Lectures – Föredrag [1]

Lecturer (in italics) in alphabetical order. / I alfabetisk ordning efter talare (i kursiv). side/page

[1] Inbjudna talare i fet stil. / Invited speakers in bold.

Compensation for carnivore killed reindeer and lynx survey

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The compensation for predator-killed reindeer in Sweden is dependent on the number of predators in the reindeer management units (districts, villages). The quality of the survey of predator populations (lynx, wolverine, wolf, bear and golden eagle) will therefore be essential for the compensation system to function correct and just. Furthermore, the management of predators in both Sweden and Norway needs high quality survey to make informed management decisions (e.g. hunting quotas).
The aim with the survey is to find all lynx family groups and to accurately separate between different groups. The lynx survey in Sweden and Norway is performed in January and February by snow tracking. Tracks from two or more individuals are considered to be a lynx family group, i.e. an adult female with her offspring (9 months old).
In Sweden, one tries to separate between two neighbouring family groups by simultaneous tracking. When this is not possible, an alternative is to use the distance between two family groups. If this distance exceeds 25 km they should be considered two separate lynx family groups and compensation will be given accordingly.
In Norway, the number of lynx family groups in an area is estimated from the accumulated observations of such groups. The observations are grouped together into separate family groups using distance criteria. However, the use of the distance criteria might cause some misclassifications, i.e. one family group may be classified as two groups (over-estimation) or two neighbouring groups may be counted as one group (under-estimation). We used GPS-marked female lynx with kittens to estimate both errors.
The family groups are only a segment of the total lynx population and one multiplies the number of family groups by approximately 5.5 to 6 to get the total lynx population. However, there is large between-year variation in this factor due to differences in reproduction and survival of the kittens from birth to mid winter (Jan and Feb). Thus, the total adult lynx population might be the same even if the number of family groups has changed from one year to another. Such erroneous interferences may have large consequences for reindeer and carnivore management as the compensation is based on the number of family groups whereas losses might more closely correlate with the size of the total lynx population.

References

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Linnell, J.D.C., Odden, J., Andrén, H., Liberg, O., Andersen, R., Moa, P., Kvam, T., Brøseth, H., Segerström, P., Ahlqvist, P., Schmidt, K., Jedrejewski, W., Jędrezejewski, W., & Okarma, H. 2007. Distance rules for minimum counts of Eurasian lynx *Lynx lynx* family groups under different ecological conditions. – *Wildlife Biology* 13: 447-455.

Ersättning för rovdjursdödade renar och loinventering

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Ersättningssystemet för rovdjursdödade renar i Sverige bygger på antalet rovdjur i en sameby. Kvalitén på inventeringarna av rovdjurspopulationerna (lodjur, järv, varg, björn och kungsörn) är därför avgörande för att ersättningssystemet ska vara rättvist. Dessutom behöver rovdjursförvaltningen i både Sverige och Norge inventeringar av hög kvalité för att kunna ta välgrundade förvaltningsbeslut (t.ex. jakttilldelning).
Målsättningen med loinventeringen är att hitta alla lodjursfamiljegrupper och att särskilja närliggande familjegrupper. Loinventeringen i Sverige och Norge genomförs i januari och februari med hjälp av snöspårning. Spår från två eller fler individer tillsammans tolkas som en familjegrupp, d.v.s. en vuxen hona med sina ungar (9 månader gamla).
I Sverige är målet att särskilja närliggande lofamiljegrupper med hjälp av detaljerad snöspåring. Om detta inte har varit möjligt kan man använda avståndet mellan två familjegrupper. Om detta avstånd är mer än 25 km ska familjegrupperna klassificeras som två olika och ersättning ska utgå för båda grupperna.
I Norge beräknar man antalet lofamiljegrupper utifrån ackummulerade observation av familjegrupper. Efter inventeringen sammanställer man alla observation och särskiljningen mellan olika lo-familjegrupper bygger på avståndskriterier. Men avståndskriterier kan leda till felbedömningar, d.v.s. en familjegrupp kan klassas som två (överskattning) eller två närliggande familjegrupper kan klassas som en (underskattning). Vi har studerat GPS-märkta lodjurshonr med ungar för att beräkna dessa både felen.
Familjegrupper utgör bara ett segment av den totala lopopulationen och man ska multiplicera antalet familjegrupper med ungefär 5,5 till 6 för att få fram den totala lopopulationen. Men det finns en stor mellanårsvariation i denna faktor beroende på skillnader i reproduktion och ungarnas överlevnad från födseln till vintern (januari - februari). Den totala vuxna lopopulationen kan vara ungefär densamma även om antalet familjegrupper har förändrats från ett år till nästa. Denna mellanårsvariation har stor betydelse för renskötseln och rovdjursförvaltningen eftersom ersättningssystemet bygger på antal familjegrupper medan förlusterna troligen är bättre relaterat till storleken på den totala lopopulationen.

Litteratur

Andrén, H., Linnell, J.D.C., Liberg, O., Ahlqvist, P., Andersen, R., Danell, A., Franzén, R., Kvam, T., Odden, J., & Segerström, P. 2002. Estimating total lynx (*Lynx lynx*) population size from censuses of family groups. – *Wildlife Biology* 8: 299-306.

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Genetic profile of domestic reindeer of northern Fennoscandia through a century

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Reindeer has been kept as a domesticated animal for several hundred years in northern Fennoscandia, and traditional Sami reindeer herding has been based on seasonal migrations independent of national boundaries. However, the national borders between the Nordic countries and Russia were closed in the 19th century, restricting the seasonal movements and interactions within the region. To address the effect of hindering migrations and genetic exchange between countries within the Sami areas, we examined the genetic composition of northern Fennoscandian reindeer collected in the years 1909 to 1911 and compared with the genetic constitution of contemporary reindeer from the same areas. Mitochondrial control region sequence data shows that northern Fennoscandian domestic reindeer was a homogenous population a hundred years ago with little differentiation among the countries. The genetic profile of reindeer from Finnmark has changed little within a hundred years. On the other hand, anthropogenic activity of effectively ending genetic exchange within this region has changed the genetic constitution of contemporary Russian Kola reindeer, making it more prone for eastern influence.

Genetisk profil av tamrein fra nordlige Fennoskandia gjennom et århundre

Tamreindrift har eksistert i flere århundrer i det nordlige Fennoskandia, og tradisjonelt samisk reinsdyrhold er basert på sesongmessige vandringer uavhengig av nasjonale grenser. Da grensene mellom de nordiske land og Russland ble stengt på 1800-tallet, ble de sesongmessige trekkrutene og interaksjoner over landegrenser innen regionen svært begrenset. For å undersøke virkningen av en effektiv stopper av det tradisjonelle trekkmønsteret og hindring i genetisk utveksling mellom landene innen de samiske områdene, undersøkte vi den genetiske sammensetningen av nordlige Fennoskandiske reinsdyr innsamlet i årene fra 1909 til 1911, og sammenliknet den med den genetiske sammensetningen av reinsdyr fra de samme områdene i dag. Sekvensdata fra den mitokondrielle kontrollregionen viser at tamrein fra Nordkalotten var en homogen bestand for hundre år siden, med liten differensiering mellom land. Den genetiske profilen av reinsdyr fra Finnmark har forandret seg lite i løpet av hundre år. På Kolahalvøya er situasjonen derimot en annen, hvor menneskelig aktivitet effektivt har satt en stopper for genetisk utveksling innen regionen, endret den genetiske sammensetningen av dagens reinsdyr, og gjort den mer tilgjengelig for østlig innflytelse.

Dialog as a tool in conflict resolution

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The lecture will present the experiences from the use of dialog as a tool for communication in heavily divided communities, often with strong territorial disputes. Dialog focus more on the understanding of the conflict, and the relation between the parties in the conflict than on the solution itself.
Traditional conflict resolutions focus on conflicting values and interests, or the struggle over resources, power and territorial integrity. Although these are all important; the dialog approach focus more heavily on the perception/description of reality and the propaganda war as it is carried out in the homes, schools, media and political life.
This means that a strong dialog component in the meditation and negotiation processes will increase the chances of finding sustainable solutions. Nansen Dialog has visible results in the Balkans and Middle East and argues that dialog is often a neglected component in conflict resolution. The lecture will answer the questions; What is Nansen dialogue? When does it work? How does it work? For whom does it work?

The effect of large (300 and 420 kV) power lines on free-ranging, migratory and herded reindeer

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Numerous power lines transverse reindeer habitat throughout Scandinavia and their number and size in terms of voltage passing through them as well as their physical appearance are increasing. Reindeer may be disturbed by power lines and as a result, alter their feeding behaviour, range use, and large scale (migratory) or small scale (within season) movement patterns. Reindeer can also habituate towards power lines in the absence of negative interactions with power lines over time. However, when roads, houses/cabins or new, additional parallel power lines are introduced together with existing power lines, a cumulative effect of the combined infrastructure may cause even greater disturbance towards the reindeer than the existence of the one power line or single other disturbance factor would have done if they were not located in close vicinity to each other. This theory of "cumulative impacts", defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" and the presumed amplified negativity towards reindeer has never been thoroughly or experimentally tested.
We studied the interactions of free-ranging, migratory and herded semi-domestic reindeer while crossing under or using the area adjacent to a 300 kV power line. Using collars with GPS and GSM technology, we collected the positions of up to 22 female reindeer every 15 minutes while near the power line from October 2007 and until the present. On a relatively small scale (within 1 km), we tested the rate (speed and direction over time) between eight consecutive positions in conjuncture with crossing beneath the power line; four before the crossing and four after the reindeer crossed the power line. We also compared these to an equal number of eight consecutive positions randomly chosen from control areas at various increasing distances away from the power line and controlled for important environmental variables such as elevation. At a larger geographical scale, we also tested the success of migratory movements and herding attempts by the reindeer herdsmen while shifting between the herd's winter and summer ranges and round-ups in the area adjacent to the power line. During summer 2008, a new 420 kV power line was constructed along the same corridor as the existing 300 kV power line. Data will be gathered until 2012. We can then experimentally test on a large, free ranging scale the cumulative affects of the two power lines together before and after the original 300 kV power line is removed in 2010.

Effekten av store kraftledninger (300 og 420 kV) på atferd hos tamrein

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Som et resultat av økende energibehov bygges stadig flere kraftledninger i hele Skandinavia og mange av disse går på tvers av reinsdyrhabitater. I tillegg til et økende antall traséer, brukes nå høyere spenning og større master. Kraftledninger kan virke forstyrrende på reinsdyr, og effekten kan man se som endringer i reinens bevegelsesmønster (stor skala: migrasjon mellom sesongbeiter, og liten skala: innen sesongbeitet), beiteatferd og områdebruk. Man kan også se habitueringseffekter hos reinsdyr dersom ingen negative interaksjoner oppstår i forbindelse med kraftledningene over tid. Imidlertid bygges ofte veger, hus, hytter eller nye parallelle kraftledninger i forbindelse med krafttraséer. Slike inngrep vil sammen kunne gi en kumulativ effekt, der summen av forstyrrelse på reinsdyr blir større enn om hvert enkelt inngrep hadde forekommet alene. Teorien om kumulative effekter defineres slik: ”Påvirkning av miljøet som kommer fra trinnvis økning av handling når den summeres med andre tidligere, nåværende og nært forestående handlinger.” Den antatt forhøyede effekt av flere forstyrrelsesfaktorer har ikke tidligere blitt grundig eller eksperimentelt testet.
Vi har studert interaksjoner hos tamrein som går fritt og migrerer mellom sesongbeiter, samtidig som at arealbruken til en viss grad styres av reineierne ved gjeting/driving. Vårt fokus har vært atferd ved kryssing under en 300 kV kraftledning, samt atferd ved bruk av områder nær denne. Ved bruk av halsbånd med GPS og GSM-teknologi ble geografiske posisjoner fra opptil 22 simlers lagret hvert 15 minutt, fra oktober 2007 til oktober 2008. På en relativt liten skala testet vi fart og retningsstabilitet ved kryssing under kraftledning. Ved å måle avstand mellom åtte påfølgende posisjoner, hvorav fire før og fire etter kryssing av kraftledning, fikk vi et godt mål på eventuelle endringer i bevegelseshastighet. For sammenligning valgte vi tilfeldig åtte punkter tilsvarende, i områder med ulik avstand fra kraftledningen. Vi kontrollerte disse for viktige uavhengige variabler, så som høyde over havet. På en større geografisk skala testet vi for suksess for migrasjon og drivingsforsøk gjort av reineierene ved flytting mellom vinter- og sommerbeiter og til reingjerder nær kraftledning. Sommeren 2008 ble anleggsarbeid for en ny 420 kV ledning som plasseres omtrent parallelt med eksisterende 300 kV ledning. Data for dette prosjektet skal samles inn hele året til og med år 2012. Dette materialet skal så brukes til eksperimentelle tester på stor skala for å studere kumulative effekter av de to kraftledningene sammen, både før og etter at den originale 300 kV kraftledningen skal fjernes i år 2010.

Wild predators but tame prey – consequences of large predators on reindeer industry

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The wild large predator populations in northern Fennoscandia have domesticated animals as key preys, whereof the semi-domesticated reindeer is the calculated main prey. Particularly in Sweden, the depredation is the single largest threat to the reindeer industry and hits it at several levels. The conditions of the reindeer industry in relation to the predators have received very limited attention in scientific as well as management contexts. Assessments of the extent of the depredation using a precautionary principle from the prey population's point of view indicate direct yearly losses of 45 000 to 50 000 reindeer in Sweden, approx. 20 000 in Norway and about 10 000 in Finland. This is equivalent to about 20% of the winter stock in Sweden, 8% in Norway and 5% in Finland.

The difference between using a domesticated prey population instead of wild prey as resource base for wild predators is fundamental. Domesticated stock, including reindeer, is a naïve prey as a result of the domestication process, and therefore more exposed and vulnerable than wild prey. Furthermore the domesticated animals are components in optimised production systems with important economic, social and cultural roles in human systems. In a well-functioning reindeer husbandry, the production consequence in terms of harvested numbers is around 1.7 times the number of killed animals. This is due to dynamic effects in an optimised herd, and even larger if nutritional consequences, resulting in worsen body condition and lower production, and hampered selection and culling possibilities are included. In addition to the direct and dynamic losses in the reindeer herd, the presence of predators makes the use and management of available grazing resources less efficient. Operationally, the occurrence of predators leads to worsened control of the animals on range, reduced predictability, increased unpaid labour inputs and operating costs, and difficulties to handle the animals.

Economically, reindeer husbandry is very vulnerable for predation due to the low turn over and limited business margins of the system, resembling what is common in "wild" systems. The decreased production also worsens the market price for reindeer products due to lower range, decreases the profitability in the processing industry and reduces the employment in the processing sector of the industry.

The social consequences are devastating due to traumatic experiences at meeting killed, wounded and disabled animal in the range, strong feelings of insecurity, uneasiness, distrust and powerlessness, as well as amplified conflicts with the surrounding world. An extremely serious consequence of the economic and social strains is the evident increase in mental illness during recent years especially among young people in the herder societies. The likely long-term consequence of this situation is that the profession as active reindeer herder becomes less attractive and the industry gets difficulties in recruiting young people to become herders.

The current depredation situation especially in Sweden, together with the strains caused by all other difficulties for the reindeer industry, seems to be almost a textbook case for a social-ecological system rapidly approaching a resilience collapse. Scientists have a key responsibility to illuminate this danger for the society.

Vilda predatorer men tama bytesdjur – konsekvenser av stora rovdjur på rennäring

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De vilda stora rovdjuren i norra Fennoskandien har tamdjur som sin främsta kalkylerade födoresurs, varav tamrenarna svarar för huvudparten. I synnerhet för svenskt vidkommande är rovdjuren det enskilt största akuta hotet mot rennäringen och drabbar näringen på flera plan. Rennäringens situation i relation till rovdjuren är lite uppmärksammad såväl forskningsmässigt som i förvaltningssammanhang. En skattning av predationens omfattning enligt en försiktighetsprincip med utgångspunkt i renskötseln tyder på predationsnivåer på mellan 45 000 och 50 000 renar i Sverige, ca 20 000 i Norge och ca 10 000 i Finland. Detta motsvarar ca 20% av vinterstammen under senaste åren i Sverige, 8% i Norge och 5% i Finland.
Skillnaderna mellan att basera rovdjurspolitiken på tama i stället för vilda bytesdjurspopulationer är fundamental. Tamdjur inklusive renar är naiva byten p.g.a. domesticeringen och därmed mer utsatta för rovdjursangrepp än vilda bytesdjur. De ingår dessutom i optimerade produktionssystem med viktiga ekonomiska, sociala och kulturella roller i mänskliga system. I en väl fungerande renskötsel är produktionskonsekvenserna i form av minskad slakt ca 1,7 ggr större än själva predationen p.g.a. dynamiska effekter i en optimerad renhjord, och ytterligare större om även nutritionella effekter med försämrad kondition och produktion som följd och minskat urvals- och gallringsutrymme beaktas. Utöver de direkta och dynamiska förlusterna i renhjorden gör rovdjursnärvaron också utnyttjandet och förvaltningen av tillgängliga betesresurser mindre effektiv. Driftsmässigt leder rovdjursnärvaro till försämrad kontroll över djurens betesgång, minskad förutsägbarhet, ökade obetalda arbetsinsatser och driftskostnader och svårigheter att hantera djuren.
Ekonomiskt drabbas renskötseln mycket hårt genom den inneboende låga omsättningen och begränsade ekonomiska marginalerna, liknande det som är typiskt för ”vilda” system. Den lägre produktionsvolymen leder också till ett sämre marknadsläge genom lägre utbud och ger samtidigt mindre intjäning och lägre sysselsättning i förädlingsledet.
De sociala konsekvenserna är betydande till följd av traumatiska upplevelser vid möten med dödade, skadade och lemlästade djur, starka känslor av otrygghet, olust, misstroende och vanmakt, liksom ökade konflikter med omvärlden. En ytterst allvarlig konsekvens av påfrestningarna är de påtagliga bevisen på ökad mental ohälsa under senare år i synnerhet bland unga människor i renskötarleden. De sannolika långsiktiga konsekvenserna av denna situation är att renskötaryrket blir mindre attraktivt och näringen får svårigheter vid generationsväxlingar och nyrekrytering av unga till näringen.
Nuvarande rovdjurssitution särskilt i Sverige, tillsammans med alla övriga svårigheter rennäringen möter i dag, framstår som ett skolexempel på ett socialt-ekologiskt system som snabbt närmar sig ett resilienssammanbrott. Forskningen har en nyckelroll när det gäller att tydliggöra situationens allvar för omvärlden.

