which maintain the resilience (defined as the ability to absorb stress) of ecological and social systems. It is argued that conventional resource management impedes sustainability by reducing the resilience of management systems. Adaptive resource management, an applied field of ecology, stresses the interconnections between social and ecological systems and that the existence of uncertainty and unpredictability within these systems are linked, but detailed examinations of these linkages are scarce. My study of caribou co-management in northern Canada looks at the cross-cultural exchange between state and indigenous resource

management systems. Co-management represents a renewal or reworking of conventional resource management systems where the continued lack of communication between centralized government resource management agencies and local-level management systems often leads to ineffective management efforts. Co-management may help to synthesise a new resource management science open to meaningful participation by resource users.

177

Reindeer impact upon the hydrobiological regime of the northern water bodies

Y.S. Kuzmina. Institute of Biology, Komi Science Centre, UrD RAS, Russia (zagirova@ib.ksc.komi.ru).

Intensive development of tundra environments during the last decades has increased the need for research concerning complex ecological interactions. Aquatic ecosystems are particularly vulnerable and they are not easily remediated. They require rational and careful management, and their multifaceted study is of utmost importance. Laya-To Lake (67°60'N, 56°E) is situated in the south tundra belt. Most of the lake is 3-5 m deep. Sediments in the middle of the lake are mainly silt and sandy-silt, whereas littoral sediments are sandy and stony. Water vegetation includes mainly pondweeds, hornwort, water mosses and Nostoc species. Mean July water temperature = 9.05 °C, pH = 6.6 - 6.7, O_2 = 12.86 mg/l, and CO_2 = 3.0 mg/l. On the northwestern shore of the lake there is a reindeer pen where the young antlers are cut and treated. Extremely high concentrations of NH_4 were detected during the first year of the study, due to the great amount of the reindeer livestock kept in the pen. On the second year of research, when there were no reindeer in the pen, the NH_4 concentration exceeded the standard but was much lower than during the first research year. Eighteen groups of the benthic invertebrates were observed in the lake. Most abundant were Nematoda, Oligochaeta, Mollusca, Chironomidae. Oligochaeta. Also, the larvae of *Chironomus* gr. *plumosus* and *C. cingulatus* were found in great numbers at the lake center in the silty sediment. On the stony sediments in the littoral areas, the mollusks *Anisus albus*, *Lymnea* sp., *Spherium* sp., and the chironomids *Cladotanytarsus* sp. and *Cricotopus algarum* were found. Among the macrophytes *Polyfemus pediculus* occurred in masses. On the whole, the fauna of the water body is represented by widely distributed, eurybiontic species.

178

The impact of reindeer grazing on the ornitofauna of the Indiga river basin

O.Y. Mineev. Institute of Biology, Komi Science Centre, UrD RAS, Russia (zagirova@ib.ksc.komi.ru).

Because of small number and free migration, wild reindeer do not influence the flora and fauna as much as the intensive grazing of domestic reindeer (Aleksandrova, 1956). In this study, we investigated the impact of reindeer husbandry on the composition and distribution of ornitofauna in thte Malozemelskaya tundra (Indiga river basin) during summer 1998. The domestic reindeer lives and grazes in herds numbering 2500-3000 animals. The lake complexes and tundra plots with excessive humidity serve as nesting areas for birds (54 and 17 species respectively, with population densities of 25.7 and 54.9 individuals/km^2). The landscapes favorable for reindeer grazing are the willow and dwarf-birch plots, dwarf-shrub - greenmoss, sedge-mossy plots with excessive humidity, flat-ridged lichen plots with tundra with sparse woods, as well as the valleys of rivers and brooks. The tundra areas surrounding the lakes, with hill slopes covered by shrubs and dwarf shrubs, are intensively used by reindeer. Their activities, including tramping and eating, lead to a decrease in number of birds with terrestrial nests (0.27 nests/km^2) because the nests are trumped and eaten by reindeers. By eating the birds' eggs, nestlings, lemmings, the bones of dead animals etc. the reindeers make up for the deficient mineral salts (Sdobnikov, 1935). The reindeer impacts the tundra ecosystems globally, if we consider that in summertime the herd covers 15-20 km every day, exploiting the square of 200-300 ha (Polezhaev, 1979).

