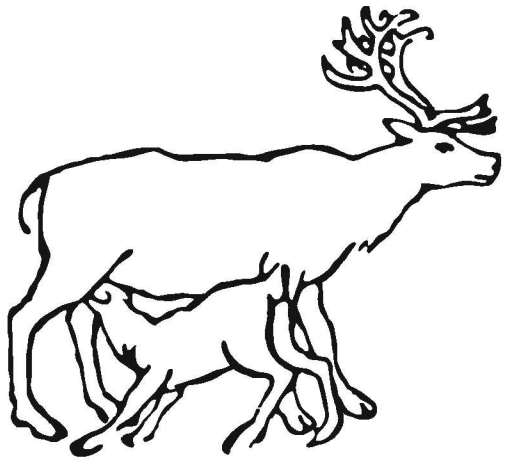
NOR:n 14. pohjoismainen porotutkijakokous

NORs 14. nordiske forskningskonferanse om rein og reindrift

The 14th Nordic Conference on Reindeer and Reindeer Husbandry Research

Helsinki, Finland, 20-22 March 2006

Ohjelma ja lyhennelmät
Program og sammendrag
Programme and abstracts



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Nordisk Organ for Reindriftsforskning (NOR) ble etablert i 1980 og har vedtekter vedtatt av Nordisk Ministerråd (landbruksministrene) i 2003. Organet er et samarbeidsorgan mellom Finland, Norge og Sverige. Med reindriftsforskning menes naturfaglig og samfunnsfaglig/ humanistisk forskning om problemstillinger knyttet til reinen som dyr og reindriften som næring og kultur. Formålet er å fremme forskning og forskningssamarbeid til nytte for reindriftsnæringen i de nordiske land. Virksomheten finansieres ved direkte bidrag fra deltakerlandene.

Nordic Council for Reindeer Husbandry Research (NOR) was founded in 1980 to promoting cooperation in research on reindeer and reindeer husbandry. From 1993 the organisation is under the auspices of the Nordic Council of Ministers (the Ministers of Agriculture). The work of NOR depends on funds from the member governments (Finland, Norway and Sweden).

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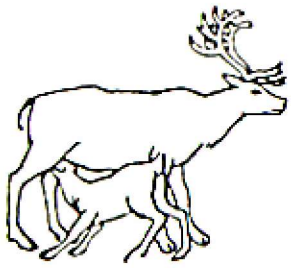

PROGRAM OG SAMMENDRAG

PROGRAMME AND ABSTRACTS

NORs 14. nordiske forskningskonferanse om rein og reindrift
Helsingfors 20-22 mars 2006

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Reindeer and Reindeer Husbandry Research
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Redaktør/Editor:

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Utgitt av Nordisk organ for reindriftsforskning (NOR), Tromsø, 2006
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Sisällysluettelo / Innhold / Contents

Järjestely / Organisasjon / Organisation

Yhteistyötahot / Samarbeidsorganisasjoner / Co-operating organisations:

Nordiskt organ för rennäringsforskning / Nordic Council for Reindeer Husbandry Research
RKTL, Game and Fisheries Research Institute
EELA, The National Veterinary and Food Research Institute of Finland
University of Helsinki

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Kaija Pönni-Susiluoto, RKTL
Rolf Egil Haugerud, NOR

Informaatio / Informasjon / Information

Foredrag og plakater:
NORs arbeidsutvalg har besluttet at konferansespråket skal være skandinavisk (norsk eller svensk). Enkelte foredrag vil bli gitt på engelsk. Samleoversikt med henvisning til sidetall for foredragene finnes på s. 13-15 og for plakatene (posterne) på s. 17-18. Sammendrag for den enkelte presentasjon skal normalt være både på engelsk og skandinavisk/finsk.
Maksimaltiden avsatt til foredragene inkluderer tid til kommentarer og spørsmål.
Under postersesjonene vil ansvarlig forfatter være tilgjengelig.

Oral presentations and posters:
The conference language is Scandinavian but some of the lectures will be given in English. You will find overview and reference to abstract page number of the oral presentations on pp. 13-15 and of the poster presentations on pp. 17-18. Abstracts are both in English and Scandinavian or Finnish. The author(s) will be present at the poster sessions.

Betaling til hotellet/konferansesenteret for rom, konferansepakke og konferansemiddag.
Alle betaler konferansepakke som inneholder lunsj og kaffe etter programmet, samt omfatter konferansefasiliteter.
1) Privat innkvartering: Deltakere som ikke bor på hotellet, betaler til hotellet/konferansesenteret for konferansepakken og evt. konferansemiddagen.
2) Deltakerne som bor på konferansehotellet Sokos Hotel Vantaa, har frokost inkludert i prisen for overnatting. Disse betaler til hotellet/konferansesenteret for rom og også for konferansepakke og evt. konferansemiddag.
Utsjekking skjer normalt kl 1200 avreisedagen.
NB. For innbudte gjester og innbudte foredragsholdere skjer betaling som avtalt med NOR. Delegater og evt. innkalte suppleanter til NORs årsmøte sender refusjonskrav for utlegg til de respektive departementer.

Payment:
Participants cover their own expenses for travel, accommodation and other costs. Each participant have to pay the conference packet (includes lunch and coffee in programme and conference facilities) either private housing or staying at the conference hotel.
1) Private housing: Participants without hotel accommodation pays the hotel/conference centre for conference packet (and conference dinner).
2) Participants staying at the conference hotel pay the hotel/conference centre for hotel accommodation, conference packet and conference dinner.
Checking out is normally at 1200 the day of departure.
NB. Invited guests and invited lecturers have special payment arrangements with NOR. Delegates and substitutes called-up for the yearly meeting of NOR send their demand of reimbursement to the respective ministries.

Program

Måndag 20. mars

Ankomst

1800-1900 **Registering, Posteruppsättning,Vantaa Sokos Hotel**

1900-2200 **Reception** (get together)(RKTL, EELA, Helsingfors Univ., NOR), Vantaa Sokos Hotel

Tisdag 21. mars

0800-0845 **Registering/Postersuppsättning**

0845 **Öppning av konferens, Mauri Nieminen och Christian Krogell**
Meddelanden

Invitert foredragsholder er markert med fet skrifttype (Names in bold denote invited speakers)

Taxonomi/renens innvandring og renskötselhistoria

0900-0940 **Røed, K.** Taksonomi og opprinnelse til rein (Taxonomy and origin of reindeer).

0940-1020 **Lundmark, L.** Renskötseln i Sverige 1550-1950 (Reindeer pastoralism in Sweden 1550-1950).

1020-1100 Kaffe, posters

1100-1140 **Nieminen, M.** History and development of reindeer husbandry in Finland (Finsk reindriftshistorie).

1140-1200 Jernsletten, J-L. Konsesjonsreindriften i Tornedalen: Historisk utvekling, utfordringer og muligheter (The concession reindeer management in Tornedalen: Historical development, challenges and opportunities).

1200-1240 Lunch (Vantaa Sokos Hotel)

Renens biologi i huvudsak

1240-1320 **Blix, A-S.** Fysiologi og fôring – utvikling av kunnskap gjennom 25 år (Physiology and feeding – establishing knowledge through 25 years).

1320-1340 Norberg, H. Spatio-temporal mortality patterns of semi-domesticated reindeer calves in Finland.

1340-1420 **Holand, Ø.** Fokus på flokkproduktivitet (Herd productivity — revisited).

1420-1440 Vistnes, I. Forskning på effekter av menneskeskapt forstyrrelse av rein gjennom 25 år – eksisterende kunnskap og framtidige utfordringer (Research on impacts of antropogenic disturbance of reindeer trough 25 years – current knowledge and future challenges).

1440-1500 Forbes, B. Effects of petroleum development on reindeer herding in northwest Russia.

1500-1520 Kaffe

1520-1600 **Oksanen, A**. Semi-domesticated reindeer health and diseases before and during the NOR era.

1600-1620 Tryland, M. Smittsom munnskurv hos tamrein i Norge: kliniske utbrudd, infeksjonsforsøk og viruskarakterisering (Contagious ecthyma in semi-domesticated reindeer in Norway: clinical outbreaks, experimental infection and virus characterization).

1620-1640 Åsbakk, K. Lang oppholdelsestid for ivermectin i reinmøkk på beite (Prolonged persistence of faecally excreted ivermectin from reindeer in an arctic environment).

1700-1745 **Heureka, planetarium (Solarmax-film Chicago 2000)**

1800-1900 **Fotokavalkad, posters**

2000- **Konferensmiddag** (Vantaa Sokos Hotel)
- NOR 25 år (**Öje Danell, festtal**)
- 3 bästa posters

Onsdag 22. mars

0830 Meddelanden, dagens öppning

0840-0920 **Wiklund, E.** Renkött – er det alltid mört, gott och nyttig? (Reindeer meat – is it always tender, tasty and healthy?).

0920-0940 Rylander, C. Renkött – hälsosam och trygg mat? (Reindeer meat – healthy and safe food?).

0940-1020 **Reimers, E.** Villrein i Norge – populasjonsøkologi, forvaltning og jakt (Wild reindeer in Norway – population ecology, management and harvest).

1020-1040 Kaffe, posters

Rennäringen av idag

1040-1120 Johansen, B. Satellittdata – et viktig hjelpemiddel innen kartlegging og overvåking av reinbeiteområder på Nordkalotten (Satellite images – an important tool for mapping and monitoring reindeer ranges in northern Fennoscandia).

1120-1140 Olofsson, J. Effekter av renbete på fjällekosystem (Effects reindeer grazing on tundra ecosystems).

1140-1200 Suominen, O. Effekter av sommar- och vinterbete av ren på mikroklimat och skogsvegetationen (Reindeer impacts on microclimate and structure of forest floor communities in summer and winter ranges).

1200-1220 Uhlig, C. Reinbeite øker ikke nødvendigvis beitenes kvalitet (Arctic ungulate grazing does not necessarily increases tundra fertily).

1220-1240 Moen, J. Hur påverkar skogsbruket lavtillväxt (How does forestry affect lichen growth?

1240-1320 Lunch

1320-1400 **Kojola, I**. Predation in wild and domestic reindeer herds.

1400-1440 **Saitton, B. (Renskötseln/ändringar/ny teknik)** – foredraget utgår.

1440-1500 Kaffe (NOR)

1500-1520 Nordin, Å. Sociala relationer med utgångspunt från skötesrensystemet (Social relations and the system of "skötesrenar").
1520-1540 Labba, N. Renen – inkomstkälla eller kulturfäste (Reindeer – source of income or cultural linkage).

1540-1620 **Kettunen, J.** Economic research of reindeer husbandry in Finland.

1630 Avslutning av konferens, Mauri Nieminen

Foredrag – Lectures[1]

[1] Inviterte foredragsholdere står med fet skrift (Invited presentations are written in bold).
[2] Medforfattere står i sammendraget (For co-authors, see abstract).

[2] Medforfattere står i sammendraget (For co-authors, see abstract).

Plakater – Posters[1]: side/page

Reindrift / Reindeer Husbandry – Villrein / Wild reindeer

[1]Deltakere på konferansen er markert med fet skrift (Conference' participants are written in bold text).

Biologi – Fysiologi / Biology – Physiology

Taxonomy and origin of reindeer

Knut H. Røed
Institute of Basic Science and Aquatic Biology, Norwegian School of Veterinary Sciences, Boks 8156 Dep., N-0033 Oslo 1, Norway (knut.roed@veths.no).

Reindeer and caribou was probably the key species for the human immigration and colonization in the Arctic and sub-Arctic by the retreat of the ice in the last glacial period. The close connection between human and reindeer has contributed to great interest and variation in reindeer taxonomy and origin. Through the history several both species, subspecies and types of reindeer and caribou have been described. The early taxonomy of the species is marked by comparisons of individual specimen using traits as body size, skin colour or antler formations - characteristics known to be highly variable and subjected to environmental and nutritional level. During the mid 1900s the taxonomy was more based on variation of morphological traits among populations by analysing a large series of specimens representative of the various geographic populations and a consensus of classification of several subspecies, all belonging to the same species, evolved. During late 1900 the development of modern molecular techniques procured tools for revealing genetic structure of populations reflecting different origin and isolation rather than environmental influences. The genetic structure revealed a major genetic dichotomy between American woodland caribou on the one hand and all other types of reindeer and caribou on the other which gave evidence that the ancestors of present woodland caribou had survived and evolved in ice free refugium south to the glacier in North America and the ancestors of all other types of reindeer and caribou had evolved separated from these in refugium in Eurasia and Beringia. The ancestors of present reindeer in Scandinavia appear furthermore to have evolved from different populations separated during the last glaciation period and the colonization and origin of present wild and domestic reindeer will be discussed in this perspective.

Taksonomi og opprinnelse til rein

Rein og caribou har hatt stor betydning for det moderne menneskets utvikling og kolonisering av nordlig Eurasia og Nord Amerika etter siste istid. Den nære sammenhengen mellom mennesker og rein har bidratt til stor interesse og variasjon i oppfatningen av reinens taksonomi og opprinnelse. Et uttall av både arter, underarter og raser av rein er beskrevet opp gjennom historien. Tidlig taksonomi av rein bar preg av å være basert på enkeltobservasjoner og på morfologiske karakterer som kroppsstørrelse, pelsfarge og størrelse og form på gevir, karakterer som i stor grad påvirkes av miljø og næringsforhold. Først på midten av 1900 tallet ble taksonomien i større grad basert på ulike morfologiske trekk som viste variasjon mellom bestander av rein og en fikk bl.a. en forståelse av at alle underarter og former av rein og caribou tilhørte samme art. Med utviklingen av den moderne molekylærbiologien på slutten av 1900 tallet fikk en tilgang til verktøy som avdekket genetiske strukturer som reflekterer ulik opprinnelse og utvikling mer enn miljømessig påvirkning. Den genetiske strukturen som ble avdekket viste liten overensstemmelse med oppdelingen i underarter som var basert på morfologiske trekk. Molekylærgenetiske strukturen viser et hovedskille mellom amerikansk woodland caribou på den ene siden og all annen rein og caribou på den andre siden, noe som reflekterer at forfedrene til woodland caribou levde og utviklet seg i isfrie områder sør for iskanten i Nord Amerika, mens forfedrene til andre typer rein levde atskilt fra disse i isfrie områder i Eurasia og Beringia. Forfedrene til dagens rein i Skandinavia syntes også å ha utviklet seg fra atskilte bestander av rein som kan føres tilbake til slutten av siste istid. Innvandring og opprinnelse til dagens vill og tamrein i Skandinavia vil bli belyst i dette perspektiv.

Reindeer pastoralism in Sweden 1550-1950

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In the middle of the 16th century we get the first opportunity to a more detailed knowledge of reindeer pastoralism in Sweden. At that time the Sami lived in a hunter-gatherer economy. A family had in average about 10-20 domesticated reindeer, mainly used for transport. They could also be milked and used as decoys when hunting wild reindeer.
During late 16th century the Swedish state and merchants bought large amounts of fur from the Sami. The common payment was butter and flour. This created a new prosperity, which lead to a considerable increase in population in Swedish Lapland. The population became too large for a hunter-gatherer economy. A crisis in early 17th century was the starting point for the transition to a large-scale nomadic reindeer pastoralism.
Up to the middle of the 18th century intensive reindeer pastoralism was successful. But the pastoralism became gradually too intensive and diseases started to spread when the herds were kept too densely crowded for milking in summertime. During the first decades of the 19th century reindeer pastoralism in Sweden went through a major crisis. The number of reindeer herding mountain-Sami decreased considerably, mainly because they went to live permanently along the Norwegian coastline.
Intensive reindeer pastoralism started to give way for extensive herding towards the end of the 19th century. In the north of Sweden influences from the Kautokeino Sami were an important factor, in the south extensive reindeer herding started to expand when the market for meat came closer to the Sami.
During the 1920s the milking of reindeer ceased in Sweden, except in a few families. At that time Sami families from the north had been removed southwards. They further demonstrated the superiority of extensive herding to the Sami in mid- and southern Lapland.
Reindeer pastoralism is basically a system of interaction between man and animal, but it has been heavily influenced by market forces and state intervention during hundreds of years. To a large extent these long-term external influences have made reindeer pastoralism what it is today. That aspect should not be overlooked when assessing the future prospects of reindeer pastoralism in Scandinavia.

Renskötseln i Sverige 1550-1950

Först vid mitten av 1500-talet finns det källmaterial som ger oss en tämligen detaljerad bild av renskötseln i Sverige. Vid den tiden levde samerna i en jakt- , fiske- och samlarekonomi. En familj hade normalt 10-20 renar som främst utnyttjades vid transporter. Tamrenarna kunde också mjölkas och fungera som lockdjur vid vildrensjakt.
Under senare delen av 1500-talet köpte svenska staten och handelsmän stora mängder pälsverk av samerna. Den vanligaste betalningen var smör och mjöl. Detta skapade ett välstånd som ledde till en betydande folkökning i svenska lappmarken. Befolkningen blev för stor för att rymmas inom ramarna för en jakt- och fiskeekonomi. En kris i början av 1600-talet blev startpunkten för övergången till en storskalig rennomadism.
Fram till mitten av 1700-talet var den intensiva renskötseln framgångsrik. Men renskötseln blev efterhand alltför intensiv. Under senare delen av 1700-talet började det spridas sjukdomar i de tätt sammanhållna hjordarna. De första decennierna av 1800-talet innebar en allvarlig kris i renskötseln. Antalet renskötande fjällsamer minskade kraftigt, främst genom utvandring till norska kusten.
Den intensiva renskötseln med mjölkning av renarna började ersättas av en extensiv renskötsel inriktad på köttproduktion de sista decennierna av 1800-talet. I norr var naturförhållandena och influenser från Kautokeino-samerna en viktig faktor, i söder utvecklades renskötseln i extensiv riktning främst därför att marknaden för renkött kom närmare renskötarna.
Under 1920-talet upphörde mjölkningen av renar i Sverige, utom i några enstaka familjer. Då hade förflyttningarna av samer från nordligaste Sverige söderut påskyndat utvecklingen och ytterligare markerat den extensiva renskötselteknikens överlägsenhet.
Tamrenskötsel är ett samspel mellan människa och djur, men det är inte bara en fråga om renskötaren och hans hjord. Externa marknadsfaktorer, beskattning och lagstiftning har haft ett betydande inflytande på renskötselns utveckling under hundratals år. De har till stor del format renskötseln till vad den är i dag. Detta bör beaktas när man gör bedömningar av renskötselns framtid.

History and development of reindeer husbandry in Finland

Mauri Nieminen
Finnish Game and Fisheries Research Institute, Reindeer Research Station, Toivoniementie 246, 99910 Kaamanen, Finland.

The semi-domesticated reindeer in Fennoscandia is tamed from wild mountain reindeer (*Rangifer tarandus tarandus* L.). In some places it is mixed with wild forest reindeer (*R. t.ifennicus* Lönn.) and in the Kola Peninsula also with tundra reindeer of the Komi at the end of 19th century. The Lapps had draught reindeer around 300 AD. The oldest written source of reindeer husbandry and use of decoy animals in hunting is from 892 AD. Decreases in the number of wild reindeer and reindeer milking affected the rapid development of reindeer husbandry. The nomadic reindeer husbandry arose in West-Norway around 1200 AD and spread quickly in the Nordic Countries, also in Tornio Lappmark in 15th-17th centuries. The hunting culture with small-scale reindeer herding without nomadism and reindeer milking remained long in Kemi Lappmark, Kola and northernmost Russian Karelia.
In **Tornio Lappmark,** reindeer herding was based on the western tradition: 1) relative high numbers of reindeer were owned by the Lapps[1], 2) year-round reindeer herding was usually practised, 3) milking of reindeer and production of milk and cheese was common, 4) non-Lappish ownership and use of Lapps to take care of draught reindeer. The oldest dated remains of a reindeer sledge were found in Övertorneå in Sweden in 13th century. Reindeer were used for transportation in the Tornio river valley in the beginning of the 14th century, and at the end of the 15th century the peasants from Kemi area travelled with many draught reindeer in Lapland. At first, draught reindeer were used by the Birkarlar, later other officials and tradesmen. The nomadic reindeer husbandry arrived in Käsivarsi area in the beginning of the 17th century. In 1605, few reindeer inhabited the Tornio and Kemi Lappmarks and hunting of wild reindeer was still of great importance. Reindeer management increased during the 18th century, and in the beginning of 19th century many reindeer Lapps owned 200 reindeer each, and about 25% of reindeer were milked. In Utsjoki, there were 25 reindeer Lapp families and the wealthiest owned 1000-2000 reindeer. In the middle of 18th century, 60 families with 5000 reindeer moved during the summers from Enontekiö to the coast of Norway. Thirty-five families and 4400 reindeer also moved from Utsjoki. In the 1730s, reindeer Lapps and their reindeer migrated from Utsjoki to Inari. During the summer of 1834, approximately 12 000 reindeer from Utsjoki and 3000 reindeer from Enontekiö moved to Norway. In 1834-44, about 100 Norwegian Lapps and 50 000 reindeer over-wintered in Utsjoki and Inari. The northern (Norwegian) border of Finland was closed in 1852 and the western border to Sweden in 1888. More than 20 reindeer Lapp families and their reindeer migrated from Kautokeino, Kaaresuvanto and Enontekiö to Inari and Sodankylä. During 1880-1900, 105 reindeer Lapp families also migrated from Utsjoki to Inari.
In **Kemi Lappmark, Northern Ostrobothnia, Kainuu and northernmost Russian Karelia** reindeer herders were predominately peasants, and the herding was based on the eastern reindeer management tradition: 1) number of reindeer owned by forest Lapps was small, 2) reindeer were freely grazing during summers, 3) during autumn reindeer were collected from their pastures and divided among the owners for the winter for their own use and 4) there was no milking of reindeer. Finns adopted reindeer management with its terminology from nearby forest Lapps and developed upon it increasing the mobility of people and transport of goods in the highlands of northern Finland during 17th and 18th centuries. The development of lighter reindeer sledges, extensive single-file formations of reindeer group migrations and bigger loads accelerated long-distance transport of goods and increased the profitability of the Finnish reindeer husbandry. In 1602, King Carl IX authorized his hunters to shoot 300 wild forest reindeer in Ostrobothnia and to start reindeer husbandry in Ilmajoki. Later King Carl XI ended reindeer husbandry in this area. The peasant reindeer husbandry adopted from the forest Lapps in Kuusamo existed at that time also in the northernmost parts of Kainuu and Russian Karelia. During the 15th-17th centuries reindeer husbandry was not of great importance for the peasants living on the north coast of Finland, but in the 18th century the valuable draught reindeer of peasants were taken care of by the forest Lapps. During 1725-44 and 1776-95, the reindeer owned by freeholders in Hailuoto, were also cared for by the Lapps. The peasant reindeer husbandry was practised in the 18th century in many areas including the present day southern boundary of the Finnish reindeer husbandry area. In 1920, three Skolt Lapp villages were joined to Finland: Paatsjoki, Petsamo and Suonikylä. After the Second World War, 116 Skolt Lapp families comprising 439 people immigrated to Inari. Approximately 4000 reindeer remained in Russia, but the Skolt Lapps acquired money from the Finnish government to purchase 1252 reindeer. The arrangement of reindeer husbandry started in Finland in the 18th century, and in the 1880s reindeer herding co-operatives (in Finnish 'paliskunta') established in different parts of the reindeer herding area. This system was ratified by Russian law in 1898. In the beginning there were 70 co-operatives, today 56. The Finnish Reindeer Herders´ Association was founded in 1948. The first reindeer herding law was enacted in 1932 and was renewed in 1948 and 1968. New law came

[1] The ethnic term Lapp used in older literature is a synonym for nowadays Sami.

into effect in 1990. In 2005, there were approximately 200 000 semi-domesticated reindeer in Finland, 10 times more than in 1750, shared among 5200 owners of which 1000 are Sami. Today, 71% of calves and a few adult reindeer are slaughtered annually resulting in the net production of 2-2.5 million kg of meat.

Suomen poronhoidon historia ja kehitys

Fennoskandian poro on kesytetty villistä tunturipeurasta (*Rangifer tarandus tarandus* L.). Paikoin siihen on sekoittunut meillä metsäpeuraa (*R. t. fennicus* Lönn.), Kuolan alueella myös 1800-luvun lopulla komien tundraporoa. Lappalaisilla oli ajoporoja jo vuonna 300 jKr. Vanhin kirjallinen tieto poroista ja peuranpyynnin houkutusporoista on vuodelta 892 jKr. Villipeurojen väheneminen, poronlypsy ja -maito nopeuttivat poronhoidon kehitystä. Paimentolaisporonhoito syntyi Länsi-Norjassa noin vuonna 1200 jKr. ja levisi nopeasti Pohjoismaissa, myös Tornion Lapissa 1400-1600-luvulla. Kemin Lapissa, Venäjän Kuolassa ja Vienan-Karjalassa säilyi silti pitkään peuranpyynti ja pienimuotoinen poronhoito ilman paimentamista ja lypsyä.
Tornion Lapissa poronhoidolla oli läntiset perinteet: 1) Suhteellisen suuret lappalaisten poromäärät, 2) lähes ympärivuotinen porojen paimennus, 3) poronlypsy, maidon ja juustojen tuotto ja 4) talonpoikien ajoporojen hoito lappalaisilla. Vanhin poronpulkka on 1200-luvulta ja löydetty Ruotsin Yli-Torniolta. Torniojokilaaksossa ajoporoja käytettiin jo 1300 luvun alussa, ja 1400-luvun lopulla Kemin alueen talonpojat kulkivat suurilla pororaidoilla Lapissa. Ajoporoja käyttivät aluksi pirkkalaiset, myöhemmin muut virkamiehet ja kauppiaat. Talonpoikien omistamat ajoporot olivat yleensä lappalaisten hoidossa. Paimentolaisporonhoito tuli Käsivarteen jo 1600-luvun alussa. Vuonna 1605 sekä Tornion että Kemin Lapin poromäärät olivat vielä pienet, ja peuranpyynti oli edelleen tärkeää. Poronhoito lisääntyi 1700-luvulla, ja 1800-luvun alussa useilla porolappalaisilla oli jo 200 poroa, joista jopa neljännes oli lypsyporoja. Utsjoella oli jo 25 porolappalaisperhettä ja heistä varakkaimmilla 1000-2000 poroa. Jo 1700-luvun puolivälissä 60 lappalaista ja 5000 poroa jutasivat kesäksi Enontekiöltä Norjan rannikolle. Utsjoelta jutasi vuosittain 35 lappalaista ja 4400 poroa. Utsjoen porolappalaisia vaelsi 1730-luvulla poroineen myös Inariin. Kesällä 1834 Norjassa oli arviolta jo 12 000 Utsjoen ja 3000 Enontekiön poroa. Vuosina 1838-44 oli vastaavasti Utsjoella ja Inarissa talvisin noin 100 Norjan lappalaista ja 50 000 poroa. Suomen pohjoisraja suljettiin vuonna 1852 ja länsiraja 1888. Yli 20 Kautokeinon, Kaaresuvannon ja Enontekiön porolappalaista vaelsi poroineen Inarin ja Sodankylän alueelle. Vuosina 1880-1900 Utsjoelta muutti Inariin yhteensä 105 porolappalaista.
Kemin Lapin, Pohjois-Pohjanmaan, Kainuun ja Vienan-Karjalan talonpoikien poronhoito oli perinteiltään itäistä: 1) metsälappalaisten poromäärät olivat pieniä, 2) porot laidunsivat kesät vapaina, 3) syksyllä porot koottiin ja jaettiin talveksi omistajien käyttöön ja 4) poroja ei lypsetty. Suomalaiset omaksuivat poronhoidon sanastoineen lähellä asuvilta metsälappalaisilta ja kehittivät sitä talonpoikien tarpeeseen, liikkumiseen ja tavaroiden kuljetuksiin Pohjois-Suomen metsä- ja ylänköalueilla 1600-1700-luvulla. Kevyen poronkelkan keksiminen, pororaidon koon ja kuorman kasvattaminen nopeuttivat tavaroiden pitkiä kuljetuksia ja paransivat kannattavuutta. Kuningas Kaarle IX valtuutti vuonna 1602 metsästäjänsä ampumaan Pohjanmaalta 300 metsäpeuraa ja aloittamaan myös Ilmajoella poronhoidon. Alueelle tuotiin 50 poroa ja lappalaisia porojen hoitajia. Myöhemmin kuningas Kaarle XI tapatti alueen porot ja poronhoito loppui. Kuusamon metsälappalaisilta omaksuttua talonpoikaisporonhoitoa oli tuolloin jo Kainuun pohjoisosissa ja Pohjois-Vienassa. Poronhoidolla ei ollut Perämeren rannikon talonpojille vielä 1400-1600-luvulla suurta merkitystä, mutta 1700-luvulla metsälappalaisten hoidossa oli jo runsaasti talonpoikien ajoporoja. Myös Hailuodossa oululaisten kauppiaiden poroja oli lappalaisten hoidossa vuosina 1725-44 ja uudelleen vuosina 1776-95. Talonpoikaisporonhoitoa harjoitettiinkin 1700-luvulla jo eri puolilla lähellä nykyistä poronhoitoalueen etelärajaa. Vuonna 1920 Suomeen liitetyn Petsamon alueella oli kolme kolttien vähäporoista porokylää: Paatsjoki, Petsamo ja Suonikylä. Sodan jälkeen siirtyi Inariin 116 kolttaperhettä, yhteensä 439 henkeä. Arviolta 4000 poroa jäi Venäjälle. Valtiolta koltat saivat varat 1252 poron ostoon. Poronhoidon järjestäytyminen alkoi Suomessa jo1700-luvulla, ja 1880-luvulla paliskuntajärjestelmä oli levinnyt suurimpaan osaan poronhoitoaluetta. Pakolliseksi se tuli vuonna 1898 Venäjän senaatin päätöksellä. Paliskuntia oli alussa 70, nykyään 56. Paliskuntain yhdistys perustettiin vuonna 1948. Ensimmäinen poronhoitolaki säädettiin vuonna 1932, sitä uudistettiin vuosina 1948 ja 1968 ja uusi poronhoitolaki saatiin vuonna 1990. Vuoden 1750 tilaston mukaan Suomessa oli vain 17 000 poroa. Nykyään eloporoja on noin 200 000, teurasporoja 100 000 ja päätuotteen, porolihan, tuotto vuosittain on 2-2,5 miljoonaa kiloa. Poronomistajia on enää noin 5200, niistä noin tuhat saamelaista.