Economic consequences of the large predators for the reindeer industry in Sweden

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Based on a precautionary projection of the depredation pressure on reindeer husbandry in Sweden (47 500 killed reindeer/year: Danell & Danell, this conference), the consequences for the productivity and the economy of the reindeer industry were projected with different harvest strategies, herd compositions and numbers of reindeer in winter stock. Three harvest strategies were used: a maximised calf harvest strategy (K), a combined calf and adult male harvest strategy (KS), and a harvest strategy without selection on animal type (U). In the K strategy, which aims at maximising the productivity per head in the winter stock, the proportion of females was set to 0.9. In the KS strategy, which gave opportunities for production of adult males for slaughter while maximising calf slaughter on the female side, the proportion of females was 0.65. The same female proportion was used in the U strategy, which has similarities with traditional harvesting strategies.
The three strategies were compared at three population sizes: the recent approx. 260 000 reindeer in winter stock, the long term mean of 225 000 reindeer, and 200 000 reindeer under which the reindeer number periodically has gone. Economic assessments in the husbandry section were based on 40 SEK/kg carcass (currently 55 SEK/kg) plus official subsidies of 14 and 8.50 SEK/kg calf and adult carcasses, respectively, the current 56 MSEK in predator compensation, and 346 SEK/reindeer in running expenses in all alternatives (although likely lower without predators than with predators). The market price of reindeer meat products was set to 90 SEK/kg processed carcasses in alternatives without depredation, and 80 SEK/kg in alternatives with depredation (currently both likely 15 SEK higher). The running costs excluding labour were set to 10 SEK/kg processed carcasses.
Without depredation the three harvest strategies K, KS, and U resulted in 3744 to 3242, 3169 to 2717 and 2763 to 2410 tons of processed carcasses, respectively, in the range from 260 000 to 200 000 reindeer. Using the mean carcass price, the economic results in the production sector were projected to between106 and 101 MSEK with the K strategy, and near 70% and 50% of this with the KS and U strategies, respectively. Using the mean carcass and market prices, the results in the processing industry were projected to between 150 and 130 MSEK with the K strategy and 84% and 75% of that with the two other harvest strategies, respectively. In total without predation, the results in the reindeer industry amounted to 256 to 231 MSEK in the K strategy, and 78% to 61% of that with the KS and U strategies.
The depredation reduced the carcass production with 52% to 63% with the K strategy. The economic results in the production part (incl. 56 MSEK in predator compensations) decreased to between 60 and 43 MSEK (-43% to -52%) and between 54 and 36 MSEK in the processing industry (-64% to -72 %). The reductions with the KS and U strategies were slightly lower in relative terms, due to the lower productivity of these strategies.
With the KS and U strategies the reindeer stock was near collapse with 225 000 reindeer in winter stock, shown by a very low surplus of female calves. They collapsed at 219 000 and 207 000 reindeer, respectively. With the K strategy, the collapse appeared at slightly more than 190 000 reindeer.
The conclusion is that the reindeer industry is very close to a collapse both biologically and economically with the current depredation pressure. Collapses are locally at risk already with the depredation level projected here at occasional decreases of reindeer numbers (unfavourable years, enterprises becoming bankrupt, etc.) and/or continued increase of the depredation pressure. Since local collapses decrease the number of reindeer, they may rapidly propagate. The current Swedish predator policy is, without any doubts, an extremely serious treat for the reindeer industry.

Ekonomiska konsekvenser av de stora rovdjuren för rennäringen i Sverige

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Baserat på en skattning av nuvarande predationstryck på rennäringen i Sverige utifrån en försiktighetsprincip sett ur bytespopulationens synpunkt (47 500 renar/år: Danell & Danell, denna konferens) beräknades produktionsmässiga och ekonomiska konsekvenser i rennäringen vid olika slaktstrategier, hjordstrukturer och renantal i vinterstammen. Slaktstrategierna var maximerad kalvslakt (K), ett kombinerat kalv- och sarvslaktalternativ (KS) och ett slaktalternativ utan selektion på djurtyp i slaktuttaget (U). I K-strategin, som maximerade produktiviteten per ren i vinterhjorden, var hondjursandelen i vinterhjorden 90%. I KS-strategin, som gav utrymme för produktion av sarvar till slakt jämsides med en maximal kalvslakt på hondjursidan, och i U-strategin, som har viss likhet med traditionella slaktuttagsformer, var hondjursandelen 65%.
Alternativen jämfördes på tre olika djurantalsnivåer: de senste årens ca 260 000 renar i vinterstam, långtidsmedelvärdet 225 000 renar samt nivån 200 000 renar som periodvis har understigits. Ekonomiska kalkyler i produktionsledet baserades på medelpriset 40 SEK/kg slaktkropp (aktuellt pris är 55 SEK/kg) plus statliga pristillägg om 14 och 8,50 SEK/kg slaktkropp för kalvar resp. vuxna, nuvarande rovdjursersättning om totalt 56 MSEK/år, samt 346 SEK i driftskostnad per ren (i verkligheten troligen lägre utan rovdjur än med rovdjur). I förädlingsledet användes medelpriset 90 SEK/kg förädlad slaktkropp i alternativ utan predation och 80 SEK/kg vid predation (aktuella priser torde vara ca 15 SEK/kg högre), samt produktionskostnader exkl. arbete om 10 SEK/kg förädlad slaktkropp.
Utan predation resulterade de tre uttagsstrategierna K, KS och U i mellan 3744 och 3242, 3169 och 2717 resp. 2763 och 2410 ton slaktkropp i spannet från 260 000 till 200 000 renar. Resultaten i produktionsledet baserat på medelpriset beräknades ligga mellan 106 och 101 MSEK i K-strategin och nära 70% resp. nära 50% av detta i KS- och U-strategierna. I förädlingsledet blev resultaten 150 till 130 MSEK i K-strategin och 84% resp. 74% av detta i de två andra slaktstrategierna. Sammantaget för branschen blev de potentiella resultaten mellan 256 och 231 MSEK i K-strategin och mellan 78% och 61% av detta för KS- och U-strategierna.
Predationen (47 500 dödade renar) reducerade den producerade mängden slaktkropp med 52% till 63% i K-strategin. De ekonomiska resultaten (inkl. rovdjursersättningar) minskade i produktionsledet till mellan 60 och 43 MSEK och i förädlingsledet till mellan 54 och 36 MSEK. Sammantaget minskade resultatet i branschen således till mellan 115 och 84 MSEK. I KS- och U-strategierna var sänkningarna relativt sett något mindre beroende på att produktionsformerna i sig var mindre produktiva.
KS- och U-strategier låg dock nära kollaps vid 225 000 renar till följd av predationen, vilket framgick av mycket låga överskott av honkalvar till slakt. De kollapsade vid 219 000 resp. 207 000 renar då predationen svarade mot 22% resp. 23% av vinterstammen.. I K-strategin var brytpunkten för kollaps strax över 190 000 renar då predation utgjorde 24,6% av vinterstammen.
Slutsatsen är att situationen i rennäringen är ytterst nära kollaps både biologiskt och ekonomiskt vid nuvarande rovdjurstryck. Kollapser riskerar att utlösas lokalt redan vid det predationstryck som förutsatts gälla här i samband med nedgångar i renantal (dåliga år, konkurser e.d.) och/eller vid fortsatt ökning av predationstrycket. Eftersom lokala kollapser sänker renantalet ytterligare kan de snabbt sprida sig. Tveklöst är den nuvarande rovdjurspolitiken ett ytterst allvarligt hot för rennäringen.

Females' spatial organization during rut

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Considering the economical importance of reindeer herding and maximizing meat production, emphasis should be put on an appropriate herd structure. Manipulations of population size, sex ratio and age structure may influence females' distribution and social organization during rut and the degree of polygyny. Matrilineal organization, as seen in many gregarious ungulates, may increase the chance that closely related females being fertilized by the same male and increase the herd's inbreeding vulnerability. Given no active inbreeding avoidance mechanisms in reindeer this may induce reduced genetic heterogeneity and fitness of animals. Furthermore, the availability of males may affect the reindeer females' association and distribution during the rut: the presence of prime-aged males may lead to females being less dispersed; less harassed by younger males and hence might increase the probability of more synchronous rut. This, in turn, may influence the pregnancy rates and calving dates. The aim of this study was to determine if reindeer females are organized in matrilines during rut and the effects of male age on these bonds. Further, we examined if female age as well as the phenology of the rut influenced the females' association.

The study was conducted at the Kutuharju Field Reindeer Research Station, in Kamaanen, Northern Finland. During the rutting season the composition of the male segment of herds was manipulated with three 4.5 year old male in 1999, and 3 1.5 year old males in 2000; the female segment, with known pedigree, was kept similar between treatments (1999: 75 females; 2000: 74). The males were radio collared. During the rut (from the 25th September to the end of October) the males were located daily and the females' associated with them recorded. The association index was calculated based on the frequency with which each dyad was observed within the same groups. We used GENMOD procedure to asses the effects of matriline and treatment on association.

The association between female reindeer during rut was higher among closely related individuals (mothers and daughters, half sisters, aunt / niece and grandmother / granddaughter) as compared to non-related individuals, indicating the existence of matriline organization in reindeer. Further, the association was higher when exposed to three young males as compared to three adult males and in post rut than in pre-, and toprut. Among the closely related individuals the mother-daughter associated more than the other related individuals. Neither effect of phenology of the rut nor effect of male segment was found. Among mother-daughter relationships there was no effect of age on the association and these bonds didn't weaken with time. The size of the mating groups varied throughout the rut, being highest in the toprut in 1999 and postrut during 2000. There was no significant difference in group size during rut between the two years.

The effect of matriline, being highest among mother-daughter, does not necessarily pose inbreeding problems since matriline females are moving between groups and will be exposed to different males at the time of oestrus. This was confirmed by the fact that only a few mothers and daughters were sired by the same male.

Simlenes organisering og romlige fordeling under brunst

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Flokkstrukturen er avgjørende for økonomien i reindrifta. Samtidig vil flokkens størrelse, dens kjønns- og alderssammensetning påvirke simlenes fordeling og organisering under brunsten og bukkenes reproduktive suksess. Hos mange flokklevende klauvdyr er hunndyrene organisert langs morslinjer. Dersom dette er tilfelle også hos rein, vil sjansen øke for at nært beslekta simler bedekkes av samme bukk og kan gjøre flokken sårbar for innavl. Det er ikke observert aktive mekanismer for å unngå innavl hos rein – dette vil forsterke muligheten for reduksjon i genetiske variasjon og redusert "fitness". Videre vil tilgjengeligheten av bukker under brusten kunne påvirke simlenes organisering og fordeling: er det mange storbukker i flokken, kan dette føre til at simlene holder seg mer samla og blir mindre forstyrra av småbukker. Dette kan øke sjansen for en synkron kalving, en høgere drektighetsprosent og påvirke kalvingstidspunktet.

Målet med studiet var å bestemme om simlene er organisert langs morslinjer under brunsten og om bukkenes alder påvirker denne organiseringen. Videre undersøkte vi om simlenes alder og brunstperiode (før-, topp- og etterbrunst) påvirker organiseringen. Studiet ble gjennomført i Paliskuntain yhdistys sin forsøksflokk i Kutuharju, Kaamanen, Finland. Vi manipulerte med sammensetningen av bukkesegmentet under brunsten i 1999 (tre storbukker; 4,5 år) og i 2000 (tre småbukker; 1,5 år), mens tallet på simler (med kjent avstamning) ble holdt konstant; henholdsvis 75 og 74. Bukkene ble market med radiosendere. Under brunsten ble disse lokalisert daglig og simlene rundt dem identifisert. En assosiasjonsindeks for hvert simle-simle par ble kalkulert basert på antall ganger de var observert sammen og hver for seg. Vi brukte GENMOD prosedyren i SAS for å undersøke slektskap langs morslinjer og om alder på bukkene påvirket assosiasjonsindeksen mellom simlene.

Assosiasjonen var høyere mellom nært beslekta simler (mødre-døtre, halvsøstre, tanter-nieser og bestemødre-døtredøtre) sammenlignet med mindre beslekta simlepar, noe som tyder på at simlene er delvis organisert langs morslinjer. Videre var assosiasjonsindeksen blant simler generelt høyere ved eksponering til bare småbukker under brunsten sammenlignet med bare storbukker og under etterbrusten sammenlignet med under før- og toppbrusten. Blant nært beslekta simlepar var det ingen effekt av brunstperiode eller alder på bukkene. Mødre-døtre hadde en høyere assosiasjonsindeks sammenlignet med andre nært beslekta simlepar. Blant mødre-døtre parene var det ingen effekt av mødrenes alder, og båndet mellom dem svekket seg ikke over tid. Størrelsen på haremsgruppene varierte gjennom brunsten og var størst under toppbrunsten i 1999 og under etterbrunsten i 2000. Det var ingen forskjell i haremstørrelse mellom de to bukkesegmentene (storbukk *vs*. småbukk).

Effekten av morslinjer, mest markert blant mødre-døtre, trenger ikke nødvendigvis å føre til innavl siden simlene beveger seg mellom haremsgrupper kontrollert av ulike bukker under brunst og er derfor eksponert til ulike bukker under eggløsningen. Dette bekreftes også av at få mødre-døtre par ble bedekka av samme bukk.

Do windmill parks affect the range use of free ranging semi-domestic reindeer?

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Nowadays, there is a rapid increase in the development of large scale wind power plants in Scandinavia. Construction of a wind power plant area entails a relatively wide spread infrastructure of internal roads, buildings and high towers with continuously moving parts visible and audible from distances of many kilometres. Reindeer move over large areas for grazing, and usually with seasonal shifts. Between season and large scale range use, semi-domestic reindeer is, in a practical manner, most often controlled by their respective herdsmen. However, within season and small scale to medium areas (1 km^2 to 50+ km^2), range use is less influenced by herdsmen and mostly controlled by a number of environmental variables such as pasture properties, weather, and harassment by parasitic insects, etc. Small to medium scale range use can be negatively influenced by disturbances leading to avoidance or aversion towards anthropogenic infrastructure such as windmills and other human constructions and activities. The aversion and/or avoidance of certain pastures can lead to less optimal range use, overgrazing, complications with herding, increased costs and reduced production. Habituation is also possible, and varying degrees of avoidance and habituation may change over time.
We tested the effect of the Kjøllefjord wind power plant, opened in 2006 on the Dyfjord peninsula in Finnmark county, on reindeers' area use. The study aimed at testing area use while reindeer were on their summer range and at the small to medium geographical scale of approximately 1 km^2 to 50 km^2. Reindeer positions in the study area were registered through direct observations. Additional variables were year, within season periods (post calving, summer, and autumn), group size, behaviour of individuals in a group, vegetation type and per cent cover, weather and herding activities. Fieldwork was conducted over approximately one week once a month from late May and until September/ October from September 2005 to September 2008. The study area composed of the Dyfjord peninsula (the wind power plant test area) and three control areas also within the herd's summer range; Skjøtningberg peninsula (since September 2005), Blåfjell (since summer 2006), and the area west of highway 888 and north of highway 894 (since summer 2007). The reindeer positions were imported to ArcGIS for precise calculations of elevation, vegetation types and distance to human infrastructure. To compliment the reindeer position data, we also conducted faeces counts at the end of each season along transects throughout the study area. We assumed that the distribution and total number of faeces sampled in the study area represented a reliable, relative measure of the number of individual reindeer in each area in total for the entire season for each year. The area within and surrounding the windmill park was used by reindeer in all years.
According to the faeces counts, more reindeer used the test area in the following years (2006, 2007, and 2008) after construction of the windmill park compared to the year construction began (autumn 2005). Also, according to directs observations, the wind power plant test area (Dyfjord peninsula) was used equally or more by reindeers within years compared to the control areas. In the summer of 2008, the internal road was used considerably by reindeer, especially during days with insect harassment. Detailed analyses are underway, but there are presently few indications of strong avoidance or aversion towards the Kjøllefjord wind power plant, the Dyfjord peninsula by reindeer at the scale of our study. At a larger scale encompassing the entire summer range of this herd, herding activities, fencing, round-ups, spring arrival and autumn departure from the area were clearly overriding factors for the reindeers' range use.

Påvirker vindmølleparker tamreinens områdebruk?

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Det er i dag en rask økning i utviklingen av vindmølleparker i Skandinavia. Utbygging av områder med vindmøller medfører relativt mye infrastruktur, så som veier og bygninger, og vindmøllene selv er høye med bevegelige deler med en diameter på flere titalls meter. Disse synes og høres ofte på flere kilometers avstand. Reinsdyrenes naturlige atferd er migratorisk, de forflytter seg over store områder for å finne beite, og dette styres av blant annet sesongvariasjoner. For tamrein er mellom-sesong-trekk og storskalabruk av områder i dag i praksis styrt av reineierne. Imidlertid er områdebruk innen sesongen og for liten til middels skala (1 km^2 til 50+ km^2) mindre påvirket av reineieren og styres i hovedsak av flere miljøfaktorer. Dette kan være beitekvalitet, værforhold, insektsforstyrrelse etc. Liten til middels skalaområdebruk kan bli negativt påvirket av forstyrrelser, noe som kan medføre unngåelse av områder med infrastruktur og menneskelig ferdsel. Unngåelse av visse beiteområder kan gi mindre optimal områdebruk, med overbeite, problemer for reineierenes driving av flokkene, økte økonomiske og energetiske kostnader og redusert produksjon som negative konsekvenser. Det kan også tenkes at dyrene over tid vil vise en viss tilvenning til vindmølleparken og graden av unngåelse og tilvenning kan variere over tid.