179

Veterinary and ecological aspects of reindeer breeding in northern Russia

S. N. Mishenev. Agricultural Department, Petrozavodsk State University, Lenin St. 33, 185640 Petrozavodsk, Russia (mish@mainpgu.karelia.ru).

The purpose of the study is to investigate the veterinary situation of reindeer populations, taking into consideration the ecological aspects. The various diseases of reindeer lead to substantial losses of economic value. It has been established that >50% of all non-productive losses occur due to reindeer death. The ethical aspect also should be considered. The main reasons of such situations are; infectious diseases (brucellosis, siberian ulcer, hydrophobia, foot-and-mouth disease, necrobiosis), invasia (echinococcosis, cysticercosis, monieziasis, dictyocaulosis and entomoses) and non-contagious illnesses (pulmonary diseases, poisoning, trauma). Until now, in veterinary science and practice the questions of perfection of methods of

against gadfly's diseases, reindeer protection against mosquitoes attacks, struggle with necrobacteriosis and helmint are problematic. The gregarious lifestyle of reindeer, constant transitions, the congestion during migrations, the same places of calving, and polygamy result in formation of the natural centres of infections and helmint diseases. For example, brucellosis of reindeer affects up to 49% of the herd. Experimental vaccination renders up to 80% of the reindeer resistant. The research carried out in Russia, provides the basis to consider that the brucellosis pathogens of reindeer during evolution and adaptation of the animal in extreme northern conditions has biological features, in particular infectiousness. As to ecological aspects of pasture resources, botanical structure and opportunity of use of natural fodder base of Karelian forests, seasonal change of pastures are analysed. Nowadays, it is necessary to project the organisation of reindeer breeding, basing on the revealed sites with the greatest concentrations of lichen winter pastures. As experimental introduction of tundra reindeer to Karelian forest shows, summer grazing should be on seaside pastures, as it is necessary for reindeer nutrition by vegetation enriched in minerals. Presently, reindeer breeding experiences crisis. The state program of development of reindeer breeding in the European North is named as one of the important industrial problems. Petrozavodsk State University was recommended to be the educational and research centre on reindeer breeding. One of major factors in reindeer breeding is the protection of health of animals, in view of ecological aspect.

180

Physiological characteristics of reindeer in relation to nutritional status and transition from pasture to feeding

A. Nilsson. SLU (Swedish University of Agricultural Sciences), Reindeer Husbandry Unit, Kungängens Research Center, S-753 23 Uppsala, Sweden (anna.nilsson@huv.slu.se).

Feeding of reindeer may become necessary during winters with poor grazing conditions and the transition from pasture to feeding can cause severe health problems. In the project, we study the changes occurring in the metabolism and behavior of reindeer during malnutrition and subsequent feeding, in comparison with reindeer during good winter conditions, with the aim to find characteristic physiological patterns of reaction in reindeer of different nutritional status. Sampling methods for blood, rumen content and monitoring heart rate in reindeer have been evaluated and used in an experiment at Oulu University during winter 1996/97. A situation imitating an adaptation from poor pasture to feeding was created by restricting feed-intake to 50% of *ad lib*. of a mimicked winter diet followed by feeding with various combinations of lichens, silage and pelleted reindeer feed. The restricted feed intake caused adaptational problems occurring in practice, such as diarrhoea and so-called 'wet belly'. We are continuing with sample analyses and evaluations of data to get a more complete picture of the behavior, metabolism and health status of the reindeer. The final aim of the project is to develop adequate strategies for adaptation of reindeer to feeding after periods of malnutrition.