The concession reindeer management in Tornedalen - historical development, challenges and opportunities

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This presentation touches upon the unique reindeer management system in Tornedalen – the co called *concession reindeer management system* – small in territorial extent, yet highly significant in principle. The concession reindeer management system is interesting in several different ways. It has an interesting historical development – a development that differs from the development within Lappmarken. Further, a development of the legal framework connected to the concession reindeer management system has taken place, and the traditional "verdde"-relations (explained below) have been revitalized and modernized, through the contract reindeer system.
The concept of concession management system means that there exists a concession or permission to stay year-around in the Kalix - and Torne Valleys, in other words below Lappmarksgrensen. This border, established by the Swedish government back in 1751, has divided Sami rights of use from the local population. The immemorial rights to access the winter pastures is still very strong below Lappmarksgrensen, but according to the Swedish government, no such rights exist in connection with summer pastures in the same area. The legal basis for the concession reindeer management system is connected to the Sami reindeer herding rights (Sw: renskötselsrätt) through a Sami concession holder, while the right to use this area, especially the right to use the summer pastures, is connected with the contract reindeer owners private ownership of land. The concession reindeer management system could therefore be viewed as both a cultural cornerstone and an industry based upon a Sami and a local customary law and private property in Tornedalen. The concession, given from the government, is a time-limited permission (1-10 years) between the Swedish government, one or several Sami concession holders, and indirectly, the private land owners (the contract reindeer owners).
The concession reindeer management system, as we know it today, was introduced by the government in the 1928 Reindeer Grazing Act under the heading "About reindeer herding in some areas below Lappmarksgrensen" (Om renskötsel å vissa trakter nedom lappmarksgränsen). This law came as a result from the protests made by the local population in Torne Valley when the Swedish government back in 1917 wanted to make it illegal to own contract reindeer. The argument from the local population was that the contract reindeer were important as a part of the small scale economy as meat resource and transportation, and that the farmers ownership to reindeer was a tradition in this area with deep historical roots.
The presentation will also focus on the relationship between the Sami concession holder and the contract reindeer owners. This relationship could be viewed as a modern form of the verdde-relationship, an institution found i.e. on the coast of Finnmark between the local coastal population and the "nomadic" Sami reindeer owners.
The concession reindeer management system is of unique interest, because it offers an opportunity to look into a management system that, compared to other reindeer management systems, is different in history, in legal framework, in management practice, and thereby in its approach to the pursuit of sustainability. Despite its small number of animals and a rather invisible position in the academic mindscape, the concession management system is of importance politically and as to the principles involved. This system is highly significant as an analytical model, and it offers solutions to many of the challenges the industry faces today.

Konsesjonsreindriften i Tornedalen: Historisk utvikling, utfordringer og muligheter

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Foredraget tar for seg noen sider ved den unike formen for reindrift som man finner i Tornedalen – den såkalte konsesjonsreindriften – liten i territoriell utstrekning, men av stor prinsipiell betydning. Konsesjonsreindriften i Tornedalen er interessant på flere måter. Den har en interessant historisk utvikling – en utvikling som skiller seg fra utviklingen som har funnet sted i lappmarken. Videre har det funnet sted en interessant juridisk utvikling knyttet til konsesjonsreindriften, og en modernisering av de tradisjonelle verdderelasjonene (forklart nedenfor) gjennom skötesrensystemet.
Begrepet konsesjonsreindrift betyr at det er gitt tillatelse til å drive helårsreindrift i et område (Kalix - og Torne elvedaler) nedenfor *Lappmarksgrensen*. Grensen, som ble opprettet av den svenske stat tilbake i 1751, har fungert som et skille for samiske bruks- og beiterettigheter i Sverige. Samiske vinterbeiterettigheter står fremdeles sterkt nedenfor Lappmarksgrånsen mens rettigheter knyttet til sommerbeite anses av myndighetene som fraværende. Det lovmessige utgangspunktet for konsesjonsreindrift er knyttet mot den samiske *renskötselsrätt* gjennom *konsesjonsinnehaver* mens bruksrettigheter, spesielt til sommerbeite, er knyttet til *skötesreneiernes private eiendomsrett*. Konsesjonsreindriften må derfor forstås som en kulturbærer og næring som er fundamentert på både samisk og tornedalsk lokal sedvane og eiendomsrett. Konsesjonen er en tidsbegrenset avtale (1-10 år) mellom den svenske stat og en eller flere samiske konsesjonsinnehavere, og mer indirekte de private markeierne.
Den helårlige reindriften på nedsiden av Lappmarksgrensen ble første gang lovregulert gjennom 1928 års renbeteslag (RBL) og ble i denne loven behandlet under overskriften "Om renskötsel å vissa trakter nedom lappmarksgrånsen". Denne lovreguleringen kom som en følge av de sterke lokale protestene fra bl.a. Tornedalen da myndighetene i 1917 ville forby sytingsreinordningen. Argumentasjonen fra lokalbefolkningen var at dette var en viktig sosial institusjon mellom lokalbefolkningen og den samiske befolkningen; at reinen var viktig for det mangefasettede småskalaøkonomien i dette området gjennom økt tilgang til kjøtt; som transport (kjørerein), og sist men ikke minst at bøndenes eierskap til rein har en svært lang historie i Tornedalen.
Foredraget tar opp forholdet mellom de(n) samiske konsesjonsinnehaver(ne) og eierne av skötesren. Dette forholdet kan beskrives som en moderne utgave av *verdderelasjonen* som man blant annet har funnet på kysten av Finnmark, mellom den fastboende befolkningen og de "nomadiserende" reineierne.
Utviklingen av denne egne formen for verdderelasjoner er også en viktig forutsetning for analysen av en interessant ressursforvaltningsmodell. I dag er én av reindriftens store utfordringer tilgang til beiteområder, og konsesjonsreindriften gir oss en mulighet til å studere en forvaltningsmodell som har et potensiale for å være økologisk bærekraftig og konfliktdempende.

Spatio-temporal mortality patterns of semi-domesticated reindeer calves in Finland

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Reproduction, growth and calf survival are essential factors when assessing production parameters and management of semi-domesticated reindeer stocks in Fennoscandia. In Finland, calves currently comprise over 75% of all reindeer slaughtered. Therefore, it is apparent that survival of calves affects the productivity of reindeer stock and subsequently the operation and profitability of the husbandry. Despite decades of discussions and assessments of the magnitude and causes of calf losses, lack of knowledge on cause-specific calf mortality has prevailed. Predators have been suspected to cause a marked proportion of the total calf mortality but the variation in overall mortality pattern and the role of predation has not been documented adequately before the quantitative study presented here. The obtained information on the impacts of predation on calf losses is currently being applied in the new compensation regime for predator-killed reindeer in Finland.

The aim of this study was to investigate the rate, temporal distribution and causes of calf mortality as well as the intrinsic (body weight and condition) and extrinsic (snow and weather conditions, herding practices, predator populations) factors affecting mortality. Consequently, the aim was also to assess factors affecting the annual variation in the rate and causes of calf mortality. The study was conducted in six reindeer-herding cooperatives (Lappi, Ivalo, Käsivarsi, Oivanki, Poikajärvi and Kallioluoma) during years 1997-2004, in 1-3 cooperatives simultaneously. Finding dead calves from the study areas was based on mortality indicating radio-transmitters (attached on expandable collars), which activated after being 2,5 hours motionless (silent mortality function). Altogether 3430 calves were fitted with radio-collars during the eight study years. Of those calves 1330 were marked during calving time in May (in calving enclosures), and 2100 during calf earmarking round-ups in June and July. Annually, 262-557 calves were radio-collared.

Altogether 182 radio-collared calves were found dead between the application of radio-collars and the end of October, i.e. during the first 5-6 months post-calving (some dead calves were registered after October as well, but were not included in the current survival analysis). The average mortality (for all study years) of those calves marked during calving time varied between 6-11% in different study areas, and of those marked during calf earmarking between 1-11%, respectively. The annual variation in mortality rates was large within and between the studied areas (0-23%). Golden eagle was the most significant single cause of death in the northern cooperatives (Lappi, Ivalo and Käsivarsi): 0-4.4% of radio-collared calves were verified as eagle-kills in different study areas and years. Calves killed by eagles were generally smaller than survivors. In the southeastern cooperative of Oivanki predation by brown bear comprised on average 2% (annually 0-5,5%) of all radio-collared calves during 2000-04. Additionally, on average 6% (annually 0-16.1%) were eaten by bears, but the few remains of these calves did not allow conclusion on the cause of death. In Oivanki, most mortality occurred in May and June, while in the northern cooperatives mortality was more evenly distributed over the entire summer with a few deaths discovered also in September and October.

Poron vasakuolleisuuden alueellinen ja ajallinen vaihtelu Suomessa

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Lisääntyminen, kasvu ja vasojen selviytyminen kesän yli seuraavan syksyn ja alkutalven erotuksiin ovat porotalouden kannalta tärkeitä tekijöitä. Nykyään kaikista Suomen poronhoitoalueella teurastettavista poroista yli 75% on vasoja, ja vasateurastuksen osuus on noussut myös Ruotsissa ja Norjassa. Teurastuksen painottuessa vasoihin on ilmeistä, että vasojen kesäaikainen kuolleisuus vaikuttaa porokannan tuottoon ja siten myös porotalouden toimintaan ja kannattavuuteen. Vaikka vasahävikin suuruutta ja sen taustalla olevia tekijöitä on selvitetty useissa tutkimuksissa, on etenkin kuolleisuuden ajoittumisesta ja syistä ollut edelleen saatavilla varsin vähän tietoa. Petojen osuus vasakuolleisuudesta on yleensä oletettu merkittäväksi, mutta ennen tätä tutkimusta kuolinsyiden jakautumisesta ei ollut tietoa Suomen poronhoitoalueen osalta. Parhaillaan tutkimuksen tuloksia sovelletaan uuden suurpetojen aiheuttamien vahinkojen korvausjärjestelmän tarpeisiin.

Tutkimuksen tavoitteena oli selvittää poronvasojen kesäaikaisen kuolleisuuden suuruutta, ajoittumista ja syitä sekä kuolleisuuteen vaikuttavia lajinsisäisiä (mm. paino ja kunto) ja –ulkoisia (sääolosuhteet, poronhoitokäytännöt, petokannat) tekijöitä. Vuosina 1997-2004 suoritetun tutkimuksen tavoitteena oli myös selvittää vuosien välistä vaihtelua kuolleisuudessa ja kuolinsyissä. Tutkimukset sijoittuivat kuuden eri paliskunnan (Lappi, Ivalo, Käsivarsi, Oivanki, Poikajärvi ja Kallioluoma) alueelle. Saman vuoden aikana voitiin seurantaa toteuttaa vain 1-3 paliskunnassa. Menetelmällisesti tutkimus perustui vasojen merkintään kuolevuusradiolähettimillä, jotka aktivoituvat oltuaan liikkumatta kaksi ja puoli tuntia. Kahdeksan tutkimusvuoden aikana merkittiin radiopannoilla yhteensä 3430 vasaa, joista 1330 sai radiopannan kaulaansa jo vasonta-aikana (toukokuussa) ja 2100 keskikesän vasanmerkintöjen yhteydessä (kesä-heinäkuussa). Vuosittain radiopannoitettiin 262-557 vasaa.

Radiopannoituksen ja lokakuun lopun välisenä aikana löydettiin kuolleena yhteensä 182 vasaa (muutamia kuolleita vasoja löytyi myös lokakuun jälkeen, mutta niitä ei käsitelty tässä tutkimuksessa). Tarhavasonnan yhteydessä radiopannoitettujen vasojen kuolleisuus vaihteli eri tutkimusalueilla keskimäärin välillä 6-11% (tutkimusvuosien keskimääräinen kuolleisuus) ja vasanmerkinnässä radiopannoitettujen vastaavasti välillä 1-11%. Vuotuiset vaihtelut kuolleisuudessa olivat huomattavia niin tutkimusalueiden sisällä kuin välilläkin (0-23%). Poronhoitoalueen pohjoisosan paliskunnissa (Lappi, Ivalo ja Käsivarsi) merkittävin yksittäinen kuolinsyy oli maakotka, jonka aiheuttama kuolleisuus vaihteli eri tutkimusalueilla ja -vuosina välillä 0-4,4% (kotkan tappamaksi vahvistetut tapaukset). Kotkan tappamat vasat olivat keskimäärin pienempiä kuin selvinneet vasat. Kuusamon alueella Oivangin paliskunnan itäosassa merkittävin yksittäinen kuolinsyy oli karhu, jonka aiheuttama kuolleisuus oli vuosina 2000-04 keskimäärin 2% (vuosien välinen vaihtelu 0-5,5%). Karhun tappamaksi vahvistettujen tapausten lisäksi Oivangissa löytyi keskimäärin 6% (vuosittain 0-16,1%) radiopantavasoista karhun syömänä, mutta vähäisten jäänteiden vuoksi näiden vasojen kuolinsyy jäi tuntemattomaksi. Oivangissa kuolleisuus ajoittui pääosin touko-kesäkuun vaihteeseen, kun pohjoisilla tutkimusalueilla kuolleisuutta esiintyi läpi kesän aina syys-lokakuulle asti.

Reindeer herd productivity – revisited

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Herd productivity is a pursuit to meet defined production goal(s). The challenge is to efficiently transform primary plant production into animal product(s), mainly meat in a marked economy or a combination of products (including meat) in a subsistence economy. Accordingly herd productivity has to be put in a historical context.
Herd composition has traditionally focussed on shaping the herd as a continuation of the domestication process where the dialectical relationship between herders and herds is in focus. Control of the herd being emphasized through age and sex composition and selection of behavioural traits and easily recognisable animals which favour handling. The herd represents the owner's capital which is secured through a high proportion of age classes with low mortality risk and ability to withstand the highly stochastic environment. The manageability of the herd is size dependent. Also environmental conditions; especially forages' availability and climatic conditions, will influence the herd's propensity to being controlled. Historically this has resulted in rises and falls in reindeer numbers, since the limited means of controlling large herds restricted the expansions.
The introduction of the snowmobiles and other means of transportation revolutionized the herding and the opportunity of controlling large herds, and amplified the ongoing transformation into a marked economy. This modernisation has been supported by introducing new culling practise, herd composition and selection schemes derived from range management theories in order to optimize production output. The bottom line being a fixed range area with exclusive grazing rights, assuming limited winter range resources and opportunities to manipulate the stocking rate in order to aim at a maximum sustainable yield (MSY) density based on equilibrium modelling. Intuitively given these assumptions, in addition to the highest absolute growth during the animals first summer of life the reindeer herd should be composed of highest proportion of reproductive females possible with a male segment just able to serve the females successfully during rut. The culling should primarily aim at calves and removal of females reaching reproductive senescence. The stocking rate should be adjusted to allow females to reproduce early; preferably at an age of 1.5 year. Selection of phenotypic superior female (and male) calves as herd recruits will normally secure high fecundity and low pre weaning mortality and hence a largest possible surplus of harvestable calves. This strategy has been tested and successfully implemented in herds in all Nordic countries.
I will review the "state of the art" and the biological challenges and limitations in applying such a "modern" production strategy. The strategy is based on a stable stocking rate in order to reduce the environmental noise and hence the animals' phenotypic plastic response. The selection scheme has also to take into account potential effects of range encroachment, disturbance and climatic changes. The basic question is; What is a good reproductive female? To elucidate the maternal effect necessitates keeping track of the females' maternal pedigree, reproductive history, body condition and offspring performance within the herd. I will further evaluate the importance of the male segment for offspring performance and herd productivity.

Fokus på flokkproduktivitet

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Flokkproduktivitet er og har vært en stadig jakt på måloppfyllelse. I en markedsbasert økonomi er utfordringa å omforme plantevekst primært til kjøtt, mens produktspekteret var mye breiere i naturalhusholdet. Dette innebærer at flokkproduktivitet må sees i ett historisk perspektiv.
Tradisjonelt var flokksammensettinga et viktig redskap for å kunne utøve tilstrekkelig kontroll over flokken. Dette ble vektlagt gjennom en stabiliserende alders- og kjønnssammensetting og gjennom utvalg av dyr med atferdsmessige og fenotypiske trekk som letta gjetinga og handteringa av flokken. Flokken kan betraktes som reineierens kapital som ble sikra ved høg andel voksne dyr med lav dødelighet og evne til å motstå miljøvariasjon. Hvor lett flokken er å handtere avhenger bl.a. av dens størrelse. Også miljøforhold, både næringstilgang og klima vil påvirke flokkens handterbarhet. Historisk har dette ført til svinginger i reinbestandene siden de tekniske hjelpemidlene for kontroll av store flokker var begrensa.
Innføringa av snøskoteren og andre terrengkjøretøy pluss andre tekniske hjelpemidler førte til mulighet for kontroll av større flokker. Dette forsterka overgangen til en kjøttbasert markedsorientert næring og blei fulgt opp av veiledning og forskning for å tilpasse slakteuttak, sammensetning av flokken og utvalgskriterier av livdyr til en optimalisering av kjøttproduksjonen. Utgangpunktet var som i "range management" teori generelt; ett begrensa men eksklusivt beiteareal, med muligheter for manipulering av dyretettheter for å oppnå en maksimal bærekraftig avkastning basert på likevektsmodeller. I tillegg ble vinterbeitene ansett som begrensede for reintallet i de fleste områder. Gitt disse forutsetningene, i tillegg til at den absolutte tilveksten er størst den første sommeren følger det naturlig at flokken bør sammensettes av en størst mulig andel reproduserende simler med en bukkeandel stor nok til å sikre full bedekking av simlene. Slakteuttaket skal primært legges på kalvene pluss eldre simler som ikke klarer årlig å produsere og fø opp en tilfredsstillende kalv og bukker som har gjort "jobben" sin. Beitebelegget bør tilpasses slik at de aller fleste 1,5 årige simler har en vekt og kondisjon slik at de "tar seg" til normal tid. Utvalg av livdyr basert på fenotypiske trekk hos simlekalver (og bukkekalver) skal sikre produktive simler som over mange påfølgende år kommer med kalv og med morsegenskaper som sikrer overlevelse og god kalvetilvekst. Dette vil gi et størst mulig antall høstbare kalver og denne strategien er utprøvd og anvendt i mange flokker med suksess.
Jeg vil gå gjennom denne moderne strategien og de biologiske utfordringene og begrensingene som ligger i den. Strategien baserer seg på et stabilt og optimalt beitebelegg for å sikre at dyras fenotypiske respons til miljøet ikke påvirker utvalgskriteriene for livdyr. Utvalget må også ta "høgde for" mulige effekter av forstyrrelse, fysiske inngrep som reduserer beitearealet og klimaendringer. Det grunnleggende spørsmålet er; Hva kjennetegner ei reproduktiv simle med gode morsegenskaper? For å "avsløre" dette trengs nøye "bokføring" med slektstreet på simlesida, simlene livshistorie (reproduksjon, kroppsvekt og kalvenes vekst) samt påsatte simlekalvers suksess. Jeg vil videre vurdere betydningen av bukkesegmentets sammensetting for produksjonspotensialet.

Research on impacts of anthropogenic disturbance of reindeer through 25 years – current knowledge and future challenges

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The understanding of the behavioral responses of reindeer to anthropogenic disturbance has increased substantially over the past 25 years as a result of research associated with the growth in industries, infrastructure and power development within reindeer and caribou habitats. Research on disturbance of *Rangifer* has mainly followed two different approaches, focusing either on local or regional effects of disturbance. Research on local effects investigates the immediate response of the individual animal to a disturbance source, measuring e.g. physiological reactions or changes in behavior locally. The main conclusions drawn from this research are that individual reindeer may react to disturbance by short-term responses such as fleeing <1 km, and that the energetic costs associated with physiological or behavioral reactions normally do not pose any threat to reindeer condition in the long run. Research on regional effects focuses on large shares of a herd rather than the individual animal, measuring avoidance and changes in use of grazing grounds well beyond the initial zones of contact, most often several km from the disturbance source. This research concludes that disturbance effects may be long-term and lead to substantial habitat loss as a result of avoidance by larger shares of the herd from disturbance zones, and by infrastructure being perceived as semi-permeable barriers excluding parts of the range. A large body of disturbance studies including several pre and post development studies have shown that while local effects may be minor, roads, pipelines, power lines, dams, or concentrated tourist activity may lead to a 40-95% reduction in use within 2.5-10 km from source of disturbance. Local and regional effects operate at different scales both in time, space and number of animals, giving two different and complementary sets of knowledge about effects of disturbance on reindeer. The third effect of disturbance often mentioned; cumulative effects on herd production as a consequence of habitat loss, remains to be explored more thoroughly.

Forskning på effekter av menneskeskapt forstyrrelse av rein gjennom 25 år – eksisterende kunnskap og framtidige utfordringer

Kunnskapen om reinens reaksjoner på menneskeskapt forstyrrelse har økt betydelig i løpet av de siste 25 årene som et resultat av forskningen på konsekvenser av den økende utbyggingen av industri, infrastruktur og kraftutbygging i rein- og caribouhabitat. Forskningen på forstyrrelse av *Rangifer* har i stor grad fulgt to forskjellige retninger, der man har studert enten lokale eller regionale effekter av forstyrrelse. Forskningen på lokale effekter kartlegger den umiddelbare responsen til enkeltdyr i møte med en forstyrrelseskilde, ved å måle f.eks. fysiologiske reaksjoner eller endring i atferd lokalt. Disse studiene har i hovedsak konkludert med at enkeltdyr kan reagere på forstyrrelse ved flukt <1 km, og at de energimessige kostnadene som følge av fysiologiske eller atferdsmessige reaksjoner normalt sett ikke påvirker reinens kondisjon på lang sikt. Forskning på regionale effekter fokuserer på en stor andel av flokken framfor enkeltdyr, og kartlegger eventuell unnvikelse og endringer i beitebruk over en større del av beiteområdet, også flere kilometer unna forstyrrelseskilden. Disse studiene konkluderer i hovedsak med at forstyrrelseseffekter kan være langvarige og føre til betydelig tap av beiter ved at en stor del av flokken unnviker forstyrrelsessoner, og ved at infrastruktur kan oppfattes som delvis ugjennomtrengelige barrierer og dermed avskjære deler av beiteområdet. En stor mengde forstyrrelsesstudier, inkludert flere studier utført før og etter utbygging, har vist at selv om de lokale effektene kan være små, kan veier, rørledninger, demninger og turistanlegg føre til en 40-95% reduksjon i bruk av områder innen 2,5-10 km fra forstyrrelseskilden. Lokale og regionale effekter opererer på forskjellig skala både i tid, rom og i forhold til antall dyr studert, noe som gir to verdifulle og komplementære sett med kunnskap om forstyrrelse av rein. Den tredje typen effekt som ofte blir nevnt; kumulative effekter på produksjon i flokken som et resultat av tap av beiteland, gjenstår det å forske mer på.

Effects of Petroleum Development on Reindeer Herding in Northwest Russia

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The project ENSINOR is funded by the Finnish Academy during 2004-2007. Oil and gas activities over the past 30+ years have had profound impacts on the social and ecological systems of northwestern Russia. At the same time the region has been undergoing pronounced and rapid climatic warming, with potentially important ramifications for tundra vegetation and permafrost soils. We are investigating the extent of visible and perceived changes by using a case study approach in two areas of intensive oil (Nenets Autonomous Okrug) and gas (Yamal-Nenets Autonomous Okrug) development. Migratory Nenets reindeer herders, whose 'brigades' (collective herding units) interact directly with oil and gas infrastructure and workers, are active participants in the project. Our aim is the co-production of knowledge relevant to assessing the overall impacts – both positive and negative – from past exploration and current production phases. This approach combines state-of-the-art quantitative methods, such as very high-resolution satellite image analysis, with the qualitative practitioners' knowledge that comes from the collective experience of herding, hunting, fishing, and gathering throughout the same territories for centuries. Gross changes in land cover, such as desertification and expanding infrastructure, are relatively easy to detect via remote sensing procedures. However, understanding how contemporary livelihoods actually interact with, are affected by, and respond to these processes requires extensive participant observation and interviews with Nenets herders both in the tundra and in the villages.

Öljy- ja kaasuteollisuuden vaikutus Luoteis-Venäjän poronhoitoon

Suomen Akatemian rahoittamassa Ensinor-projektissa tutkitaan öljy- ja kaasuteollisuuden vaikutuksia Luoteis-Venäjän poronhoitoon. Tutkimus toteutetaan vuosina 2004 – 2007 Jamalin niemimaalla sekä Nenetsian autonomisessa piirikunnassa, jotka ovat Venäjän öljy- ja kaasuteollisuuden lähitulevaisuuden kasvukeskuksia. Samoilla alueilla ilmastonmuutoksen ennustetaan tulevina vuosikymmeninä aiheuttavan merkittäviä muutoksia veden ja jään prosesseissa sekä kasvillisuudessa.
Tutkimusalueet ovat perinteisesti suomensukuisten Nenetsien laidunmaata. Projektin tarkoituksena on selvittää, miten öljy- ja kaasuteollisuus vaikuttavat nenetsien elinehtoihin tundralla. Tutkimuskysymykset ovat sekä ekologisia (esimerkiksi muutokset laidunten määrässä ja laadussa), että yhteiskuntatieteellisiä (esimerkiksi muutokset nenetsien taloudellisissa ja sosiaalisissa rakenteissa). Tutkimus toteutetaan läheisessä yhteistyössä paikallisten poronhoitajien sekä öljy- ja kaasuyhtiöiden edustajien kanssa.
Projektissa yhdistetään ekologian, antropologian sekä maantieteen tutkimusmetodiikkaa. Kasvillisuuden nykyinen tilanne selvitetään kartoituksin, muutos ajassa ilmakuva-analyysin avulla, ja muutosten merkitys poronhoidolle antropologisten haastattelujen avulla. Projektin yhtenä tarkoituksena onkin löytää uusia tapoja yhdistää eri tieteen alojen tuottamaa tietoa maankäyttöön liittyvässä tutkimuksessa.

Semi-domesticated reindeer health and diseases before and during the NOR era

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Reindeer husbandry has changed continuously with changes in the general society. Sami and Finnish reindeer husbandry used to be self-sufficient until the establishment of pronounced monetary economics after World War II. The change gave availability to various goods and services that previously had been self-produced, such as milk. This made milking reindeer redundant and contributed to the change to less-domesticated reindeer. Motorized vehicles replaced draft reindeer and herding dogs, the latter contributing to the virtual eradication of echinococcosis, an important parasitic zoonosis. The change required increased productivity to give access to all the commercial goods. Therefore, winter feeding became common, first in Finland and then also in Norway and Sweden. Winter feeding led to increase of the stock giving rise to pasture shortage and crisis.