Vi har her testet effekten av Kjøllefjord vindmøllepark,(Dyfjordhalvøya, Finnmark, åpnet i 2006) på tamreins områdebruk. Siden storskala og mellom-sesong-trekk områdebruk styres av reineierne, konsentrerte vi vår studie på test av områdebruk på sommerbeitet og på en liten til medium geografisk skala (ca 1 km^2 til 50 km^2). Ved direkte observasjon ute i felt ble reinens posisjoner kartlagt. Variabler som år, innen-sesong-perioder (”etter kalving”, ”sommer” og ”høst”), gruppestørrelse, atferd hos gruppens individer, vegetasjonstype og -dekke, vær og gjetingsaktivitet inngikk også i registreringen. Feltstudiet ble gjennomført i en uke en gang per måned fra mai til september/oktober hvert år, med første feltperiode september 2005 og siste feltperiode september 2008. Studieområdet besto av Dyfjordhalvøya, hvor vindmølleparken er lokalisert, og tre kontrollområder; Skjøtningberhalvøya, Blåfjell og området vest for riksvei 888 og nord for riksvei 894. Registrerte posisjoner for reinsdyr ble importert til ArcMap 9.2 og analysert for høyde over havet, vegetasjonstyper og avstand til infrastruktur. Som støtte til direkte observasjoner av reinsdyr ble det gjort feaces-tellinger ved slutten av hver feltsesong langs transekter gjennom studieområdene. Vi antok at fordeling og summen av registrert faeces i studieområdet ga et representativt, relativt mål på totalt antall rein som hadde brukt hvert studieområde hele sesongen for hvert enkelt år. Området i og rundt vindmølleparken ble brukt av reinsdyr hvert år.

Faeces tellingene viste at flere reinsdyr brukte områdene i årene etter at bygging av vindmølleparken var startet (2006, 2007 og 2008) enn i det året anleggsvirksomheten startet opp (2005). I tillegg har de direkte observasjonene vist at testområdet (Dyfjordhalvøya) totalt sett har blitt like mye eller mer brukt innenfor de enkelte år sammenlignet med kontrollområdene. Sommeren 2008 viste det seg at veiene i vindmølleområdet ble hyppig brukt av reinsdyr, særlig på dager med store insektsplager. Mer detaljerte analyser kommer, men vi ser ut fra foreløpige analyser få indikasjoner på unnvikelseseffekter fra Kjøllefjord vindmøllepark eller nærliggende områder for reinsdyrene med den skala vår studie hadde. På en større skala hvor hele sommerbeitet til reinflokken inngikk var variabler som drivinger, inngjerding, tidspunkt for ankomst til sommerbeite og flytting fra sommerbeite de styrende faktorer for reinenes områdebruk.

Evaluation of preventive efforts against loss of reindeer to predators in Norway

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During the period 2003-2007, between 25% and 37% (28 000 to 51 000 no. of calves) of the reindeer calves have been reported lost from spring to autumn in Norway. The most important factors were carnivore depredation, illness and nourishment failure. The reindeer herders report that protected carnivores caused the loss of about 75% to 90% of the total loss of calves. In Norway, the County Governors have financed the following preventive measures:
-Extraordinary supervision during the calving season. -Fences/intensive herding in other periods than the calving season. -Supplementary feeding. -Extraordinary moving/transportation of the reindeer heard. The County Governors have also granted financing for measures directed toward carnivores (Permitted hunting on harmful individuals, guidance in how to hunt for carnivores, registration of populations, bounty for registration of younglings). These measures can reduce the losses as well as the conflicts:
Through surveys, meetings, in depth interviews, and the applications and reports on preventive measures from the different reindeer herding *siidas* (herding groups) in Norway during the period 1990-2006, broad information have been gathered. The preventive measures are evaluated on their effectiveness regarding protection towards carnivores, animal welfare and resources required. However, one also has to take into account the strong tradition reindeer herding has within the Sami culture.
Suggestions directed toward the reindeer herding are: -Preventive measures distributed throughout the whole of the year. -Economic compensation for reduced breeding abilities. -Guidance in supplementary feeding. -Better search for carcasses. -Use of GPS tracking device to enhance the supervision. -Adjusted reindeer stock to the grazing area.
Suggestions directed toward research and management are: -Cooperation across borders between Norwegian counties and the Nordic countries. -Extended period of application for economical compensation of losses due to carnivore depredation. -Simplified application process and more effective application management. -Enhanced registration of populations. -Enhanced quality of projects and preventive measures, and use of the competence from the reindeer herders.
Suggestions directed toward carnivores are: -Decreasing the carnivore population and prioritized hunting of especially harmful individuals. -An even distribution of carnivores within the managed areas/a removal of the zone system. -Calving areas free form carnivores.

Conclusion: The most used measure is extraordinary supervision during the calving season. However, according to the herders this measure is the easiest to get financed, and therefore perceived as the only real possibility. The herders mostly coincide in that the only effective measure is to achieve better control of the carnivores, in addition to fewer carnivores within the reindeer grazing areas. The herders have many suggestions for changes. Many of them deal with a structural change within the application system. The herders also have some suggestions for changes that include a higher quality in research and management. In conclusion, the herders evaluate several of the preventive measures as partly effective in different regions. However, there is a need for more flexibility within the application period and the prioritized measures. Many herders do not use the system of financed preventive measures because of the time-consuming application process, in addition to the strict prioritizing of measures that do not fit their needs. For this reason, they request that the management look at the year as a whole when deciding on which measures to finance.

Evaluering av forebyggende tiltak mot tap av rein til rovvilt i Norge

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I perioden 2003-2007 ble 25% til 37% (28 000 til 51 000) av reinkalvene i Norge tapt fra våren og fram til høsten. De viktigste tapsårsaker hos rein var rovvilt, sykdom og ernæringssvikt. Reindrifta angir at fredet rovvilt er årsak til 75% til 90% av kalvetapene. I Norge har Fylkesmannen (Länsstyrelsen) finansiert følgende tiltak rettet mot reindrifta: -Ekstraordinært tilsyn i kalvingsperioden/ kalving i gjerde. -Gjerder/intensiv gjeting utenom kalvingsperioden. -Tilleggsfôring. -Ekstraordinær flytting.
Opplysninger fra reindriftsutøverne om deres erfaringer med forebyggende tiltak mot rovviltskader på rein er innhentet gjennom en skriftlig spørreundersøkelse, møter, dybdeintervju og en gjennomgang av søknader og rapporter fra de ulike reinbeitedistriktene i Norge som har mottatt tilskudd fra Fylkesmannen i perioden 1990 til 2006). I tillegg er brukernes egne forslag til endringer i forvaltning og forebyggende tiltak registrert. Foruten tiltakene direkte rettet mot reindrift, har Fylkesmannen bevilget midler til tiltak rettet mot rovdyr (skadefellingstillatelser, jaktkurs/veiledning, bestandsregistrering, dusør for innmelding av nye ynglinger og hekkeområder). Disse tiltakene kan både ha en tapsreduserende og en konfliktdempende effekt.
Reindriftsnæringen har utpekt viktige prioriteringsområder i den videre forvaltningen. Forslag rettet mot rein og driftsform er: -Forebyggende tiltak fordelt over hele driftsåret. -Økonomisk kompensasjon for redusert avlsmessig framgang. -Kompetanseheving rundt tilleggsfôring av rein. -Bedre kadaversøk.- Bedre oversikt og raskere tilsyn ved bruk av radiobjeller. -Reintall tilpasset til beitegrunnlaget.
Forslag rettet mot forskning og forvaltning er: -Grensekryssende samarbeid. -Utvidet søknadsperiode for midler til forebyggende tiltak. -Forenkle søknadsprosessen og raskere behandling av søknader. -Bedre bestandsovervåking og økt bemanning. -Benytte reindriftas kompetanse i utarbeiding av forebyggende tiltak.
Forslag rettet mot rovvilt er: -Redusere antallet rovdyr og et rettet uttak av skadegjørende individ. -Jevnere fordeling av rovdyr innenfor forvaltningsområdet og utvisking av rovdyrsoner. -Rovviltfrie kalvingsområder

Konklusjoner: Ekstraordinært tilsyn i kalvingsperioden det mest brukte tiltaket. I samtale med brukerne selv er imidlertid dette tiltaket det som er lettest å få midler til. Å sikre økt overlevelse av reinkalvene er viktig for å sikre næringa i et langsiktig perspektiv. Næringa selv er i stor grad samlet om at det eneste tiltaket som fungerer er en bedre kontroll på og reduserte rovviltbestander i beiteområdene. Det er et klart behov for mer fleksibilitet innen søknadsperioden og prioriterte tiltak. Det er ønskelig at forvaltningen må ha et mer helhetlig blikk på reindriftsåret når de avgjør hva slags tiltak som skal gis tilsagn.

Nutritional mapping of grazing areas using nutrient and fiber profiles of reindeer forage plants of the Seward Peninsula, Alaska

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Reindeer producers on the Seward Peninsula, Alaska must place animals in areas of high quality forage during spring and summer to maximize growth rates and herd production.
Regression models were developed using Julian date (JD), growing-degree-days (GDD) and phenology (PH) to predict concentrations of nitrogen (N), phosphorus (P), potassium (K), neutral detergent fiber (NDF), acid detergent fiber (ADF) and in-vitro true dry matter digestibility (IVTDMD) of forage plants throughout the growing season found on reindeer ranges of the Seward Peninsula.
Mineral and fiber concentrations and digestibility differed greatly across plant growth forms, but were similar among members of the same genus. N, P and K concentrations were very high in emerging leaves of willow and forbs and declined at a fluctuating rate through the growing season. Concentrations of nitrogen and minerals, and digestibility of leaves of graminoids and digestibility of willow leaves increased during spring to early summer when they began to decrease. NDF and ADF concentrations in graminoids were at a minimum during midseason, in contrast to deciduous shrubs that exhibited low fiber concentrations in the spring with progressive increases through midseason to senescence. Fiber concentrations in forbs were lower and fluctuated less dramatically than either graminoids or shrubs. Digestibility of willows and graminoids was less than forbs.
These data were coupled with existing forage production data to predict the net nutrient pool of all reindeer forage plants within a habitat (ecological site). A computer program and interactive website was developed capable of generating a daily nutritional map reflecting forage quality across the landscape to guide placement of reindeer on large, diverse ranges. Julian date was used as a general predictor of plant chemistry and indicator for reindeer placement, whereas the relationship between GDD and plant chemistry was used to refine animal location based on the unique thermal characteristics of specific sites. A reindeer producer can also use the stage of growth (PH) to evaluate the real time, nutritional status of forage across his range.

Contrasting reindeer management regimes in Fennoscandia and Nenets regions of Russia: Implications for adaptation to climate and land use change

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The most productive semi-domestic reindeer breeding systems in Eurasia are those based in Fennoscandia and the Nenets regions of northern Russia, which straddle the Ural Mountains. The management regimes in these regions share some commonalities, such as their general adherence to carrying capacity models. Yet they also present stark contrasts. The modern Fennoscandian system is characterized by motorized extensive herding practiced within much shorter annual migrations and territories, which are often divided and subdivided by fences, with a diversity of terrain not found in the Nenets regions. The latter are represented by flat to slightly rolling landscapes void of fences where close herding with humans and dogs is practiced along migrations routes of up to 1200 km. Climate change ranks high among the concerns of in Fennoscandian scientists and herders. Despite the absence of supplemental feeding to buffer against extreme snow and ice conditions, Nenets view oil and gas development and rights to land as much graver and more immediate threats than what they perceive as examples of 'extreme weather'. Both regions experience to some extent a disconnect between the state institutions charged with overseeing management, other encroaching land users, and the actual day to day needs of herders. The differences between these two systems are discussed with regard to the implications for long-term resilience in the face of ongoing climate and land use change.

The dispute about the legislation concerning reindeer herding in Norway and Sweden

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The paper will present the arguments in the dispute about new legislation concerning the reindeer herding in Norway and Sweden from mid 1990s to the final political decision making in the years 2005 to 2007. It is based on a project with a theoretical basis in institutional theory within the academic fields of political science and sociology, sociology of knowledge as well as discourse analysis. The focus is on discourses of meaning and reality construction and studies of institutional processes and institutional change.
We have identified (a) ”established” discourses about reindeer herding, management of reindeer herding and Sami questions in Norway and Sweden in the period before 1990. These discourses contain arguments about conflicts between reindeer herding and agriculture and forestry about the use of the land. Another established discourse is whether reindeer herding should be considered as a modern economic activity or as a pillar in the Sami culture. Further (b) the “new” discourses from 1990 on, are the discourses of sustainable development, public management and finally the international discourse about the rights of indigenous peoples’ rights. We ask what type of discourses are the dominant in the political debate from the 1990s to 2007. Moreover, we inquire what type of relations we can find between arguments and interests of the actors. This includes both actors from reindeer herding groups, agriculture groups and from different parts of public administration.
We find that the debate in Sweden is more relentless than in Norway and also charecterised by less accepatance of the arguments of the counterpart.The different actors have both different interpretations of both rights and of courts decisions especially the decisions of the supreme court in the Tax Mountain Case (Skattefjällsmålet). In particular, this concerns questions of rights where not only positions are different, but also the interpretations of legislation and legal documents.
In Norway the organisation of the public reindeer administration has been debated. Based on the argumenst used we find that in Norway the siida institution have been associated with: the purpose of increased legal protection for reindeer herding, as a revitalisation of a traditional Sami institution, and as a possible instrument for more efficient government. Generally, the argumentation is dominated by two types of logics: a logic referring to rights of land-use and a functional logic. Each of the logics can be related to different types of knowledge and practices developed by different professions in different social and political contexts. The connection between these logics are very much not discussed within any of the two countries. Thereby, the unclear discussion of the interelation of the logics are not persist both in the reports and the disputes related to them.

The presentation is based on a report in press to be published by Department of Economics and Resource Management, Norwegian University of Life Sciences. The report will be in Norwegian but with a summary in North-Sami, Swedish and English.

Argumentasjonen omkring endringer av reindriftslovene i Norge og Sverige

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Foredraget vil presentere argumentasjon fra ulike aktører som var aktive i debatten om utredningene om reindriften, om endringer i lovverket for reindriften og reindriftsforvaltningen, i Norge og Sverige fra slutten av 1990-tallet og fram til den endelige politiske behandlingen i årene 2005-2007. For Norges del dreier dette seg om endringen av reindriftsloven i 1996, Reindriftslovsutvalgets rapport, høringsuttalelser til rapporten, den politiske behandlingen av denne rapporten i Stortinget i 2005 og 2007, Riksrevisjonens rapport om reindriften i Finnmark, saken om Finnmarksloven samt Sameretts-utvalget. For Sveriges del har prosjektet konsentret seg om diskurser i sammenheng med tre utredninger: SOU:1999 nr. 25 ”Samerna – ett ursprungsfolk i Sverige. Frågan om Sveriges anslutning till ILOs konvention nr. 169”, SOU:2001:1001, Gränsdragningskommisionen, samt utredningen om jakt og fiske.
Prosjektet anvender institusjonell teori innen statsvitenskap, sosiologi og kunnskapssosiologi, med fokus på diskurser, menings- og virkelighetskonstruksjon samt studier av institusjonelle prosesser og institusjonell endring. Prosjektet har identifisert a) ”etablerte” diskurser om reindrift, reindrifts-forvaltning og samiske spørsmål i Norge og Sverige i perioden før 1990. Dette dreier seg om hvordan saksforhold og argumenter knyttes til konflikter mellom reindrift, landbruk og skogbruk om bruken av arealer og spørsmålet om reindrift som moderne næring eller som samisk kulturbærer. Prosjektet har videre b) studert i hvilken grad de ”etablerte” eller ”nyere” diskurser fra 1990-tallet slik som bære-kraftig utvikling, public management og urfolks rettigheter dominerer i utredningene og debattene i forbindelse med disse utredningene fra 1990-tallet og fram til 2007.
Vi har søkt etter sammenhenger mellom standpunkter, argumentasjon og interesser som aktørene har. Dette gjelder både næringsinteresser og posisjoner knyttet til tilhøringet til ulike typer forvaltning. Vi har spurt hvordan aktørene forholder seg til ulike typer saksforhold og argumenter og videre hvordan disse blir elementene knyttet sammen, eller ikke knyttet sammen, i de uttalelsene som kommer.
Vi har funnet at debatten er mer uforsonlig og mer preget av at en ikke aksepterer motpartens argumenter i Sverige enn i Norge. Dette gjelder særlig spørsmålet om rettigheter der en ikke bare har helt ulike ståsted, men hvor en også har helt ulike fortolkninger av både lovgivning og rettsdokumenter. I Norge er det også uklarhet omkring sentrale spørsmål knyttet til organiseringen av reindriften. Ut fra de argumentene som framkom i debatten i Norge ser vi at for eksempel siida- institusjonen både blir assosiert med større rettsikkerhet for reindriften, et uttrykk for en revitalisering av en samisk institusjon og som et mulig instrument for en mer effektiv styring fra de statlige myndigheter. Generelt preges argumentasjonen av to typer logikker, en rettighetslogikk og en funksjonalitetslogikk som hver for seg knyttes til ulike typer kunnskap og praksis som igjen utvikles av ulike faggrupper i ulike kontekster. Sammenhengen mellom disse logikkene er lite diskutert og dermed lite klargjort både i utredningene og i debatten i forbindelse med dem.

Innlegget bygger på et arbeid som er under utgivelse: Gundersen, Frode & Jan Åge Riseth. Diskurser om utviklingen av reindriften og reindriftsforvaltningen i Norge og Sverige. En studie av argumentasjonen om reindriften og reindriftsforvaltningen i Norge og Sverige. Institutt for Økonomi og ressursforvaltning. Universitetet for miljø og biovitenskap.Ås, Norge.

The reindeer industry at a climate turning point?