181

Reindeer calf mortality as a key factor for population management and productivity in reindeer husbandry

H. Norberg. Department of Biology, University of Oulu, P.O. Box 3000, FIN-90401 Oulu, Finland (hnorberg@mail.student.oulu.fi).

Reproduction, growth and survival of reindeer are the main ecological factors affecting the productivity of reindeer husbandry. At present, >70% of all annually slaughtered reindeer in the Finnish reindeer husbandry area are calves. As a consequence, the economical income of reindeer herders is increasingly dependent on calving and calf survival. Deterioration of natural pastures and increasing number of predators during the last decade has created a situation where success in calf survival is even less predictable than before. Many subsequent bad years in winter weather and snow conditions, and low survival rates of calves during summer, have drastically reduced the profitability of reindeer husbandry in many areas, thus increasing the need for state subsidies. In particular, the question of adequate compensations for predator-killed reindeer has increased in importance. To address direct and indirect causes of reindeer calf mortality, research is needed in many respects. The causes of reindeer calf mortality have been studied in a current research project in one reindeer herding co-operative situated in mid-Lapland. The study has revealed a lot of information needed when developing new models for compensation policy. Still, more research is to be done to improve knowledge on the patterns of juvenile mortality, especially during calving time and in different habitats.

182

Using geographical information systems (GIS) for reindeer range mapping

N.A. Polezhaev. Institute of Biological Problems of the North, Far-Eastern Branch of Russian Academy of Sciences, Magadan 685000, Russia (berkuten@online.magadan.su).

Use of computer technology can greatly increase the efficiency of reindeer range mapping for reindeer farms. In this study, we are developing a computer system for reindeer range mapping for reindeer farms. We usedGIS Arc/Info and GLA (Grazing Land Applications). GIS Arc/Info ver.3.4.5 was used for preparation of digital reindeer range maps scale of 1:200000. We show on these maps: hydrology, reindeer range polygons, roads, slaughter plots, fences, cabins along the grazing routes of herds. The digital map has a database containing the following information: polygon number, forage store for winter, spring, summer and autumn, as well as reindeer capacity of each polygon per season. Economic evaluation of usage of reindeer ranges can be given with help from GIS GLA. Using this program we plan also to elaborate recommendations to reindeer herders concerning preferable directions of reindeer farm development. Directions depend on reindeer range quality. Reindeer farms can specialize in the production of meat, the production of horns, or, if the correlation is optimal, both production of meat and horns.

183

Socio-economic development and reindeer herding in northern Finnish Lapland

T. Porsanger. Department of Regional Studies, Faculty of Business Administration, University of Vaasa, P. O. Box 700, FIN-65101 Vaasa, Finland (tarja.porsanger@pp.inet.fi).

I am going to research the economic development of reindeer herding in northern Finnish Lapland, in the Sami region. The aim of the research is to describe and evaluate the impacts of economic expansion in industrial society. In what way have the changes of the society influenced reindeer herding, and how has reindeer herding adapted itself to these new conditions. I am going to analyse reindeer herding in view of sustainable development because there are many economic and ecological problems. In my study of reindeer herding I will be concerned with the sources of livelihood and the relationship between reindeer herders and nature. The reindeer herding area is divided into herding cooperatives (paliskunta) and my research area consists of the 12 northernmost reindeer herding cooperatives in Finland. This is called the Sami Region in Finland. The first step is to research the socio-economic situation of the reindeer herders in the Sami Region by analyzing the existing materials, litterature and statistics and by using field studies. The second step is to make a case study about one reindeer herding oooperative and collect additional data. I will use field studies, including interviews, to obtain a detailed insight into the ongoing changes on the micro-level. As a theoretical framework I will use economic theories and models of economic development and changes of cultural structures. For example the theories of Rostow, Matti Sarmela and Tim Ingold (the hunting-pastoralism-ranching triangle) will be applied.