When NOR was founded 25 years ago, antiparasitic treatment of reindeer had recently been started in the Nordic countries with organophosphate compounds to kill parasitic insects, such as warble fly larvae and throat bots. This treatment was assumed to help the animals to survive over winter, although the compounds were toxic also to reindeer. A few years later, ivermectin was introduced; it was safer to reindeer, superior in effect against insect larvae and also killed nematode parasites. Ivermectin treatment once yearly is currently standard in many herding districts, especially in Finland. In spite of the well documented efficacy against many parasite species, after more than two decades of use, it is still scientifically unproven if ivermectin treatment does advance reindeer health and improve the economical income of reindeer owners.

Winter feeding often takes place in corrals where animal density is high, which makes the spread of infectious diseases easier. Therefore, viral and bacterial diseases have emerged or re-merged. Some of these have been known from the pre-WW II period, but the causative agents have been recognized and described more in-depth during the last decades. One such disease is mouth inflammation, outbreaks of which have been seen in corralled reindeer herds especially following rainy autumns. Various causative viruses have been identified, such as the reindeer herpesvirus, Orf virus, and reindeer parapoxvirus. Moreover, similar disease has been caused by mechanical trauma or bacterial infections. Viral infections are generally followed by secondary bacterial infections, most important of which is obviously necrobacillosis. Winter feeding may also, if fodder is substandard, predispose reindeer to listeriosis caused be *Listeria monocytogenes*. The bacterium thrives in bad silage and has caused sepsis of newborn reindeer calves as well as keratoconjuctivitis causing blindness of reindeer. Corralling has also predisposed reindeer to toxoplasmosis, a zoonotic protozoan infection affecting most warm-blooded animals. Reindeer appear to be extremely susceptible and may abort following infection. Corralling and feeding increase the reindeer's contact with cat faeces which may contain oocysts of *Toxoplasma gondii*, the causative agent. Antibodies against *T. gondii* were most common in herding districts with highest corralling rates.

Animal welfare has become an important issue in the modern society. Also reindeer herding is expected to follow the general development and to prevent animals from being exposed to unnecessary distress, pain or suffering. As the owner is responsible for her/his animals' well-being even if they are in the forest or mountains, death by disease or starving, deemed natural just a few decades ago, has become generally unacceptable. In Finland, a reindeer health care program has been in progress a couple of years now. There are plans to combine the existing expertise, and create new, within the NOR member countries to create a Nordic Reindeer Welfare State model. The goal of the model is to guarantee the absence of unnecessary suffering by taking care of necessary nutrition and treatment of disease. To achieve this goal, careful monitoring of the condition of the herd is required to be able to react to problems, either by feeding, slaughter or by other treatment.

Poron terveys ja sairaus ennen NOR:ia ja nykyään

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Muussa yhteiskunnassa tapahtuva kehitys on aina heijastellut porotalouteenkin. Saamelainen ja suomalainen porotalous olivat ennen sotia varsin omavaraisia, mutta sittemmin siirtyminen luonnontaloudesta rahatalouteen muutti tilanteen. Muutos toi porotalouden ulottuville ostohyödykkeitä, kuten kaupan maidon. Ostomaidon myötä lypsyporot menettivät merkityksensä ja puolikesy poro puolivilliintyi. Moottoriajoneuvojen käyttöönotto porotaloudessa syrjäytti porokoirat, jotka sitten melkein kuolivat sukupuuttoon. Porokoirien myötä hävisi myös porojen ja koirien välillä kiertänyt merkittävä ihmisellekin vaarallisen taudin aiheuttava pieni heisimato, ekinokokki. Nyttemmin sitä tosin esiintyy jälleen Suomessa hirvieläinten ja suden välisessä kierrossa. Rahatalouteen siirtyminen vaati tuottavuuden tehostamista, jotta elinkeinonharjoittajalla oli varaa ostaa kaupan hyödykkeitä ja turhakkeita. Siksi laidunten heikentyessä porojen talviruokinta alkoi yleistyä ensin Suomessa ja sittemmin myös Ruotsissa ja Norjassa. Talviruokinta kuitenkin lisäsi poromääriä ja siten laidunten kulutusta entisestäänkin.

Kun NOR perustettiin 25 vuotta sitten, porojen loislääkintää oli jo äskettäin aloitettu Pohjoismaissakin organofosfaattivalmisteilla, jotka tappoivat tehokkaasti hyönteisloisia, kurmuja ja saulakoita. Alkutalvesta annetun lääkityksen oletettiin helpottavan porojen selviytymistä talven yli, vaikka valmisteet olivat myrkyllisiä porollekin. Muutamaa vuotta myöhemmin esiteltiin ivermektiini, joka on vielä tehokkaampaa kurmuja ja saulakoita vastaan ja tehoaa lisäksi sukkulamatoloisiin, ja toisaalta on poroille turvallisempaa. Syksyinen ivermektiinilääkitys on nykyään lähes sääntönä useissa osissa poronhoitoaluetta, etenkin Suomessa. Vaikka käsittelyn teho on yli kahdenkymmenen vuoden käytön aikana selvästi osoitettu useita loislajeja vastaan, luotettava tieteellinen näyttö puuttuu edelleen siitä, että lääkitys parantaa poron terveyttä tai poromiehen taloutta.

Rehu annetaan usein tarhassa, missä porotiheys on suuri., ja tämä helpottaa tarttuvien tautien leviämistä. Sen vuoksi on poroihin ilmestynyt tai palannut virus- ja bakteeritauteja. Osa niistä on tuttuja luontaistalouden ajoilta, mutta aiheuttajat on viime vuosikymmeninä voitu tunnistaa ja kuvata aiempaa tarkemmin. Sellainen tauti on mm. suutauti, jota on tavattu erityisesti tarhaporoilla sateisten syksyjen jälkeen. Erilaisia aiheuttajaviruksia on kuvattu: herpes, ns. suurokon aiheuttaja orf-virus, ja sen lähisukuinen poron parapoxvirus. Lisäksi samanlaista tautia ovat aiheuttaneet karkea rehu ja bakteeritartunnat. Virustartuntojen jälkeenkin seuraa usein bakteeri-infektio. Tärkeimpänä pidetään nekrobasilloosia, joka voi iskeä ilman edeltävää virustakin. Jos rehu on huonoa, ruokinta voi altistaa myös listerioosille. Aiheuttajabakteeri viihtyy huonossa säilörehussa ja sen on todettu aiheuttavan verenmyrkytyksiä pikkuvasoille ja sokeuttavaa sarveis- ja sidekalvontulehdusta teurasikäisille vasoille. Tarhaus altistaa porot myös toksoplasmoosille, joka on ilmeisesti kaikkiin lämminverisiin eläimiin tarttuva alkueläintartunta. Se leviää kissan ulosteiden välityksellä. Tarhaus ja ruokinta lisäävät poron mahdollisuutta joutua tekemisiin kissan ulosteiden kanssa. Porolle tartunta voi aiheuttaa hyvinkin vakavan taudin, mm. luomisia. Toksoplasmavasta-aineita oli eräässä tutkimuksessa poroilla sitä enemmän, mitä enemmän paliskunnassa poroja tarhattiin.

Eläinten hyvinvointi on nyky-yhteiskunnassa entistä tärkeämpi asia. Myös porotalouden odotetaan seuraavan yleistä kehitystä, eikä poroille enää saa aiheutua tarpeetonta kärsimystä. Koska omistaja on vastuussa eläimensä hyvinvoinnista sen olinpaikasta riippumatta, sairauden tai nälkiintymisen aiheuttama kuolema, jota vielä muutama vuosikymmen sitten pidettiin luonnollisena, ei enää olekaan hyväksyttävissä. Suomessa on parin vuoden ajan kehitelty porojen terveydenhuoltoa. Nyt on suunnitelmissa yhdistää NOR:n jäsenmaiden olemassa oleva osaaminen, ja hankkia tutkimuksella uutta tietoa, ja luoda pohjoismaiden porojen hyvinvointivaltiomalli. Mallin yhtenä tarkoituksena on estää tarpeeton kärsimys huolehtimalla porojen ravinnonsaannista ja sairauksien hoidosta. Tavoitteen saavuttamiseksi tokan kuntoa seurataan huolellisesti ja mahdollisiin ongelmiin puututaan joko ruokinnalla, teurastamalla tai muuten.

Contagious ecthyma in semi domesticated reindeer in Norway: clinical outbreaks, experimental infection and virus characterization

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Norway experienced the first cases of contagious ecthyma in semi-domesticated reindeer under normal herding conditions in 1999 (Troms County) and 2000 (Nordland County). Contagious ecthyma has occurred in reindeer from Finland (1992-93 and later), and a similar disease was also reported from Sweden (1973; non-verified). Contagious ecthyma is caused by a parapoxvirus and is a zoonosis (transmission from animals to man). In the outbreak in 2000, eight animals died or were euthanized and approximately 30 animals were treated with antibiotics against secondary bacterial infections, and the disease seems to be more severe in reindeer compared to sheep and goats. No clinical cases in semi-domesticated reindeer have been reported in Norway since 2000. During the winter 1999-2000, 48 carcasses of semi-domesticated reindeer were collected from pastures in Finnmark County. Parapoxvirus DNA was detected in 6 animals (liver, parotid salivary gland and/or pulmonary lymph node) by polymerase chain reaction (PCR), showing that also reindeer in Finnmark County have been infected with parapoxvirus, although clinical contagious ecthyma never has been reported in reindeer from Finnmark. These findings also support the view that contagious ecthyma is a multi-factorial disease in reindeer. In an experimental study in 2003, eight one-year-old semi-domesticated reindeer and two sheep (kept separately from the reindeer) were inoculated with a reindeer parapoxvirus isolate (2000-outbreak). Six non-inoculated reindeer were kept as sentinels, sharing feed and water with the inoculated reindeer. The time from inoculation to onset of clinical signs (incubation time) varied from 5 to 12 days. Six of the eight inoculated animals and the two sheep developed contagious ecthyma lesions. Two of the inoculated animals and the six sentinels had no clinical symptoms, but parapoxvirus DNA was detected in one of the sentinel animals (PCR), indicating transmission from the inoculated animals. Two of the inoculated animals had been vaccinated with a commercial attenuated orf-virus vaccine (Scabivax®, Schering Plough Animal Health) four weeks prior to inoculation, but still developed contagious ecthyma lesions, indicating a low degree of protection from the vaccine in these two animals. The parapoxvirus from Norwegian reindeer has been characterized and compared with parapoxvirus isolates from sheep, goats, cattle and musk ox from Norway, and with isolates from reindeer from Finland (1992 and 1994 outbreaks). Phylogeny based on DNA (379 nucleotides) from the B2L gene showed that the reindeer parapoxvirus grouped with orf-virus, the virus species known to cause contagious ecthyma in sheep and goats world-wide, including Norway. These findings indicate a probable spread of the virus from sheep (or goats) to reindeer. Common use of pastures, corralls, equipments and animal transport vehicles may contribute to the spread of virus between sheep and reindeer.

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Smittsom munnskurv hos tamrein* i Norge: kliniske utbrudd, infeksjonsforsøk og viruskarakterisering

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De første kliniske tilfellene av smittsom munnskurv hos semi-domestiserte reinsdyr under vanlige driftsforhold i Norge ble oppdaget i 1999 (Troms) og 2000 (Nordland). Munnskurv har forekommet hos rein i Finland siden vinteren 1992-93, og en lignende sykdom ble rapportert hos rein i Sverige i 1973. Munnskurv forårsakes av et parapoxvirus og er en zoonose (smitter fra dyr til mennesker). Under utbruddet i 2000 døde 8 reinsdyr og rundt 30 dyr ble behandlet med antibiotika mot bakterielle sekundærinfeksjoner, og sjukdommen synes generelt å være mer alvorlig hos reinsdyr sammenlignet med sau og geit. Det har ikke vært rapportert kliniske tilfeller av munnskurv hos rein i Norge siden 2000. I løpet av vinteren 1999-2000 ble det samlet inn 48 reinkadavre fra beiter i Finnmark. Parapoxvirus ble funnet i 6 dyr (lever, spyttkjertel og/eller lungelymfeknute) ved hjelp av polymerase kjedereaksjon (PCR). Dette viser at reinsdyr i Finnmark har vært infisert av parapoxvirus, selv om munnskurv aldri har vært rapportert hos rein i dette fylket. Disse funnene støtter også teorien om at munnskurv er en multi-faktoriell sjukdom hos rein. Under et eksperimentelt forsøk i 2003 ble åtte ett år gamle reinsdyr og to sauer (holdt separat) inokulert med et parapoxvirus-isolat fra rein (2000-utbruddet). Seks reinsdyr ble ikke inokulert men ble holdt sammen med de inokulerte som kontaktdyr. Tiden fra inokulasjon til tilstedeværelse av kliniske symptomer (inkubasjonstiden) var 5-12 dager. Seks av de åtte inokulerte dyrene og de to sauene utviklet munnskurv-symptomer. To av de inokulerte reinsdyrene og de seks kontaktdyrene utviklet ikke slike symptomer, men parapoxvirus DNA ble funnet i ett av kontaktdyrene, noe som indikerer en overføring av virus mellom dyrene i gjerdet. To av de inokluerte dyrene ble vaksinert med en kommersiell svekket munnskurv-vaksine til sau (Scabivax®, Schering Plough Animal Health) fire uker før inokulasjon. De vaksinerte dyrene utviklet likevel munnskurv, noe som indikerer en lav grad av beskyttelse av vaksinen for disse to dyrene. Parapoxvirus isolert fra reinsdyr med munnskurv i Norge er sammenlignet med parapoxvirus-isolater fra sau, geit, storfe og moskus i Norge, og med isolater fra reinsdyr fra Finland (1992 og 1994). Fylogeni basert på DNA (379 nukleotider) fra B2L-genet viser at virus fra rein grupperes sammen med orf-virus, som forårsaker munnskurv hos sau og geit verden over, inkludert Norge. Disse funnene indikerer en sannsynlig overføring av virus fra sau (eller geit) til reinsdyr. Felles bruk av beiter, samlegjerder, utstyr og transport-kjøretøyer kan bidra til en virussmitte mellom sau og geit og reinsdyr.

Disse undersøkelsene ble støttet økonomisk av Reindriftens utviklingsfond.

* Med tamrein menes semidomestisert rein.

Prolonged persistence of faecally excreted ivermectin from reindeer in an arctic environment

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Faeces from groups of reindeer calves treated either subcutaneously or orally with ivermectin, collected over the first nine days following treatment, as well as faeces from untreated reindeer calves, were distributed on 1 m x 1 m plots established on two types of forested reindeer pasture in northern Finland during the winters of 2001 and 2002. The Ungrazed plots were on an enclosure that had been fenced to prevent reindeer access for the last six years. The Grazed plots were on an area which had been heavily stocked by reindeer for five years immediately prior to the experiment. The vegetation of the two areas differed from each other in that lichens (*Cladina* spp.) were present on the Ungrazed and not on the Grazed area. Reindeer and large wildlife were prevented from entering the enclosures by a fence after enclosures had been established. Topsoil samples (reindeer faeces, vegetation and soil) were collected from the plots monthly during the summers of the following two years, over a period spanning from 24 to 94 weeks after plot establishment. The samples were analysed for ivermectin using HPLC – high pressure liquid chromatography. Although apparent ivermectin degradation rapidly took place during the first spring, concentrations (mean levels > 55 ng/g dry weight) could be measured for the whole period of more than 90 weeks after deposition of faeces on plots.

Lang oppholdelsestid for ivermectin i reinmøkk på beite

Møkk fra grupper av reinkalver behandlet med ivermectin gjennom munnen eller ved injeksjon, innsamlet over de første ni dagene etter behandling, samt møkk fra ubehandlete kalver, ble fordelt på 1 m x 1 m prøveruter på to typer av skogkledd reinbeite i nord-Finland gjennom vintrene 2001 og 2002. Ubeitete prøveruter var på område som hadde vært avstengt med gjerde til hinder for rein gjennom de siste seks årene før forsøksoppstart. Beitete prøveruter var på område som hadde vært kraftig beitet av rein gjennom de siste fem årene før forsøksoppstart. Vegetasjonen på de to områdene skilte seg fra hverandre ved at det var reinlav (*Cladina* spp.) på Ubeitet område og ikke på Beitet område. Etter forsøksoppstart ble rein og større vilt holdt borte fra områdene med gjerde. Prøve (utstemplet 10 cm x 10 cm x 5 cm) fra toppen av prøveruter (reinmøkk, vegetasjon og jord) ble tatt månedlig gjennom hver sommer de to påfølgende årene, over en periode som strakte seg fra 24 til 94 uker etter etablering av prøveruter. Prøvene ble analysert for ivermectin ved HPLC – høytrykks-væske-kromatografi. Selv om det var rask nedbryting av ivermectin gjennom den første våren, kunne gjennomsnittskonsentrasjon større enn 55 ng/g tørrvekt måles gjennom hele perioden på mer enn 90 uker etter utlegging av møkk på forsøksruter.

Reindeer meat – is it always tender, tasty and healthy?

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Flavour, tenderness and wholesomeness are attributes valued by today's consumer as significant in relation to the eating quality of meat. Consumer attitudes are increasingly important for all meat industries, and production systems based on grazing - as used for reindeer - are often valued by consumers as more animal friendly and ethical compared with the more commercial production of beef, pork and chicken. Reindeer meat is a high quality product that also has several other attributes attractive to health conscious consumers *e.g.* low fat content, favourable fat composition and high levels of minerals. Preferences vary between different populations of consumers, however, regardless of the consumer group, the consistency of meat quality is essential, and the product should be of the same quality every time it is purchased. This paper will give an overview of research related to reindeer meat quality.

Meat with high pH values, so called DFD (Dark, Firm, Dry) meat, is a persistent quality defect found in all meat species. DFD shortens shelf life, especially for vacuum-packed meat and affects meat colour, tenderness and water-holding properties. High pH values in reindeer meat have been related to pre-slaughter handling stress and poor nutritional status of the animals. There are numerous reports that variation in muscle pH and glycogen content give rise to considerable variations in meat tenderness in species such as beef and lamb. In contrast, reindeer meat has been found to be extremely tender regardless of ultimate pH. This phenomenon has been related to the speed of post mortem protein degradation and the small muscle fibre size in reindeer.

Previous research has demonstrated that the fatty acid composition of meat changes in response to diets. Generally, a higher proportion of long, unsaturated fatty acids were found in meat from grazing animals compared with animals fed a grain-based diet. Reindeer meat has been found to contain moderate amounts of polyunsaturated fatty acids (PUFA), especially so-called *n*-3 (or omega-3) PUFAs. The PUFAs are known to be susceptible to oxidation and may therefore be easily oxidized during processing by techniques like smoking and drying. A trained sensory panel concluded that meat from reindeer fed commercial feed scored higher for liverish and sweet flavours and lower for off-flavour (*i.e.* 'grass', 'wild' and 'game') compared with meat from grazing animals. Consumer preference tests on reindeer meat showed that 50 per cent of the consumers preferred meat from grazing reindeer and 50 per cent meat from pellet-fed animals.

Recent reindeer meat research has included new feed mixtures using ingredients like linseed and fish meal. Crushed linseed in the feed gave meat with a fat composition similar to that of natural pasture, which meant more PUFA than in meat from reindeer fed the normal grain-based mixture. Fish meal used as a protein source in reindeer feed mixtures demonstrated good feed conversion and weight gain in the animals, and sensory evaluation by both a trained panel and consumers did not show any negative effects on flavour attributes of the meat. The fat composition of the meat changed just slightly when comparing fish- and soy bean meal, with more PUFA in the meat from fish meal fed animals. The control group of free-ranging reindeer had significantly highest PUFA content in the meat.

Studies on carcass handling techniques like electrical stimulation and pelvic suspension, seasonal effects for different animal categories on carcass composition, various meat quality attributes (including sensory analysis) and chemical composition as well as continuing work on the relationship between diet and meat composition are currently on-going in Alaska and Scandinavia. Our knowledge about various factors affecting reindeer meat quality has increased significantly over the last 25 years, but there is still information missing particularly regarding the interaction between production systems, slaughter handling techniques and ultimate meat quality.

Renkött – är det alltid mört, gott och nyttigt?

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Smak, mörhet och näringsinnehåll är egenskaper som värderas högt av konsumenter som de viktigaste i förhållande till köttets ätkvalitet. Konsumenternas åsikter blir allt viktigare för köttindustrin och produktionssystem som håller djuren på bete under större delen av året (som också gäller för rennäringen) betraktas som mer djurvänliga och etiska jämfört med den mer kommersiella produktionen av nöt- och griskött eller kyckling. Renkött är en högkvalitativ produkt som också har ett flertal andra egenskaper som tilltalar den hälsomedvetna konsumenten som t.ex. lågt fettinnehåll, fördelaktig fettsammansättning och högt innehåll av mineraler. Olika konsumentgrupper kan naturligtvis föredra olika egenskaper i köttet, men generellt är det viktigt att köttets kvalitet varierar så lite som möjligt, den bör vara den samma vid varje köptillfälle. Följande artikel kommer att ge en översiktlig beskrivning av forskning relaterad till renköttets kvalitet.

DFD (Dark, Firm, Dry) kött med höga pH-värden är ett kvalitetsproblem som kan drabba kött från alla djurslag. Detta kött har dålig hållbarhet speciellt i en vakumförpackning, men andra egenskaper som köttets färg, mörhet och vattenhållande förmåga påverkas också av DFD. Höga pH-värden i renkött har visats bero på stress i samband med slakthantering och på dålig näringsstatus hos djuren. Ett flertal undersökningar på t.ex. nöt- och lammkött har rapporterat att en variation i pH-värde och glykogeninnehåll har stor betydelse för köttets mörhet. Renkött har däremot visats vara mycket mört oberoende av pH-värde, vilket har förklarats bero på en hög aktivitet av proteinnedbrytning efter slakt men också på små muskelfibrer i renköttet.

Tidigare undersökningar har demonstrerat att fettsyrasammansättningen i kött förändras beroende på vad djuren äter. Allmänt gäller att i kött från betande djur finns en högre andel fleromättade fettsyror (PUFA) jämfört med djur som utfodrats med spannmålsbaserade foder. Renkött har visats ha en relativt hög andel PUFA och särskilt de sk. omega-3 PUFA. Det är välkänt att PUFA lätt oxiderar och de kan därför påverkas av förädlingmetoder som t.ex. torkning och rökning. En tränad smakpanel bedömde att kött från renar som utfodrats med kommersiellt renfoder smakade mer lever och sött och hade mindre bismaker (som t.ex. gräs, vilt och ren) jämfört med kött från naturbetande renar. I en konsumentundersökning av samma typer av renkött föredrog 50 procent av konsumenterna beteskött och 50 procent föredrog kött från utfodrade renar.

Den senaste forskningen har studerat nya foderblandningar där ingredienser som linfrö och fiskmjöl har utvärderats. Linfrökaka som tillsats i renpellets gav köttet en fettsammansättning som påminde om den i kött från naturbetande renar, d.v.s. köttet innehöll mer PUFA än kött från renar som utfodrats med normala pellets. I försök där fiskmjöl har använts som proteintillskott i renfoder visades ett bra foderutnyttjande och god tillväxt hos renarna och inga negativa effekter på renköttets smak kunde påvisas varken av en tränad smakpanel eller vid en konsumentundersökning. Fettsammansättningen i köttet påverkades marginellt av tillsatsen av fiskmjöl jämfört med normalfodret baserat på sojaprotein. Kött från kontrollgruppen av naturbetande renar hade det signifikant högsta innehållet av PUFA.

Pågående forskning i Alaska och Skandinaven handlar om slaktkroppshantering (tekniker som elstimulering och bäckenhängning), säsongsvariationer för olika djurkategorier i köttets kemiska profil, köttkvalitetsegenskaper och slaktkroppssammansättning. Fortsatta studier av sambanden mellan fodertyp och köttkvalitet pågår också. Kunskapen om de olika faktorer som påverkar renköttets kvalitet har ökat påtagligt under de senaste 25 åren, men fortfarande saknas en del fakta när det gäller sambanden mellan produktionssystem, slakthantering och köttkvalitet.

Reindeer meat – healthy and safe food?

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Previous studies indicate that reindeer meat may be rich in healthy unsaturated fatty acids, so-called omega-3 fatty acids. Intake of omega-3 fatty acids may decrease the risk of cardiac diseases. Reindeer meat and food products from reindeers may also contain important essential vitamins. Liver, bone marrow and fat are also traditionally used as food in addition to meat.
Today, persistent organic pollutants (POPs), for example PCB and DDT, will be found in traditional food like reindeer meat. These compounds may be transported many thousands of kilometres away from the pollution source by the atmosphere and therefore it is possible to find them all over the world. Many POPs are soluble in fat and persistent in nature. As a result they may concentrate in the food web. The marine food web is most exposed to this phenomenon and animals in the terrestrial ecosystem, for example reindeer, are expected to have low content of POPs.
Heavy metals, for example lead and cadmium, are also susceptible to be transported long distances by air currents. When deposited on land, lichens and plants may take up heavy metals. As a result grazing animals may be affected by heavy metal pollution. A previous study performed by the Norwegian Food Safety Authority indicates high amounts of cadmium in reindeer liver and kidney.
Finnmark in northern Norway has a reindeer herd of approximately 140 000 animals. For some Sami families reindeer meat is an important source of income and an ordinary part of the diet. The Centre for Sami Health Research at the University of Tromsø has performed a study to investigate whether reindeer meat/reindeer products can be classified as nutritious and safe food. Samples were taken from 31 reindeers grazing in seven different herding districts in Finnmark and Nordland. From each animal four different samples were analyzed; meat, liver, bone marrow and fat. The levels of a number of compounds were monitored in each sample; fat- and water soluble vitamins, saturated and unsaturated fatty acids, PCB, DDT, brominated flame retardants, chlorinated pesticides and some heavy metals, for example lead, cadmium and nickel. Results from the study will be presented during the conference.

Renkött - hälsosam och trygg mat?

Tidigare studier antyder att renkött/renprodukter kan innehålla betydande mängder av hälsosamma fleromättade fettsyror, så kallade omega-3 fettsyror. Intag av ”omega-3” fettsyror minskar risken för hjärt- och kärlsjukdomar. Renprodukter kan även vara en viktig källa till essentiella vitaminer. Traditionellt sett används inte bara kött utan även lever, benmärg och fett som livsmedel.
Idag återfinns persistenta organiska miljögifter, till exempel PCB och DDT, även i traditionell kost som renkött. Dessa föreningar kan transporteras många tusen kilometer från den ursprungliga utsläppskällan med atmosfären och går därför att finna överallt på jorden. Eftersom många av de organiska miljögifterna är fettlösliga och svårnedbrytbara koncentreras de i näringskedjan. Värst utsatt är den marina näringsväven. Djur som tillhör den terrestra näringskedjan, däribland ren, förväntas ha låga nivåer av organiska miljögifter men få studier har gjorts på norska renar.
Tungmetaller, till exempel bly och kadmium, kan transporteras partikelbundet med luftströmmar för att sedan tas upp av växter och lavar vid deponering. Betande djur kan på grund av detta vara utsatt för tungmetallförorening och därför är det intressant att undersöka tungmetallhalten i renkött. En tidigare undersökning av Mattillsynet i Norge antyder förhöjda halter kadmium i lever och njure från ren.
I Finnmark i Nordnorge finns idag en renstam på ungefär 140 000 djur. Renkött innebär en viktig inkomstkälla för många samefamiljer och en naturlig del i deras kosthåll. Under 2005 och 2006 har Senter for Samisk helseforskning vid Universitetet i Tromsø bedrivit en studie för att undersöka om renkött och renprodukter kan klassificeras som sund och trygg mat. Totalt har det tagits prover från 31 renar i sju olika renbetesdistrikt i Finnmark och Nordland. Från varje djur har fyra olika organ analyserats; kött, benmärg, lever och fett. Nivån av vatten- och fettlösliga vitaminer, mättade och fleromättade fettsyror, PCB, DDT, bromerade flamskyddsmedel, klorerade pesticider och ett urval tungmetaller, däribland bly, kadmium och nickel har analyserats i dessa prover. Resultat från studien kommer att presenteras under konferensen.