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The reindeer industry has so far been well suited to cope with the ongoing climate changes, but has to be prepared for larger adaptations in the future. This is the main conclusions from the project ”Effects in Sapmi”, which have studied the climate change effects the last 50 to 100 years, as well as future consequences for the reindeer industry in Norway. ”Effects in Sapmi” was part of the research project ”PhenoClim” (Phenology as an indicator of climate change effects), funded by the Norwegian Research Council for the period 2003 to 2008.
The project ”Effects in Sapmi”, which mainly addressed the winter season, is based on meteorological data, written sources from the reindeer management body and others during 50 years, interviews with experienced reindeer herders and managers, future climate scenarios, as well as other research in this field, especially from other parts of the “PhenoClim” project.
Increasing temperatures and extended growing season have so far had minor effects on the reindeer management land use patterns. Changes over time in Finnmark are mainly an effect of adaptations to other reindeer management groups. In Nordland and Nord-Trøndelag changes are mainly caused by land interventions and other land use interests.
The reindeer industry have always coped with and adapted to changing weather and pasture conditions from year to year. Some extremely hot and cold summers, and blocked access to pastures some winter seasons, have caused serious problems, but this has mainly been a consequence of high reindeer densities.
Increased temperatures of 2 to 4 degrees the next 100 years, slightly more in the autumn than in the winter, will probably cause increased precipitation and prolonged growing season, and consequently shrub increase and elevated timberline. The reindeers ability to utilize the increased vegetation biomass is however uncertain. A shift in the summer and winter pasture ratio is likely to occur, with increased stay in the summer pasture lands. More unstable winters may cause increased frequency of freeze-thaw cycles and accordingly blocked pastures in continental areas. Oceanic reindeer farming areas will on the other hand get better winter pastures.
The adaptation capacity is quite varying between different areas; due to high reindeer density and increased internal competition on pasture land in Finnmark, and more alternative pasture land in Troms and Trøndelag.

Reference

Norut Alta Report 2008:6:
http://www.finnmark.norut.no/norut_alta_lt/publikasjoner/rapporter/reindrifta_i_et_skiftende_klimabilde

Reindrifta ved et klimatisk veiskille?

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Reindrifta klarer seg bra til tross for et stadig varmere klima, men må regne med større tilpasninger i framtida. Det viser prosjektet "Effects in Sapmi", som har studert klimautviklinga og følger for samisk reindrift de siste 50-100 år, samt drøftet mulige konsekvenser i framtida.
"Effects in Sapmi" var et delprosjekt i forskningsprosjektet "PhenoClim" (Phenology as an indicator of climate change effects), finansiert av NFR (Norges forskningsråd) i årene 2003 til 2008. "PhenoClim" beskriver blant annet endringer i vekstsesongen på Nordkalotten i perioden 1982 til 2003, basert på fenologiske hendelser som tidspunkt for lauvsprett og lauvfall. Delprosjektet "Effects in Sapmi" har hatt fokus på endringer i vintersesongen og bygger på egne analyser av meteorologiske feltdata, beskrivelser av driftsmønster før og nå og årsmeldinger fra lappefogder og reinbeiteområder gjennom mer enn 50 år, samt intervjuer med erfarne reineiere og reindriftsforvaltere. I tillegg bygger prosjektet på annen forskning, blant annet PhenoClim og klimascenarier fra prosjektet RegClim.
Analysene viser at klimaet er blitt mildere og vekstsesongen lengre, men uten større endringer i driftsmønster. Endringene som vi ser er ikke direkte klimarelatert. I Finnmark er endringer i driftsmønster i stor grad tilpasninger til andre driftsgrupper. I Nord-Trøndelag og Nordland er dette tilpasninger til inngrep og andre arealbruksinteresser. Reindrifta er vant til å endre driftsmønster og beitebruk etter vær- og beiteforhold fra år til år. Enkelte varme og noen svært kjølige somre har likevel gitt problemer. Noen vintre har det vært låsing av beiter og forholdsvis store tap, men dette har delvis vært en følge av høy reintetthet og større sårbarhet.
En forventa temperaturstigning på 2 til 4 grader på 100 år, litt mer om høsten enn vinteren, vil gi sannsynlighet for mer nedbør og lengre vekstsesong. Det vil føre til tilgroing av åpne heisamfunn, heving av skog- og tregrense og følgelig mer skogsbeite og mindre fjellbeite. Det er usikkert om reinen kan gjøre seg nytte av den økte biomasseproduksjonen. Det er sannsynlig med en forskyving av balansen mellom sommer- og vinterbeiter med lengre opphold i sommerbeiteområdene. Klimautviklinga vil kunne gi mer usikker beitetilgang i kontinentale beiteområder på grunn av ustabile vintre med hyppigere ising og låsing av beiter. Havnære områder kan derimot oppleve sikrere og mer stabile vinterbeiter.
Det er store forskjeller i tilpasningsmulighetene mellom nord og sør. Stor reintetthet og trangt mellom driftsgruppene særlig vinterstid i Finnmark, vil øke usikkerheten om beitetilgangen. I Troms og Trøndelag har man større tilgang til alternative beiteområder.

Referanse
Norut Alta Report 2008:6:
http://www.finnmark.norut.no/norut_alta_lt/publikasjoner/rapporter/reindrifta_i_et_skiftende_klimabilde

National parks and reindeer management in Norway

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Classical nature conservancy and Sami reindeer management should ideally have common interests in taking care of nature for the future. Based on the authors' experiences with the reindeer industry during three decades, we have analyzed the relations between national parks and other categories of great protection areas and the reindeer industry. The starting point is the experiences and understandings of active reindeer managers of protection areas and protection processes registered by a survey. This material is complemented by conversations with researchers, employees of environmental agencies, some politicians, participant observation in and connected to protection areas, other field trips and studies of literature. We have considered effects on reindeer management by nature protection and vice versa.

The relations between reindeer management and nature protection are more difficult than most outsiders would expect. Protection has turned out positively for reindeer management and reindeer management for protection in some protection areas in Norway, but definitely not all. Border issues, by-laws and attraction affects of national parks – have unfortunate effects in some cases. This is especially the case where national parks are situated in spring, summer and also all-year areas for reindeer management, while national parks in winter areas are less conflicting. The accessibility of the areas for tourists and local people are also an influencing factor.

National parks (IUCN protection category II) aim to take care of both biological diversity and recreation interests. This fact includes a potential of conflict. Since the 1960s, modernization through economical and technological development has created a basis for new conflicts. On the one hand, road web development and family car use and also expansion of secondary home development have increased the use pressure on nature and reindeer management areas. On the other hand, reindeer industry use of ATVs contributes to changes in landscape appearance deviating from the expectations of pristine nature.

Changes in Norwegian protection policy since the turn of the millennium by the so called Mountain Text aiming to advance industrial development in protection areas based on eco-tourism, reinforces the recreation interests and increases the pressure on reindeer management, especially when the protection areas includes reindeer summer land. We see a clear need to reinforce the position of reindeer management in protection areas related to recreation interests. This could be achieved in parallel with taking care of the nature protection aspect. We consider the IUCN protection category VI *"Managed Resource Protected Area"* to be a good basis as it juxtaposes sustainable use and maintenance of biological diversity. This creates opportunities for combination of traditional use and conservation of original nature but at the premises of the traditional use, in this case Sami reindeer management. This would make reindeer management in protection areas a practical option. Active use, where also reindeer management takes care of nature, is the best protection.

This includes recognition that reindeer management areas are Sami cultural landscapes in stead of pristine nature. As an outcome of consultations the Sami Parliament and the Ministry of Environment have agreed that the new Act of Biodiversity will recognize and stress Sami indigenous knowledge as a part of the knowledge base for public decisions influencing biodiversity. This means that Sami use, including users of Sami culture and industries can contribute to sustainable use and nature protection will be better integrated with scientific knowledge before governmental decisions. We consider this as considerable progress for reindeer management interests, but it is conclusive that this implemented and fulfilled in practice.

Based on a number of preconditions we will recommend protection area expansion, more adequate borders and by-laws adapted to a modern and sustainable reindeer management. The current national park plan is by the government intended to be completed during 2009. When the plans are fulfilled about 15% of Norway's land surface is protected, and about one half of this is actively used reindeer management land. Therefore it is very important that the protection authorities not only listen to the reindeer industry but also take its recommendations seriously.

Nasjonalparker og reindrift i Norge

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Klassisk naturvern og samisk reindrift burde ideelt sett hatt felles interesser i å ta vare på naturen for framtida. Med bakgrunn i forfatternes erfaringer med reindriftsnæringen gjennom tre tiår har vi analysert forholdet mellom nasjonalparker/andre kategorier av større verneområder og reindriftsnæringen. Utgangspunktet er aktive reindriftsutøveres erfaringer med og oppfatninger av verneområder og verneplanprosesser kartlagt gjennom en spørreundersøkelse. Dette materialet er supplert med samtaler med forskere, ansatte i miljøforvaltningen og enkelte politikere, deltakende observasjon i og i tilknytning til verneområdene, andre befaringer og litteraturstudier.

Vi har sett på virkninger av naturvern på reindrifta og vice versa. Relasjonene mellom reindrift og naturvern er vanskeligere enn det de fleste utenforstående ville forvente. Vern har vist seg å være gunstig for reindrifta og reindrifta bra for vernet i noen verneområder i Norge, men slett ikke alle. Grensedragning, forskrifter, samt "trekkplastereffekten" av nasjonalparker får av og til uheldige virkninger. Spesielt gjelder dette nasjonalparker i vår-, sommer- og også helårsområder for reindrifta, mens parker i rene vinterområder er mindre konfliktfylt. Hvor tilgjengelige områdene er for turister og lokalbefolkning spiller også inn her.

Nasjonalparker (IUCNs vernekategori II) forutsettes å ivareta både biologisk mangfold og rekreasjonsinteresser. Dette rommer i seg selv et konfliktpotensiale. Siden 1960-tallet har modernisering gjennom økonomisk og teknologisk utvikling skapt grunnlag for nye konflikter. På den ene siden har utbyggingen av veinettet og privatbilismen samt ekspansjon i utbyggingen av fritidsboliger økt brukspresset på naturen og reindriftas driftsområder. På den andre siden bidrar reindriftas bruk av barmarkskjøring til endringer i landskapsbildet som avviker fra det som forventes i "urørt" natur.

Endringene i norsk vernepolitikk etter årtusenskiftet gjennom den såkalte Fjellteksten som tar sikte på tilrettelegging for næringsutvikling i verneområder basert på økoturisme, styrker rekreasjonsinteressene og øker presset på reindrifta, særlig når verneområdene omfatter sommerbeiteområder.

Vi mener at det er et klart behov for å styrke reindriftas posisjon i verneområdene i forhold til rekreasjonsinteressene. Dette kan gjøres samtidig som naturvernaspektet ivaretas. Vi anser at IUCN's vernekategori VI "*forvaltet ressursbeskyttelsesområde*" ville være et godt utgangspunkt da denne sidestiller bærekraftig bruk og opprettholdelse av biodiversitet. Dette gir mulighet for å kombinere tradisjonell bruk og vern av den opprinnelige, men på den tradisjonelle brukens, i dette tifelle den samiske reindriftas premisser. Dette vil gjøre det praktisk mulig å drive reindrift i nasjonalparkene. Aktiv bruk, hvor også reindrifta tar hensyn til naturen, er det beste vern. Dette innebærer en anerkjennelse av at reindriftsområdene er samisk kulturlandskap framfor "urørt" natur.

Etter konsultasjoner har Sametinget og Miljøverndepartementet blitt enige om at den nye naturmangfoldloven skal anerkjenne og vektlegge samisk tradisjonell kunnskap/árbediehtu som en del av kunnskapsgrunnlaget ved offentlige beslutninger som berører naturmangfoldet. Dette innebærer at samisk bruk, herunder utøvere av samisk kultur og næring som kan bidra til bærekraftig bruk og bevaring av naturen, blir bedre integrert med vitenskapelig kunnskap i forkant av myndighetsutøvelse. Vi ser dette som et betydelig framskritt for reindriftas interesser, men det er avgjørende at dette gjennomføres og får en praktisk oppfølging.

Ut fra visse forutsetninger er derfor våre anbefalinger at verneområdene utvides, grensene gjøres mer hensiktsmessige og forskrifter og regelverk tilpasses en miljøvennlig, moderne og framtidsrettet bærekraftig reindrift. Den nåværende nasjonalparkplanen skal etter Regjeringens intensjoner sluttføres i løpet av 2009. Når planene er gjennomført er om lag 15% av Norges areal vernet, og omtrent halvparten av dette ligger i aktivt brukte reindriftsområder. Det er derfor svært viktig at vernemyndighetene ikke bare lytter til reindrifta, men også tar anbefalingene fra næringen på alvor.

Is traditional ecological knowledge important to the reindeer herding industry?

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Extended abstract: In Scandinavia larger scale reindeer husbandry was founded during the 1600th century (Lundmark, 1989). Earlier the Sami had kept a few tamed reindeer. Female reindeer could be utilized to entice wild reindeer to come into traps and the Sami also used tamed reindeer as pack and draft animals and for milking. Slaughter animals were (mostly) hunted among wild reindeer. The Sami designation for domesticated reindeer is boazu attributed to the word milking, while wild reindeer are called goddi that can be compared to the verb kill.
When examining traditional ecological knowledge it is important to understand that the richness of detail in the language is often tied to the culture-bearing language used in the daily work. The Sami languages are known for its extensive terminology for describing many natural occurrences (Ruong, 1964, 1968; Jernsletten, 1997; Ryd, 2001; Helander-Renvall, 2007). It has roughly 300 words for snow according to texture, appearance and how the snow is to travel on or to dig in for the reindeer. The Sami languages are also rich on the subject of reindeer and there are special names for reindeer of different age and sex, hair colour and on different type of antlers. In all communication, use of a common language and terminology are of utmost importance for a successful transfer of knowledge. The reindeer herders can effortlessly convey a very precise description of any reindeer.
Sami traditional ecological knowledge is such knowledge that you need to be a successful reindeer herder. My working hypothesis was that the herders to be skilled reindeer herders knew the plants reindeer utilized. To find out how well the reindeer herders were in recognizing plants at the species level, I did a survey in some selected Sami communities (samebyar in Swedish). Besides the species level, I also speculated if the herders used another plant designation or classification than scientists to be more functional in their daily work. My informants were 22 herders from the communities Gabna, Laevas, Girjas, and Udtja and they were asked to identify or tell if they recognised the plant species in question. They would also comment on whether or not the plant was one the herders knew was grazed by reindeer, and they were finally asked to characterize a good winter pasture. Forty vascular plants were shown on picture to each informant.
The herders identified a total of 21 plant taxa and five plant groups. They especially recognised species like berries and forbs such as *Angelica archangelica* ssp. *archangelica* and *Rumex acetos.* These species are also widely known by the Sami since they traditionally have been used in their diet, but certain specific forage plants were also identified. Grasses did not have names at the species level but there was a clear and uniform nomenclature for a group of grasses called sitnu (*Deschampsia flexuosa* ssp. *flexuosa, D. alpina, Festuca ovina* and *Poa alpina*). All the informants did identify the grasses sitnu and 11 of them also gave descriptions that confirmed the name they had used for these specific grasses. The grasses they called rássi included different species of grass and forbs that reindeer graze during the summer. It is obvious that the informants distinguished between sitnu and rássi.
The herders were asked to identify and name different dried lichen species and to describe a good winter grazing land. To describe a good winter pasture they had to rank seven boxes with different amount and species of lichens and with different kind of mosses and dwarf scrubs. They also gave a reason of the ranking.
The Sami nomenclature is more detailed for plants grazed in seasons with forage shortage (autumn-, winter-, and springtime), and the herders had very good knowledge of what plants the reindeer grazed, especially about the lichens. According to all the informants, lichens were the most important fodder for the reindeer's welfare during the winter season, and in view of this importance, the informants also had a uniform nomenclature (Inga, 2007). Among the reindeer herders the lichen terminology was clear in relation to habitat and appearance: jeagil (North-Sami) or visste (Lule-Sami) for fructiose

lichens on the ground, lahppu for tree living pendulous lichens and gatna for foliose or crustose lichens that live on trees or on rocks.

The reindeer herders paid more attention to the conditions of the snow than the amount of lichens in the winter grazing land. The discussions where the informants were to rank seven boxes of different plant communities, gave some information on what the reindeer herders considered to be important features of good winter foraging areas. Firstly, they mentioned to what extent the lichens covered the ground and rated the boxes after that. For the next, they discussed the snow cover, how deep it could be and if certain boxes represented areas where the snow was easy to dig for the reindeer.

Detailed knowledge on the plant level was surprisingly scarce, indicating that the knowledge of range resources is of vital importance on a general but not on a more detailed level. This fact is in sharp contradiction to the detailed knowledge that Sami people express for example about reindeer (as an animal) or snow (as physical element). The plausible explanation is that observations of plant species are unnecessarily detailed information in large scale reindeer pastoralism, because the animals graze freely under only loose herding and border surveillance.

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Är traditionell ekologisk kunskap viktig för rennäringen?

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I Skandinavien grundlades "dagens" renskötsel under 1500-talet (Lundmark, 1989) och före det hade samerna ett fåtal tämjda renar som man använde som lockrenar, mjölk, klövje- och dragdjur. Slaktdjur jagade man bland den vildrenspopulation som levde här. Den domestiserade renen kallas boazu, ett namn som kan härledas till ordet mjölka medan vildren heter goddi som kan jämföras med ordet döda. Detaljrikedomen är ofta knuten till det kulturbärande språket som används i det dagliga arbetet, i detta fall samiska, som är känd för sin omfattande terminologi för att beskriva olika naturfenomen (Ruong, 1964, 1968; Jernsletten, 1997; Ryd, 2001; Helander-Renvall, 2007). I samiskan finns det 300 ord för snö vad gäller konsistens, utseende och hur snön är att färdas på eller att gräva i. Dessutom finns en mängd ord för hur renen kan se ut, speciella namn på ålder och kön, på hårfärg, färgteckningar och hur geviret ser ut. Utan att se renen kan en sådan muntlig beskrivning ge en bra bild av renens kön, ålder och utseende. I all kunskapsöverföring är språket och/eller terminologin av största betydelse för att överföringen ska lyckas.

Min arbetshypotes var att renskötare måste känna igen renbetesväxter för att vara en bra renskötare. För att undersöka om renskötare känner växter på artnivå har jag valt ut ett antal samebyar som ligger i det samiska språkområde jag behärskar. Jag har, förutom att vara intresserad av ren artkunskap, också funderat på om man har någon annan växtindelning som är mer funktionell för en renskötare än den som vetenskapen använder. Som informanter har 22 renskötare från samebyarna Gabna, Laevas, Girjas och Udtja fått a) identifiera och namnge växter antingen på samiska eller svenska; b) ange vilka växter renen betar; c) specifiera under vilken tid på året olika växter betas och d) karaktärisera ett bra vinterbete.