184

History and prospective use of reindeer genetics in the Russian north

E. Romanova. Agricultural Department, Petrozavodsk State University, Lenin St. 33, 185640 Petrozavodsk, Russia (Romanova@mainpgu.karelia.ru).

The purpose of the study is to investigate genetic potential use of reindeer. Reindeer breeding is the ancient branch of animal breeding in Karelia. During the 18th and 19th centuries, almost all Karelian settlements had domesticated reindeer of the forest type. Reindeer populations were approximately 9000-10 000. But, after The Great Patriotic War (2nd WW) fewer than one hundred reindeer remained. There were unsuccessful attempts to introduce tundra reindeer: the animals were sick because of mineral insufficiency, females aborted prematurely, and the reindeer left Karelia. The herd was moved to a coast of the White sea: the transition to grazing on seaside pastures had stopped negative consequences of acclimatisation. Nowadays, due to the Russian economic crisis, commercial breeding of Karelian reindeer has stopped. The reindeer are now bred only by enthusiasts. However, forest reindeer breeding is necessary for Karelian natural conditions and for creation of additional workplaces in northern areas, characterised by risky agriculture. Because of the previous loss of reindeer, we face the same problems of reintroduction and acclimatisation now. There are 4 reindeer breeds in Russia. Nowadays, in the north of Russia the questions of artificial insemination and organisation of laboratory and sperm bank of reindeer breeds are raised. Especially, the opportunity of sperm use is interesting to Karelia, because the reindeer crossing by artificial insemination may solve the problem of acclimatisation. Methods of receiving, dilution, freezing and prolonged keeping of sperm from male reindeers have been developed. Reindeer calves are received from females after artificial insemination in Russia. But to

use reindeer males it is necessary to take into account the genetic value of resistance to diseases. We assume, the genetic evaluation allows authentically to create genetic groups with increased resistance to some diseases. In particular, it would allow selection of reindeer according to qualities of production and immunology, similar to the basic principle of reindeer breeding - an accumulation of little hereditary changes, which do not break the general integrity and adaptation of organism to extreme conditions. We address the creation of the educational and research centre on reindeer breeding. Petrozavodsk State University is able to be the co-ordinator of this endeavour.

185

Selection strategies in reindeer management

L. Rönnegård. Animal Breeding and Genetics, Swedish University of Agricultural Sciences, Uppsala, Sweden (Lars.ronnegard@hgen.slu.se).

The genetic capacity of the individual animal is of importance for the total production of a reindeer herd. The capacity of the herd can be increased by short- and long-term selection. Short-term selection is accomplished by slaughtering the unwanted adult animals, which mainly results in an improved phenotypic level of the producing animals. The long-term genetic change is achieved by selecting recruitment calves each year. Up to date selection decisions have not been objectively based on recorded data. There has not been any clear strategy developed for which traits the selection should be based on. The reason why this has been difficult is that the external conditions of the reindeers cannot be controlled as in other domestic animal systems. Another difficulty different from other domestic animals is that the sires cannot be kept apart during the mating season, and if the reindeer owners within a grazing area have different breeding strategies there will be an interference between strategies. Therefore, it is essential to have a common strategy for the direction of the selection as well as the recruitment of sires within a grazing area. The aim of my thesis is to study long-term genetic change using empirical and theoretical methods, which will be applied in practice by developing common selection strategies within herding communities.