Wild reindeer in Norway – population ecology, management and harvest

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Wild reindeer in Norway, presently (winter 2005-06) numbering some 25 000 animals, are found in 23 more or less separated areas in the mountainous southern part of the country. All herds are hunted and management is organized in close cooperation between owner organizations and state agencies. I will provide a historical review of the wild reindeer management and research in Norway and conclude with the present situation. We identify three types of wild reindeer on basis of their origin: (1) the original wild reindeer with minor influence from previous domestic reindeer herding activities (Snøhetta, Rondane and Sølenkletten), (2) wild reindeer with some influx of animals from past domestic reindeer herding in the area (Nordfjella, Hardangervidda, Setesdal-Ryfylke) and (3) feral reindeer with a semi-domestic origin (reindeer released or escaped from past reindeer husbandry units (Forolhogna, Ottadalen North og Ottadalen South, Norefjell-Reinsjøfjell and several smaller areas). In Norway, genetic origin (wild or semi-domestic), body size and reproductive performance of reindeer differs among areas. Feral reindeer have higher body weights and enjoy higher reproductive rates than their originally wild counterparts. These differences may partially be explained by differences in food quality and availability among the populations. However, there is a growing suspicion that other explanatory factors are also involved. Wild reindeer are more vigilant and show longer fright and flight distances than feral reindeer. Number of animals harvested was 4817, or ca. 20% of the total population in 2005, but varies between 40% in feral reindeer areas to below 20% in some of the "wild" reindeer areas. Causal factors behind this variation include differences in age at maturation, postnatal calf mortality and herd structure. The Norwegian Institute for nature research (NINA) in cooperation with the Directorate for nature management (DN) allocate considerable resources to monitoring wild reindeer herds and pastures, especially winter pastures. A total of seven wild reindeer areas are monitored annually (the monitoring program was initiated in 1991), recording calf recruitment rates in nursery bands in June/July from aerial photographs and herd composition from ground counts of rutting groups in September/October. Carcass weights and mandibles are sampled at regular intervals from harvested animals in the same areas in order to investigate reindeer body weight development. The botanical part of the monitoring program is concentrated on lichen regrowth in areas under variable reindeer grazing pressure, and annual measurements of radiocesium load in plants and reindeer meat from fall-out areas following the Tsjernobyl accident in 1986. Reindeer research relating to the wild reindeer herds in southern Norway is mainly conducted by NINA in Trondheim and the Biology Institute, University of Oslo. Most mountain ranges and wild reindeer populations in Norway are experiencing an increase and expansion of human use, including infrastructure such as road and power-lines, and private cabins, tourism/recreation, etc. Present research activities focus on wild reindeer area use, behaviour and activity budgets in selected areas on a 24 hour and a seasonal basis by use of GPS technology. An important part of the ongoing projects emphasizes a close monitoring and investigation of reindeer behaviour and activity in relation to human activities and infrastructure. Furthermore, development and quality control of methods for measurement of response towards anthropogenic activities and population reproduction and early calf mortality are included in the research activities.

Villrein i Norge – populasjonsøkologi, forvaltning og jakt

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Villreinen i Norge utgjør i 2005-06 en vinterbestand på ca. 25 000 dyr fordelt på 23 stort sett isolerte villreinområder som jaktelig sett forvaltes enkeltvis og i et samarbeid mellom rettighetshavere og statlige forvaltningsorganer. Presentasjonen gir en historisk fremstilling av villreinforvaltningen i Norge og den forskningsutvikling som ligger bak dagens situasjon. Vi har tre typer villrein i Norge: (1) den opprinnelige med liten tamreininnblanding karakterisert ved områdene Snøhetta, Rondane og Sølenkletten, (2) villrein med varierende innslag av tamreinpåvirkning (Nordfjella, Hardangervidda, Setesdal-Ryfylke) og (3) villrein med tamreinopphav, dvs. forvillet tamrein (Forolhogna, Ottadalen Nord og Ottadalen Syd, Norefjell-Reinsjøfjell og en rekke mindre områder). Reinens kroppsvekter i kategori 3-områdene er vesentlig høyere enn de i kategori 1 og 2. Forskjeller i beiteforhold områdene i mellom er nok medvirkende årsak, men adferdsundersøkelser som omfatter vaksomhetsadferd og frykt- og fluktadferd i ulike områder tyder på at vaktsomhet og aktivitetsmønster kan være andre, viktige påvirkningsfaktorer. Avkastningen i form av felte dyr var i 2005 ca 20% av samlet vinterbestand, men varierer mellom 40% i områder der kroppsvektene er store til under 20% der reinen har lavere kroppsvekter. Forklaringsfaktorer omfatter forskjeller knyttet til alder for kjønnsmodning og reproduksjon, postnatal kalvedødlighet og kjønns- og alderssammensetning i de ulike villreinområdene. Norsk villreinforvaltning i regi av Norsk institutt for naturforskning (NINA)/Direktoratet for naturforvaltning (DN) satser store ressurser på overvåkning av villrein og deres beiter, særlig vinterbeiter. Til sammen syv spesielt utvalgte villreinområder overvåkes årlig (start 1991) med flyfotografering av fostringsflokker i juni/juli for å bestemme kalvetilvekst og bakkeregistreringer om høsten for å bestemme bestandsstruktur. Med jevne mellomrom innsamles også kjever og slaktevekter fra høstjakten for å vurdere reinens kondisjonsutvikling i overvåkningsområdene. I den botaniske del av overvåkningsaktivitetene måles gjenvekst av lav i områder utsatt for vekslende beitepress og radiocesiumbelastningen etter Tsjernobylulykken i 1986 i næringsplanter og i kjøttprøver fra felt villrein i de områdene som ble hardest rammet av nedfall. Villreinforskningen er særlig lokalisert til NINA og Universitetet i Oslo. Forskningsaktivitetene omfatter måling av reinens adferd og aktivitet gjennom døgnet og dyrenes sesongmessige områdebruk i relasjon til menneskelig infrastruktur i utvalgte områder ved hjelp av bl.a. GPS-instrumentering og utvikling og kvalitetskontroll av metodeverktøy til bestemmelse av reproduksjon og tidlig kalvedødlighet.

Satellite images – an important tool for mapping and monitoring reindeer ranges in northern Fennoscandia.

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In the period 1970 to 1990 the reindeer population in the Finnmark expanded from about 90 000 animals to more than 200 000. The result was a considerable decline in lichen cover within the winter ranges, a significant decrease in reindeer body-weights, increased mortality rates, especially during winters, and low calving capacity for several siidas/districts within the area. Additional to the changes in the nature, considerable changes have occurred in the Sámi society, as well, during the past decades. Particularly from the 1960s reindeer management has been rapidly modernising. Traditionally the principal element in the reindeer husbandry in northern Fennoscandia has been to secure an appropriate balance between winter and summer ranges. The depletion of the winter ranges has interrupted this balance. Several scientific reports have documented the unfavourable status for the winter ranges. The experiences from Norway are also valid for the reindeer herding in both Finland and Sweden. Updated maps are though important to keep track of the changes going on within the reindeer range areas.

This presentation describes how satellite data have contributed to the mapping and monitoring of the reindeer ranges through the past decades. Especially the lichen heaths and lichen woodland have proven to be easily detectable by use of satellite data due to high reflectance in the visible part of the electromagnetic spectrum compared to most other types of vegetation. The differences in spectral pattern for different vegetation types are used to classify vegetation units into spectral classes. By integrating different types of ancillary data, spectrally classified images can be converted into vegetation maps. The methods for creation of vegetation map are well established among researchers in Scandinavia. Norut Information Technology has used the method to work out vegetation maps for large areas for northern Scandinavia, including Kola Peninsula. The seamless map created for areas in Norway have a ground resolution of 30 meters, while areas in Finland and Sweden are presented with a resolution of 100 meters. Areas on Kola Peninsula are so far only worked out as pre-classified images due to lack of ancillary map data.

From the vegetation maps produced different types of information important for the reindeer herding can be extracted. The occurrence and distribution of lichen heaths and woodland is important for the management of the reindeer winter ranges. Changes in the lichen cover on Finnmarksvidda are described by use of several satellite images from the period 1973-2000. The green biomass in different summer ranges can be extracted using vegetation indexes. By comparing data concerning grazing conditions to other herding parameters a more holistic picture of the herding activity can be obtained. A preliminary approach of this type of comparison is worked out for herding areas in Western Finnmark. Similar approaches can now be performed for large areas in northern Fennoscandia.

Satellittdata – et viktig hjelpemiddel innen kartlegging og overvåking av reinbeiteområder på Nordkalotten

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I perioden 1970 til 1990 økte reintallet i Finnmark fra 90 000 dyr til mer enn 200 000. Denne økningen i reintallet fikk effekter for reindrifta i fylket på ulik vis. Vinterbeitene i fylket ble kraftig forringet gjennom reduksjon i lavdekket. Vekttall og kalvingsrate ble redusert, samtidig som flere distrikt opplevde økt dødelighet. I samme periode gjennomgikk næringa en betydelig moderniseringsprosess. Moderne hjelpemidler som snøscooter, terrengsykler og helikopter ble introdusert i reindrifta. Reindrifta er en naturbasert næring og har tilpasset seg bruk av ulike beiteområder gjennom ulike tider på året. Et viktig element i næringa har vært å sikre en god balanse mellom tilgangen til gode vinter- og sommerbeiter. Den gradvise forringelsen av vinterbeitene i Indre Finnmark har svekket denne balansen. En rekke forskningsrapporter dokumenterer endringene som har pågått. Erfaringene for norsk side har gyldighet også i Finland og Sverige. Vinterbeitene er her knyttet til lavrike furuskoger med skogsdrifta som et forstyrrende element.

Denne presentasjonen beskriver på hvilken måte satellittdata har bidratt til overvåking og kartlegging av reinbeiteområder gjennom de siste årtier. Spesielt har det vist seg at lavrike vegetasjonstyper er velegnet for kartlegging og overvåking basert på data fra optiske satellitter. Reflektansen i lavrike vegetasjonstyper er signifikant forskjellig fra andre vegetasjonstyper, spesielt i den synlige delen av spekteret. Det forholdet at ulike vegetasjonstyper har forskjellig reflektansmønster brukes til å klassifisere vegetasjonsdekket. Klassifiserte produkt bearbeides videre til vegetasjonskart ved å integrere forskjellige typer tilleggsdata. Metoden for produksjon av vegetasjonskart på denne måten er i dag godt innarbeidet i flere forskningsmiljø i Skandinavia. Norut IT har kartlagt store deler av Nordkalotten, inkludert Kolahalvøya. For norske områder finnes denne type kart med en oppløsning på 30 m. For områdene i Sverige og Finland er kartene framstilt med en oppløsning på 100 m. For Kolahalvøya finnes dette kartmaterialet kun som et pre-klassifisert produkt. Dette fordi en her mangler gode tilleggsdata.

Fra dette kartmaterialet kan en ekstrahere informasjon som er av stor betydning for reindrifta. Status og forekomst av lavheier og lavrike skogstyper er viktig informasjon om vinterbeitene på Nordkalotten. Endringene i lavdekket på Finnmarksvidda er beskrevet gjennom en serie av satellittbilder fra perioden 1973-2000. Produksjonsforhold i ulike sommerbeiteområder kan utledes gjennom vegetasjonsindekser utarbeidet på grunnlag av satellittdata. Ved å sammenstille denne type data med produksjonstall fra reindrifta kan et mer helhetlig bilde av hele drifta oppnås. Denne type sammenstilling av data fra ulike fagområder er forsøkt for Vest-Finnmark reinbeiteområde. Tilsvarende sammenstillinger kan i dag gjøres for store deler av reindriftsområdet på Nordkalotten.

Effects of reindeer grazing on tundra ecosystems

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The dwarf-shrub dominated vegetation has been replaced by grass-dominated vegetation in areas heavily grazed and trampled by reindeer. The grass-dominated vegetation is associated with a higher litter and soil organic matter (SOM) quality, higher nutrient availability and higher soil temperatures. Greenhouse experiments have shown that neither higher SOM nor higher temperature increased N mineralization rates and growth rate of grasses on their own, but the combination of higher temperatures and higher SOM quality had strong positive effects on nitrogen mineralization and plant growth. Moreover, a transplantation experiment has shown that grass-dominated vegetation from heavily grazed areas changed little when grazing and trampling pressure were reduced for three years. In contrast, the dwarf shrub-dominated vegetation in the lightly grazed area changed rapidly into grasslands when the grazing pressure was enhanced. Reestablishment of dwarf shrubs appears to be both seed- and microsite-limited, but it appears that dwarf shrubs may be able to re-establish in previously heavily grazed vegetation in the absence of reindeer.

Effekter av renbete på fjällekosystem

Rishedsvegetation ersätts av gräsdominerad vegetation som betas och trampas intensivt av renar. Den gräsdominerade vegetationen är associerad med högkvalitativ förna och organiskt material i jorden (SOM), hög näringstillgång och hög marktemperatur. Växthusexperiment har visat att varken en högre kvalitet på SOM eller förhöjda marktemperaturer ökar kvävemineraliseringen eller tillväxten av gräs var för sig, men i kombination leder de till en högre kvävemineralisering och en snabbare tillväxt av gräs. Ett transplantationsexperiment visar att gräsdominerad vegetation från hårt betade områden inte förändras om den inte betas i tre år. Tidigare lätt betad risvegetation omvandlas däremot snabbt till gräsmark när den transplanterades till hårt betade områden. Att återväxten av risvegetationen går långsamt beror på att etableringen begränsas av låg tillgång på frön och av brist på konkurrensfria ytor där groddplantor kan etablera sig. Vegetationsförändringen är dock på lång sikt förmodligen reversibel eftersom risväxterna kan etablera sig i gräsvegatationen.

Reindeer impacts on microclimate and structure of forest floor communities in summer and winter ranges

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We studied the impact of reindeer on vegetation, invertebrates, microclimate and soil moisture in both summer and winter pastures in Finnish Lapland. Winter grazing was studied in lichen dominated pine forests on both sides of the reindeer fence on the Finnish-Russian border in north-eastern Lapland. Summer grazing was studied using experimental reindeer exclosures in sapling stands in moss dominated spruce-birch forests in central Lapland. Vegetation was lower in grazed plots in both summer and winter ranges and the difference was most pronounced for the preferred food plants, such as *Cladina* lichens, graminoids (*Carex* spp., *Deschampsia flexuosa*) and bilberry (*Vaccinium myrtillus*). Air and soil temperature was higher and humidity lower in grazed plots in both summer and winter ranges. Soil moisture was significantly higher in ungrazed plots in winter ranges under thick *Cladina* cover. However, in summer ranges soil moisture was lower inside the exclosures under the dense birch sapling stand compared to the outside where the reindeer prevented birch growth.
In addition to the soil moisture, the results of both vegetation and invertebrate studies suggest that in *Cladina*-type winter range a long term protection from grazing leads to cooler and wetter soil and can even lead to bog formation (paludification). In the Finnish-Russian border, plants typical of boggy vegetation, like *Sphagnum* mosses, Labrador tea (*Ledum palustre)* and bog bilberry (*Vaccinium uliginosum*), were more common in ungrazed side of the fence in *Cladina*-type sites. Likewise, in the same sandy pine forests we found spider species characteristic to boggy habitats from the ungrazed plots. In the moss dominated spruce forests summer grazing had partly opposite impacts. There the soil was somewhat more wet and even *Sphagnum* was more frequent in grazed plots.

Effekter av sommar- och vinterbete av ren på mikroklimat och skogsvegetationen

Vi studerade hur ren påverkar vegetation, evertebrater, mikroklimat och jordfuktighet i sommar- och vinterbetesmarker i finska Lappland. För vinterbete vi utnyttjade renstängslet på gränsen mot Ryssland i nord-östra Lappland och för sommarbete forskningshägn i skogsplanteringar i mossrika granskogar i centrala Lappland. Vegetation var lägre i betade ytor i både habitaten och skillnaden var störst för de mest utnyttjade födoväxterna, t.ex. renlavar (*Cladina* spp.), gräs (*Carex* spp., *Deschampsia flexuosa*) och blåbär (*Vaccinium myrtillus*). Luft- och marktemperaturer var högre och luftfuktigheten lägre i betade ytor i båda habitaten. Jordfuktigheten var högre i obetade ytor med tjock lavmatta i vinterbetesmarkerna, medan jorden var torrare i betade ytor i sommarbetade skogsplanteringar. Det fanns gott om björksly inom hägnen men lite utanför på grund av hård betning.
Resultaten antyder att i *Cladina*-typ vinterbetesmarker leder långvarigt skydd från renbete till våtare och kallare mark vilket i sin tur kan tänkas leda till försumpning. I renlavdominerade furuskogar vid ryska gränsen förekom karaktärsväxter för sumpig mark, som vitmossa (*Sphagnum* spp.), skvattram (*Ledum palustre*) och odon (*Vaccinium uliginosum*), oftare på obetade ytor. Likaså hittade vi fler spindelarter typiska för sumpiga habitaten från obetade ytor vid ryska gränsen. I de sommarbetade mossdominerade granskogarna hade renens påverkan en delvis motsatt effekt. Där var jorden fuktigare i betade ytor och vitmossa förekom oftare i de betade ytorna.

Arctic ungulate grazing does not necessarily increase tundra fertility

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Mammalian herbivores can generally affect soil nutrients and nutrient cycling through their defecation and trampling. For arctic ungulates it is generally supposed that their direct consumption of plants normally enhances nutrient cycling, as urine and faeces create an organic soil nutrient pool where nutrient release tends to be faster than nutrient release from litter. However, recent studies found that reindeer grazing of lichen-dominated ecosystems in Fennoscandia can cause severe soil degradation. The overall aim of this paper is to explain these obviously opposing findings by reviewing reported impacts of herbivores on pasture fertility. It was found that herbivores may affect pasture fertility in all possible ways: positively, negatively or not detectable. The overall character of ecosystems response to herbivory grazing appears to be related to its ability to utilize herbivory enhanced bioavailable nutrients for primary production, and consequently its long time feed back on nutrient cycling. Thus, at sites were herbivory increase nutrient cycling this is likely to increase soil and thus pasture fertility. The opposite can be expected at sites where herbivores influence negatively on nutrient cycling. By applying this perception on the lichen-dominated winter pastures at Finnmarksvidda the following is found. Labile nutrients from dung and urine become bioavailable in a period with low biological activity and thus low rates of biological fixation. Furthermore, faeces are often dropped into the snow or onto the frozen ground and thus do not immediately enter the soil nutrient pool. The seasonally delay between herbivory release of nutrients during winter and their biological assimilation in summer certainly increases risks for nutrient losses, especially during spring melt periods. Furthermore, the retention of nutrients within a pasture is highly dependent on its cation exchange capacity (CEC). The CEC of the nutrient poor lichen-dominated tundra at Finnmarksvidda is highly determined by their organic matter content and its fruticose lichen cover, which both are negatively influences by reindeer grazing. Thus, detected soil degradation at Finnmarksvidda can, at least partly, be explained by an incomplete nutrient cycling caused by a combination of seasonally grazing and low soil fertility. Consequently, it appears that particularly arctic ungulate winter grazing not necessarily increase tundra fertility.

Reinbeite øker ikke nødvendigvis beitenes kvalitet

Beitende pattedyr kan ha stor innvirkning på jordsmonnets fertilitet gjennom tilføring av avføring og tråkk. For arktiske herbivorer som reinsdyr har det hittil vært antatt at de øker beitenes fertilitet. Resultater fra nyere undersøkelse viser derimot at dette ikke er tilfelle for beitene på Finnmarksvidda, hvor det ble påvist at reinbeite kan føre til jordforringelse. Hovedmålet med denne presentasjonen er å finne en forklaring på de åpenbart motsigende påstandene ved å sammenstille resultatene om herbivorenes innflytelse på beitenes fertilitet. Resultatene viser at herbivorer kan påvirke beitenes kvalitet på alle tenkbare måter: positiv, negativ og ikke målbart. Generelt viser det seg at økosystemets respons på beiting er avhengig av dets evne til å nyttiggjøre seg avføringens næringsstoffer, og dermed dens betydning på systemets primær- produksjon og næringssyklus. På steder hvor beiting øker den langsiktige næringssyklusen vil dette føre til økt fertilitet og dermed økt beitekvalitet. Det motsatte kan derimot forventes på steder hvor beiting minker næringssyklusen. Ved å overføre dette konseptet til de lavdominerte vinterbeitene på Finnmarksvidda ble følgende funnet. De lett biotilgjengelige næringsstoffene fra reinens avføring ble tilført systemet i en periode med forholdsvis lav biologisk aktivitet som dermed har liten evne til å fiksere dem. I tillegg havner reinens urin og møkk ofte i snøen eller på frossen mark, og blir dermed ikke umiddelbart tilført jordmonnets næringspool. Den sesongbestemte utsatte tidsforskjell mellom reinens tilgjengeliggjøring av essensielle næringsstoffer om vinteren og deres biologiske assimilasjon øker risikoen for tap av disse, spesielt under snøsmeltings perioder om våren. Samtidig bestemmes økosystemets fysiske evne til å holde på næringsstoffene av dets kationbyttekapasitet (KAK). På de lavdominerte beitene på Finnmarksvidda er det humus og reinlav som utgjør det meste av systemets KAK, og begge blir negativ påvirket av reinbeite. Jordforringelsen på Finnmarksvidda kan dermed, i hvert fall delvis, forklares gjennom en ukomplett næringssyklus som resultat av både beitetidspunkt og en i utgangspunktet lav jordfertilitet. Reinbeite, spesielt om vinteren, øker dermed ikke nødvendigvis beitenes kvalitet.

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How does forestry affect lichen growth?

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Lichens are a key resource for reindeer during winter. The winter grazing grounds in Sweden are located in the boreal forest where commercial forestry is also being conducted. Forestry practices will affect the amount and availability of lichens through changes in forest stand structure, through an increased fragmentation of the landscape, through cultivation of the soil, and through leaving tree residues. In this paper we focus on the relationship between variations in forest stand structures and lichen growth. We describe how lichens function, how variation in environmental factors affects growth, and a first attempt to construct a model for predicting lichen growth from these factors.
Lichen growth is mainly determined by three factors: the amount of time the lichen is wet and active, the irradiance that reaches the lichen when wet, and the concentration of chlorophyll (i.e. the concentration of algae) the lichen contains. The wet time is mainly determined by climate and forest stand structure through precipitation, humidity, and temperature because lichens lack roots and structures restricting desiccation. The irradiance that reaches the lichens is strongly dependent on the openness of the stand. The chlorophyll concentration varies between species, but also within a lichen thallus where the upper parts of fruticose, terricolous, lichens have a higher concentration of algae than lower parts.
As a first step to construct a predictive model of lichen growth, we have focused on estimating their wet time in relation to air humidity and temperature. We have then regarded wetting and drying as biophysical processes where the lichen water content equilibrates with the surrounding environment. Our model predicts the wet time of a lichen with high accuracy, but it also highlights species- and growth form-specific attributes.

Hur påverkar skogsbruket lavtillväxt?

Lavar är en nyckelresurs för renar under vintern. Vinterbetesmarkerna i Sverige ligger i den boreala skogen där också ett kommersiellt skogsbruk bedrivs. Skogsbruket påverkar mängden och tillgängligheten av lavar genom förändringar i skogsbeståndens struktur, genom en ökad fragmentering av lavbärande marker, markberedningsåtgärder samt kvarlämnande av avverkningsrester. I detta 'paper' fokuserar vi på hur variationer i skogsbeståndens struktur påverkar lavarnas tillväxt. Vi beskriver hur lavar fungerar, hur variationer i omvärldsfaktorer påverkar tillväxten, samt ett första försök till att konstruera en modell för att förutsäga lavtillväxt utifrån dessa faktorer.
Tillväxten hos lavar bestäms i huvudsak av tre faktorer: den tid som lavarna är blöta och därmed aktiva, ljusintensiteten som når lavarna när de är blöta, samt den mängd klorofyll (dvs mängden alger) som finns i laven. Lavarnas blöta tid bestäms i huvudsak av klimatet och skogsbeståndets struktur via nederbörd, luftfuktighet och temperatur eftersom lavar saknar rötter och skydd mot uttorkning. Ljuset som når lavarna är starkt beroende av slutenheten i skogsbeståndet. Klorofyllmängden varierar både mellan olika arter, men också inom en och samma lavindivid där de övre delarna hos buskformiga marklavar har en högre mängd alger än lägre delar.
Som ett första steg i att konstruera en prediktiv modell för lavtillväxt har vi fokuserat på att beräkna lavarnas blöta tid i förhållande till luftfuktighet och temperatur. Vi modellerar detta genom att betrakta uppblötning och uttorkning av laven som en biofysikalisk process där lavens vatteninnehåll strävar mot att bilda en jämvikt med närmiljöns fuktförhållanden. Vår modell beskriver en lavs blöta tid med hög noggrannhet, men den visar också på art- och växtformspecifika drag.

Predation in wild and domestic reindeer herds

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Predation impact in wild reindeer and caribou (*Rangifer tarandus*) populations is suggested to increase toward south where ungulate communities are more diverse than in the north. Domestication probably reduces vigilance and increases vulnerability to predation. Furthermore, some other behavioural responses to predation identified in wild herds cannot evolve functional in reindeer production systems. In Fennoscandian semi-domesticated reindeer herds also predation is highly different from that in wild reindeer and caribou. The most important predator in wild populations, wolf (*Canis lupus*), has been exterminated from the guild of carnivores. Consequently, wolverine (*Gulo gulo*) that is mostly scavenging from wolf-killed wild ungulates within wolf territories is actively preying on reindeer in domestic herds. Substantial decrease in depredation by predators is not likely by means of changing the herding systems. Predation by golden eagle (*Aquila chrysaetos*) on calves appears to be partly compensatory because eagles kill more calves in years when overall calf mortality is increased. High birth synchrony may decrease predation by brown bears (*Ursus arctos*) because predation is concentrated on calves during their first weeks of life.

Predaatio peura- ja porokannoissa

Predaation merkitys peura- ja karibukannoissa voimistunee pohjoisesta etelään, missä sorkkaeläinyhteisöt ovat monilajisempia kuin pohjoisessa. Domestikaatio luultavasti vähentää valppautta ja lisää alttiutta joutua petojen saaliiksi. Eräät villeissä populaatiossa todetut, predaatiota vähentävät käyttäytymismallit eivät myöskään voi kehittyä toimiviksi porotalouden tuotantosysteemissä. Fennoskandian porokantoihin kohdistuva petojen saalistus on keskimäärin varsin toisenlaista kuin peura- ja karibupopulaatoissa, sillä villien kantojen keskeisin peto, susi, on poronhoitoalueella harvinainen. Tämän seurauksena ahma näyttäisi omaksuneen poronhoitoalueella aktiivisemman rooliin kuin susien elinalueilla, missä se käyttää ravinnokseen pääasiassa susien tappamien eläinten haaskoja. Kotkan poronvasoihin kohdistama saalistus näyttää olevan ainakin osittain kompensatorista, sillä predaation merkitys korostuu vuosina jolloin kuolleisuus on keskimääräistä suurempaa. Vasonnan ajoittumisen voimakas synkronia saattaa vähentää vasoihin kohdistuvaa karhupredaatiota, sillä vasat jäävät herkimmin saaliiksi ensimmäisten elinviikkojensa aikana.

Social relations and the system of *skötesrenar*[1]

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Conflicts between reindeer-herder and property-owner are common today, because they use the land in different ways. Reindeer-herder and property-owner that earlier had cooperate to survive in area far away from the power-concentration in Sweden, are meeting each other in trials today. The elderly from both groups, remember that there was great relationship between them, when they were young. Old solidarity and friendship do not exist any longer. The elderly often tell about the system of *skötesrenar*, which had an important significance for the relations between them. The reindeer became something that both groups were interested in and the reindeer could unite them.
The system of *skötesrenar* was built upon the fact that non-Sami owned reindeers, which the Sami herded. The non-Sami were dependent on the reindeers, because the reindeers meant food but were also important for transports during the winter. For the Sami, the system of *skötesrenar* meant had mouthpiece when they were not able to be at meetings for example. It also meant that they have places to stay at when they were moving between the different grazing-areas and much more. From a socially point of view the system of *skötesrenar* meant that the both groups met and their view upon each other became more positive. The relation between those two groups were much better, compared with the relation between reindeer-herders and non-Sami that did not own reindeers. The relation between the non-Sami groups were not always the best. It obvious that the non-Sami that owned reindeers, sometimes identified themselves more with the Sami, than with the non-Sami without reindeers. The system of *skötesrenar* changed a lot during the 20th century through law-changes, industrialization, internal sami society changes and changes in the graze.
The system of *skötesrenar* lost its significance during the last century, which also meant that the population-groups lost contact with each other. Instead the populations became became more and more unaware about each others livingcircumstances. Instead alienation became more common. It is more easily to suit somebody that you do not know, instead of people that you have a lot in common with. So one can say that the system of *skötesrenar* have contributed to a low level of conflicts among some groups in north Sweden.