Av de 40 kärlväxter som informanterna fick se på bild så var det 21 växtarter och fem växtgrupper som informanterna kände igen. Växter som traditionellt har nyttjats i kosthållet såsom bär, fjällkvanne (*Angelica archangelica* ssp. *Archangelica*) och fjällängssyra (*Rumex acetosa*) kände de flesta informanterna till, men de identifierade också vissa betesväxter. Gräs har inget namn på artnivå, men det finns en klar och entydig nomenklatur på en grupp av gräs som kallas sitnu (*Deschampsia flexuosa* ssp. *flexuosa, D. alpina*, *Festuca ovina* och *Poa alpina*). Alla informanter identifierade gräsen sitnu och 11 av den gav också en beskrivning som bekräftar namnet de har använt på dessa specifika gräs. Det gräs som kallas rássi innefattar även olika arter av gräs och örter som renen betar under sommaren. Det är uppenbart att de skiljer på sitnu och rássi.

Renskötarna fick i uppgift identifiera och namnge olika lavarter samt att beskriva ett bra vinterbetesland. För att beskriva ett bra vinterbetesland fick de rangordna sju lådor med olika mängd lav och olika lavarter samt med olika mossor och ris. I samband med rangordningen fick de också motivera sin rangordning.

Det framgår tydligt att den samiska nomenklaturen på olika renbetesväxter är mer detaljerad då det gäller växter som betades under perioder då det var ont om bete. Särskilt tydligt är det när det gäller samisk nomenklatur på lavar, som har namn efter utseende och växtplats (Inga, 2007). Marklevande busklavar heter jeagil (nordsamisk) eller visste (lulesamisk), trädlevande hänglavar lahppo, och blad- och kartlavar som växer på träd eller sten heter gatna.

Då det gäller vinterbeteslandet lägger renskötarna större vikt vid hur snön ser ut än mängden lav. Diskussionen som uppkom under experimentet att rangordna olika växtsamhällen, gav viss information på vad renskötarna menade vad som var viktigt för bra vinterbetesland. Först såg det hur mycket laven täckte marken och rangordnade efter det. Sedan diskuterade de snötäcket, hur djupt det förmodades vara och om vissa lådor representerade områden där snön var lätt att gräva i för renarna.

Detaljerad kunskap på växtartnivå var överraskande begränsad, vilket antyder att kunskap om markresurserna är av större betydelse på en övergripande, men inte på detaljerad nivå. Detta är i skarp kontrast till den detaljerade kunskapen samerna visar vad gäller renen (som ett djur) eller om snö (som ett fysiskt element). Den tänkbara förklaringen är att observationer på växtartnivå är en onödig detaljerad information i en storskalig renskötsel pastoralism, eftersom djuren betar fritt i betesområdet.

Inside or outside? An academic reflection of the position of reindeer husbandry in the majority society

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The presentation will focus on the reindeer herding industry`s position in today's society and ask whether the development that can be seen today in the interaction between the industry and society is a desirable way to go. Reindeer industry throughout the Circumpolar area is dependent on the access to good pastures. At the same time we see a trend throughout this region where pastures in greater and greater degree are fragmented or completely destroyed. How do we handle such a development?
Historically, the contract reindeer system and guest relationship (Sami: verddevuohta) with the local population have been important elements in bridging the needs of both the industry and society. Such institutions have contributed positively to an increased understanding between different actors. The general picture today is that both the contract reindeer system and guest relationship (vérddevuohta) is weakening (or no existing) and that the industry's challenges increasingly seek to be resolved through different national legal systems. But there is one important exception from this rule.
The concession reindeer system in Kalix- and Torne valleys in northernmost Sweden is an example where these traditions are still strong and have been regulated in the (Swedish) Reindeer Herding Act. The lecture will examine some selected parts of the concession reindeer system and show how this industry is based on a common understanding between reindeer owners and the local population. Despite its small number of animals and a rather invisible position in the academic mindscape, the concession reindeer management system is of importance politically as well as academically concerning the principles involved. This system is highly significant as an analytical model, and it offers not only problems but also solutions to many of the challenges the industry faces.

Innenfor eller utenfor? En faglig refleksjon over reindriftens plass i storsamfunnet

Foredraget fokuserer på reindriften sin posisjon i dagens samfunn og spør om den utviklingen man ser i dag i samhandlingen mellom næring og storsamfunnet er en ønsket vei å gå? Reindriften i hele det sirkumpolare området er avhengige av gode beiteområder. Samtidig ser vi en utvikling i hele dette området hvor beitene i større og større grad fragmenteres eller ødelegges helt. Hvordan kan man håndtere en slik utvikling?
Historisk har sytingsreinsystemet og verdderelasjoner (samisk: verddevuohta)med lokalbefolkningen vært viktige elementer i en brobygging mellom næringen og samfunnet rundt. Slike institusjoner har bidratt positivt for en økt forståelse mellom ulike aktører.
Det generelle bildet i dag er at både sytingsreinsystemet og verdderelasjoner er på sterk vikende front, eller blitt helt borte, og at næringens utfordringer stadig oftere søkes løst gjennom nasjonale retts-system. Men det finnes et viktig unntak fra dette bildet. Konsesjonsreindriften i Kalix- og Torne elve-daler er et eksempel på at disse tradisjonene fremdeles står sterk og at de er blitt regulert inn i den (svenske) nasjonale reindriftslovgivningen. Foredraget vil ta for seg noen utvalgte deler av denne organiseringen som er å anse som konfliktdempende og som bygger på gjensidig forståelse mellom reineierne og lokalbefolkningen. Selv om konsesjonsreindriften er (geografiske) marginal i den sir-kumpolare konteksten, og samtidig har en usynlig posisjon i det akademiske landskapet, så er konse-sjonsreindriften viktig hva gjelder de prinsippene vi finner her. Konsesjonsreindriften er meget relevant som en analytisk modell, og den tilbyr ikke bare utfordringer, men også løsninger til mange av de utfordringene som hele den sirkumpolare reindriftsnæringen står ovenfor i årene fremover.

Predicting growth of mat-forming lichens in northern Scandinavia using models as potential tools for management of lichen-rich habitats

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Mat-forming lichens are important components of the vegetation of boreal and arctic ecosystems and are the main reindeer forage during the winter. However, forestry has during the 20th century adversely affected lichen-rich habitats. To support the long-term management of these habitats we developed models for predicting growth of the species *Cladina stellaris* and *Cetraria islandica* in northern Scandinavia. These lichens were transplanted along a natural west–east climate gradient varying in precipitation, temperature and light exposure. Growth was then recorded seasonally over 16 months. We developed semi-mechanistic models of varying complexity based on descriptive meteorological data, irradiance, physiological data, and hydration models. The models ability to predict lichen annual growth was considered. In addition, to be able to identify habitats with high growth potential, more practical models were also evaluated. Annual growth ranged from 12.5% to 29% and 6.4% to 24.5% for *C. stellaris* and *C. islandica*, respectively. Growth was highest at the most open sites and irradiance was a limiting factor for sites with a canopy cover of more than ca 60%. Growth was even higher at more humid sites. Parameters related to irradiance predicted most of the annual growth for both species and could, in combination with precipitation, predict 52% of annual growth for *C. stellaris* and, in combination with total wet time and the irradiation received while wet, predict 66% of annual growth for *C. islandica*. The practical model predicted 43% of annual growth for *C. stellaris*, using basal area and the normal average temperature, and 24% for *C. islandica* using basal area alone.
Management of lichen-rich habitats requires a knowledge of a habitat's potential for lichen growth. To attain this, we present models of lichen growth as a function of habitat properties and conclude that sufficient irradiance below forest canopy is of crucial importance in the long-term management of mat-forming lichens and easily recorded parameters can be used to identify appropriate habitats.

Modeller som verktyg för att förutsäga tillväxt av mattlevande lavar i norra Skandinavien – medel för att sköta lavrika habitat

Mattlevande lavar är viktiga för rennäringen som föda för renarna under vintern. Samtidigt har skogsbruket påverkat lavrika habitat negativt under de senaste hundra åren. För att stödja skötseln av dessa habitat har vi utvecklat modeller för att uppskatta tillväxten av lavarna fönsterlav och islandslav i norra Skandinavien. På så sätt kan man identifiera vilka habitat som utgör miljöer med högst tillväxtpotential av mattlevande lavar och som därmed också är viktiga ur ett rennäringsperspektiv.
Lavarna placerades ut i en öst-västlig gradient som varierade naturligt i nederbörd, temperatur och ljustillgång (omvänd krontäckning). Tillväxten följdes säsongsvis i 16 månader. Semi-mekanistiska modeller som byggde på meteorologiska data, ljustillgång, fysiologiska data och lavarnas vatteninnehåll utvecklades med varierande komplexitet. För att kunna identifiera vilka miljöer som har hög tillväxtpotential utvecklades också rent praktiska modeller som baserades på grundyta och meteorologiska normaldata. Den årliga tillväxten varierade från 12.5% till 29% för fönsterlaven och 6.4% till 24.5% för islandslav. Tillväxten var högst vid de mest öppna habitaten och var ljusbegränsad vid en slutenhet högre än 60% krontäckning. Tillväxten var också högre i habitat med mer nederbörd och i snitt högre relativ fuktighet. Den praktiska modellen förklarade 43% av variation i tillväxt hos fönsterlav med hjälp av grundyta och medeltemperatur. Motsvarande modell för islandslav förklarade 24% med grundyta. Mer komplicerade modeller kunde förklara upp till 52% för årlig tillväxt av fönsterlav och motsvarande 66% för islandslaven. För att sköta lavrika habitat krävs kunskap om ett habitats förmåga till lavtillväxt. De modeller som presenteras visar att tillräckligt öppna miljöer är den viktigaste faktorn för långsiktigt bruk av mattlevande lavar.

Effects of forestry on the winter grazing resources of reindeer in Sweden

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Reindeer husbandry and forestry are the main land users in boreal forests in northern Sweden. The boreal forest is mainly used for winter grazing by reindeer, although some herding districts may also use the forest during summer. In winter and early spring reindeer's diet consists up to 80% of mat-forming terrestrial lichens (*Cladina, Cetraria*) and arboreal lichens (*Bryoria, Alectoria, Usnea*) and these winter resources thus create a bottle-neck for the reindeer herding system. Commercial cultivation and extraction of timber have mainly negative effects on reindeer husbandry and conflicts between these two industries have escalated during the past century. For example, ground lichens may either be destroyed through soil scarification or become inaccessible due to logging residues. Young forest stands may have a high canopy cover which restricts the light reaching the ground and reduce lichen growth. Dense young forests may also hinder the movement of reindeer. The abundance of lichens can decrease as a result of nitrogen fertilization. Furthermore, reindeer have been observed to avoid grazing in fertilized forest stands. Arboreal lichens are key resources during late winter when snow conditions make it difficult for the reindeer to dig for ground lichens. Due to slow growth rates and limited dispersal, arboreal lichens are strongly dependent on old forests and continuity in canopy cover. Harvesting of trees and short rotation times will thus have strong negative effects on the amount of arboreal lichens.

In general, modern forest management has resulted in increasing proportion of even-aged young stands and scarcity of old-growth stands. The changes in the forest landscape structure were measured in two study areas (Akkajaur-Abraur and Eggelats) located in northern Sweden using digitized historical maps. The results showed that the cover of continuous old pine forest had decreased from ca 47-59% in the beginning of the 20th century to only 9-14% in 2006. Furthermore, the mean patch size of continuous pine forests had strongly decreased and the degree of fragmentation increased during the past 100 years. Correspondingly, the cover of young forests has increased in the studied landscapes. Small and fragmented patches of suitable pastures cannot be effectively used for reindeer herding. Furthermore, decreasing size and increasing isolation of old forest patches hamper the dispersal of arboreal lichens in the landscape. Climate change is likely to exacerbate the effects of forestry on reindeer husbandry as increased forest productivity will result in denser forests with shorter rotation times.

Metsätalouden vaikutukset porotalouden talviresursseihin Ruotsissa

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Poronhoito ja metsätalous ovat kaksi merkittävintä maankäyttömuotoa boreaalisissa metsissä Pohjois-Ruotsissa. Boreaalisia metsiä käytetään porojen talvilaidunnusalueena ja tämän lisäksi joillain alueilla porot laiduntavat metsissä myös kesäisin. Talvella ja varhain keväällä maajäkälät (esim. *Cladina, Cetraria*) sekä puissa kasvavat naava (*Usnea*) ja luppo (*Bryoria, Alectoria*) muodostavat jopa 80% porojen ruokavaliosta ja siten nämä resurssit muodostavat poronhoitojäjestelmän "pullonkaulan". Metsätaloudella on enimmäkseen negatiivisia vaikutuksia porotalouteen ja ristiriidat näiden kahden maankäyttömuodon välillä ovat kasvaneet viime vuosisadan aikana. Esimerkiksi maajäkälät voivat laajalti tuhoutua maan muokkauksen yhteydessä, ja hakkuujätteet estävät maajäkälien kaivamista. Nuorten metsien tiheä latvuspeitto voi rajoittaa valonmäärää pohjakerroksessa ja vähentää jäkälien kasvua. Samoin porojen liikkuminen voi vaikeutua tiheissä nuorissa metsissä. Jäkälien määrä voi vähentyä typpilannoituksen seurauksena. Porojen on havaittu myös välttävän laiduntamista typpilannoitetuissa metsissä. Lupot ovat avainresurssi lopputalvesta, jolloin vaikeat lumiolosuhteet estävät poroja kaivamasta jäkälää maasta. Hitaan kasvunopeuden ja rajoittuneen leviämiskyvn vuoksi luppoja esiintyy enimmäkseen vanhoissa metsissä. Hakkuilla ja lyhentyneellä hakkuukierrolla on siten merkittäviä negatiivisia vaikutuksia luppojen määrään.
Nykyaikainen metsätalous on johtanut tasaikäisten nuorten metsien kasvavaan osuuteen ja vanhojen metsien vähenemiseen. Metsämaisemassa tapahtuneita muutoksia mitattiin kahdella tutkimusalueella (Akkajaur-Abraur ja Eggelats) Pohjois-Ruotsissa digitoitujen historiallisten karttojen avulla. Tulokset osoittivat että vanhan mäntymetsän peittävyys on vähentynyt noin 47-59%:sta 1900-luvun alusta 9-14%:iin vuonna 2006. Vanhan metsän muodostamien laikkujen keskikoko on myös huomattavasti pienentynyt ja pirstoutuminen lisääntynyt viimeisen sadan vuoden aikana.Vastaavasti nuoren metsän peittävyys on lisääntynyt tutkimusalueilla. Sopivien laidunten väheneminen ja pirstoutuminen johtaa siihen, että niitä ei voida hyödyntää tehokkaasti porolaidunnukseen. Samoin vanhan metsän laikkujen pieni koko ja laikkujen eristäytyminen vaikeuttavat luppojen leviämistä uusille alueille. Ilmastonmuutos vahvistaa todennäköisesti metsätalouden vaikutuksia porotalouteen metsien tuottavuuden kasvaessa, joka johtaa tiheämpiin metsiin ja lyhyempiin hakkuukiertoaikoihin.

Different land use pressures and the present state of reindeer winter ranges in northernmost Finland

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In the Finnish reindeer herding area various forms of land use operate in the same area, often with overlapping operational ranges and interests. Forestry, tourism and mining as well as settlements and holiday and recreation infrastructure use and continuously change the reindeer herding environment. At the same time, also reindeer herding affects pasture areas by causing changes in the vegetation. All of these have certain effects on the state of pasture environment and possibilities to practice reindeer herding, therefore, it is necessary to monitor the extent and causes of these changes. This kind of comprehensive evaluation of the state of the environments is becoming increasingly more important if our aim for the future is to use natural resources in an ecologically sustainable and, at the same time, more pluralistic way.

The aims of the present project were to survey the present state of pasture environments and also to investigate recent changes in the winter ranges in the 20 northernmost reindeer herding districts of Finland (the specific reindeer herding area). The study was conducted during 2005-2008 by the Finnish Game and Fisheries Research Institute using improved and more diversified field and image classification methods. This pasture inventory produced a versatile and accurate picture on the present condition of lichen pastures and the general state of winter range environments. However, the extent and causes of changes occurring in the pasture environment should be studied in more detail.

The results of the inventory showed that lichen ranges were to a large extent heavily worn out in the studied herding districts and their pasture areas (lichen biomass under 300 kg/ha). Lichen ranges in good (lichen biomass > 1000 kg/ha) or moderate (lichen biomass 500-100 kg/ha) condition still occur in those pasture areas where reindeer grazed only during winter and which, at the same time, were located in conservation areas outside the operational range of forestry and infrastructure. The most heavily worn out lichen ranges were located in the mountainous areas and also in middle and western Lapland, where reindeer densities on lichen ranges have been relatively high. In these districts, it has also been difficult to develop well-designed annual pasture rotation systems; therefore, reindeer have grazed lichen ranges also during the summer season (whole snow free period). From the mid 1990s to the period 2005 to 2008, the lichen biomasses on lichen ranges have decreased in the studied field sites in most of the districts. The long term effects of forestry appeared clearly in those reindeer herding districts located in the operation ranges of forestry, where forest and landscape structure has been fragmented into a mosaic of felled and sapling stand areas and young forests. At present, large and continuous winter range areas with old growth forest can be found only in conservation areas. Also the continuous increase of infrastructure constructions in the reindeer herding environment has intensified the fragmentation of winter ranges. Altogether in 11 of all studied herding districts, the areas of coverage and impact by infrastructure formed 5% to 27% of the total land area, but in the backcountry districts these amounts were smaller.