186

Reindeer herding after the Sovhoz: a tundra-centred field-research in the Kola Peninsula

D. Sabev. Institute of Anthropological Field Research, Sofia, Bulgaria (dessisalv@hotmail.com).

With the present deterioration in the economy of the former USSR, sustainable use of traditional renewable resources in the Russian Far North has entered into a new critical phase. A crisis in reindeer herding followed after the abandonment of the central planning Soviet collective farm. Private herding - which was expected to appear - is facing very serious obstacles and is not happening in the region. In the resultant void, post-sovhoz people are developing survival strategies relying on traditional knowledge. So I see a fundamental conflict of interests between local people exploiting traditionally renewable resources (like reindeers) and some big economic actors exploiting non-renewable resources (like underground ores). The imminent mining-prospecting activities in the reindeer-herding part of Murmansk Region by the *Voronya Minerals Company* threaten to destroy a major part of the reindeer herding in the region, and thus destroy the basis for subsistence of the local tundra-depended population. As a result there is an abrupt change in the ecology of the human-reindeer relationship. This raises the more general problem of the impact of global changes (like the end of the Cold War) on sharply specific ecosystems like Arctic reindeer herding.

187

Reindeer grazing and soil carbon and nitrogen dynamics in northern-boreal and oroactic ecosystems

S. Stark. Department of Biology, University of Oulu, P.O. Box 3000, FIN-90401 Oulu, Finland (sstark@paju.oulu.fi).

By influencing the vegetation of the northern-boreal forests and oroarctic tundra heaths of northern Fenno-scandia, reindeer have an indirect effect on soil processes. In conjunction with my PhD research, I have studied the effect of reindeer grazing on the gross and net nitrogen mineralization, carbon mineralization and the size of soil microbial biomass in forests and tundra heath sites with adjacent grazed and ungrazed areas. My study hypothesis is that reindeer grazing affects the soil processes according to the vegetation type, so both the forest and tundra sites represent two vegetation types and productivity levels. The results show that there are complex interactions between the effect of reindeer grazing on nutrient cycling, the vegetation type and the grazing intensity. The vegetation and nutrient cycling constitute feedback mechanisms, where the plant species

composition affects the nutrient cycling and vice versa. The soil processes also interact strongly with the productivity of the ecosystem. I have also studied the possible underlying mechanisms behind the reindeer-mediated changes in soil processes by transplant experiments, which separate the effects of microclimate and the chemical composition of decomposing matter, respectively, on nutrient cycling.

10
Factors influencing the *in vitro* digestibility of lichens in reindeer. *P.V. Storeheier, S.D. Mathiesen, N.J.C . Tyler & M.A. Olsen.*

188
Traditional livelihood coping in a transitional society: reindeer herding in Nenets autonomous district
T. Tuisku. Arctic Centre, University of Lapland, P.O. Box 122, FI-96101 Rovaniemi, Finland. (Tuula.Tuisku @urova.fi).

Reindeer herding is one of the traditional livelihoods of the Nenets people. During the 1990's, political and economic changes have taken place in Russia and the society is in a process of transition. Rapidly changing circumstances make it difficult for reindeer herding units and reindeer herders to cope with different situations. Political changes give reindeer herders and units more possibilities to act independently, but the economic situation restricts way of acting. The unstable situation requires quick changes in behaviours of herders and herding units, but there are also factors which have impacted reindeer herding over longer time periods. The policy of the Soviet Union towards reindeer herding caused some really serious problems to reindeer herders and herding units. We could say that as a result of Soviet policy the existence of herding was threatened during the end of 1980's. Today reindeer herding units and herders have to cope with the problems inherited from the Soviet period and at the same time with current problems and possibilities. The expectations of the state towards reindeer herders are now different from the Soviet time. During the Soviet time, the tendency of the state was to urge herders and their units to obey orders and to follow the given pattern of action. But, today's tendency is that the state urges herders and units to act independently. Reindeer herders and herding units have to learn this new way of action. Herding units and herders are active actors in reindeer management, although there are also other actors (district's administration, Federal State, oil companies, markets). I have studied the current situation at two different levels, on the level of herding families and the collective level (herding units). I have conducted fieldwork in Nenets autonomous district in three different reindeer herding units in 1996 and 1997 and in two collective farms (Harp and Vyueiskij) and in one association of private reindeer herders (Erv).

24
Early reindeer calf mortality. *E.O. Ågren* (Erik.Agren@sva.se).