[1] The practice of reindeer belonging to non-Sami herded by Sami.

Sociala relationer med utgångspunkt från skötesrensystemet

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Konflikter mellan renskötare och markägare till följd av näringsmässigt skilda intressen är inte något ovanligt i dag. Den senaste domen kom den 20 januari vid Umeå tingsrätt. Bofasta och samer som tidigare samarbetat med varandra för att underlätta livet i ett område långt från landets maktcentra möts nu som bittra fiender i olika rättegångar. De äldre ur både befolkningsgrupperna har minnen om att det fanns en god relation mellan dem när de var unga. Gammal gemenskap och vänskap är som bortglömd, vad har hänt? De återkommer ofta till skötesrensystemet och vilken betydelse det systemet hade för de goda relationerna. Renen blev något gemensamt som man kunde enas kring.
Skötesrensystemet som avses här baserades på att icke-samer ägde renar som de renskötande samerna ansvarade för. De bofasta var beroende av renarna eftersom de innebar föda, men även transportdjur om man inte hade tillgång till hästar, för de renskötande samerna innebar systemet hade de hade fasta ställen att bo på längsefter flyttvägen, men även språkrör då de själva var i fjällen under sommarhalvåret. Socialt sett innebar skötesrensystemet att de skilda befolkningsgrupperna möttes och att synen på varandra blev mer positiv i jämförelse med den bofasta gruppen som inte ägde skötesrenar. Inom den bofasta gruppen uppstod det meningsskiljaktigheter beroende på om man ägde eller om man inte ägde renar, konflikten har därmed varit mellan olika grupperingar inom den bofasta befolkningen och inte enbart mot samer. De som ägde renar verkar ha identifierat sig mer och mer ofta ställt sig på samma sida som de renskötande samerna och försvarat deras intressen när samerna själva inte hade möjlighet. Skötesrensystemets betydelse förändrades under 1900-talet bland annat till följd av lagstiftningsförändringar, industrialiseringsprocessen, inre samiska samhällsförändringar och betesförutsättningarna.
Genom att skötesrensystemet mer eller mindre upphörde under den andra halvan av 1900-talet förlorade befolkningsgrupperna den naturliga kontakten och kom allt längre ifrån varandra. I stället växte okunskapen om varandras näringar och ett främlingskap växte fram som fördjupas för varje generation. Det blir genast lättare att stämma någon som man inte har något gemensamt med istället för en vän. Det finns en konkret episod som visar på detta. Renarna sökte sig ofta ut på isvägarna som gick från timmerhyggena ut till de större vägarna. Renarna lämnade ofta spillning efter sig, vilket förstörde isvägarna och det blev tungt för hästen att dra fram timret. Min bofasta informant berättade att när renskötaren kom för att se över sina renar hade han börjat gräla på renskötaren att han inte hade bättre kontroll på sina renar. Renskötaren hade låtit honom gräla klart, sedan hade han sagt: om nu renarna är till sådant stort besvär kan du ju alltid börja med att slakta ut den största sarven (rentjur) för den tillhör dig. Skötesrenägaren sa att han aldrig hade skämts så mycket i hela sitt liv och att han aldrig efter denna episod har grälat på samerna och deras renar. Det här exemplet visar tydligt på vilken god effekt skötesrenarna hade för relationerna mellan befolkningsgrupperna.

Reindeer – source of income or cultural linkage

- an analysis of Sami reindeer management households economies

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The aim of this partial study is to analyse how the economies of different reindeer management households are structured. Further, how they are adapting to the economic conditions for maximizing earnings, if profit maximizing is the goal. Earlier research demonstrates that different regions provides various terms. Consequently there exists a different economic structure among different households. Based on a selection of households from districts /villages from a range of geographical locations, management patterns, and region size, different economic structures are searched for. Households with similar economic structures are group in categories. The standard deviation confirm whether the grouping in categories. Sami Reindeer Management in Norway and Sweden has during the period from 1993 to 2003 provided recognized slaughterhouses with an even quantum of meat supply. That indicates that it probably is the same set of factors that influence the slaughter quantities of both countries. The differences in economic structure among the reindeer management households imply that there is no institution regulation or distributing the economy of reindeer management households. The relationship between the stock value of reindeer and the commercial value of reindeer meat, with in each household, suggests whether there is an accumulation in herd size and its magnitude. The herd increment depends on the competitive situation between the households in the district/village. As a single household cannot influence wholesale price of reindeer meat, the sales quantum is the single factor that can influence total sales. The struggle for herd increment, due to the competitive situation, prevents the household from a maximum slaughter quantum, which thereby reduce the returns from reindeer management. Later common factors for the different structures are sought for, analysed and finally discussed. The indication is that neither sale price of reindeer meat or line of politics influence sales quantum.

Renen – inkomstkälla eller kulturfäste

-en analys av samiska renskötarhushålls ekonomi

Syftet i denna delstudie är att analysera hur olika renskötarhushålls ekonomi är strukturerad. Och hur de tillpassar sig de ekonomiska förutsättningar som existerar för att maximera den ekonomiska avkastningen, i de fall en ekonomisk vinstmaximering är målsättningen. Tidigare forskning visar att renskötselområden uppvisar skilda betingelser. Det medför att det existerar olika ekonomiska strukturer hos renskötarhushållen. Genom ett urval av hushåll i olika distrikt och samebyar baserat på geografisk lokalisering, driftsmönster och renskötselsområdesstorlek söks olika ekonomiska strukturer. Hushåll med liknade ekonomisk struktur grupperas i kategorier. Standardavvikelsen bekräftar om hushållen bildar en hushållskategori. Den samiska renskötseln i Norge och renskötseln Sverige har från år 1993 till år 2003 haft en kvantitetsmässigt jämn köttförsäljning till godkända slakterier. Det indikerar att det troligtvis är samma faktorer som påverkar ländernas slaktkvantitet. Olikheterna i den ekonomiska strukturen hos renskötarhushållen tyder på att det inte finns någon institution som reglerar eller fördelar renskötarhushållens ekonomi. Förhållandet mellan lagervärde av renar och försäljningsvärdet av renkött, i det enskilda hushållet, åskådliggör om det föreligger någon tillväxt i renantalet och tillväxtens storlek. Tillväxten i renantalet beror av den konkurrenssituation som finns mellan hushållen inom distriktet/samebyn. Då ett enskilt hushåll inte kan påverka uppköpspriset av renkött är försäljningskvantiteten det enda som kan påverka omsättningen. Strävan efter att uppnå ett högre renantal, på grund av konkurrenssituationen, förhindrar hushållet att göra ett maximalt slaktuttag vilket därmed minskar avkastningen från renskötseln. Sedan söks gemensamma faktorer för de olika ekonomiska strukturerna vilka analyseras och ligger till grund för slut-diskussionen. Allt pekar mot att slaktkvantiteten inte påverkas av uppköpspriset på renkött eller av politiska tilltag.

Economic research of reindeer husbandry in Finland

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Reindeer husbandry is an old means of livelihood that still has an effect on both economy and employment in the area that covers more than a third of the Finnish area. Reindeer husbandry in Finland was intensified during the last decades of 1900s by rapid development of technology when snowmobiles, motor bikes and helicopters renewed traditional approaches. Also the additional feeding of reindeers starting gradually in 1960s changed the economic nature of the reindeer management. Furthermore, the medication of reindeers started to be developed.
Reindeer research in Finland started at the end of 1950s. First projects aimed at studying the damages of the reindeers on the agriculture. In addition to that also feeding, breeding and animal medication were studied. Starting from 1980s the research concentrated in pasture ecology, in animal behavior and reindeer physiology.
The economic research of reindeer husbandry started at the very last years of 1900s. It was motivated and activated by great changes in Finnish economy. Regulated food markets were opened to free competition. Also, the systems of subsidies differed greatly from earlier practice and required more intensive production of information.
In the following paper, I shall summarize the economic research of reindeer husbandry in Finland. I use the national "Reindeer Husbandry Research Programme 2003-2007" as a frame of the presentation. The program has created a common basis for research planning, research evaluation and reindeer research policy. There are three main themes in the program: The production of reindeer meat, Reindeer and tourism and Reindeer husbandry as an aspect of society. The themes are prioritized in ten research areas under focus. The research has also been active in many of the focused areas like the Future studies on reindeer husbandry, Information management, Profitability of reindeer management and Reindeer and tourism.

Porotalouden taloudellinen tutkimus Suomessa

Porotalous on ikimuistoinen elinkeino, jolla on edelleen taloudellista ja työllisyyteen vaikuttavaa merkitystä alueella, joka kattaa yli kolmanneksen Suomen pinta-alasta. Poronhoito tehostui Suomessa 1900-luvun viimeisinä vuosikymmeninä erittäin nopeasti, kun tekniikka, erityisesti moottorikelkat, mönkijät, helikopterit ja nykyaikainen tieto- ja tietoliikennetekniikka uudistivat perinteiset työtavat. Myös 1960- ja -70-luvuilta alkaen yleistynyt porojen lisäruokinta muutti vähitellen poronhoidon luonnetta taloudellisena toimintana. Niinikään porojen lääkintä alkoi kehittyä.
Porontutkimus käynnistyi Suomessa 1950-luvun lopulla. Aluksi selvitettiin porojen aiheuttamia vahinkoja maataloudessa, tutkittiin porojen ruokintaa ja aloitettiin porojen loislääkintään ja eläinjalostukseen liittyvät kokeet. 1980-luvulta alkaen porontutkimus keskittyi laidunten ekologiaan, poron käyttäytymiseen ja poron elintoimintoihin.
Porotalouden taloudellinen tutkimus alkoi Suomessa vasta aivan 1900-luvun viimeisinä vuosina. Keskeisimpänä syynä suuriin taloudellisiin muutoksiin ja niiden motivoimaan taloudelliseen tutkimukseen oli Suomen EU-jäsenyys, joka lopullisesti avasi aiemmin suljetut, kansallisesti säännellyt elintarvikemarkkinat avoimelle kilpailulle. Toisaalta alkutuotannolle tarkoitetut tukijärjestelmät uudistettiin täydellisesti ja uudet, eurooppalaiset tukijärjestelmät edellyttivät merkittävästi laajempaa tietojärjestelmää kuin aiemmat kansalliset käytännöt.
Tässä esitelmässä referoidaan lyhyesti tähän mennessä Suomessa tehtyä porotalouteen liittyvää taloudellista tutkimusta. Erityisesti esitelmä keskittyy vuosille 2003-2007 laadittuun porotalouden taloudelliseen tutkimusohjelmaan, jonka toteutus on vielä kesken, mutta joka on luonut yhteisen keskustelukehikon tutkimuksen suunnittelulle, -arvioinnille, -rahoitukselle ja porotalouden tutkimuspolitiikalle. Tutkimusohjelmassa on kolme tutkimuskokonaisuutta: Porolihan tuotanto, Poro- ja matkailu ja Porotalous osana yhteiskuntaa. Tutkimuskokonaisuudet on priorisoitu kymmeneen painopistealueeseen, joista mm. porotalouden tulevaisuuteen, porotalouden tietohuollon kehittämiseen, porotuotteisiin ja niiden markkinoihin ja poronhoidon kannattavuuteen sekä poromatkailuun liittyvät tutkimuskokonaisuudet ovat käynnissä.

Range characterization and grouping of the Swedish reindeer herding districts

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The 51 reindeer herding district in Sweden have been characterized and grouped with the support of multivariate statistical analyses of conditions for productivity in reindeer husbandry. Originally 37 indicator variables describing climate, weather events, ice-crust occurrence, vegetation, topography, insect harassment, and competing infrastructure, were reduced to15 variables in a stepwise procedure and used to divide the herding districts into nine major groups. Some of the groups were distinctly and significantly identified, while other groups were less clear and further divided into subgroups. The grouping of herding districts does not follow the current administrative borders. The grouping gives opportunities for a zonation of the reindeer herding area. The results provides possibilities to identify strengths and weaknesses for individual herding districts with respect to conditions for reindeer herding, as well as a basis for development of productivity conditions in individual herding districts.

Karaktärisering av renbetesland och gruppering av samebyar i det svenska renskötselområdet.

De 51 samebyarna i det svenska renskötselområdet har karakteriserats och gruppindelats med hjälp av multivariata statistiska analyser av förutsättningar för produktivitet i renskötsel. Analyserna har utgått från 37 indikatorvariabler som beskriver klimat, väderhändelser, skarebildning, vegetation, topografi, insektsstörning och konkurrerande infrastruktur. Dessa har efterhand stegvis reducerats till 15 variabler och använts för indelning av samebyarna i nio huvudgrupper med avseende på yttre förutsättningar för renskötsel. Några av dessa grupper var entydiga och statistiskt säkerställda, medan andra var mindre tydliga och innehöll flera undergrupper. De indelade samebygruppernas utbredning följer inte dagens administrativa gränser. Indelning ger underlag för en zonindelning av renskötselområdet. Resultaten ger möjlighet att kartlägga styrkor och svagheter i olika samebyar med avseende på förutsättningar för renskötseln, samt ger underlag för utveckling av samebyarnas produktionsförutsättningar.

The relative impacts of several disturbance sources on wild reindeer in summer

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Wild reindeer *Rangifer tarandus* L. inhabit alpine and sub-alpine regions attractive to tourism and hydro-power development. In the last decades, the tourism industry has grown rapidly through an increased number of cabin resorts and infrastructure such as National tourist routes. Little is known about the disturbance effects on reindeer habitat use in summer.
In this study, reindeer distribution in Nordfjella wild reindeer region was mapped through aerial surveys during 8 years 1983–97. We examined differences in reindeer density in relation to distance to various potential disturbance sources, and possible barrier effects of infrastructure.
For comparable elevations, reindeer avoided all major disturbance sources, but the disturbance effect varied with type of disturbance source. Areas < 5.0 km from tourist resorts and major roads were used less than expected from availability; only 2.0% of all reindeer were observed in these areas which constituted 39% of the study area. Likewise, reindeer used areas < 2.5 km from tourist trails, power lines, and minor roads less than expected. Our study is the first to document wild reindeer avoidance of hiking trails.
Less disturbed areas were used more than expected from availability. Near 86% of all reindeer were found in the 39% of the study area classified as undisturbed.
An alpine tourist road crossing the north-western part of the range was apparently perceived as a semi-permeable barrier to wild reindeer movements. Only three male groups and no females were observed west of this road during the eight years of our study, despite availability of insect relief habitat and good grazing conditions.
Wild reindeer may avoid zones reaching several km away from tourist resorts, roads, trails and power lines, the size of zones depending on the level of disturbance and the availability of less disturbed habitat. Popular tourist roads may exacerbate habitat loss from avoidance by generating semi-permeable barriers to migration. Rapid growth in the tourism sector is currently not coordinated at regional scales. While trails can be re-routed, resorts involve permanent developments. Land use planning must include significant impact zones around tourist resorts and trails to ensure availability of undisturbed areas for reindeer.

De relative effektene av flere forstyrrelseskilder på villrein om sommeren

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Villrein *Rangifer tarandus* L. lever i alpine og sub-alpine områder som også er attraktive for turisme og vannkraftutbygging. Spesielt turistnæringen har vokst betydelig de siste tiårene gjennom økt hyttebygging og tilrettelegging av infrastruktur som f.eks. nasjonale turistveier. Vi vet i dag lite om effekten av menneskeskapt forstyrrelse på villreinens habitatbruk om sommeren.
I dette studiet ble fordelingen av rein i Nordfjella villreinområde kartlagt gjennom flytellinger over åtte år i perioden 1983—97. Vi kartla reintetthet i forhold til avstand til potensielle forstyrrelseskilder, og studerte mulige barriereeffekter av infrastruktur.
For sammenliknbare høydelag fant vi at reinen vek unna alle større forstyrrelseskilder, men at effekten varierte med type forstyrrelse. Områder < 5.0 km fra hyttefelt og hovedveier ble brukt mindre enn forventet fra tilgjengeligheten; kun 2.0% av all rein ble observert i slike områder, som utgjorde 39% av studieområdet. På samme måte ble områder < 2.5 km fra merkede turstier, kraftlinjer og mindre veier brukt mindre enn forventet. Dette studiet er det første som dokumenterer redusert bruk av områder nær merkede turstier.
Mindre forstyrrede områder ble brukt mer enn forventet ut fra tilgjengelighet. Nærmere 86% av all reinen ble observert i de 39% av studieområdet som ble klassifisert som uforstyrret.
En nasjonal turistvei i den nordvestre delen av studieområdet fungerte trolig delvis som som en barriere for villreintrekk. Kun tre bukkeflokker og ingen simler ble observert vest for veien gjennom åtte år med flytellinger, på tross av god tilgang til luftingsplasser og frodige beiter her.
Villrein kan redusere bruken av flere kilometer brede soner rundt hyttefelt, turistanlegg, veier, løyper og kraftlinjer. Bredden på sonene er avhengig av graden av forstyrrelse og tilgjengeligheten av mindre forstyrrede områder andre steder. Trafikkerte veier kan forsterke tapet av habitat som allerede er generert gjennom unnvikelse, ved å virke helt eller delvis som barrierer. Den raske veksten i turistnæringen er per i dag ikke koordinert på regionalt nivå. Mens merkede turstier kan legges om, er hytter og turistanlegg permanente inngrep. Arealplanleggingen må inkludere brede influenssoner rundt turistanlegg og løyper for å sikre tilgjengeligheten av uforstyrrede områder for villreinen.

The Impact of off - road vehicle use on reindeer pastures' vegetation in the vicinity of Bovanenkova gas field, Central Yamal Peninsula (70°20'N, 68°00'E)

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Tundra areas in Northwest Russia are traditionally used as reindeer pastures by indigenous Nenets people. Since the recognition of vast oil and gas deposits in the area in the 1960s pastures have been split by exploratory drilling, off-road vehicle use, and building pumping stations and pipelines. In this multidisciplinary research the impact of vehicle tracks was studied from the perspectives of plant ecology, anthropology, and geography. The study site, Bovanenkova gas field (70°20'N, 68°00'E) is one of the most promising gas fields in the Yamal Penisula. It is not yet in use, and thus its effect on vegetation is mainly mechanical. The impact of off-road vehicle drive on vegetation was studied in three different vegetation types: in willow thicket, *Sphagnum* bog, and tundra heath. In each of the vegetation types three old vehicle tracks were chosen with help of a satellite image. The tracks were in use between 1978 and 1989, and thus the recovery on them had been going on for fifteen years by the study time in 2005. Six study plots of size 50 cm x 50 cm were set up in the middle of the tracks in every 12 meters. The six comparison plots were 12 meters aside in the original vegetation. Coverage of all the plant species, biomass and height of plant groups, depth of thaw, and soil characteristics were measured in the study plots. In a landscape level the area of tracks and other forms of mechanical disturbance were estimated with help of a satellite image. The changes in the quality of reindeer pastures were studied by interviewing Nenets reindeer herders that migrate through the study area. Within fifteen years recovery after mechanical disturbance the secondary plant communities had evolved in all the three vegetation types, but they differed remarkably from the original communities. The most common species groups in tracks of all the types were sedges (Cyperaceae) and granimoids (Poaceae), whereas willows (*Salix* spp.), mosses (Bryophyta), and lichens (Lichenophyta) were the most poor in their recovery. The decrease in total amount of biomass in the tracks compared to the original vegetation was significant only in *Sphagnum* bog, where also the increase in active layer in the tracks was remarkable. These secondary communities would be rich in their value as reindeer pastures, but their utilization is strongly prevented by other disturbing factors of a gas field such as glass garbage, noise of the power plants, and dogs of the gas workers.

Mekaanisen kulutuksen vaikutus porolaidunten kasvillisuuteen Bovanenkovan kaasukeskuksessa, Jamalin niemimaalla (70°20'P, 68°00'I)

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Luoteis-Venäjän tundra-alueet ovat suomensukuisten nenetsien perinteistä laidunmaata. Alueiden suurten öljy- ja kaasuvarojen etsintä ja hyödyntäminen aloitettiin 1960 – luvulla, mistä lähtien koeporaukset, ajoneuvolla ajo, rakennusten ja putkien rakentaminen sekä kemiallinen saastuminen ovat pirstoneet voimakkaasti porolaitumia. Tässä poikkitieteellisessä tutkimuksessa tutkittiin kaasukentän rakentamisesta aiheutuvia mekaanisia vaikutuksia kasvillisuuteen sekä näiden vaikutusten laajuutta ja merkitystä alueen poronhoidolle. Tutkimuspaikka oli Bovanenkovan kaasukenttä Keski-Jamalilla (70°20'P, 68°00'I), joka on alueen merkittävimpiä kaasukeskuksia, mutta jonka hyödyntäminen on vasta alkuvaiheessaan.
Ajoneuvolla ajo tiettömällä tundralla kiellettiin vuonna 1989. Kuitenkin sitä ennen ajelu oli niin voimakasta, että urille viidentoista vuoden aikana (tutkimusvuosi 2005) kehittynyt sekundaarinen kasvillisuus erosi täysin alkuperäisestä. Tutkimusta varten valittiin kolme kasvillisuustyyppiä: pajukko, suo ja tundrakangas, joilta kultakin valittiin satelliittikuvan avulla kolme vanhaa uraa. Kasvillisuusanalyysissä selvitettiin, miten urien kokonaislajimäärä sekä kasviryhmien (pajut, vaivaiskoivu, varvut, heinät, sarat, ruohot, sammalet ja jäkälät) korkeus ja biomassa poikkeavat alkuperäisestä kasvillisuudesta. Lisäksi mitattiin roudan syvyys ja maaperän vesipitoisuus uralla ja sen ulkopuolella. Maisematasolla laskettiin satelliittikuvaa apuna käyttäen urien sekä muiden mekaanisen kulutuksen lähteiden kuten teiden, rakennusten ja putkien osuus alueen kokonaispinta-alasta. Kasvillisuuden muutosten merkitys porolaidunten laadulle selvitettiin haastattelemalla alueen läpi laiduntavia nenetsi poronhoitajia.
Viidessätoista vuodessa ajelun lopettamisen jälkeen sekundaarinen kasvillisuus oli kehittynyt kaikille kasvillisuustyypeille, mutta se poikkesi täysin alkuperäisestä kasvillisuudesta. Urien yleisimmät kasvit olivat saroja (Cyperaceae) sekä heiniä (Poaceae), kun taas pajuja (*Salix* spp.), sammalia (Bryophyta) ja jäkäliä (Lichenophyta) oli urilla tuskin lainkaan. Kasvillisuuden kokonaisbiomassa urilla oli alkuperäisestä kasvillisuudesta merkittävästi alhaisempi vain suolla, missä myös roudan syvyys oli merkittävästi kasvanut. Tällaiset sekundaariset kasviyhteisöt olisivat sarakasvien ja heinien hyvän ravintoarvon vuoksi hyviä porolaitumia, mutta niiden hyödyntämistä rajoittaa muut kaasukentän häiriötekijät kuten lasi- ja metalliroskat, meluhaitat sekä kaasutyöntekijöiden koirat.

Reindeer pastures under pressure of gas and oil exploration in the Russian arctic: Remote Sensing in assessment of impacts

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Aim of the research is to study impacts of oil and gas exploration to reindeer pastures in the Russian arctic. This research is part of the ongoing research project funded by the Finnish Academy during 2004-2007, Environmental and Social Impacts of Industrial Development in Northern Russia (ENSINOR).

The research is taken place in the Yamal-Nenets Autonomous Okrug (YNAO) and in the Nenets Autonomous Okrug (NAO). Nenets are practicing reindeer husbandry in the area. Gas and oil exploration is growing rapidly in the area which causes increasing pressures to reindeer herding. Pressures are environmental, social and economical. Some areas have become totally unusable or unaccessible. Various constructions like road, pipelines, quarries and various garbage hinders the use of traditional migration routes.

Remote sensing data is used to study how large areas have been effected by industrial sites. Important questions are also: what is the usability of effected areas to reindeer and reindeer herders and what is the general quality of pastures. Very high resolution remote sensing data produce detailed information about the effects around the drillings sites and other constructions. Even 5-15 year old all terrain vehicle tracks are visible in the images.

Remote sensing and GIS data base building is in progress. Main data used to evaluate the current situation is Very-high-resolution Quickbird-2 satellite images (2.5 meter multispectral and 0.6 m panchromatic resolution). We have four intensive study sites with Quickbird-2 images (years 2004-2005). Lower resolution ASTER Terra VNIR (15 m) and Landsat TM (30 m) images are used to cover larger area. We have build time series of satellite images since late 1960s. Corona spy satellite images provide the oldest data from 1969. Corona images are black and white with 10 meter resolution. Data allows building of 35 year long time window to estimate the possible changes.

The first two intensive study areas are in Bovanenkovo, the largest natural gas deposit and industry-related settlement located well inland on north-central Yamal Peninsula in YNAO. In Bovanenko field work was started in summer 2005. In 2006 field work will be done in the coastal tundra around Varandei, site of a recently built marine shipping terminal on the Northern Sea Route and accessible to several of the major oil deposits in NAO.

Preliminary data processing results indicate that it is possible to evaluate the disturbances from VHR satellite images and calculate how much area have totally became unusable and also how much of land have changed from one vegetation type to another due to the petroleum activities.

Porolaiturnet öljy- ja kaasuteollisuuden puristuksessa arktisella Venäjällä: Kaukokartoitus vaikutusten arvioinnin apuna

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Tutkimuksen tarkoituksena on öljy- ja kaasuteollisuuden vaikutusten arviointi porolaitumille Pohjois-Venäjällä. Tutkimus on osa Suomen Akatemian rahoittamaa ENSINOR projektia (Öljy- ja kaasuteollisuuden ympäristölliset ja sosiaaliset vaikutukset Pohjois-Venäjällä)
Tutkimusta tehdään Jamal-Nenetsian (YNAO) ja Nenetsian (NAO) autonomisissa piirikunnissa. Nenetsian harjoittama poronhoito on alueen perinteinen maankäyttömuoto. Öljy- ja kaasuteollisuus kasvaa kummallakin alueella voimakkaasti, mikä aiheuttaa ympäristöllisiä, taloudellisia ja sosiaalisia paineita poronhoidolle. Jotkut alueet ovat muuttuneet käyttökelvottomiksi tai niille pääsy on estynyt. Erilaiset rakennelmat, kuten tiestö, öljyputket, soranottopaikat ja maastossa lojuva jäte vaikeuttaa perinteisten jutaamisreittien käyttöä.
Kaukokartoitusaineistojen avulla pyritään selvittämään miten laajat alueet ovat poraustoiminnan vaikutuksen alaisina. Tärkeä kysymys on myös mikä on näiden alueiden merkitys porolle ja porohoitajille sekä mikä on laidunten tila tällä hetkellä. Erittäin tarkoilta satelliittikuvilta voidaan havaita poraustoiminnanvaikutukset yksityiskohtaisesti, jopa 5-10 vuotta vanhat maastoajoneuvojen urat ovat havaittavissa kuvilta.
Kaukokartoitus ja paikkatietoaineistovaraston rakennus on käynnissä. Tämänhetkisen tilan arvioimiseen käytetään Quickbird-2 satelliittikuvia (2,5 m / 0,6 m erotuskyky). Tarkemman tarkastelun kohteena on 4 tutkimuskohdetta (jotka ovat noin 100 km^2 kokoisia), joilta on Quickbird-2 kuvat (vuosilta 2004-2005). Laajempia alueita kattamaan käytetään ASTER Terra VNIR (15 m erotuskyky) ja Landsat TM (30 me erotuskyky) kuvia. Satelliittikuva-aikasarja kattaa vuodet 1969-2005. Vanhinta aineistoa edustaa Corona vakoilusatelliittikuvat 1960-luvulta. Aikasarjan avulla pyritään arvioimaan alueilla tapahtuneita muutoksia.
Maastotyöt aloitettiin kesällä 2005 Bovanenkovossa, joka laajin kaasuesiintymä Jamalin niemimaalla (YNAO). Kesällä 2006 tehdään maastotyöt Varandein lähistöllä (NAO), jonne on vastaikään rakennettu öljyterminaali merikuljetuksia varten.
Alustavat tulokset osoittavat, että tarkka kaukokartoitusaineisto mahdollistaa yksityiskohtaisen vaikutusten arvioinnin. Voidaan laskea kuinka paljon laidunta on tuhoutunut tai muuttunut jostain toisesta tyypistä toiseen poraustoimintaan liittyvien aktiviteettien seurauksena.