The results suggest that, besides regulation of the number of reindeer, for a lasting improvement of lichen ranges attention should be paid to developing and employing well-working annual pasture rotation systems. Because the effects of forestry and infrastructure are usually negative on the state and usability value of winter ranges, reindeer herding should be taken more into consideration than previously when implementing forestry operations or expanding infrastructure especially in the northern part of reindeer herding area. Besides the effects of long term reindeer densities the effects of the grazing methods of pastures and impact of other land use forms on the state of lichen ranges should be studied in more detail. At the same time, the possible link of air pollution emissions from Nikel in Russia to the marked reduction of lichens in the eastern Inari area should be studied in more

detail. The evaluation of the state of the reindeer herding environments should also be more versatile, expanding co-operation and combining resources from the Finnish Game and Fisheries Research Institute, the Finnish Forest Research Institute and the Finnish Environment Institute. In this way reindeer pasture inventories would also act as an important tool for observing the state of environments.

Erilaiset maankäyttöpaineet ja porojen talvilaidunten nykytila pohjoisimmassa Suomessa

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Useiden eri maankäyttömuotojen toiminta-alueet ja intressit menevät päällekkäin Suomen poronhoitoalueella. Metsätalous, matkailu ja kaivostoiminta sekä asutus ja loma- ja virkistysrakentaminen hyödyntävät ja muuttavat koko ajan koko ajan luonnonympäristöä, jossa myös poronhoito toimii. Samalla myös poronhoito vaikuttaa laidunalueisiin kasvillisuusmuutosten kautta. Kaikki nämä muutokset vaikuttavat jollain tavalla laidunympäristön tilaan ja poronhoidon toimintaedellytyksiin, mistä johtuen erilaisten muutosten laajuutta ja syitä poronhoidon laidunympäristössä olisi kyettävä seuraamaan. Tällainen kokonaisvaltainen ympäristön tilan seuranta nousee entistä tärkeämmäksi pyrittäessä mm. ekologisesti kestävämpään ja moniarvoisempaan luonnonvarojen käyttöön.

Vuosina 2005–2008 toteutettiin RKTL:n vetämänä tutkimushanke, jonka tavoitteena oli inventoida aikaisempaa tarkemmilla ja monipuolisemmilla inventointimenetelmillä talvilaitumet ja kartoittaa laidunympäristöjen tila sekä selvittää laidunten tilan muutoksia poronhoitoalueen pohjoisosan 20 paliskunnassa (ns. erityisesti poronhoitoa varten tarkoitettu alue). Inventointi rahoitettiin osittain MAKERA:n tutkimusvaroilla. Laiduninventointi antoi entistä monipuolisemman ja luotettavamman kuvan paliskuntien jäkälälaidunten kunnosta ja talvilaidunympäristön nykytilasta. Sen sijaan laitumilla tapahtuneiden muutosten laajuutta ja näiden muutosten syitä tulee jatkossa selvittää vielä tarkemmin.

Laiduninventoinnin tulokset osoittivat jäkälälaidunten olevan suuressa osassa paliskuntia ja laidunalueita voimakkaasti kuluneita (jäkäläbiomassa alle 300 kg/ha), mutta hyväkuntoisia (jäkäläbiomassa yli 1000 kg/ha) tai kohtuullisessa kunnossa (jäkäläbiomassa 500–1000 kg/ha) olevia jäkälälaitumia löytyi tutkituista paliskunnista edelleen niiltä talvilaidunalueilta, joissa porot laiduntavat pääosin vain talvella ja jotka samalla sijaitsivat metsätalouskäytön ja infrastruktuurin ulkopuolella olevilla suojelualueilla. Voimakkaimmin kuluneet jäkälälaitumet sijoittuivat tunturialueille sekä Länsi- ja Keski-Lapin alueille, joissa porotiheydet jäkälälaidunten pinta-alaa kohti ovat olleet suhteellisen korkeat. Näissä paliskunnissa ei myöskään ole usein voitu kehittää toimivaa vuodenaikaista laidunkiertoa, minkä vuoksi porojen laidunnus on kohdistunut laajasti jäkälälaitumille myös kesäkautena (lumettomana aikana). Jäkäliköiden jäkälämäärät olivat pudonneet tutkituilla koealueilla useimmissa paliskunnissa 1990-luvun puolivälistä vuosiin 2005–2008 tultaessa. Metsätalouden pitkäaikaiset vaikutukset talvilaitumiin näkyivät selvinä metsätalousalueella sijoittuvissa paliskunnissa, joissa metsä- ja laidunkuva on voimakkaasti pirstoutunut pääosin hakkuualueiden, taimikoiden ja nuorten metsien mosaiikiksi. Käytännössä laajimmat ja yhtenäisimmät varttuneiden ja vanhojen metsien talvilaidunalueet löytyvät tällä hetkellä enää suojelualueilta. Myös infrastruktuurin liittyvien rakenteiden vähittäinen lisääntyminen porolaitumilla on voimistanut talvilaidunalueiden pirstoutumista. Yhteensä 11 paliskunnassa infrastruktuurin peitto- ja vaikutusalueet kattoivat 5-27% paliskuntien maa-alasta, mutta erämaapaliskunnissa jäivät tämän alapuolelle.

Tulokset viittaavat siihen, että poromäärien säätelyn ohella tulisi kiinnittää entistä enemmän toimivien laidunkiertojärjestelmien kehittämiseen ja toteuttamiseen paliskunnissa, jotta jäkälälaidunten tilaa voitaisiin parantaa pitkällä aikavälillä. Koska metsätalouden ja infrastruktuurin vaikutukset ovat

talvilaidunten tilan ja käytettävyyden kannalta yleensä negatiivisia, tulisi metsätalouden toiminnassa ja infrastruktuurin laajentamisessa voida huomioida poronhoito entistä paremmin erityisesti poronhoitoalueen pohjoisosassa. Pitkäaikaisten porotiheyksien vaikutusten lisäksi laidunten käyttötavan ja muun maankäytön vaikutuksia jäkälälaidunten kuntoon on syytä tutkia yksityiskohtaisemmin. Samalla mm. Venäjän alueella sijaitsevan Nikkelin saastepäästöjen mahdollista yhteyttä Itä-Inarin alueella havaittuun jäkälämäärien voimakkaaseen vähenemiseen pitäisi tutkia vielä tarkemmin muiden vaikutustekijöiden ohella. Porolaidunympäristön tilan seurantaa olisi myös kehitettävä entistä monipuolisemmaksi laajentamalla yhteistyötä ja yhdistämällä resursseja mm. RKTL:n, METLA:n ja SYKE:n välillä. Tällöin laiduninventoinnit toimisivat osaltaan myös ympäristön tilan seurantaan liittyvinä työkaluina.

Ecological implications of petroleum industry to Nenets reindeer herding in Yamal Peninsula, Arctic Russia

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The aim of the this research is to assess the capacity for satellite imagery in detecting different natural and anthropogenic land cover changes in the vicinity of a modern petroleum extraction development in the Russian Arctic. The Yamal Peninsula in northwest Siberia contains some of the largest untapped deposits known in the world. It also serves as the homeland of the Yamal Nenets, who have exploited first wild and then domestic reindeer in the region for at least 1000 years. Their annual migration from the treeline to the northern tundra brings them into contact with a number of impacts associated with gas exploration and production. These range widely and include physical obstructions from roads, railways, and pipelines, as well as direct and indirect ecological impacts, such as changes in vegetation, soils and hydrology due to e.g. drilling, infrastructure development, and seismic surveys. Some of the effects are relatively small-scale, only a few meters across, while others cover several hectares. Nenets' perceptions of the spatial aspects of their territories encompass changes in both quantity and quality of terrestrial habitats, rivers, lakes and campsites that have been used seasonally for centuries. Satellite imagery used was Landsat MSS/TM/ETM, SPOT, ASTER TERRA VNIR and Quickbird-2. Even with most high-resolution imagery it was not possible to detect things like trash (rusted metal, broken glass), drilling muds and petro-chemicals that can strongly affect the overall quality of reindeer pastures.
In Bovanenkovo, 450 km^2 have been affected by the gas field and about 33 km^2 of the vegetation have destroyed or changed from original. Impacts are local and small scale but for example about 20% of late summer pastures of two reindeer herding brigades of Yarsalinksi sovhoze are directly affected by Bovanenkovo gas field. Especially migration through gas field has become more difficult after increasing constructions. Impacts can be drastical to certain brigades. To properly assess the overall ecological impacts of petroleum development requires a combination of state-of-the-art remote sensing coupled with detailed ground-truthing efforts that embrace both scientific and local knowledge from indigenous herders and also non-indigenous gas field workers.

Kaasuteollisuuden ekologiset vaikutukset nenetsi poron-hoitoon Jamalin niemimaalla, Pohjois-Venäjällä

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Tutkimuksessa pyrittiin arvioimaan satelliittikuvien soveltuvuutta maankäytön muutosten havainnointiin arktisen Venäjän öljyn- ja kaasuntuotantoalueilla. Jamalin niemimaalla Luoteis-Siperiassa sijaitsevat maailman laajimmat kaasuesiintymät. Nenetsit ovat harjoittaneet poronhoitoa Jamalilla satoja vuosia. Vuotuisen laidunkierron varrella metsänrajalta Karanmeren rannikolle (1500 km), nenetsipaimentolaiset kohtaavat useita erilaisia kaasuteollisuuteen liittyviä kohteita. Öljy- ja kaasuteollisuuden vaikutukset tutkimusalueella voidaan jakaa karkeasti: suoranaisiin ympäristövaikutuksiin sekä vaikutuksiin poronhoitoyhteisöön. Ympäristövaikutukset vaihtelevat teistä, putkistoista, jätteistä, muuttuneesta kasvillisuudesta saastuneeseen maaperään tai veteen. Öljy ja kaasuteollisuuden vaikutukset tutkimusalueella voidaan jakaa karkeasti kahteen osa-alueeseen: suoranaisiin ympäristövaikutuksiin sekä vaikutuksiin poronhoitoyhteisöön. Osa vaikutuksista on hyvin pienialaisia, kuten muutaman metrin levyiset maastoajoneuvourat (vain) ja osa useita hehtaareja kuten maanottoalueet. Tutkimuksessa käytettyjä satelliittikuvia olivat Landsat MSS/TM/ETM, SPOT, ASTER TERRA VNIR ja Quickbird-2 -kuvat. Vaikeimmin havaittavia vaikutuksia satelliittikuvilta olivat yksittäiset erilaiset roskat ja jätteet (metalli, betoni, lasi). Kyseiset jätteet ovat puolestaan yksi merkittävimmistä laidunten arvoa alentavista tekijöistä; alueita joilla on porojen sorkkia mahdollisesti vahingoittavaa jätettä pyrkivät poropaimenet kokonaan välttämään.
Bovanenkovon kaasukentän vaikutusalue on noin 450 km^2. Noin 33 km^2 kasvillisuutta on tuhoutunut tai muuttunut toiseksi tyypiksi. Vaikutukset ovat lähinnä paikallisia ja suhteellisen pienialaisia, mutta esimerkiksi noin 20 prosenttia kahden Yarsalinskin sovhoosin poroprikaatin loppukesänlaitumista sijaitsee Bovanenkovon kaasukentän vaikutusalueella. Erityisesti porojen ja paimentolaisten kulkeminen kaasukentän läpi on vaikeutunut yhä lisääntyneen rakentamisen myötä. Näin ollen vaikutukset voivat olla paikallisesti erittäin merkittäviä. Ekologisten vaikutusten arviointiin tarvitaan kaukokartoitusmenetelmiä sekä kenttätöitä. Maankäytön muutosten tutkimuksen kannalta poronhoitajien paikallistuntemus sekä öljy- ja kaasuteollisuuden työntekijöiden tietämyksen huomiointi tuo tutkimukseen merkittävää lisäarvoa.

Reindeer husbandry, hydroelectric power development and reindeer husbandry research – a history

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The establishment of a more organized research on reindeer husbandry in Sweden is in many ways connected to the increased exploitation of the reindeer husbandry area, not least the development of hydroelectric power. Individual research projects on separate issues with connection to reindeer husbandry were carried out during the first half of the twentieth century but it was not until after World War II that a more structured organization was established. The start was modes, but was soon expanded, since the hydroelectric power development demanded both more dependable estimations of the value of the grazing land that was lost as well as finding measures to utilize the remaining grazing lands more rationally. This presentation will follow the development of reindeer husbandry research in Sweden from the first projects up until the start of the Nordic cooperation in this arena during the 1960s.

Renskötsel, vattnkraftsutbyggnad och renskötselsforskning – en historik

Tillkomsten av en mer organiserad forskning kring renskötseln i Sverige har många kopplingar till den ökande exploateringen av renskötselområdet, och då inte minst utbyggnaden av vattenkraften. Enskilda forskningsprojekt inom skilda områden med betydelse för renskötseln hade genomförts vid olika tillfällen under första halvan av 1900-talet, men det är under efterkrigstiden som en fast organisation skapas. Från en blygsam start utvidgades verksamheten snart, framför allt eftersom den pågående utbyggnaden av vattenkraften ställde krav både på säkrare bedömningar av värdet på den renbetesmark som gick förlorad liksom åtgärder för att mer rationellt utnyttja de betesmarker som återstod. Denna presentation kommer att beskriva utvecklingen av renforskningen i Sverige från de första projekten fram till starten för det nordiska samarbetet på renforskningens område på 1960-talet.

Cabins in reindeer grazing land: Reindeer husbandry interests in municipal planning processes

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Cabin construction is one of the most common human-made constructions in outlying fields used as reindeer grazing land in Norway. Cabins and people using cabins as a base for outdoor activities may disturb reindeer grazing patterns, and studies show that the majority of the herd may avoid grazing in areas nearer than 2 to 4 km. from cabin resorts. Currently, near 1000 cabins are built every year in Sami reindeer husbandry areas in Norway, with subsequent loss of grazing land.
The location and extent of areas set aside for cabin construction are decided through municipal planning processes resulting in comprehensive plans. These processes shall include reindeer husbandry representatives, ensuring that the planned cabin construction is not harmful for reindeer husbandry in the area. However, there are problems both with the municipalities' involvement of reindeer husbandry interests, as well as the participation of the representatives from the reindeer husbandry in these processes. These involvement - and participation problems relate to both comprehensive plans for whole municipalities, and local plans for specific construction areas, i.e. cabin resorts.
We have studied these problems both from a national perspective including the entire area of Sami reindeer husbandry in Norway (about 40% of the Norwegian land area), and from a case study perspective in three different areas (including five municipalities). The national analyses show that most of the comprehensive and local plan processes end with compromises allowing a lot of cabin construction. In addition some municipalities open up for numerous exemptions from the comprehensive plan, allowing cabin construction in areas where this was not originally allowed according to the comprehensive plan. The result is both more cabins and a more scattered cabin location pattern than the reindeer husbandry wants.
The case studies indicate that the municipal planning processes to a large extent are negotiation processes between conflicting interests; the municipalities welcome building activity because it generates employment and income, while the reindeer herders are negatively affected by increased construction activity in grazing areas. Thus the participation in the processes can often be strategic from both the municipalities and the reindeer husbandry representatives, and the mutual confidence between the municipalities and reindeer husbandry may be low, making communication between the parties difficult. Different views on how the plans will affect reindeer husbandry within different groups in the reindeer husbandry society, and between the local and regional representatives of the reindeer husbandry, also makes planning difficult for the municipalities. On the other hand, the municipalities' lack of understanding of the reindeer herds need for large areas of undisturbed grazing land, make it difficult to reach compromise solutions that the reindeer husbandry can cope with in the long perspective. Being a minor economic interest in most municipalities, reindeer husbandry is not given priority by the municipalities.

Hyttebygging i reinbeiteland: Reindriftsinteressenes posisjon i kommuneplanprosesser

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Hyttebygging er et av de vanligste inngrep i utmark som brukes som reinbeiteland i Norge. Hyttene og hyttefolkets aktiviteter forstyrrer reinflokkenes beitemønster, og forskning viser at flertallet av flokkene unngår å beite i områder nærmere enn 2 til 4 km fra hytteområder. Det bygges om lag 1000 nye hytter hvert år i eller i tilknytning til samiske reindriftsområder i Norge, som følgelig medfører tap av beiteland.
Omfang og lokalisering av hyttebygging avgjøres av kommuneplanprosesser i den enkelte kommune og fastlegges i kommuneplanens arealdel. I disse planprosessene skal reindriftas representanter høres, for å sikre at planlagt hyttebygging ikke er til skade for reindrifta i området. I praksis fungerer dette ikke alltid slik det skal verken med hensyn til kommunenes involvering av reindriftsinteressene eller reindriftsinteressenes deltakelse i planprosessene. Dette gjelder både for kommuneplanprosesser for hele kommuner og for reguleringsplanprosesser for konkrete hyttefelt.
Vi har studert dette både i en oversiktsanalyse over hele det området hvor det drives samisk reindrift (om lag 40% av landets areal), og i nærmere studier av tre områder (inkludert fem kommuner). Den nasjonale oversiktsanalysen viser at de fleste kommuneplanprosesser og konkrete reguleringsplanprosesser ender med kompromissløsninger som åpner for mye hyttebygging. I tillegg har en del kommuner svært liberal dispensasjonspraksis og tillater mye hyttebygging i områder som i kommuneplanens arealdel ikke er åpen for slik utbygging. Resultatet av dette er både mer hyttebygging og et mer spredt hyttebyggingsmønster enn reindrifta ønsker.
Studiene i de tre utvalgte områdene viser at planprosessene i stor grad er forhandlingsprosesser mellom motstridende interesser; kommunene ønsker bygging da det gir arbeid og inntekt for lokalbefolkningen, mens reindriftsinteressene ikke ønsker bygging og aktivitet som forstyrrer reinflokkene. Deltakelsen i planprosessene kan derfor fra begge parter ofte være strategisk, og tilliten mellom partene er tilsvarende lav, noe som vanskeliggjør kommunikasjon og dialog mellom partene. Ulike meninger om konsekvensene av hyttebygging internt i reindrifta og mellom lokale representanter for reinbeitedistrikt og regionale representanter for reinbeiteområder vanskeliggjør planleggingen for kommunene. På den andre siden er kommunenes manglende forståelse for reindriftas behov for store uforstyrra beitearealer et klart hinder for å nå fram til gode kompromissløsninger som reindrifta også kan leve med i et langsiktig perspektiv. I og med at reindrifta i de fleste kommuner utgjør en marginal økonomisk interesse, blir ikke reindriftas interesser prioritert av kommunene.