Monitoring the state of reindeer ranges in Finland

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The permanent project, *Monitoring the state of reindeer ranges*, was established in 1995. Two large scale inventories covered the whole reindeer management area, for winter pastures in 1995-96 and for summer pastures in 1997-98. Large numbers of field sites were studied and pastures of districts were mapped using the supervised image classification of Landsat-5 TM data. During 1999-2003 the monitoring project was continued and the field sites of lichen pastures in the 13 northernmost districts were revisited. Pastures of each district were mapped using the supervised classification of Landsat-7 ETM+images. Results of the inventories were compared and sources of errors and possible improvements of the inventory methods were evaluated. Although the need for several improvements was found, conclusions on major trends of changes in the state of winter pastures were still viable.
From 2004 the permanent monitoring project has focussed on the special reindeer management area (20 northernmost districts). During 2004-2005 the inventory methods have been developed and this work will be continued during 2006. Now, field sites are located comprehensively on the area of each district paying also attention to the pasture rotation system. Within each field site ten circular plots (radius 3.99 m) and ten vegetation squares (size 0.25 m^2) are studied. Vegetation type as well as age, density and proportion of trees are determined within each circular plot. Also the amount of arboreal lichens under and over two meter levels in two randomly selected trees within each plot is estimated. Vascular plants are estimated firstly within each vegetation square as coverage and height of reindeer lichens is measured. Then height of lichens, wavy hair grass and dwarf shrubs are measured in 25 points of the square using the method described by Malm *et al.* (2002). When a certain species is missing in a point the measurement is marked as zero. Also occurrences of other plants as well as litter and mineral soil in these points are counted.
For calculating the biomass of lichens, wavy hair grass and dwarf shrubs by means of the average height of measurement points the biomass equations were established using the data collected in 2004-2005. Wetness of lichens causes a certain error in measurement of the height of lichens but this error is eliminated by correcting the height of lichens using the corrections terms, established from the data collected in 2005. Also the classification system for the condition of lichen pastures was changed for expressing better the ecological stage of lichen pasture. The supervised classification system of satellite images was changed to the semi-unsupervised post-classification system (Johansen, 2004). Evaluation of the extension and effects of the other land use on reindeer pastures was integrated a new part in the monitoring project. At this point estimates are made on the amount of disturbed or destroyed pasture area. However, the aim is to develop more comprehensive analyses for the evaluation of the impacts of other land use and natural landscape factors on the state of reindeer ranges.
In 2005, reindeer pastures in four of the districts located in the central and eastern Lapland were inventoried using the new methods. Lichen pastures of these districts were mainly classified as heavily worn, however with the exception of the separate winter range areas in Kemin-Sompio and Pohjois-Salla where lichen pastures were clearly in better condition. Especially due to the impacts of forestry the amount of arboreal lichen pastures (old growth forests) was reduced while the amount of grass and shrub pastures had increased. Different land use classes (forestry not included) covered 1.5-2.6% of the total area of the districts and on the basis of the preliminary analyses their disturbance effects comprised 5.0-8.9% of the total area of the districts. The inventory method of reindeer ranges will be developed further and the pasture area of three districts in central Lapland will be inventoried during 2006. The aim is to carry out the pasture inventory in the whole special reindeer management area during 2007-2009 using the improved methods if the ministry of agriculture and forestry provides funding for the planned inventory.

Porolaidunten tilan seuraaminen Suomen poronhoitoalueella

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Pysyvä tutkimushanke, *Porolaidunten tilan seuranta*, käynnistettiin vuonna 1995. Hankkeessa suoritettiin aluksi kaksi laajamittaista laiduninventointia koko poronhoitoalueella, talvilaiduninventointi vuosina 1995-96 ja kesälaiduninventointi vuosina 1997-98. Laidun-inventoinnissa tutkittiin suuri määrään maastokoealueita ja kartoitettiin paliskuntien talvi- ja kesälaitumet Landsat-5 TM kuvilta ohjattuna luokituksena. Laidunten tilan seurantaa jatkettiin vuosina 1999-2003 inventoimalla poronhoitoalueen 13 pohjoisimman paliskunnan jäkälälaitumilla sijainneet koealueet uudestaan. Myös paliskuntien porolaitumet kartoitettiin uudestaan ohjattuna luokituksena Landsat-7 ETM+ -kuvilta. Inventointien tuloksia vertailtiin samalla kun arvioitiin menetelmän virhelähteitä ja kehittämistarpeita. Havaittiin, että vaikka inventointimenetelmään liittyi monia kehittämistarpeita, talvilaidunten tilan muutoksista voitiin silti saada suuntaa antavaa tietoa.
Vuodesta 2004 lähtien laidunten tilan seurantahanke on keskitetty vain ns. erityisesti poronhoitoa varten tarkoitetulle alueelle. Vuosien 2004-2005 aikana inventointimenetelmää on kehitetty ja kehitystyö jatkuu vielä vuoden 2006 aikana. Maastokoealueet sijoitetaan nyt kattavasti paliskuntiin huomioiden myös paliskunnan laidunkierojärjestelmä. Jokaiselle koealueelle tehdään 10 ympyräkoealaa (säde 3,99 m) ja 10 kasvillisuusruutua (koko 0,25 m²). Kasvupaikkatyyppi sekä puuston ikä, tiheys ja lajisuhteet määritetään ympyräkoealoilta. Lisäksi jokaisesta ympyräkoealasta valitaan satunnaisesti kaksi puuta, joissa lupon määrä arvioidaan erikseen alle ja yli kahden metrin korkeudella. Muu kasvilajit arvioidaan aluksi kasvillisuusruuduissa peittävyyksinä ja jäkälien osalta myös pituutena. Sen jälkeen jäkälien, metsälauhan ja eri varpukasvin pituudet mitataan kasvillisuusruudusta 25:stä solmukohdasta ns. solmumittausmenetelmällä (Malm ym. 2002). Kun joitain kasveista ei esiinny solmukohdassa, merkitään mittaustulos nollana. Myös muiden kasvien ja mm. karikkeen ja mineraalimaan esiintyminen solmukohdissa lasketaan.
Jäkälien, metsälauhan ja eri varpukasvien biomassojen laskemiseksi solmukohtien keskipituuden avulla määritettiin kullekin kasville biomassakaavat kesinä 2004-2005 kerätystä aineistosta. Jäkälien kosteus aiheuttaa mittausvirhettä jäkälien pituuteen, mutta virhe voidaan poistaa korjaamalla jäkälien pituutta tietyillä korjauskertoimilla, jotka määritettiin vuonna 2005 kerätystä aineistosta. Myös jäkäliköiden kuntoa kuvaavaa luokitusta muutettiin entistä paremmin jäkäliköiden ekologista tilaa kuvaavaksi. Satelliittikuvien luokittelussa on siirrytty ohjatusta luokituksesta puolittain ohjaamattomaan moniaineistoluokitukseen (Johansen, 2004), jossa useita tarkentavia ja korjaavia työvaiheita tehdään ennen että jälkeen kuvien luokituksen. Uutena osiona laiduninventointiin on otettu muun maankäytön vaikutusten arviointi ja seuranta porolaitumilla. Tässä vaiheessa arvioidaan ns. infrastruktuurin viemien ja häiritsemien alueiden laajuutta paliskunnissa. Tarkoitus on kehittää jatkossa entistä kokonaisvaltaisempia analyysejä muun maankäytön ja luontaisten maisematekijöiden vaikutusten arvioimiseksi porolaidunten tilaan.
Vuoden 2005 aikana inventoitiin neljän Keski- ja Itä-Lapin paliskunnan porolaitumet uudistetuilla menetelmillä. Näiden paliskuntien jäkäliköt luokittuivat pääsääntöisesti voimakkaasti kuluneiksi, poikkeuksena kuitenkin Kemin-Sompion ja Pohjois-Sallan erilliset talvilaidunalueet, joissa jäkäliköiden kunto oli selvästi tätä parempi. Erityisesti metsätalouden vaikutuksesta luppolaidunten määrä oli kaikissa paliskunnissa vähentynyt ja vastaavasti varpu-, lehti- ja ruoholaidunten määrä lisääntynyt. Eri maankäyttöluokat (metsätalous ei mukana) peittivät paliskuntien kokonaispinta-alasta 1,5-2,6% ja alustavasti niiden arvioitiin häiritsevän porolaidunten käyttöä alueella, joka kattoi 5,0-8,9% paliskuntien kokonaispinta-alasta. Porolaidunten inventointimenetelmää kehitetään vielä vuoden 2006 aikana ja inventoidaan kolmen Keski-Lapin paliskunnan porolaitumet. Vuosina 2007-2009 on tarkoitus suorittaa koko erityisesti poronhoitoa varten tarkoitetun alueen laiduninventointi uudistetuilla menetelmillä, mikäli siihen saadaan maa- ja metsätalousministeriön erillisrahoitus.

Changes on land-cover in reindeer pastures of the Ivalo reindeer herding district, Finland in years 1987-2001

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The research was part of my master's thesis which I made in the LUIAS-project, funded by the Academy of Finland. The project was carried out together with Department of Geography, University of Oulu and the Reindeer Research Station of the Finnish Game and Fisheries Research Institute (FGFRI) Th studyarea was the Ivalo reindeer herding district which is situated in Northern Lapland, in the municipality of Inari.

The aim of the research was 1) to study the remote sensing change detection methods and 2) to evaluate which method would be suitable for detecting changes in reindeer pastures by the existing remote sensing data (Landsat TM and -ETM+ satellite images). The temporal coverage of the images was 14 years (1987-2001). One aim was also 3) to evaluate what kind of influences land use and changes in land use have on reindeer husbandry of the area. There are various remote sensing change detection methods from which "classification of multitemporal data sets" was used. With this method the changes of land cover in the reindeer pastures was evaluated.

The area of the Ivalo reindeer herding district was classified to three classes which represent changes: 1) increase of vegetation (mainly changes from logging areas to young forest stands) 2) no-changes 3) decrease of vegetation (mainly changes from mature forest to logging areas and roads etc). Because of the spatial resolution (30 m x 30 m) of the data, it was not possible to form more accurate classes. From these the "no-changes" class was largest, covering almost 80% of the Ivalo district. These areas were located, as expected, mainly on the protected areas of the district. Two other classes formed approximately 20% of the Ivalo area being almost equal in sizes: "increase of vegetation" 12% and "degrease of vegetation" 9%. Decrease of vegetation was situated on central and northern parts of the study area, where loggings have been transferred in the past few years. Increase of vegetation on the other hand was situated mainly on the central and south-western parts of the area where forests have been handled earlier.

The accuracy assessment showed that overall accuracy of the classification was about 83% and accuracy of different classes varied from 69% to 90%. In the accuracy assessment, the forest stand data from Finnish Forest and Park Services (Metsähallitus) was used as the ground truth data. Accuracy figures can be though as good; one has to remember that in remote sensing studies 100% accuracy is usually never achieved and map is always a generalization of the surrounding world.

Relationship between reindeer husbandry and other users of natural resources can be described complex. For example forestry can be important part of the reindeer herder's economy but on the other hand forestry can reduce utility value of certain area from reindeer husbandry's point of view. For example logging and forest handling (cultivation) of reindeer winter pastures can reduce the amount of ground and arboreal lichens. But on the other hand changed conditions can improve the growth of some fodder plants.

This kind of change detection studies can be useful in reindeer pasture monitoring. When changes are located the influences of them can also be evaluated. This used method proved to be relatively easy to use considering that author had prior remote sensing experience. This kind of studies could be used when modelling reindeer pasture landscape structure for example fragmentation. In my PhD thesis I am concentrating on more detailed analysis of reindeer pasture structure (amount of pastures, fragmentation etc.) and its influences on reindeer pasture use as well as the effects of other forms of land use on reindeer pasture selection. Also the size and the structure of reindeer home range areas in different seasons will be studied. The study methods are based on GPS-tracking of reindeer, remote sensing based change detection and GIS (Geographical Information System) analysis.

Maanpinnan muutokset Ivalon paliskunnan porolaitumilla vuosina 1987-2001

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Tutkimus on osa Pro gradu –tutkielmaani, jonka tein Suomen Akatemian rahoittamassa Oulun yliopiston maantieteen laitoksen ja Riista- ja Kalatalouden tutkimuslaitoksen (RKTL) yhteisessä LUIAS-hankkeessa. Tutkimusalueena oli Ivalon paliskunnan alue Inarin kunnassa.
Tutkimuksen tarkoituksena oli 1) perehtyä maanpinnan muutoksia tutkittaessa käytettäviin kaukokartoitusmenetelmiin sekä 2) arvioida, millainen menetelmä soveltuisi parhaiten porolaidunten maisematason muutosten arviointiin käytettävissä olevalla kaukokartoitusaineistolla (Landsat TM ja -ETM+ satelliittikuvat). Kuvien kattama aikajakso on 14 vuotta (1987-2001). Lisäksi tarkoitus oli 3) pohtia millaisia vaikutuksia alueen porotalouteen muutoksilla mahdollisesti on tai tulee olemaan. Muutosten tutkimiseen kaukokartoituksen avulla on kehitetty lukuisia menetelmiä, joista tässä tutkimuksessa perehdyttiin useisiin ja kokeiltiin käytännössä ”eri aikoina kuvatun aineistojoukon yhtäaikaista luokittelua”. Menetelmän avulla tehtiin Ivalon paliskunnasta maankäytön maisematason muutoksia kuvaava esitys.
Mm. aineiston suuresta resoluutiosta (30 m x 30 m) johtuen paliskunta luokiteltiin lopulta ainoastaan kolmeen muutosta kuvaavaan luokkaan: 1) kasvillisuuden lisääntyminen, 2) ei-muutosta sekä 3) kasvillisuuden väheneminen. Näistä luokista pinta-alallisesti suurin oli ei-muutosta -luokka (lähes 80% paliskunnan pinta-alasta). Nämä alueet sijoittuvat odotetusti esim. suojelualueille. Kaksi muutosta kuvaavaa luokkaa muodostivat näin ollen 20% paliskunnan pinta-alasta, ollen suurin piirtein tasapainossa keskenään (noin 12% ja 9%), kuitenkin siten, että kasvillisuuden lisääntyminen oli pinta-alallisesti suurempaa kuin sen väheneminen. Väheneminen sijoittui paliskunnan keski- ja pohjoisosiin - alueille, joille metsien hakkuut ovat viimevuosina siirtyneet. Kasvillisuuden lisääntyminen puolestaan sijaitsi alueilla, jotka on käsitelty aiemmin ja jotka kasvavat jo taimikkoa (paliskunnan keski- ja lounaisosiin).
Menetelmän tarkkuutta tutkittiin Metsähallitukselta saatujen metsäkuviotietojen avulla. Luokituksen kokonaistarkkuus oli n. 83% ja eri luokkien luokitusten luotettavuudet vaihtelivat n. 69–95% välillä. Luotettavuustulosta voidaan tämän tutkimuksen osalta pitää hyvänä, sillä tulee muistaa että kaukokartoituksen keinoin tehtävässä luokituksessa ei koskaan päästä sadan prosentin tarkkuuteen - kartta on aina yleistys ympäröivästä maailmasta.
Porotalouden ja muu maankäytön välinen suhde on monitahoinen kokonaisuus. Esimerkiksi metsätalous saattaa tuoda joillekin poronhoitajaperheille tärkeän lisä- tai päätulon, mutta se aiheuttaa myös muutoksia laitumilla ja ongelmia niiden käyttöön. Esimerkiksi talviaikana erityisen tärkeät jäkälälaitumet saattavat kärsiä hakkuista ja maan muokkauksista, minkä johdosta jäkälä osittain häviävää. Samoin luppolaitumille hakkuut ovat vahingollisia: niiden myötä häviää lupon kasvualusta kymmeniksi tai jopa sadoiksi vuosiksi, etenkin jos lupon siirtymisestä ”emopuusta” taimikkoon ei huolehdita. Toisaalta kasvuolosuhteiden muutokset voivat parantaa joidenkin ravintokasvien menestymistä alueella.
Menetelmä osoittautui käyttökelpoiseksi. Sen käyttö on suhteellisen helppoa, etenkin jos tekijällä on aiempaa kaukokartoituskokemusta. Porolaiduntutkimuksessa on jatkossakin hyötyä tämän kaltaisista analyyseistä. Kun muutoksen sijainti saadaan paikannettua, myös sen vaikutusta voidaan paremmin arvioida. Tämänkaltainen muutosluokitus voisi toimia pohjana esimerkiksi maisemarakenteen muutosta mallinnettaessa. Tulevissa tutkimuksissa keskityn porolaidunten maisemarakenteen yksityiskohtaisempaan analysointiin (pirstoutuminen, laidunten määrä) sekä tutkin porojen laidunten käyttöä suhteessa muuhun maankäyttöön ja maisemarakenteeseen. Aikomuksena on myös tutkia porojen liikkuvuutta sekä elinpiirin kokoa ja rakennetta eri vuodenaikoina. Aineistona on satelliittikuvien ja paikkatietoaineistojen lisäksi RKTL:n keräämä porojen GPS-seuranta-aineisto Ivalon paliskunnan alueelta.

Importance of Nature Conservation Areas in Finnish Reindeer Husbandry

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Eightyfour per cent of all the nature conservation areas in Finland are situated in the reindeer herding district which includes nearly one-third of the total land area. The amount of land area protected increases considerably in the most northern parts of the reindeer herding district called designated area for reindeer management. Seventyfour per cent of all the national parks and strict nature reserves in Finland are situated there. According to the questionary research the attitude of chairmen of reindeer herding co-operative towards nature conservation was very positive. The pastures in National parks and strict nature reserves were considered to be in better condition than elsewhere and nearly 70% of the interviewees considered the areas especially important in the winter and spring time for reindeer. Protection of large carnivores and hunting restrictions were seen as the most negative aspects in the nature reserves. Although half of the interviewees thought tourism has negative effects on the reindeer management in the nature reserves one-third still saw tourism as a vital line of business also for reindeer husbandry. As a whole the nature conservation was seen as an advantage to the reindeer husbandry especially against forestry and other land use industries. In the future we are going to find out more specific how protected areas are used in different seasons and also the number of reindeer and condition of pastures.

Luonnonsuojelualueiden merkitys Suomen poronhoidolle

Kaikista Suomen luonnonsuojelualueista 84% sijaitsee poronhoito alueella, joka on lähes kolmasosa koko maan pinta-alasta. Suojellun alan määrä kasvaa huomattavasti mentäessä kohti erityisesti poronhoidolle tarkoitettua aluetta pohjoisessa. Kansallispuistoista ja luonnonpuistoista 74% sijaitsee tällä alueella. Kyselytutkimuksen mukaan poroisäntien suhtautuminen luonnonsuojeluun oli erittäin myönteistä. Porolaitumet kansallis- ja luonnonpuistoissa ovat paremmassa kunnossa kuin muualla ja 70% vastaajista piti näitä alueita erityisen tärkeinä laidunalueina talvella ja keväällä. Kielteisimpänä asiana luonnonsuojelualueilla koettiin suurten petojen suojelu ja metsästyksen rajoitukset. Vaikka puolet haastatelluista koki turismin aiheuttavan haittaa poronhoidolle suojelualueilla, piti kolmasosa turismia elintärkeänä porotalouden kannalta. Kaiken kaikkiaan luonnonsuojelu koettiin myönteisesti, se vähensi metsätalouden ja muiden maankäyttömuotojen vaikutusta porotalouteen. Jatkossa selvitetään tarkemmin luonnonsuojelualueiden käyttöä eri vuodenaikoina sekä poromääriä ja laidunten kuntoa.

Reindeer habitat selection in different temporal and spatial scales

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In grazing ecology of large herbivores the term hierarchical foraging is often used. Different foraging response patterns can be displayed at three different levels: patch, landscape and regional level. Semi-domesticated reindeer (*Rangifer tarandus tarandus*) in the Swedish mountain chain has been studied to display the use of the landscape in relation to vegetation type, topographic features, and distance to hiking trails at the seasonal basis and at the daily basis (also related to weather parameters) during the snow-free season. In 2002 and 2003, 20 and 30 female reindeer, respectively, in *Handölsdalen* and *Sirges* reindeer herding district was equipped with GPS-collars. The GPS registered the reindeer positions every hour or every second hour. From the positions the reindeer kernel home ranges were estimated within four sub periods of the snow-free season. Resource utilisation functions were developed to express the correlation between the utilisation distribution within the home ranges and the different habitat variables. It was found that the reindeer preferred meadow, grass heath, and heath and avoided blocky areas, sparsely vegetated areas, mires and forests. Early in the season the reindeer used lower altitudes and had small home ranges, while they used higher terrain and had larger home ranges during mid summer. In mid summer the harassment from insect parasites are severe this is evident in the use of high terrain and this is also seen in the daily habitat use where there was an obvious periodic pattern. During predicted insect harassment periods the reindeer shifted between higher altitudes in day time and lower terrain in the night time. The reindeer also had a higher velocity during the movements up and down the hillsides. The reindeer were seemingly indifferent to hiking trails within their home ranges, which however usually coincided with preferred vegetation types. They avoided areas with houses and holiday huts during early summer. Vegetation types, time within season and day and possibilities to avoid insect harassment appear to be key factors in reindeer habitat selection.

Renens val av habitat på landskapsnivå

I studier av betesekologi används ofta termen hierarkisk betning, där olika betesmönster brukar urskiljas på tre olika nivåer: patch, landskap och regional nivå. Här har renens (*Rangifer tarandus tarandus*) habitatval i relation till vegetationstyp, topografi och avstånd till vandringsleder studerats på landskapsnivå under en hel barmarkssäsong och under dygnet. Habitatvalet har då även relaterats till väderlek. Under barmarkssäsongen 2002 och 2003 utrustades 20 respektive 30 vajor i Handölsdalens- och Sirges sameby med GPS-halsband. GPS-halsbandet registrerade renarnas positioner en gång i timmen eller varannan timme. Utifrån positionerna beräknades renarnas hemområden under fyra olika perioder av barmarkssäsongen. Renens val av habitat inom hemområdet relaterades sedan till de olika habitatvariablerna. Det visade sig att renen generellt föredrog örtäng, gräshed och rished framför block och hällmark, områden med sparsam vegetation, myrar och skogsområden. Tidigt på säsongen höll de sig i lägre terräng och hade mindre hemområden jämfört med högsommaren då hemområdena var både större och låg högre upp i terrängen. Under högsommaren är störningar från insektsparasiter som störst vilket också kunde märkas i renens aktivitet under dygnet. En periodicitet kunde framförallt märkas under dagar med hög insektsaktivitet, då renarna vandrade högre upp i terrängen under förmiddagen och gick ner igen under kvällen. Renarna rörde sig också fortare under förflyttningarna upp och ner längs fjällsidan. Avståndet till vandringsleder påverkade inte betesvalet inom hemområdet, men vandringslederna låg tätare i områden med föredragen vegetationstyp. Däremot undvek renarna stugområden under försommaren. Vegetationstyp, tid på säsongen och på dygnet och möjlighet att undvika insekter verkar vara avgörande faktorer när det gäller renes habitatval under barmarksäsongen.

Economic losses caused by large predators – a case study from four Finnish herding cooperatives

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Total economic losses caused by brown bear, wolf, wolverine and lynx were studied during the herding year 2002/03 in four herding cooperatives, which differ in their predator numbers and circumstances for reindeer management. Kallioluoma and Ivalo near the Russian border have relatively high predator populations, and the reindeer losses per year (mainly by brown bear and wolf) were on the average 50-65 during 1998-2004. Käsivarsi herding cooperative in western Lapland borders Sweden and Norway. Losses by predators (mainly wolverine) were high, on the average 260 reindeer per year. Pyhä-Kallio in central Lapland has few predators, and the losses during 1998-2004 were on average 7 reindeer/year.

Besides of the value of killed reindeer, expenses are caused e.g. for the searching of killed animals, and for protecting reindeers from predators. Reindeer herders in the four study areas recorded all the expenses during the herding year. The expenses for the herding cooperatives and the individual reindeer owners were calculated separately. Some herding cooperatives compensate reindeer owners their work and vehicle expenses when herders search for killed reindeer, but the amount of compensation varies among cooperatives. As the basis for calculations, we used the sums that were recommended by the Finnish Reindeer Herders' Association. If the cooperative paid less than was recommended, the remainder was calculated as an expense for the reindeer owner. As a value for the working hour, we used the mean salary of a working hour paid in agricultural work.

The state compensates the economic value of a killed reindeer to a reindeer owner on the basis of the found carcass. The sum paid is double for the value of reindeer, to compensate also those killed reindeer which are not found. In all studied cooperatives the total expenses of losses exceeded the compensations paid by the state. The highest deficit was in Käsivarsi, where the total expenses of the cooperative and owners together were 31 000 € more than the compensations. In Ivalo, the total costs exceeded 4600 € the compensations. In Pyhä-Kallio, the deficit was about 770 €, and in Kallioluoma 190 €. In Käsivarsi, the whole deficit was targeted to reindeer owners, because the cooperative does not compensate any expenses to the owners. In Ivalo and Kallioluoma, the cooperative compensates part of the searching costs, but also in these cooperatives the main costs were targeted to the owners. In Pyhä-Kallio, the cooperative compensates all the costs, and also the deficit was targeted to the cooperative.

The results are indicative, because there were some inaccuracy in the calculations. For instance, we could not calculate all the working hours, because they were not recorded exactly in all cases. Furthermore, in Käsivarsi herding cooperative all the herders did not record their expenses. The results indicate, however, that the present compensations do not cover the total expenses caused by large predators, and no compensation was left in our study cooperatives to those killed reindeers that were not found from the terrain.

Petovahinkojen taloudellinen merkitys – tapaustutkimus neljästä Pohjois-Suomen paliskunnasta

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Tutkimuksessa selvitettiin maasuurpetojen porotaloudelle aiheuttamia vahinkoja ja kustannuksia neljässä paliskunnassa poronhoitovuonna 2002/03. Tutkimuspaliskunnat (Ivalo, Kallioluoma, Käsivarsi ja Pyhä-Kallio) poikkeavat toisistaan petokannoiltaan ja poronhoito-olosuhteiltaan. Kallioluoman ja Ivalon paliskunnat rajoittuvat Venäjän rajaan, ja petovahingot ovat näissä paliskunnissa kohtalaisen suuria (keskimäärin 51-65 poroa/v vuosina 1998-2004). Suurimmat vahingon aiheuttajat ovat karhu ja susi. Käsivarren paliskunta Länsi-Lapissa rajoittuu Norjaan ja Ruotsiin. Vuosittaiset petovahingot ovat suuret (keskimäärin n. 260 poroa/v), ja suurin vahinkojen aiheuttaja on ahma. Pyhä-Kallion paliskunta sijaitsee Keski-Lapissa, ja alueella on petoja hyvin vähän (keskimäärin 7 vahinkoa/v.).

Paitsi menetettyjen porojen arvosta, kustannuksia aiheutuu mm. petovahinkojen etsinnästä ja porojen suojelemisesta pedoilta. Poronhoitajat pitivät poronhoitovuoden ajan ajopäiväkirjaa petojen takia tehdyistä kelkka-, auto- ja mönkijäajoista sekä muista petovahinkojen aiheuttamista kustannuksista. Laskelmassa pyrittiin erottamaan yksittäisille poronomistajille ja paliskunnalle aiheutuneet kustannukset ja korvaukset. Paliskunnissa on vaihteleva käytäntö sen suhteen, kuinka paljon poromiehille maksetaan korvauksia petojen aiheuttamista töistä (palkat ja päivärahat) ja petovahinkojen etsintään liittyvistä ajoista (kilometrikorvaukset). Korvausperusteina laskelmissa on käytetty Paliskuntain yhdistyksen antamia suosituksia. Mikäli paliskunta maksoi suosituksia pienemmän korvauksen, tämän laskettiin jäävän poronomistajalle kustannukseksi. Poronomistajalle maksettavan työn arvona käytettiin maataloustyöntekijän keskituntiansiota arkipyhäkorvauksineen (10,80 €/h).

Valtio korvaa petojen tappamien porojen arvon poronomistajille kaksinkertaisena. Korvauksen ylimääräisellä osalla pyritään kattamaan niiden petojen tappamien porojen arvo, joita ei löydetä maastosta. Kaikissa tutkimuspaliskunnissa petovahingoista aiheutuvat kokonaiskustannukset olivat suuremmat kuin niistä saadut korvaukset. Suurin tappio oli Käsivarren paliskunnassa, jossa poronomistajien ja paliskunnan yhteenlasketut kustannukset olivat yli 31 000 € suuremmat kuin saadut korvaukset. Ivalon paliskunnan ja sen osakkaiden kustannukset olivat n. 4600 € suuremmat kuin korvaukset. Pyhä-Kalliossa tappio oli noin 770 € ja Kallioluomassa noin 190 €. Paliskuntien välillä oli suuria eroja siinä, kohdistuiko tappio paliskuntaan vai yksittäisiin osakkaisiin. Käsivarressa paliskunta ei korvaa lainkaan petovahinkojen etsintäkuluja poronomistajille ja tappio kohdistui kokonaisuudessaan poronomistajille. Ivalossa ja Kallioluomassa paliskunta korvaa etsintäkulut osittain, mutta sielläkin valtaosa kustannuksista kohdistui yksittäisiin poronomistajiin. Pyhä-Kalliossa kaikki poronhoitotyöt tehdään paliskunnan lukuun, joten myös tappio kohdistui paliskunnalle.

On huomattava, että laskelmat ovat suuntaa-antavia, koska niihin sisältyy monia epätarkkuuksia. Petovahinkojen etsinnän ja porojen suojelun kokonaistyökustannuksia ei pystytty laskemaan tarkasti tuntimäärien puuttumisen takia. Lisäksi petovahinkojen etsintään liittyvissä ajokustannuksissa oli epätarkkuuksia etenkin Käsivarressa, jossa vain osa petovahinkojen etsintään osallistuneista poromiehistä piti ajopäiväkirjaa. Tulokset viittaavat kuitenkin selkeästi siihen, että nykyiset maasuurpetokorvaukset eivät kata petovahingoista aiheutuneita kokonaiskustannuksia. Yhdessäkään tutkimuspaliskunnassa ei maasuurpetokorvauksista jäänyt lainkaan korvausta löytymättömille petojen tappamille poroille, vaikka löytyneet petojen tappamat porot oli korvattu kaksinkertaisen korvauksen periaatteella.

The Market of Reindeer Meat Products in Finland

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In 2004 the production of reindeer meat was about 2.5 million kilos in Finland. About 1.80 million kilos of reindeer meat were sold and delivered through retailing stores, catering sector, wholesale business or food industry. The reindeer producers consumed by them selves or sold directly to final customers about 0.7 million kilos of reindeer meat.
The reindeer meat is a restricted material to the meat processing industry, and it is utilized for processing high-valued products to special segments in the meat markets. Most of reindeer meat processors are establish in 1990s or later. The reindeer processing is the most important branch of them and the turnover of these companies is modest. The competitiveness of these small companies is based on closely situated supply of fresh reindeer meet. These companies are mostly specialised on local markets, own product range or customer-oriented service.
Most of reindeer meat is processed in a few large companies, however the reindeer meat has only a small share in the turnover of these companies. Seven biggest companies process about 80 per cent of annual reindeer meat supply. The large meat processors sell their products to nationwide retailing markets, and the reindeer products have important role in confirming the arctic image of these companies. In 2004 the combined turnover of the companies, which processed reindeer meat was about € 79 million, and € 16.5 million was the approximate share of reindeer processing. About 120 persons are employed in reindeer processing. Generally the reindeer meat is sold as frozen products. Almost half of the processed reindeer meat is sold as frozen fry. About 20% of the meat is sold fresh, and about same amount was sold as smoked, mainly as cold smoked products.
The consolidation of the retailing sector, the segmentation of food market and the changing consumption patterns are the ongoing trends, which are setting new demands on the reindeer producers, processors and merchants. At the moment the restricted supply of reindeer meat is offering living for a small and skilled group of professionals. By improving the cooperation between the companies the reindeer meat could be processed and sold more effectively to the well paying marketing sector.

Poronlihatuotteiden markkinat Suomessa

Vuonna 2004 poronlihaa tuotettiin Suomessa noin 2,5 miljoonaa kiloa. Vähittäismyymälöiden, suurtalouksien, tukkuliikkeiden ja jalostusteollisuuden kautta myytiin kuluttajille noin 1,80 miljoonaa kiloa poronlihatuotteita. Poronomistajien omaan käyttöön mennyt tai poronomistajien suoraan kuluttajille myyty poronlihamäärä oli noin 0,7 miljoonaa kiloa.
Lihanjalostajille poro on niukka raaka-aine, josta valmistetaan arvostettuja tuotteita erikoislihamarkkinoille. Yli puolet poronlihaa jalostavista yrityksistä on perustettu 1990-luvulla tai sen jälkeen. Näistä suurin osa on pieniä yrityksistä, joille poronlihanjalostus on tärkein toimiala. Pienten yritysten kilpailukyky perustuu lähialueelta hankittuun raaka-aineeseen ja ne ovat yleensä erikoistuneet lähimarkkinoihin, omaan tuotteistoon tai räätälöityyn asiakaspalveluun.
Pääosa poronlihasta käsitellään kuitenkin muutamassa suuressa lihanjalostusyrityksessä, joille poronlihatuotteet muodostavat usein vain pienen osan yrityksen liikevaihdosta. Seitsemän suurinta yritystä käsittelee 80 prosenttia poroista. Suuret jalostusyritykset myyvät tuotteensa valtakunnallisille vähittäiskauppamarkkinoille ja niille porolihatuotteet ovat tärkeitä yrityskuvaa vahvistavia erikoistuotteita. Vain runsas kolmannes poronlihasta jalostettiin yrityksissä, joissa päätoimialana oli poronlihanjalostus. Poronlihaa käsittelevien yritysten kokonaisliikevaihto oli noin 79 miljoonaa euroa vuonna 2004. Poronlihan jalostuksen osuus oli siitä noin 16,5 miljoonaa euroa. Jalostus työllistää kaikkiaan noin 120 henkeä.
Poronliha myydään useimmiten pakasteena. Lähes puolet kaikesta jalostetusta poronlihasta on pakastekäristystä. Valtaosa siitä myydään kuluttajille vähittäiskaupan kautta. Poronlihajalosteista noin viidesosa on tuoretuotteita, esimerkiksi raakapaloiteltua lihaa, paistia tai fileitä. Saman verran poronlihaa myydään savutuotteina. Pääosa niistä on kylmäsavutuotteita.
Vähittäiskaupan keskittyminen, markkinoiden segmentoituminen ja kulutustottumusten muuttuminen asettavat uusia vaatimuksia poronlihan tuottajille, jalostajille ja kauppiaille, mutta luovat myös uusia mahdollisuuksia koko poronlihan tuotantoketjulle. Tällä hetkellä rajallisesta raaka-aineesta hankkii elantonsa pieni ja ammattitaitoinen joukko toimijoita, joiden yhteistyö on vielä kehittymätöntä. Yritysten välistä yhteistyötä ja työnjakoa tiivistämällä voitaisiin pieni raaka-ainemäärä jalostaa ja myydä entistä tehokkaammin hyvin maksaville markkinasegmenteille.

The response of summer pasture plants of reindeer to ultraviolet (UV) radiation

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Stratospheric ozone depletion and increasing levels of ultraviolet (UV) radiation were discovered over the Arctic by the mid-1990s. It has been predicted that subarctic regions will be subjected to 14% maximum increases in the annual UV dose in 2010-20 relative to 1979-92. Northern ecosystems subsist plants and animals under harsh climatic conditions at or near their adaptation levels, and may be sensitive to additional stress due to increased UV-B radiation. In this study, we investigated the effects of UV-radiation on the chemical composition and digestibility of a few of the most important summer pasture plants of reindeer.

The studies were conducted in natural peatland ecosystem with UV-B filtration experiment in reindeer pastures of the Lappi Reindeer Herding District in Vuotso (67°N, 27°E), in the Eastern Lapland, Finland during 2002-2003. The two most dominant vascular plant species in the field site were *Menyanthes trifoliata* and *Eriophorum russoleum*. They both are important grazing plants of reindeer. Plant species studied included also *Betula nana, E. angustifolium, Rubus chamaemorus* and *Carex* spp. The UV-filtration experiment was conducted in 2002 and 2003 with three treatments, each conducted in ten experimental plots (30 plots in total). The treatments consisted of plots fenced with wooden frames and covered with plastic filters adjusted over a natural peatland ecosystem: 1) UV-B exclusion treatment (a clear polyester plastic), 2) control treatment (a clear cellulose acetate) and 3) ambient plots for studying the effect of natural solar UV irradiance (plots with frames, but no plastic filters). Plants were sampled twice during summer. Total content of soluble phenolics, nitrogen, fibers and *in vitro* digestibility was analysed from the plant samples.

Total content of soluble phenolics varied a lot among the plant species. In the UV filtration experiment in summers 2002 and 2003, total contents of soluble phenolics was the lowest in both *M. trifoliata* and *E. russoleum* under UV-B exclusion treatment. In summer 2003, total content of soluble phenolics of *E. russoleum* responded more sensitively in the UV-B exclusion treatment than *M. trifoliata*. Total content of soluble phenolics in *E. russoleum* was significantly higher in ambient plots (natural UV radiation) and in the control plots studying the effects of plastic filter ($P<0.01$) than in plants growing under UV-B exclusion. The response indicates that UV-B radiation is essential for the synthesis of soluble phenolics and the content of phenolics increases with increasing UV-radiation. The concentration of nitrogen, fibers and *in vitro* digestibility varied significantly between different plants species. *In vitro* digestibility of leaves and root of *M. trifoliata* was significantly higher (2 times) than digestibility of leaves of *Rubus chamaemorus* and *Betula nana*. There were no statistical differences in nitrogen, fiber or *in vitro* digestibility between the UV-treatments neither in M. *trifoliata* nor in *E. russoleum.* The results show that UV-B radiation induces production of UV-absorbing soluble phenolics in some peatland pasture plants of reindeer during summer. The effects of UV radiation were, however, small in the plant species studied and not the same in all plant species. Varying responses during different years may be due to varying irradiance, temperature and moisture conditions. Longer-term studies are needed to assess preliminary results. This study was conducted as part of the EU-funded RENMAN project (2001-2003) studying challenges of modernity for reindeer management in northern Fennoscandia.

Poron kesälaidunkasvit ja ultravioletti (UV) -säteily

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Stratosfäärin otsonikerroksen oheneminen ja siihen liittyvä ultravioletti (UV) -säteilyn lisääntyminen todettiin arktisilla alueilla 1990-luvun puolivälissä. Viimeaikaisten ennusteiden mukaan vuotuisen UV-B-säteilyn voimakkuus lisääntyy subarktisilla alueilla 14% ajanjaksolla 2010-20 verrattuna jakson 1979-92 tilanteeseen. Pohjoisten ekosysteemien kasvit ja eläimet elävät ankarassa ilmastossa sopeutumisensa äärirajoilla ja voivat olla erityisen herkkiä lisääntyvän UV-B-säteilyn aiheuttamalle stressille. Tämän tutkimuksen tavoitteena oli selvittää miten UV-B-säteily vaikuttaa poron eräiden tärkeimpien kesälaidunkasvien kemialliseen koostumukseen ja sulavuuteen.

Tutkimukset tehtiin luonnon suoekosysteemissä UV-B-suodatuskokeella porolaidunalueella Lapin paliskunnassa, Vuotsossa (67°N, 27°E), Itä-Lapissa kesinä 2002-2003. Vallitsevat putkilokasvilajit koealueella olivat raate, *Menyanthes trifoliata* ja ruostevilla, *Eriophorum russoleum*. Molemmat ovat tärkeitä porolaidunkasveja. Lisäksi tutkittaviin lajeihiin sisältyivät vaivaiskoivu *(Betula nana)*, luhtavilla *(E. angustifolium)*, hilla, *(Rubus chamaemorus)* ja sarat *(Carex* sp*)*. UV-suodatuskoe toteutettiin Vuotsossa kesällä 2002 ja 2003 kolmella eri käsittelyllä, joista kukin tehtiin 10 koeruudulla (30 ruutua yhteensä). Käsittelyt koostuvat alueista, jotka on aidattu puisilla kehyksillä ja päällystetty muovilla: (1) UV-B-säteilyn poistokäsittely (kirkas polyesterimuovi), (2) sen kontrollikäsittely (kirkas selluloosa-asetaatti) ja (3) luontaisen UV:n vaikutusta tutkiva käsittely, jossa on puukehykset, muttei muoveja. Kasvinäytteet kerättiin koeruuduilta kahdesti kesän aikana. Kasvinäytteistä määritettiin liukoisten fenolien kokonaispitoisuudet sekä typpi, kuidut ja *in vitro* sulavuus.

Liukoisten fenolien kokonaispitoisuudet vaihtelivat suuresti kasvilajien välillä. Kesien 2002 ja 2003 UV-suodatuskokeissa liukoisten fenolien pitoisuudet olivat alhaisimmat raatteella *(Menyanthes trifoliata)* ja ruostevillalla *(E. russoleum)* UV-B-poistokäsittelyssä. Kesällä 2003, ruostevillan fenolipitoisuus reagoi herkemmin UV-B-poistokäsittelyyn kuin raatteen. Liukoisten fenolien kokonaispitoisuudet olivat ruostevillalla merkitsevästi korkeammat luontaisen UV:n tai muovin vaikutusta kontrolloivassa käsittelyssä ($P<0.01$) kuin UV-B-poistokäsittelyssä. Vaste osoittaa, että UV-B-säteily on välttämätöntä fenolien synteesille ja niiden määrä lisääntyy UV-B:n vaikutuksesta. Typen ja kuitujen pitoisuudet ja *in vitro* sulavuus vaihtelivat merkitsevästi kasvilajien välillä. Raatteen lehtien ja juurien *in vitro* sulavuus oli merkitsevästi (2 kertaa) suurempi kuin hillan ja vaivaiskoivun lehtien sulavuus. UV-kokeissa ei ollut eroja typen ja kuitujen pitoisuuksissa eikä sulavuudessa eri käsittelyjen välillä raatteella eikä myöskään ruostevillalla. Tulokset osoittavat, että luontainen UV-B säteily indusoi UV:ta absorboivien liukoisten fenolien tuotantoa eräissä poron suolaidunkasveissa. UV-säteilyn vaikutukset olivat kuitenkin vähäisiä eivätkä vasteet olleet samanlaisia kaikilla lajeilla. Vaihtelevat vasteet eri vuosina johtuvat ilmeisesti säteily-, lämpötila- ja kosteusolosuhteiden vaihteluista. Alustavien tulosten arvioimiseen tarvitaan pidempiaikaisia tutkimuksia. Tämä tutkimus oli osa EU-rahoitteista RENMAN-projektia (2001-2003), jossa tutkittiin nykyajan haasteita poronhoidolle pohjois-Fennoskandiassa.

Milk intake and energy expenditure of reindeer calves estimated by the doubly-labelled water method

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Milking of reindeer has been studied extensively and used as a measure of the milk supply of the calves. However, milking includes separation of the calf from the mother and disturbs lactation. It is well-known that free suckling by the calf continuously stimulates milk production of the mother. To examine milk intake with minimal handling and disturbance, technique based on a physiological tracer was used in this study. Milk intake and energy expenditure of the reindeer calves was measured by doubly-labelled water (DLW, $^{2}H_{2}^{18}O$) during their first weeks of life. DLW contains stable isotopes of hydrogen (^{2}H) and oxygen (^{18}O). Milk intake was calculated from the water turnover obtained from the dilution curve of ^{2}H, and energy expenditure from the difference of the dilution curves of ^{2}H and ^{18}O (carbon dioxide production).
The experiments were conducted with the Finnish Reindeer Herders' Association's experimental reindeer at the Kaamanen Reindeer Research Station in May-June 2003. Mothers and calves were kept together and calves were allowed to suckle their mothers. Two successive experiments (duration 7 days) were conducted with 4 calves and 4 mothers. The calves were 1-2 weeks old during the first experiment (23-30 May) and 3-4 weeks old during the second experiment (4-11 June). DLW was given to calves through a cannula inserted into the jugular vein and its turnover in the body was measured by blood samples. Milk output of the mothers was measured by milking machine at the end of the experiments (with ocytoxin). Milk samples were taken for the chemical analyses. Milk was the main food of the calves. The mothers were fed with high-protein concentrates and their feed intake was individually recorded by computerised feeding collars.
Milk intake of the calves was on average 1.28 kg/day (1.04-1.50 kg/day) during the first experiment and 1,47 kg/day (1.23-1.88 kg/day) during the second experiment. The energy expenditure of the calves was on average 5.87 MJ/day at the age of 1-2 weeks and 7.42 MJ/day at the age of 3-4 weeks. Milk output of the mothers varied markedly. Milk output was on average 1.37 kg/day (0.88-1.80 kg/day) at the end of the first experiment and 1.12 kg/day (0.52-1.74 kg/day) at the end of the second experiment. Milk included on average 10.8% fat, 8.2 % protein, 4.5% lactose, 23.7% dry matter and 6.9 kJ/g gross energy. The fat content of milk varied between mothers (7.4-16.3%). The calves doubled their birth weight in about 17 days. Body weight gain of the calves was 310 g/day during the first experiment and 420 g/day during the second experiment. The mothers maintained their body weight during the first experiment, but lost 2-3 kg during the second experiment. Feed intake of the mothers was on average 1.87 kg/day during the first experiment and 2.74 kg/day during the second experiment. The calving resulted to a decrease in feed intake for 1-11 days. Milk intake was highest in the calves whose mothers had highest body weights and feed intakes.
The results show that DLW method suits for the measurement of milk intake of the calves during their first weeks of life when their major water source is milk. The benefit of the method is that the lactation remains undisturbed and energy expenditure can be measured with the same method. The disadvantage is demanding technique and high cost.

Poronvasojen maidonoton ja energiankulutuksen mittaaminen kaksoisleimatulla vedellä

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Poron lypsyä on tutkittu laajasti ja käytetty myös vasojen maidonsaannin mittana. Lypsy kuitenkin sisältää vasan erottamisen emästä ja siten häiritsee imetystä. Vapaasti imevän vasan tiedetään jatkuvasti stimuloivan emänsä maidontuottoa. Jotta saataisiin vasojen maidonottoa mitattua mahdollisimman vähin käsittelyin ja häiriöin, tässä tutkimuksessa käytettiin fysiologista merkkiainemenetelmää. Poronvasojen maidonottoa ja energiankulutusta mitattiin kaksoisleimatun veden (engl. doubly-labelled water, DLW, $^{2}H_{2}{}^{18}O$) avulla ensimmäisten elinviikkojen aikana. Kaksoisleimattu vesi sisältää vedyn (^{2}H) ja hapen (^{18}O) stabiileja myrkyttömiä luonnossa esiintyviä isotooppeja. Maidonotto laskettiin veden turnoverista, joka määritettiin ^{2}H:n laimenemiskäyrästä ja energiankulutus määritettiin ^{2}H:n ja ^{18}O:n laimenemiskäyrien välisestä erotuksesta (hiilidioksidin tuotosta).

Tutkimukset tehtiin Paliskuntain yhdistyksen Kutuharjun koetarhan poroilla Kaamasen Porontutkimus-asemalla touko-kesäkuussa 2003. Vaatimet ja vasat pidettiin yhdessä ja vaatimet saivat vapaasti imettää vasojaan. Neljällä vasalla ja neljällä vaatimella tehtiin kaksi peräkkäistä koetta, jotka kestivät kumpikin 7 vrk. Vasat olivat ensimmäisessä kokeessa (23-30.5.) 1-2 viikon ikäisiä ja toisessa kokeessa (4-11.6.) 3-4 viikon ikäisiä. Kaksoisleimattu vesi annettiin vasoille kanyylin avulla kaulalaskimoon ja sen turnoveria kehossa mitattiin verinäytteiden avulla. Vaadinten maidontuotto mitattiin kokeiden lopussa lypsykoneella ja maidon heruttamiseen käytettiin oksitosiinia. Lypsyjen yhteydessä kerättiin maitonäytteet maidon kemiallisen koostumuksen määrittämiseen. Kokeiden aikana vasojen pääasiallisena ravinnonlähteenä oli emän maito. Vaatimia ruokittiin runsaasti proteiinia sisältävällä poron kesärehulla, jonka kulutusta mitattiin ruokinta-automaattien avulla.

Vasojen maidonotto oli ensimmäisen kokeen aikana keskimäärin 1.28 kg/vrk (1,04-1,50 kg/vrk) ja toisen kokeen aikana 1,47 kg/vrk(1,23-1,88 kg/vrk). Vasojen energiankulutus oli keskimäärin 5.87 MJ/vrk 1-2 viikon ikäisillä ja 7,42 MJ/vrk 3-4 viikon ikäisillä. Vaadinten lypsyjen perusteella laskettu maidontuotto vaihteli suuresti. Maidontuotto oli ensimmäisen kokeen lopussa keskimäärin 1,37 kg/vrk (0,88-1,80 kg/vrk) ja toisen kokeen lopussa 1,12 kg/vrk (0,52-1,74 kg/vrk). Maidossa oli rasvaa keskimäärin 10,8% valkuaista 8,2%, laktoosia 4,5%, kuiva-ainetta 23,7% ja energiaa oli 6,9 kJ/g. Maidon rasvapitoisuus vaihteli yksilöiden välillä (7,4-16,3%). Vasojen syntymäpaino kaksinkertaistui keskimäärin 17 vuorokaudessa. Vasat lisäsivät painoaan 310 g/vrk ensimmäisen kokeen aikana ja 420 g/vrk toisen kokeen aikana. Vaadinten painot pysyivät ensimmäisen kokeen aikana lähes ennallaan, mutta putosivat toisen koejakson aikana 2-3 kg. Vaatimet kuluttivat rehua ensimmäisen kokeen aikana keskimäärin 1,87 kg/vrk ja toisen kokeen aikana 2,74 kg/vrk. Vasonta aiheutti rehunkulutuksen alenemisen 1-11 vuorokauden ajaksi. Vasojen maidonotto oli suurin vasoilla, joiden emien painot ja rehunkulutukset olivat suurimmat.

Tulosten perusteella kaksoisleimattu vesi soveltuu vasojen maidonoton mittaamiseen jaksona jolloin vasat saavat suurimman osan vedestään maidosta. Kaksoisleimatun veden etuna on se, että imetys ei häiriinny ja energiankulutus voidaan mitata samalla menetelmällä. Haittapuolena on menetelmän teknisesti vaativa suoritus ja hintavuus.

Finnish and Norwegian reindeer milk betalactoglobulin; characterization of genetic variants

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Betalactoglobulin (βLG) is the main whey protein in most ruminants and belongs to the lipocalin protein family. According to previous data altogether 12 variants are expressed in bovine βLG from which variants A and B are predominant. Chemical and physical properties of bovine milk βLG are known while its biological function and its role as a transport protein are yet unclear.

Our aim was to characterize Finnish and Norwegian reindeer milk βLG proteins and compare the data with those of bovine milk βLG. Finnish reindeer milks were obtained from Reindeer Research Station (Kaamanen, Finland), Norwegian reindeer milks from the University of life Sciences (Ås, Norway) and bovine milk from a local farmer. βLG proteins were isolated as described earlier (*Milchwissenschaft* 60 (4), 2005) and were characterized by SDS- and Native-PAGE, by IEF and by Western blotting with antisera to bovine milk βLG.

Our data indicates that both Finnish and Norwegian reindeer milk βLG proteins as well as bovine milk βLG proteins show a similar molecular mass as estimated by a reduced SDS-PAGE. Charge differences of the milk samples were analyzed by Native PAGE in long gels (20 cm) followed by Western blotting. The antisera to bovine milk βLG recognised two protein bands in all milk samples while the mobilities of the two βLG bands in bovine milk were different as compared to those in reindeer milks. In reindeer milks the other βLG band was similar in all reindeer milks while the intensity of the other band varied. Charge differences of the βLG bands were studied also by electrofocusing in narrow pH gradients followed by Western blotting, and showed two βLG bands that were recognised by the antisera to bovine milk βLG. The isoelectric points of the two βLG bands in reindeer milks with IPs about 4.6 - 4.9 were different when compared to the two βLG bands in bovine milk with IPs about 5.1 - 5.3, in accordance with the data obtained with Native PAGE as described above.

To summarize our data indicates that Finnish and Norwegian reindeer milk βLG proteins are similar according molecular mass, but differ according to their charge (IPs about 4.6 - 4.9) when compared to bovine milk βLG proteins (IPs about 5.1 - 5.3). In addition in reindeer milks, the protein band with IP about 4.9 appeared as two bands in most reindeer milks when the gels were stained by CBR after electrofocusing. Further studies, such as of amino acid sequencing and determination of amino acid composition are needed to clarify in details the genetic variants of Finnish and Norwegian reindeer milk βLG proteins.

Poronmaidon betalaktoglobuliini: Geneettiset variantit

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Betalaktoglobuliini (βLG) kuuluu lipokaliinien proteiiniperheeseen ja on monien märehtijöiden pääheraproteiini. Lehmänmaidon βLG:lla on 12 erilaista varianttia, joista variantit A ja B ovat vallitsevia. Lehmänmaidon βLG:n ominaisuudet tunnetaan, mutta lehmänmaidon βLG:n biologisesta tehtävästä ja roolista kuljetusproteiinina ei vielä tiedetä paljonkaan. Poronmaidon βLG:n geneettisistä varianteista ei löydy aikaisempaa tutkimusta eikä poronmaidon βLG:n biologista tehtävää tai roolia kuljetusproteiinina tunneta.
Tavoitteemme oli karakterisoida suomalaisten ja norjalaisten poronmaitojen βLG-proteiineja sekä verrata poronmaitojen βLG-proteiineja lehmänmaidon βLG-proteiineihin. Suomalaiset poronmaidot saatiin Porontutkimusasemalta (Kaamanen, Suomi), norjalaiset poronmaidot Norjan biotieteiden yliopistolta (Ås, Norja) ja suomalaiset lehmänmaidot paikalliselta maidontuottajalta.
βLG-proteiinit eristettiin aiemmin kuvatulla tavalla (Milchwissenschaft 60 (4), 2005) ja analysoitiin SDS- ja Natiivi-PAGE:lla (20 cm pitkissä geeleissä) ja IEF:lla kapealla pH-gradientilla (pH 4 - 6.5) sekä tunnistettiin Western blottauksella, jossa käytettiin lehmänmaidon βLG-proteiinia vastaan tuotettua vasta-ainetta.
Tuloksemme osoittavat että pelkistävällä SDS-PAGE:lla analysoitaessa sekä suomalaisten että norjalaisten poronmaitojen βLG-proteiineilla ja lehmänmaidon βLG-proteiineilla on samanlaiset molekyylimassat.
βLG-proteiinien varauseroja analysoitiin Natiivi-PAGE:lla pitkissä geeleissä, jolloin βLG:n vasta-aine tunnisti kaksi proteiinia, joista toinen βLG vyöhyke oli samanlainen kaikissa poronmaidoissa, kun taas toisen vyöhykkeen intensiteetti vaihteli. Vasta-aine tunnisti myös kaksi βLG-vyöhykettä lehmänmaidossa, mutta näiden proteiinien liikkuvuudet olivat erilaiset kuin poronmaidon βLG-proteiineilla.
Kun varauseroja tutkittiin elektrofokusoinnilla kapeassa pH-gradientissaa (pH 4 - 6.5), βLG:n vasta-aine tunnisti kaksi poronmaidon βLG proteiinia, joiden isoelektriset pisteet olivat n. 4.6 ja 4.9. Toisen variantin (IP 4.9) intensiteetti oli lähes samanlainen kaikissa poronmaidoissa, mutta toisen variantin (IP 4.6) intensiteetti vaihteli. Lisäksi CBR-värjätyssä geelissä detektoitiin poronmaidon toisessa βLG-variantissa toinen subvariantti, jonka IP oli n. 4.85. βLG-vasta-aine tunnisti molemmat lehmänmaidon βLG variantit, A:n (IP 5.1) ja B:n (IP 5.3), joiden isoelektriset pisteet olivat erilaiset verrattuna poronmaidon βLG variantteihin.
Yhteenvetona todetaan, että sekä poronmaidon että lehmänmaidon βLG-variantit ovat molekyylimassaltaan samanlaisia. Natiivi-PAGE:ssa sekä suomalaisten että norjalaisten poronmaitojen βLG-proteiinissa detektoitiin kaksi geneettistä varianttia. Poronmaidon βLG:n geneettisten varianttien liikkuvuudet olivat samanlaiset kaikissa näytteissä, mutta verrattuna kahteen lehmänmaidon βLG varianttiin (A ja B) niiden liikkuvuudet olivat erilaiset. Elektrofokusoinnissa tulokset olivat pääosin samanlaisia kuin Natiivi-PAGE:ssa. Poronmaitojen kaksi βLG varianttia olivat erilaisia (IP:t noin 4.6 - 4.9) verrattuna lehmän βLG variantteihin (IP:t 5.1 - 5.3). Lisäksi useimmissa poronmaidoissa detektoitiin CBR-värjäyksellä variantti, jonka IP oli n. 4.9, joka erottui kahtena vyöhykkeenä joissakin suomalaisissa ja norjalaisissa poronmaidoissa. Lisätutkimuksia kuten aminohappokoostumuksen ja sekvenssin määrittämistä tarvitaan selventämään yksityiskohtaisesti suomen ja norjan poronmaitojen βLG-variantit.