Preconditions for the reindeer husbandry in a progressing climate change

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The reindeer husbandry area in Sweden will be affected by climate change on several levels. Autumn, winter and spring will be especially affected as the conditions during these seasons are strongly influenced by temperatures around 0 °C, while changes during summer will be considerably less dramatic for reindeer husbandry. On an 80-year perspective, the snow season is expected to be shortened with 1 to 2 months according to IPCC's climate scenario B2 (SRES), together with the global climate model ECHAM and SMHI's regional models RCAO/RCA3. The average winter temperature is expected to increase by 4 to 6 °C and the number of days with frost to decrease by 30 to 50 days. The precipitation will increase during autumn, winter and spring, mostly as rain. Summers will be 2 to 2.5 °C warmer, but the precipitation scenarios for summers are more geographically varied and the wind scenarios are relatively unsure.
Local scenarios for the husbandry are very complex and difficult to foresee as the reindeer husbandry area in Sweden is very heterogeneous and the husbandry differs in the different herding districts, as well as, the climate scenarios are dependent on geography, season and biotope. Therefore, a questionnaire study, including climate scenario maps with weather variables relevant to the reindeer husbandry, was carried out. The questionnaire was given to reindeer herders from all parts of the Swedish reindeer herding area and they were asked to give personal reflections and predictions of the local conditions and how it would affect their local reindeer husbandry and prerequisites. In addition, there was room for the respondents to define local requirements for a continuously sustainable husbandry based on the presumed changes. They were also asked to rank and quantify the importance of different sources of disturbances of today and of the future in relation to climate change.
The respondents reported both presumed positive and negative partial and summarised effects of climate change. Any organized local planning efforts do not seem to have been put into practice in the husbandry units. Concerns among the respondents regarding climate change and reindeer husbandry were obvious, but in relation to other threats to reindeer husbandry, such as forest cultivation, wind power plants, tourism and large carnivores, the climate change issues do not seem to be the biggest source of concern for reindeer husbandry in Sweden.

Renskötselns förutsättningar i en pågående klimatförändring

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Renskötselområdet i Sverige förväntas bli påverkat av klimatförändringarna på flera sätt och nivåer. Höst, vinter och vår kommer att förändras betydligt då förhållandena under dessa årstider starkt påverkas av temperaturer vid och omkring 0 °C, medan förändringarna under sommaren blir betydligt mindre dramatiska sett ur renskötselns perspektiv. Enligt IPCC:s klimatscenario B2 (SRES), den globala klimatmodellen ECHAM och SMHI:s regionala modeller RCAO/RCA3 förväntas snösäsongen på 80 års sikt förkortas med mellan en och två månader. Vinterns medeltemperatur förväntas öka med 4 till 6 °C och antalet frostdagar minska med mellan 30 og 50 dagar. Nederbörden kommer även att öka under höst, vinter och vår, mestadels i form av regn. Sommaren kommer att bli 2 till 2,5 °C varmare, men scenariot för nederbörd på sommaren är mer geografiskt varierat och vindscenarierna på årsbasis relativt osäkra.
Lokala scenarier är mycket komplexa och svåra att förutsäga då renskötselområdet i Sverige är heterogent och renskötseln i de olika samebyarna skiljer sig åt. Klimatscenarierna är dessutom beroende på geografi, säsong och biotop. En informationsenkät innehållande klimatscenariekartor med för renskötseln relevanta vädervariabler skickades ut till personer involverade i renskötseln. I denna ombads de ge personliga reflektioner och förutsägelser över vad klimatförändringen skulle kunna innebära för deras lokala renskötsel och förhållanden. Det gavs utrymme för de svarande att identifiera behov för att kunna fortsätta att bedriva en livskraftig renskötsel under kommande förändringar i klimat och förutsättningar. Man ombads även att rangordna och kvantifieras allvarligheten av olika störningar idag och på sikt under en pågående klimatförändring.
Både positiva och negativa effekter av klimatförändringen rapporterades av enkätdeltagarna. Några lokala organiserade planeringsarbeten med anledning av klimatförändringarna verkar inte ha startats inom renskötseln och i samebyarna. Frågor om att klimateffekterna på renskötseln kommer att bli påtagliga är tydliga i enkätsvaren, men i relation till andra hot mot skötseln, såsom skogskötsel, vindkraft, turism och rovdjur, förefaller klimatförändringarna inte vara det största orosmomentet inom renskötseln.

Large-scale productivity determinants of reindeer husbandry in Sweden

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The productivity of the reindeer industry in the 51 herding districts in Sweden is affected by a large amount of factors on different geographical and temporal scales. Combinations of factors characterizing the environmental conditions for reindeer husbandry were identified and showed to be strongly correlated with variations in productivity, both between herding districts and between years. Productivities were described by estimated herd growth rates and carcass condition of slaughtered adult females and calves. These dependent productivity variables were related to the environmental independent variables using multiple linear regression and structural equation models (SEM). The independent variables were either considered as stable (e.g. topography, vegetation and infrastructure) or temporally changing (e.g. season lengths, weather events, disturbances and animal slaughter strategies). The most relevant independent variables identified were used in a cluster analysis to suggest a grouping of herding districts. Larger variation in productivity was found between herding districts than between years. Different variables were found to be important for between-district and within-district variations, respectively. Season lengths and animal densities were found noteworthy at both levels of variation. Other relevant variables found were ruggedness, snow condition, predicted harassing insect activity, supplementary feeding, proportion of calfs in slaughter and previous-year animal condition. Snow precipitation, predicted ice-crust formation and forage quality were presumed to be relevant for reindeer productivity, but were not found to have large impacts on productivity at this scale. These factors may have been neutralized or mitigated by husbandry measures, statistically included and thereby explained by other variables with strong effects on productivity, such as animal density variables. Several of the variables that were found to be important for productivity are correlated with climate and weather and therefore predicted to be central in a climatic change context.

Vilka storskaliga faktorer påverkar renskötselns produktivitet i Sverige?

Renskötselns produktivitet i Sveriges 51 samebyar påverkas av många olika faktorer på flera olika skalor. Olika geografiska och tidsberoende faktorkombinationer identifierades och visade sig starkt korrelerade med variationer i produktivitet i renskötseln både mellan samebyar och mellan år. Produktiviteten definierades som skattad hjordtillväxt och slaktdjurens kondition mätt på slaktkroppar av vajor och kalvar. Dessa produktivitetssvariabler relaterades till miljövariabler som delades upp i stabila (t.ex. topografi, vegetation och infrastruktur) respektive variabler varierande över tiden (t.ex. säsongslängder, väderhändelser, störningar och slaktstrategier). Variablerna analyserades med hjälp av stegvisa multipla linjära regressionsmodeller och strukturella ekvationsmodeller (SEM).
De mest relevanta variablerna identifierades och inkluderades i en klusteranalys för att gruppera jämförbara samebyar. Större variation i produktivitet hittades mellan byar än mellan år. Olika variabler var relevanta mellan byar och mellan år. Säsonglängder och djurtäthet var relevanta både mellan byar och mellan år. Andra relevanta variabler såsom markens brutenhet, snöförhållanden, störande insekter, stödutfodring, kalvslaktsandel och djurs kondition föregående år var relevanta endast för endera av dessa. Snöfall, skare och beteskvalitet antogs vara viktiga variabler för renproduktiviteten men visade sig i denna storskaliga undersökning inte förklara mycket av variationen. Dessa variabler kan ha upphävts eller motverkats av skötselåtgärder och därmed vara inlemmade i andra mer variationsförklarande variabler såsom t.ex. djurtäthet. Flera av de mest relevanta variablerna är kopplade till klimat och därmed bidrar till att klimatförändringen påverkar renskötselns produktivitet.

The symbolic capital of reindeer husbandry: The importance of a large herd

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A little understood theme inside reindeer husbandry related research is the individual reindeer number set by each reindeer herder. A maximizing strategy can be viewed as a general practice among reindeer herders and also among other pastoralists, but a contemporary understanding of such behaviour and the structures supporting it is currently lacking. It is on this research problem my presentation will focus and the presentation is also based on fieldwork that has been conducted in northern Norway, Sweden and Finland.
In the preliminary results, a clear controversy emerges. In the reindeer husbandry field and by the state authorities, a high reindeer number is rewarded and not sanctioned. This is in stark controversy with the official reindeer reduction policies promoted especially by the states of Norway and Finland. A high reindeer number 1) results in a higher economic yield in combination with state subsidies, 2) provides more power inside the district, 3) provides security against an uncertain future, 4) gives a higher social status inside the local community and 5) it gives a better chance for recruitment. In addition, 6) the process of positioning must be highlighted. This means to employ the strategy of herd expansion in anticipation of distribution of rights such as individual transferable quotas of reindeer (Finland) or the division of the common pastures among the siidas or reindeer groups (Norway).

Symbolkapital i reindriften – tryggheten med å ha en stor reinflokk

Et lite forstått tema innenfor reindriftsforskningen er hvordan reintallet til den individuelle reindriftsutøver blir fastsatt og hvorfor det er viktig å eie en stor reinflokk. En maksimeringsstrategi kan bli sett på som en generell strategi hos de fleste pastoralister, inkl. reindriftsutøvere, men en forståelse av denne strategien og det rammeverket som støtter den, mangler. Dette er problematikken som denne presentasjonen vil prøve å utdype. Feltarbeid er utført i flere samiske reinbeitedistrikter i Norge, Finland og Sverige. I de preliminære resultatene fra feltarbeidet finner man kontroversielle uttalelser angående reintall. Innenfor reindriftsnæringen og innenfor det statlige forvaltningssystemet blir et høyt reintall belønnet i stedet for sanksjonert. Dette er i sterk kontrast til den statlige politikken som prøver å få både reintallet og antall reineiere redusert. Et høyt reintall 1) gir blant annet et høyere økonomisk resultat i sammenheng med subsidier/kompensasjoner, 2) gir mer makt innenfor distriktet og mellom distriktene, 3) gir mer sikkerhet mot uforutsigbare forandringer, 4) gir høyere sosial status i lokalsamfunnet og 5) gir bedre mulighet for rekruttering. I tillegg 6) så må prosessene rundt posisjonering bli understreket. Posisjonering i reindriftsnæringen skjer ved at reineiere prøver å maksimere sitt reintall i vente på at rettigheter til beite og reintall vil bli individuelt fordelt. Alle disse prosessene støtter det å eie en stor reinflokk.

Cervid herpesvirus 2 causes respiratory and fetal infections in semi-domesticated reindeer

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Viruses from the subfamily *Alphaherpesvirinae* are known to infect and cause disease in several ruminant species becoming a lifelong infection as they have the capability to establish latency in sensory ganglions. Of these bovine herpesvirus type 1 (BoHV-1), causing the diseases Infectious Bovine Rhinotracheitis (IBR), Infectious Pustular Vulvovaginitis (IPV) as well as abortion and weak born calves, has been widely described given its impact on animal health and husbandry worldwide. BoHV-1 and other viruses belonging to the genus *Varicellovirus,* are known to cross-react serologically and have been isolated from semi-domesticated and wildlife ruminant species such as cervid herpesvirus 2 (CvHV-2) from reindeer (*Rangifer tarandus tarandus*) in Finland and Sweden. Despite serological evidence of the presence of this virus in reindeer in Finnmark County, Norway, it has never been isolated in Norway and little information is available regarding its transmission, latency and potential to cause abortion and disease. The mortality of reindeer in Finnmark in 2006 was 37% during the reindeer herding year of 2005-2006 and 11% of mortalities remain of unknown etiology. To address the possibility that CvHV-2 infection may affect the respiratory system and in part explain abortions and the relatively high mortality of reindeer calves during their first year of life, tissue samples were obtained from reindeer and reindeer fetuses at slaughterhouses in Finnmark County during the period 2004 to 2006. Sampling was conducted from animals representing 10 of the 14 reindeer districts of Finnmark County that had been screened in an alphaherpesvirus serosurvey in 2004 to 2006. That serosurvey identified a significant higher seroprevalence in animals with high carcass mass (adults) compared to animals with low carcass mass (calves). A nested pan-alphaherpesvirus PCR targeting the highly conserved UL27 gene (glycoprotein B) was used to amplify viral DNA. The amplicon sequences were identical or differed just in one nucleotide when compared to the CvHV-2 isolate obtained in 1992 from a Finnish reindeer (Salla 82). The findings of CvHV-2 DNA in trigeminal ganglia (27 of 143), nasal swabs (5 of 75) and fetal tissues (12 of 48), of the latter including lung, liver, spleen and blood samples, indicate that CvHV-2 infection is endemic in this reindeer population, that the virus is transmitted horizontally by the respiratory route establishing latency in the trigeminal ganglion, and that virus is transmitted vertically to the fetus through the placenta. This virus may thus have a potential impact on reindeer health as well as reproductive success. Reindeer are a central key species to the northern boreal and sub-arctic ecosystems and of outmost economical and social importance for the indigenous peoples across Fenno-Scandia and other northern regions. The study of diseases, that may have an impact on sustainability and husbandry, should have a central place in management plans and future scientific research and further studies should focus on the reproductive impact of CvHV-2 infection in reindeer.

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Cervid herpesvirus 2 forårsaker infeksjoner i luftveiene og overføres til foster hos tamrein

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Virus i underfamilien *Alphaherpesvirinae* forårsaker infeksjoner og sjukdom hos mange drøvtyggerarter. De etablerer latens i nerveganglier og gir en livslang infeksjon. Av disse virusartene er Bovint herpesvirus type 1 (BoHV-1), som forårsaker sjukdommene Infeksiøs rhinotrakeitt (IBR), Infeksiøs pustulær vulvovaginitt (IPV), abort og svakfødte kalver, best beskrevet på grunn av betydningen for storfe verden over. BoHV-1 og andre virus tilhørende genus *Varicellovirus*, er kjent for å kryssreagere serologisk og har blitt isolert fra tamrein og ville drøvtyggere, som cervid herpesvirus 2 (CvHV-2) fra reinsdyr (*Rangifer tarandus tarandus*) i Finland og Sverige. Det er kjent fra tidligere serologiske undersøkelser at dette viruset fines hos reinsdyr i Finnmark fylke (Norge) men viruset har aldri blitt isolert fra norsk rein, og det er lite kunnskap om hvordan det overføres mellom dyrene, hvor viruset eventuelt etablerer latens, og dets potensial til å forårsake abort og sjukdom. For reindriftsåret 2005-2006 ble det registrert et tap av dyr på 37% i Finnmark hvorav 11% var av ukjente årsaker. For å undersøke muligheten for at infeksjoner med CvHV-2 kan være assosiert med luftveisinfeksjoner, aborter og en relativt høy dødelighet av kalver under første leveår, samlet vi blod og vevsprøver fra reinsdyr og fostre fra slakterier i Finnmark i perioden 2004-2006. Det ble tatt prøver fra dyr fra 10 av de 14 reinbeitedistriktene i Finnmark som var representert i en tidligere serologisk undersøkelse for antistoffer mot alphaherpesvirus (2004-2006). I den serologiske undersøkelsen ble det funnet en klart høyere seroprevalens hos dyr med høy kroppsvekt (voksne) i forhold til dyr med liten kroppsvekt (kalver). Vevsprøvene ble testet ved hjelp av en polymerase kjedereaksjonstest (nested pan-alphaherpesvirus PCR) for påvisning av virus-DNA (UL27-genet; Glycoprotein B). Sekvensering av PCR-produktet viste at virus-DNA i vevsprøvene var identiske med eller hadde kun én nukleotidforskjell fra CvHV-2-virsuet som ble isolert fra finsk reinsdyr i 1982 (Salla 82). Funn av virus-DNA i nerveganglier (27 av 143), nesesvaberprøver (5 av 75) og i prøver fra 12 av 48 fostre (lunge, lever, milt og blod) indikerer at dette viruset (CvHV-2) er endemisk i denne reinsdyrpopulasjonen, at viruset overføres horisontalt via luftveiene og etablerer latens i nerveganglier (*Ganglion trigeminale*), samt at viruset kan overføres vertikalt til foster over placenta. En kan derfor ikke utelukke at dette viruset kan ha en betydning for helse og reproduksjon hos reinsdyr. Reindrift spiller en sentral rolle i de nordlig boreale og subarktiske økosystemer og har en stor økonomisk og sosial betydning urbefolkningsgrupper i Fenno-Scandia og andre nordlige områder. Forskning på reinsdyrsjukdommer som kan ha en betydning i forhold til en lønnsom og bærekraftig reindrift bør ha en sentral rolle i forvaltningsplaner og utvikling av reindrifta. Videre forskning på reinsjukdommer bør blant annet omfatte betydningen av CvHV-2-infeksjoner i forhold til abort og sjukdom.