Seasonal variation in sensory quality of meat from Alaskan reindeer bulls and steers

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Reindeer producers in Alaska must consistently deliver a high quality product to the market place throughout the year to ensure a stable and profitable industry. No studies have systematically evaluated carcass yield and quality across animal categories of Alaskan reindeer slaughtered through an extended season. A total of 42 reindeer were included in the study (19 bulls and 23 steers). All animals came from the same herd out in the Seward Peninsula, Alaska, and were slaughtered on three different occations; mid July (group 1), late November (group 2) and mid March (group 3). Group 1 were gathered and herded with helicopter and snow machine before entering the corral, the animals were positioned in a squeeze chute and stunned with a captive bolt. Animals in groups 2 and 3 were gathered in the field with snow machine and, while still free-ranging, they were shot with a rifle. All carcasses were gutted and dressed out in the field, and immediately transported to a meat processing facility for further sampling and boning.

All sensory evaluation was conducted at the Cooperative Extension Service Food Product Development Facility/Sensory Laboratory (UAF, Fairbanks). A selected and trained sensory panel consisting of 7 members performed a descriptive test on the reindeer loin samples. All assessments were carried out in a laboratory with separate booths and under normal white light. The meat samples were thawed over-night in a refrigerator and then prepared in a conventional oven at 150 °C to a core temperature of 70 °C. Two slices from each sample of meat were placed in plastic cups coded with three-digit numbers, served to the panel members in randomised order, at room temperature and in two replicates. The panel members assessed 7-9 meat samples each session. The following attributes were selected and unanimously agreed upon during panel training: total smell intensity, tenderness, juiciness, gamey flavour, bloody flavour, liver flavour and sweet flavour. An unstructured continuous line scale from 0 (low intensity) to 10 (high intensity) was used.

No significant difference in any sensory attribute was found when comparing meat from the two animal categories included (bulls and steers), however the three different slaughter times affected the sensory quality of the meat. There was a tendency (P=0.07) towards stronger total smell intensity of the meat over the season, with lowest values for July and highest values found for March. The meat from animals slaughtered in November was most tender (P=0.02) and juicy (P=0.001) compared with meat from the July slaughter. The gamey flavour of the meat increased slightly (P=0.08) from July (lowest values) through March. Reindeer slaughtered in November produced meat with the highest intensity of sweet flavour (P=0.001).

In addition to the present results, seasonal effects in reindeer carcass composition have previously been reported from the same project (Wiklund *et al.*, 2005), where the carcasses from the late slaughter occasion were heavier with a higher proportion of valuable cuts. Reindeer bulls were more affected by the season than the steers, and showed the largest variation in carcass weight and fat content.

Results from this study will generate information necessary for Alaskan reindeer producers to develop an operational plan that will increase the value and expand the delivery of reindeer products demanded and accepted by upscale markets and consumers.

Reference:

Wiklund, E., Finstad, G. & Bechtel, P. J. 2005. Seasonal variation in carcass quality of reindeer (*Rangifer tarandus tarandus*) from the Seward Peninsula, Alaska. – *Proceedings: 51th International Congress of Meat Science and Technology, 7-12 August, Baltimore, USA.*.

Säsongsvariation i sensoriska egenskaper hos renkött från Alaska

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För att garantera en stabilitet och lönsamhet inom rennäringen måste renägarna i Alaska kunna producera en kvalitetsprodukt under en förlängd slaktsäsong. Det har tidigare inte undersökts om slakttidpunkt under året och djurkategori påverkar slaktkroppssammansättning och köttkvalitet hos renar i Alaska.
Den här undersökningen utfördes på Seward Peninsula i Alaska, och 42 renar (19 tjurar och 23 kastrerade tjurar) från samma renhjord ingick i studien. Renarna slaktades vid tre olika tillfällen; i mitten av juli (grupp 1), slutet av november (grupp 2) och i mitten av mars (grupp 3). Grupp 1 samlades och drevs med helikopter och snöskoter till en skiljningshage, klämdes fast i en fixeringsbox och avlivades med bultpistol. Grupp 2 och 3 samlades med snöskoter och sköts med gevär medan de fortfarande befann sig i renhjorden. Renarna slaktades utomhus, avhudades och inälvorna togs ur innan slaktkropparna transporterades till en styckningslokal där styckning och provtagning utfördes.
Den sensoriska analysen gjordes vid Cooperative Extension Service Food Product Development Facility/Sensory Laboratory (UAF, Fairbanks). En utvald och tränad panel bestående av 7 personer utförde beskrivande test på renkött (*M. longissimus*) i ett laboratorium utrustat med separata bås och i normalt dagsljus. Renköttsproverna tinades över natt i kylskåp och tillagades sedan i en konventionell ugn vid 150 °C till en sluttemperatur på 70 °C. Två skivor från varje prov placerades i plastburkar märkta med tresiffriga slumpmässiga nummer, serverades rumstempererade till panelen i slumpmässig ordning i två replikat. Panelen bedömde 7 to 9 prov vid varje bedömningstillfälle. Under träningstillfällena valde panelen ut och enades om följande egenskaper hos renköttet: total luktintensitet, mörhet, saftighet, viltsmak, blodsmak, leversmak och söt smak. En kontinuerlig linjeskala från 0 (låg intensitet) till 10 (hög intensitet) användes vid bedömningen.
Inga signifikanta skillnader i någon av de sensoriska egenskaperna kunde visas när kött från tjurar och kastrerade tjurar jämfördes, däremot fanns det skillnader i sensorisk kvalitet mellan de olika slakttidpunkterna. En tendens (P=0,07) till ökad luktintensitet under slaktsäsongen kunde visas, med de lägsta värdena i juli och de högsta i mars. Köttproverna från november var mörast (P=0,02) och saftigast (P=0,001) jämfört med kött från slakten i juli. Viltsmaken ökade något (P=0,08) över slaktsäsongen från juli till mars. Renarna som slaktades i november gav kött med de högsta värdena för söt smak (P=0,001).
Säsongseffekter i slaktkroppsammansättning har tidigare rapporterats från denna studie (Wiklund *et al.*, 2005), där det visades att slaktkroppar från slakten i mars hade höga vikter och en stor andel värdefulla styckningsdelar. Rentjurarna visade större variation i vikt och fettinnehåll jämfört med de kastrerade tjurarna.
Resultaten från den här undersökningen är viktiga för rennäringen i Alaska då de planerar för en ökad förädling av renköttsprodukter men också för att förlänga slaktsäsongen och därmed öka tillgången på renkött och möta efterfrågan från kvalitetsmedvetna restauranger och konsumenter.

Reference
Wiklund, E., Finstad, G. & Bechtel, P. J. 2005. Seasonal variation in carcass quality of reindeer (*Rangifer tarandus tarandus*) from the Seward Peninsula, Alaska. – *Proceedings: 51th International Congress of Meat Science and Technology, 7-12 August, Baltimore, USA.*

Population dynamics of gastrointestinal nematodes of reindeer in Lapland, Finland

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Nematode parasite infections of semi-domesticated reindeer grazing in their natural habitat were monitored by faecal egg counts and the 'tracer animal' technique for two years. Faecal samples were collected monthly from approximately 30 calves and 30 adult female reindeer from the Kutuharju Experimental Herd, northern Finland. For estimates of infective larvae acquisition from pasture, four 'tracer' reindeer calves were de-wormed each month with a subcutaneous treatment of ivermectin, released to the forest, and slaughtered eight weeks later. The abundance of nematode eggs and abomasal and small intestinal nematodes was analyzed for relationships with host age, sex, season, and between-year variation.

The overall abundance of nematodes and eggs did not differ between male and female calves, but calves shed more eggs than adults. *Ostertagia gruehneri* was the dominant abomasal parasite. Larvae were most abundant in winter ($P<0.001$) than in other seasons and the intensity of infection of adult worms and egg output steadily increased throughout the year with a peak abundance in the reindeer's second summer. Nematodirinae was the most abundant intestinal nematode taxa. The intensity of infection of larvae did not differ between seasons. Calf age was the most important factor. The abundance of larvae increased until calves were 6 months old and then steadily decreased, replaced by an increase in the adult worm population. *Capillaria* eggs were detected year-round in moderate numbers. However, unlike other gastrointestinal nematodes, eggs were shed in highest numbers in winter ($P<0.05$). Between-year variation in overall abundance of worms ($P=0.01$) and egg output ($P<0.001$) was significantly higher in 2004 than in 2003.

We conclude that the transmission of gastrointestinal nematodes, most importantly, *Ostertagia gruehneri,* occurs during the winter months from frozen, snow covered soil and vegetation. This parasite undoubtedly possesses adaptive traits, which enable it to survive within reindeer and on pasture in sub-arctic environments.

Poron ruuansulatuskanavan sukkulamatojen populaatiodynamiikka Suomen Lapissa

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Luontaisessa ympäristössään laiduntavien porojen sukkulamatoinfektioita seurattiin kahden vuoden ajan laskemalla ulosteesta madonmunat ja lisäksi käytettiin ”merkkieläintekniikkaa”. Ulostenäytteet kerättiin kuukausittain Paliskuntain yhdistyksen Kaamasen koetarhalla noin kolmeltakymmeneltä vasalta ja samalta määrältä vaatimia. Loismatojen laitumelta saannin arvioimiseksi neljä merkkivasaa lääkittiin joka kuukausi ihonalaisella ivermektiiniruiskeella, minkä jälkeen ne laskettiin tarhan luonnonlaitumille ja teurastettiin kahdeksan viikon kuluttua, minä aikana vasat keräsivät laitumelta loistoukkia merkiksi laitumen infektiivisyydestä. Ulosteen sukkulamatomunien ja juoksutusmahan sekä ohutsuolen matojen määrää analysoitiin suhteessa eläimen ikään, sukupuoleen, vuodenaikaan ja vuosien väliseen vaihteluun.
Matojen ja madonmunien määrä ei eronnut naaras- ja urosvasojen välillä, mutta vasat erittivät enemmän munia kuin vaatimet. *Ostertagia gruehneri* oli vallitseva juoksutusmahamato. Madon toukkavaiheet vasojen juoksutusmahan limakalvolla olivat yleisimpiä talvella kuin kesällä ($P<0,001$). Aikuisten matojen määrä ja munantuotto kasvoivat tasaisesti vuoden aikana niin, että huippupitoisuus saavutettiin poron toisen elinvuoden kesällä. Nematodirinae-alaheimo oli yleisin ohutsuolen loisryhmä. Alaheimon loistoukkien tartunnassa ei ollut vuodenajasta johtuvaksi tulkittavaa vaihtelua, mutta vasan ikä oli merkittävin toukkien määrään vaikuttava tekijä. Toukkien määrä vasoissa kasvoi kuuden kuukauden ikään saakka, minkä jälkeen se tasaisesti laski ja toukat aikuistuivat; ne korvautuivat aikuisilla alaheimon madoilla. *Capillaria*-munia tavattiin kohtuullisia määriä ympäri vuoden, mutta toisin kuin muiden ruuansulatuskanavan loisten, näitä munia erittyi eniten talvella ($P<0,05$). Vuosien välillä oli vaihtelua; sekä matojen määrä ($P=0,01$) että munien tuotanto ($P<0,001$) olivat suuremmat vuonna 2004 kuin 2003.
Ruuansulatuskanavan sukkulamatojen, tärkeimpänä niistä *Ostertagia gruehneri*, tartuntaa tapahtuu myös talviaikana lumen peittämästä jäisestä maasta ja kasvillisuudesta. Tällä loisella on epäilemättä hyödyllisiä sopeutumia, jotka auttavat sitä selviytymään porossa ja poronlaitumella subarktisessa ympäristössä.

Setaria tundra outbreak in reindeer in Finland

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Setaria tundra was first described in semi-domesticated reindeer in Arkhangelsk area, Russia in 1928. *Setaria* sp. infections appear to have emerged in Scandinavian cervids in the late 1960s. In 1973, *S. tundra* was observed for the first time in northern Norway where there was an outbreak of peritonitis in reindeer. Also in 1973, tens of thousands of reindeer died in the northern part of the Finnish reindeer husbandry area. Severe peritonitis and large numbers of *Setaria* sp. worms were commonly found. Following this, the incidence of *Setaria* sp. in reindeer in Scandinavia diminished.
According to meat inspection data and clinical reports from practising veterinarians, an outbreak of peritonitis in reindeer in the southern and middle part of the Finnish reindeer herding area emerged in 2003. The outbreak was caused by the Filarioid nematode *Setaria* sp. In the province of Oulu, the proportion of reindeer viscera condemned due to parasitic lesions in meat inspection increased from 4.9% in 2001 to 40.1% in 2003. In 2004 the focus of the outbreak moved approximately 100 km north and in the year 2005 the spreading continued to the north about 100 km so that only the reindeer in the northernmost small part of Finland were free of changes. In the same time the outbreak seems to have settled in the southern area.
In Kuusamo, 2511 and 2103 slaughtered reindeer were clinically examined both *ante* and *post mortem* in 2003 and 2004, respectively. *Setaria* sp. nematodes were counted and the degree of peritonitis was evaluated. Tissue, muscle and peritoneal fluid samples for histological and bacteriological studies and for meat hygiene analyses were collected. A total of 260 adult and pre-adult *Setaria* sp. nematodes were collected for morphological and molecular studies. The parasite was morphologically and molecular biologically indistinguishable from *Setaria tundra*.
Peritonitis was common both in adults and calves but the degree of peritonitis was much more severe in calves. The habitus of heavily infected calves expressed decreased welfare; low body condition and undeveloped winter coat. The meat inspection findings of peritonitic reindeer carcasses included ascites fluid, green fibrin deposits, adhesions and live and dead *S. tundra* nematodes. Histopathologically, changes indicated granulomatous peritonitis with lymphoplasmacytic and eosinophilic infiltration. No specific bacterial growth was found. No significant impact on meat pH values nor on organoleptic evaluation of meat was found. There was a significant positive correlation between worm count and the degree of peritonitis and a negative correlation between the degree of peritonitis and back fat layer.
In order to monitor the parasite dynamics in nature, parasite samples from wild cervids were also collected (moose, white-tailed deer, roe deer and wild forest reindeer). In moose only few cases of pre adult encapsulated *S. tundra* nematodes on the surface of the liver but no peritonitis were detected. Two roe deer examined fresh in the field had *S. tundra* nematodes in abdomen but no peritonitis. Of 34 wild forest reindeer, 62% had changes associated with *S. tundra*. It is not known if the high percentage of wild forest reindeer shot in Kainuu with signs of peritonitis caused by *S. tundra* is connected to the decrease of the population from 1700 individuals in 2001 to 1000 in 2005.
The present study revealed that *S.tundra* can act as a significant pathogen for reindeer, which was evident at both ante and post-mortem inspection and in histological examination

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Setaria tundra - sukkulamadon aiheuttama porojen vatsakalvon tulehdus Suomessa

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Setaria tundra sukkulamato kuvattiin ensimmäisen kerran porolla Arkangelissa vuonna 1928. *Setaria* –loiset näyttävät ilmaantuneen Skandinavian hirvieläimiin 1960 –luvun loppupuolella. Vuonna 1973, *S. tundra* havaittiin ensimmäisen kerran Pohjois-Norjassa jossa loinen aiheutti porojen vatsakalvontulehdusepidemian. Samana vuonna Ylä-Lapissa kuoli kymmeniä tuhansia poroja. Ruumiinavauksissa voimakas peritoniitti ja massoittain *Setaria* –sukkulamatoja olivat yleisiä löydöksiä. Tämän jälkeen tilanne rahoittui kolmen vuosikymmenen ajaksi
Poronlihan tarkastuseläinlääkäreiden havaintojen mukaan porojen vatsakalvontulehdus ylsi epidemiaksi vuonna 2003 eteläisellä ja keskisellä poronhoitoalueella. Epidemian aiheutti Filarioidea – sukkulamatoihin kuuluva *Setaria* -loinen. Oulun läänissä vuodesta 2001 vuoteen 2003 loisten aiheuttamien muutosten takia hylättyjen elinten osuus kasvoi 4,9 prosentista 40,1 prosenttin. Vuonna 2004 epidemian painopistealue siirtyi noin 100 km pohjoiseen ja jatkoi vuonna 2005 edelleen etenemistään kohti pohjoista n. sadan kilometrin vuosivauhtia niin että vain Ylä-Lapin porot olivat vapaita tartunnasta. Samaan aikaan epidemia osoitti laantumisen merkkejä eteläisellä poronhoitoalueella.
Kuusamossa n. 4600 teurasporoa tutkittiin kliinisesti ennen ja jälkeen teurastuksen vuosina 2003-04. *Setaria* –sukkulamatojen lukumäärät laskettiin ja vatsakalvon tulehduksen voimakkuusaste arvioitiin. Kudos-, lihas- ja vatsaontelonestenäytteitä koottiin histologisiin, bakteriologisiin ja elintarvikehygieenisiin tutkimuksiin. Yhteensä 260 *Setaria* –loista kerättiin morfologisia ja molekulaarisia tutkimuksia varten. Loinen tunnistettiin sekä morfologisesti että molekyylibiologisesti *Setaria tundra* –sukkulamadoksi.
Vatsakalvon tulehdus oli yleinen sekä aikuisilla että vasoilla, mutta tulehduksen aste oli vasoillla huomattavasti vakavampi. Voimakkaasti infektoituneiden vasojen olemus kuvasti alentunutta hyvinvointia; kuntoluokitus oli alhainen ja talviturkin vaihtuminen keskeneräinen. Yleisimmät löydökset vatsakalvontulehdusta sairastavilla poroilla oli lisääntynyt verinen tai oljen värinen vatsaonteloneste, vihertävä tai harmaa fibriinikalvo elinten pinnoilla ja kiinnikkeet elinten välillä sekä elävät ja joskus kuolleet elinten pinnoille kapseloituneet S. tundra -sukkulamadot. Histopatologiset muutokset ilmensivät jyväistä lymfoplasmasyyttistä ja eosinofiilista vatsakalvon tulehdusreaktiota. Mitään spesifistä bakteerikasvua ei esiintynyt arpikudoksissa ja tulehdusmuutoksissa tai lihan mikrobiologisissa testeissä. Vatsakalvontulehdusreaktiolla ei havaittu myöskään merkittävää vaikutusta lihan pH –arvoihin ja aistinvaraiseen arviointiin. Loisten määrän ja vatsakalvon tulehduksen asteen välillä ilmeni merkitsevä positiivinen korrelaatio ja vatsakalvon tulehduksen ja rasvakerroksen paksuuden välillä negatiivinen korrelaatio. Lois- ja kudosnäytteitä kerättiin myös villeistä hirvieläimistä (hirvi, metsäpeura, metsäkauris, valkohäntäpeura) *S. tundra* -loisen transmissiodynamiikan selvittelemiseksi. Muutaman hirven maksan pinnalta löytyi kuolleita, epäkypsiä S. tundra –loisia mutta ei vatsakalvontulehdusta. Kahden metsäkauriin ruumiinavaus paljasti eläviä S. tundra –loisia mutta ei viitteitä vatsakalvon tulehduksesta kun taas 34 ammutusta metsäpeurasta 64%:lla oli S. tundra –loiselle tyypillisiä tulehdusmuutoksia. On kuitenkin vielä epävarmaa voisiko korkea *S. tundra* –infektioprosentti olla osasyy metsäpeurakannan taantumaan Kainuussa.
Tutkimus osoitti, että *S. tundra* –loisen voimakas infektio voi olla merkittävän patogeeninen porolle. Tämän osoittivat kliiniset tutkimukset, lihantarkastuslöydökset sekä histologiset muutokset.

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A comparison of two commercial serological tests for alphaherpesvirus antibodies in reindeer (*Rangifer tarandus tarandus*) in Finnmark County, Norway

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Finnmark County in Norway constitutes the most important reindeer husbandry region in Europe with around 170 200 animals (2005). Persistent virus infections in reindeer, such as herpesvirus infections, may affect calf mortality. Virus from the subfamily *Alphaherpesvirinae* (family *Herpesviridae*) has been isolated from reindeer in Finland and Sweden, but not in Norway. However, alphaherpesvirus antibodies have been detected in Norwegian semi-domesticated reindeer (Stuen *et al.*, 1993; Tryland *et al.*, 2005). For the purpose of a serological screening, two commercial bovine herpesvirus antibody test kits (SVANOVA™, SYMBIOTICS™) were compared. The SVANOVA™ kit is designed as an indirect ELISA technique with whole bovine herpesvirus (BHV-1) as antigen, modified with rabbit anti-reindeer as secondary antibody. The SYMBIOTIC™ kit is designed as a blocking immunoenzymatic technique using the glycoprotein gB of BHV-1 as antigen. A total of 154 plasma samples from four geographically separated herds were tested. Three herds were sampled at Karasjok and Kautokeino slaughterhouses (2004-2005) while live animals at winter pasture in Karasjok (2004) were sampled from the fourth herd. In the slaughterhouse material the seroprevalence was 35% in calves and yearlings (n=49) and 83% in adults (n=41). We found a higher seroprevalence in females (59%; n=32) compared to males (55%; n=58). The overall seroprevalence for the three districts was 57% (n=90). The overall prevalences per district ranges from 50% to 63%.The results point to a lower seroprevalence in calves and yearling versus adults which would make sense as alphaherpesvirus cause a life long infection. The seroprevalence of alphaherpes antibodies in the herd sampled *in vivo* (all females) was 10% in calves (n=49) and 67% in adults (n=15) with an overall seroprevalence of 23% (n=64). The lower overall seroprevalence in this herd may be due to a higher percentage of sampled calves. Only three animals (2%) were defined different between the two kits. Both kits were able to identify the presence of alphaherpesvirus antibodies in reindeer plasma, but the intra-plate variation between duplicates was lower in the kit from SYMBIOTICS™. The high prevalences of alphaherpesvirus antibodies may indicate that alphaherpesvirus is endemic in reindeer in Finnmark, a situation deserving further studies on the impact of these infections.

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Tryland, M., Mørk, T., Ryeng, K. A., & Sørensen, K. K. 2005. Evidence of parapox-, alphaherpes- and pestivirus infections in carcasses of semi-domesticated reindeer (*Rangifer tarandus tarandus*) from Finnmark, Norway. – *Rangifer* 25 (2): 75-83.

En sammenligning av to kommersielle serologiske tester for påvisning av antistoffer mot alfaherpesvirus hos semi-domestiserte reinsdyr (*Rangifer tarandus tarandus*) i Finnmark, Norge

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Finnmark utgjør kanskje det viktigste reindriftsområdet i Europa med rundt 170 200 dyr (2005). Persistente virusinfeksjoner, som herpesvirus-infeksjoner, kan påvirke kalvedødelighet hos rein. Virus tilhørende underfamilien *Alphaherpesvirinae* (familie *Herpesviridae*) er isolert fra reinsdyr i Finland og Sverige, men ikke i Norge, men antistoffer mot alfaherpesvirus har blitt påvist i blodprøver fra rein i Finnmark (Stuen *et al.*, 1993; Tryland *et al.*, 2005). For å foreta en større serologisk undersøkelse av rein i Finnmark ble to kommersielle antistoff-tester (SVANOVA™, SYMBIOTICS™) sammenlignet. SVANOVA™ er en indirekte ELISA-teknikk med bovint herpesvirus (BHV) som antigen, og ble modifisert ved å bruke kanin-anti-reinsdyr antistoffer som sekundær-antistoffer. SYMBIOTIC™ er basert på en blokkerings-teknikk med et glycoprotein (gB) fra BHV-1 som antigen. Plasmaprøver (n=154) fra fire geografisk atskilte reinbeitedistrikter ble testet. Fra tre av distriktene ble det tatt blodprøver ved slakteriene i Karasjok og Kautokeino (2004-2005), mens det fra det fjerde reinbeitedistriktet (Karasjok) ble tatt blodprøver fra levende dyr. I slaktehusmaterialet ble det funnet en seroprevalens på 35% hos kalver og ettåringer (n=49) og 83% hos voksne dyr (n=41).Vi fant en høyere seroprevalens hos hunndyr (59%; n=32) sammenlignet med hanndyr (55%; n=58). Samlet seroprevalens for de tre distriktene var 57% (n=90), og den varierte fra 50% til 63%. Resultatene viser en lavere seroprevalens hos unge dyr (kalver og ettåringer) sammenlignet med voksne, noe som er i samsvar med at alfaherpesvirus etablerer en livslang infeksjon. Seroprevalensen i prøvene tatt fra levende dyr (alle hunndyr) var 10% hos kalver (n=49) og 67% hos voksne (n=15), med en total seroprevalens på 23% (n=64). Den lavere seroprevalensen i denne flokken sammenlignet med slaktehusmaterialet kan skyldes at det blant livdyrene var relativt sett flere kalver og ungdyr. Bare tre dyr (2%) testet ulikt i de to testene. Begge testene var i stand til å påvise alfaherpesvius-antistoffer hos reinsdyr, men variasjonen på testresultatene mellom like prøver (duplikater) var mindre for SYMBIOTICS™. Den generelt høye forekomsten av antistoffer mot alfaherpesvirus kan indikere at viruset er endemisk hos reinsdyr i Finnmark og en videre undersøkelse av betydningen av slike infeksjoner er nødvendig.

Dette prosjektet har mottatt støtte fra Reindriftens utviklingsfond.

Referanser

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Can weight records as an indicator of body condition be improved?

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In reindeer herding the pasture is the limiting resource. As a part of herd and pasture range management it is necessary to regulate the reindeer population density according to available grazing resources. The objective of this study was to investigate the possibilities to improve precision in carcass records as indicator of animal condition.
Records from 705 reindeer slaughtered in the winter 2002/2003 was included in the study. The records received from the slaughterhouses included herding district, weight (W), fat and conformation classification according to the EUROP system and animal type (age class and sex) of the carcasses. In addition reproductive status of the females and three body size measures (back-, radius- and jaw length) were recorded. Two different indicators of body condition, W-V and W/V, were analyzed (V is volume).
Results show that calves give the best estimation of body condition. All three body size measures are correlated with weight and offer a possibility to improve the precision of the weight records by adjustments for body size.

Kan viktregistreringar som indikatorer för kroppskondition förbättras?

I rennäringen är betet den begränsade resursen. Som en del i förvaltningen av hjord och bete är det nödvändigt att anpassa renpopulationens täthet till tillgängliga betesresurser. Syftet med denna studie var att undersöka möjligheterna att öka precisionen i slaktkroppsdata som en indikator på djurens kondition.
Data från 705 renar slaktade under vintern 2002/2003 inkluderades i studien. Data från slakterierna innehöll samebytillhörighet, vikt (W), fett- och formklassning enligt EUROP-systemet och djurtyp (ålder och kön) för slaktkropparna. Utöver detta noterades reproduktiv status för vajorna samt tre kroppsmått (rygg-, radius- och käklängd). Två olika kroppskonditionsvariabler, W-V och W/V, analyserades (V är volym).
Resultaten visar att kalvar ger bäst skattning av djurens condition. Alla tre kroppsmåtten är korrelerade med vikt och ger möjlighet att öka precisionen i viktregistreringarna genom att justera för djurets storlek.

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