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Reindeer husbandry problems in Inner Mongolia, China

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Extended abstract: The last hunting tribe in Inner Mongolia, the Yakute tribe, also called the Reindeer tribe, is one of the three branches of the Evenki ethnic group living deep in the Greater Xingan Mountains, the largest forest area in China. They are descendants of reindeer herding people who emigrated from the Lake Baikal area of the Lena basin about 200 years ago. The once-nomadic Evenki tribe with a population of about 170 settled in and around the village of Aoluguya in the northernmost part of Genhe in 1965. Today there are ca 500 inhabitants living in the village, 230 of them Evenki hunters. In 1976, there were totally 995 reindeer in China, whereof 810 adults; 422 males and 388 females. The rest were juveniles; 72 males and 73 females. The female reindeer were milked and males were used as transport animals. In addition the velvet antlers of reindeer were utilised (Yi-Ching, 1983). Today, houses with modern facilities have been built to 62 reindeer herding families in the western suburbs of Genhe. Altogether, they have only about 600 reindeer in five different herds. Herd 1 is the original reindeer herd since 1949, and it is the biggest herd in China, located about 280 km from Genhe to the north. The herd which consists of about 300 reindeer is owned by 10 families, and 10 people live with the herd. No slaughtering of reindeer takes place, and only old and suffering reindeer are killed for animal welfare reasons. Then the carcasses are sold. Last year dogs and bears killed one and eight reindeer calves, respectively. There are more than 60% males in the herd. Antlers are removed during summer. Herd 2 is located about 180 km from Genhe and consists of about 45 reindeer belonging to one herder family. This family had about 100 reindeer in 1990 but only 30 reindeer in 2003 when the herd was moved to the current location. The gender ratio is different from other herds; 28 of the 45 animals are females. In 2007, the herd produced 13 calves, of which eight were females. Herd 3 is 80 km from Genhe, and three families live with this herd. They have ca 140 reindeer, ca 60% males and 40% females. Equal numbers of male and female calves were born. Antlers are cut, but no reindeer have been slaughtered recently. The herd has decreased but no predator problems are reported in this area. Herd 4 grazes 35 km from Genhe; herded by men of three families, women and children stay in Genhe. About 70 reindeer, 20 females and 11 calves, are living in this area. Ten years ago, 30 reindeer were imported from Russia. During the last year, wolves killed 6 calves. A couple of years ago, some old and sick reindeer were slaughtered. The herd is collected to the camp with salt and yellow soy beans. Winter fodder consists almost exclusively of lichen. Antlers of all animals, apart from reindeer calves, are removed during summer. Herd 5 stays about 30 km from Genhe. There are ca 40 reindeer herded by one family. The population structure and pasture situation is regarded as similar to herd 3.
Altogether, parasites appear to be similar to other reindeer herding areas of the world, and yearly anti-parasitic treatments control them effectively. No signs of brucellosis have been noticed in Chinese reindeer, but *Brucella* sero-reactive animals were seen in Mongolian Tsaatan reindeer (Haigh *et al*., 2006). Despite the small number of individuals of the Genhe reindeer, and their isolation from other herds of reindeer, the analyses of genetic variability in 14 micro satellite loci revealed neither signs of reduced genetic variability nor any ongoing inbreeding. In Mongolian and Siberian reindeer, where populations have also decreased, using different genetic analytical methods, slightly different results have appeared (Kol *et al*., 2006; Røed *et al*., 2006, 2008). Currently, reindeer herding is mostly based on velvet antler trade, which has caused the distortion of sex structure of the herds (Nieminen & Oksanen, 2008). The lack of tradition in eating reindeer meat may be a major problem of Chinese reindeer husbandry but it is generation shifts in the herder families which are considered to be the major problem; their children are not interested in living a traditional Evenki life. Infrastructure, such as road network and services, which might be used for tourism purposes, is generally non-existing.

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Porotalouden ongelmat Sisä-Mongoliassa, Kiinassa

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Viimeinen metsästäjäheimo, jakuuttiheimo, kutsuttu myös poroheimoksi, on yksi kolmesta evenkien etnisen ryhmän haarasta, joka elää Kiinan laajimmalla metsäalueella, suurilla Xingan vuorilla. He ovat venäläisen poronhoitajakansan jälkeläisiä, ja muuttivat alueelle Baikal-järven ja Lena-joen alueilta noin 200 vuotta sitten. Aikaisemmin paimentolaiselämää viettäneet noin 170 evenkiä asettuivat vuonna 1965 Genhen alueen pohjoisimpaan osaan Aoluguyan kylän ympärille. Nykyään kylässä on noin 500 asukasta, joista 230 on metsästäviä evenkejä. Vuonna 1976 Kiinassa oli yhteensä 995 poroa. Aikuisia poroja oli 810, niistä 422 urosta ja 388 naarasta. Nuoria poroja oli 145, niistä 72 urosta ja 73 naarasta. Vaadinporoja lypsettiin, urosporoja käytettiin vetoeläiminä. Porojen kasvavia verisarvia tuolloin myös hyödynnettiin (Yi-Ching, 1983). Nykyään 62 poronhoitajaperheelle on rakennettu nykyaikaiset talot Genhen läntiselle esikaupunkialueelle. Yhteensä heillä on vain noin 600 poroa viidessä eri laumassa. Lauma 1 on alkuperäinen lauma vuodelta 1949, ja se on Kiinan suurin porolauma. Lauma on noin 280 km Genhestä pohjoiseen, ja siellä on 10 perheellä noin 300 poroa. Vain 10 ihmistä hoitaa näitä poroja. Poroja ei teurasteta, ainoastaan vanhoja ja sairaita poroja tapetaan ja lihat myydään. Vuosi sitten metsästyskoirat tappoivat yhden ja karhut 8 vasaa. Porojen sarvet katkotaan kesällä. Lauma 2 on noin 180 Genhestä ja käsittää noin 45 poroa. Laumaa hoitaa yksi perhe, ja sillä oli vuonna 1990 vielä noin 100 poroa, mutta vuonna 2003 vain 30 poroa perheen muuttaessa nykyiselle alueelle. Lauman sukupuolirakenne on muista poikkeava; 45 porosta naaraita on 28. Vuonna 2007 laumaan syntyi 13 vasaa, joista naaraita oli 8. Lauma 3 on noin 80 km Genhestä, ja sitä hoitaa kolme perhettä. Laumassa on noin 140 poroa, niistä noin 60% on uroksia. Uros- ja naarasvasoja syntyy yhtä paljon. Sarvet katkotaan, mutta poroja ei nykyään teurasteta. Porojen määrä on vähentynyt, vaikka alueella ei ole peto-ongelmaa. Lauma 4 on noin 35 km Genhestä, ja sitä hoitavat kolmen perheen miehet, vaimot ja lapset asuvat Genhessä. Laumassa on noin 70 poroa, niistä 20 on vaadinta ja 11 vasaa. Noin 10 vuotta sitten alueelle tuotiin 30 uutta poroa Venäjältä. Viime vuonna sudet tappoivat laumasta 6 vasaa. Muutamia vuosia sitten joitakin vanhoja ja sairaita poroja tapettiin. Lauma kootaan kämppäalueelle suolan ja soijajauhon avulla. Porojen talviravinto näyttää koostuvan lähes kokonaan jäkälistä. Vasoja lukuun ottamatta kaikkien muiden porojen sarvet katkotaan myyntiin kesällä. Lauma 5 on noin 30 km Genhestä. Lauman noin 40 poroa hoitaa yksi perhe. Lauman rakenne ja laitumet ovat kuin laumassa 3. Yleensä alueen poroilla on samoja loisia kuin muuallakin poronhoitoalueella, ja niitä vastaan käytetään tavallisesti vuosittain tehokasta loistorjuntaa. Kiinan poroissa ei havaittu merkkejä bruselloosista, vaikka tällaisia sairaita poroja on tavattu Mongoliassa Tsaatan heimon poroilla (Haigh ym. 2006). Pienestä poromäärästä ja sen eristäytyneistä laumoista huolimatta 14 mikrosatelliittilokuksen vaihtelevuus ei osoittanut merkkejä vähentyneestä geneettisestä vaihtelevuudesta eikä sisäsiitoksesta. Mongolian ja Siperian alueilla, joissa myös poromäärät ovat vähentyneet, eri geneettiset tutkimukset ovat antaneet hieman poikkeavia tuloksia (Kol ym., 2006; Røed ym., 2006, 2008). Kiinan poronhoidon suurimpana ongelma on perinteen ja poronlihan käytön puuttuminen. Nykyään poronhoito perustuukin pääasiassa verisarvituotantoon, joka on aiheuttanut myös porojen vääristyneen sukupuolirakenteen (Nieminen & Oksanen, 2008). Myös poronomistajien sukupolvenvaihdos on suuri ongelma, sillä jälkeläiset eivät ole enää kiinnostuneita evenkien perinteellisestä elämäntavasta. Alueelta puuttuvat myös turismin kehittämisen kannalta tärkeät palvelut ja hyvä tieverkosto.

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The impact of large carnivores on the mortality of reindeer in Kuusamo area

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Predators have caused increased losses in the Finnish semidomesticated reindeer stock during last years, especially in the southeastern regions of Kainuu and Kuusamo, and mainly due to expanding wolf population in Kainuu, south of the reindeer management area. In addition to the impact of wolves, also brown bears cause problems in the reindeer-herding districts situating by the Russian border. The high mobility of bears and wolves, locally varying rates of predation, as well as intrinsic and extrinsic factors affecting reindeer population constitute a challenging field for studying the impact of large carnivores on the reindeer population dynamics and productivity. However, such studies are necessary in assessing the role of predation in calf losses and the feasibility of the current and planned compensation regimes for predator-killed reindeer.

As part of a large calf mortality study (>4000 calves radio-collared from 1997 to 2006), carried out by Finnish Game and Fisheries Research Institute, we studied the impact of large carnivores on calf mortality in Kuusamo region. During six years (from 1999 to 2004) we studied survival of a total of 580 calves in the reindeer-herding district of Oivanki. From 2004 to 2006, we moved our focus to the reindeer-herding district of Kallioluoma, the southern neighbour of Oivanki, where we radio-collared in total 687 calves. Most of the calves were marked already at the age of 1 to 3 days in calving corrals. The survival of calves was monitored from the calving in May until winter round-ups in October-January. In addition to calf mortality, also information on the distribution of predators, the loss of adult reindeer and the effect on the productivity of reindeer stock was obtained. The rate, timing and causes of mortality (predation *contra* other causes) as well as underlying factors affecting survival of the study calves were assessed.

During six years we found in total 42 radio-collared calves dead in Oivanki by the end of October whereas in Kallioluoma we found 114 dead calves during three years only, of which most (111) in 2005-06. In Kallioluoma, we monitored the survival of marked calves until mid-January, by which an additional 28 calves died. The results from Kuusamo reveal the great annual variation in mortality and predation pressure. In 2000-01 few bears caused great losses among marked calves in Oivanki, and total annual mortality varied from 22% to 23%, while in 2002-04 annual mortality varied only from 0% to 5%. In 2000-01 predation by bears was on average 4-6% of calves plus 15% of potentially bear-killed calves (hardly any remains left after been eaten by a bear). In contrast, from 2002 to 2004 only 2% of calves were eaten by bears. Other carnivores (lynx, wolf and wolverine) killed each only one study calf in Oivanki. In a neighbouring district of Kallioluoma the situation in calf loss and predation was different. In 2004, only three calves out of 100 radio-collared were found dead, but in 2005-06 we found in total 139 dead calves. Mortality reached about 29% by the end of October and exceeded 40% by mid-January. Wolf predation comprised on average 18% of all radio-collared calves while the total rate of all predation was at least 21% (potentially even 25%). The adult females found dead (n=45) comprised altogether 13% and those killed by wolves (n=32) 9% of all the females that gave birth in the calving corrals. In addition to those females found dead, 21 females (6%) were lost. Thus, many calves (nearly 10%) were orphaned.

Suurpetojen vaikutus porojen kuolleisuuteen Kuusamon alueella

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Petoeläimet ovat aiheuttaneet viime vuosina yhä suurempia ja vuosittain lisääntyviä menetyksiä Suomen poronhoitoalueen porokarjassa. Suuri osa petojen aiheuttamista tappioista kohdentuu poronhoitoalueen kaakkoisosaan, Kainuun ja Kuusamon alueelle, ja yhtenä merkittävänä tekijänä on Venäjän rajan lisäksi poronhoitoalueen eteläpuolella vakiintunut ja vahvistunut susikanta. Susien lisäksi myös karhut aiheuttavat ongelmia poronhoidolle, erityisesti Venäjän rajan läheisyydessä. Suurpetojen suuri liikkuvuus, paikallisesti vaihteleva saalistuspaine, kuten myös porokantaan vaikuttavat sisäiset ja muut ulkoiset tekijät muodostavat haastavan tutkimusasetelman tutkittaessa petojen vaikutusta porokannan populaatiodynamiikkaan ja tuottavuuteen. Tutkimusta kuitenkin tarvitaan, jotta pystytään määrittelemään esimerkiksi petoeläinten vaikutus vasojen ja aikuisten porojen hävikkiin, sekä perusteet nykyisille ja uusille korvausjärjestelmille.
Osana laajaa Riista- ja kalatalouden tutkimuslaitoksen Suomen poronhoitoalueella toteuttamaa vasakuolleisuustutkimusta (yhteensä yli 4000 vasaa merkittiin ns. kuolevuusradiolähettimillä vuosina 1997-2006) keskityimme Kuusamon tutkimusalueilla erityisesti suurpetojen vaikutukseen vasahävikin ja –tuoton näkökulmasta. Oivangin paliskunnassa seurasimme kuuden vuoden (1999-2004) aikana yhteensä 580 radiopannoitetun vasan selviytymistä ja vastaavasti Oivangin eteläpuolella Kallioluoman paliskunnassa kolmen vuoden (2004-06) aikana yhteensä 687 vasan kohtaloita. Molempien paliskuntien tutkimusalueet sijoittuivat paliskuntien itäosiin, muutaman kymmenen kilometrin sisälle Venäjän rajaan nähden. Vasat merkittiin pääosin 1-3 vuorokauden ikäisinä vasotustarhoissa, mutta lisää vasoja radiopannoitettiin myös keskikesän vasanmerkinnässä. Seurasimme vasojen selviytymistä läpi kesän ja syksyn vasonnasta aina alkutalven (loka-tammikuu) poroerotuksiin asti. Vasojen kuolleisuuden ja kuolinsyiden lisäksi seurasimme myös alueiden petotilannetta sekä aikuisten siitosporojen hävikkiä. Vasahävikin osalta tarkasteltiin sen suuruutta, ajoittumista ja kuolinsyitä (pedot vs. muut) sekä vasojen selviytymisen taustalla olevia tekijöitä.
Kuuden vuoden kuluessa löysimme Oivangin tutkimusalueilta vasonnan ja lokakuun lopun välillä yhteensä 42 kuollutta radiopantavasaa. Kallioluomassa löysimme vastaavasti yhteensä 114 kuollutta vasaa kolmessa vuodessa, joista suurin osa (111) vuosina 2005-06. Kallioluomassa seurasimme radiopantavasojen kuolleisuutta tammikuun loppuun asti ja löysimme marras-tammikuun aikana lisäksi 28 kuollutta vasaa. Tulokset osoittavat, että vasakuolleisuudessa ja petojen aiheuttamassa saalistuspaineessa on huomattavia vuotuisia eroja. Vuosina 2000-01 muutama karhu aiheutti suurta hävikkiä Oivangin itäosan vasakarjassa touko-kesäkuussa ja radiopantavasojen kokonaiskuolleisuus oli 22-23%. Vuosina 2002-04 kuolleisuus oli vastaavasti vain 0-5%. Vuosina 2000-01 karhujen aiheuttama kuolleisuus oli vähintään 4-6%, mutta lisäksi 15% vasoista oli karhun syömiä (näistä vasoista ei ollut jäljellä juuri mitään kuolinsyyn varmistamiseksi). Vuosina 2002-04 vain 2% vasoista todettiin karhun syömiksi. Muut suurpedot (ilves, ahma ja susi) tappoivat Oivangissa kukin vain yhden radiopantavasan. Oivangin eteläpuolella Kallioluomassa tilanne vasakuolleisuudessa ja petopaineessa oli varsin toisenlainen. Vuonna 2004 löysimme sadasta radiopannoitetusta vasasta vain kolme kuolleena, mutta vuosina 2005-06 löysimme maastosta yhteensä peräti 139 kuollutta vasaa. Vuosina 2005-06 kuolleisuus oli lokakuun loppuun mennessä 28-29% ja ylitti 40%:n rajan tammikuun puoli-välissä. Susien aiheuttama kuolleisuus oli keskimäärin 18% radiopantavasoista kun kaikki pedot yhteensä muodostivat vähintään 21%:n kuolleisuuden (todennäköisesti 25%). Yhteensä 13% vaatimista (*n*=45), jotka vasoivat vasotustarhoissa, löytyi kuolleena, ja susien tappamia näistä oli 32. Löytyneiden kuolleiden vaatimien lisäksi 21 vaadinta (6%) jäi hukkaan. Vaadinten kuolleisuuden vuoksi useat vasat olivat alkutalven poroerotuksessa orpona.

From conflict to co-management – The small-game-hunting in the region of Ammarnäs

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In the fall 2003, the small-game-hunting in the mountain region of Ammarnäs can be described as a chaotic hunt; although the hunters got theirs quotas full they did not care about that. It was the hunting itself that was important, and consequently there were dead grouses seen "everywhere" in the mountains; dogs were running after the reindeer, herds were spread over large areas in a short time, and the gathering work to get the reindeer to slaughter were disturbed and destroyed. The situation was totally out of control. Therefore local people reacted towards this untenable situation with unregulated small-game-hunt. They demanded that they should have the right to organize the hunt, since they had the knowledge to take care of all different interests that exist in the mountain-region.
The peoples' common-pool resource (CPR) was threatened by an out-coming group's behaviour, and the locals both Sami and non-Sami were dependent on the CPR in different ways for living in the area, some through herding and others through tourism. The local groups had in common that the mountain and its resources were the base for their economical survival and they became unified in the work against the irresponsible hunters. The goal was to have the responsibility for the small-game-hunt and organize it in a way that benefited them all, including the hunters. A working-group developed a proposal on how the small-game-hunting could be organized. The county of Västerbotten and the municipality of Sorsele were well aware of all the problems with the small-game-hunting and were favourably disposed to the working-groups proposal. From the proposal, the different interests and the authorities started to develop a new organization of small-game-hunting in the Ammarnäs region, a form of co-management evolved.

Från konflikt till samförståndslösning – Småviltsjakten i Ammarnäs

Hösten 2003, småviltsjakten i Ammarnäsfjällen urartar fullständigt. Läget då kan beskrivas som kaos, ripor och ripkycklingar är skjutna och ligger slängda hur som helst i fjällområdena. Ripjägarna struntar i att de skjutit fullt på sina kvoter, själva jakten är det väsentliga. Fågelhundar jagar renar, renhjordar sprids på stora områdena, renskötarnas samlingsarbete inför sarvslakten förstörs på några timmar. Då får ortsbefolkning, såväl icke-samer som samebymedlemmar, nog. De säger helt enkelt ifrån och lägger fram krav till myndigheterna att de innehar kunskapen för att förvalta småviltsjakten på ett genomtänkt och strukturerat sätt som tar hänsyn till alla inblandade.
Det som skedde hösten 2003 i Ammarnäsfjällen var att common-pool resource (CPR) i området var hotad. Hela befolkningen oavsett etnisk tillhörighet var beroende av den för sin överlevnad i Ammarnäs oavsett om man livnärde sig på renskötsel, turism, fiske eller hade andra företag där naturen var en grundförutsättning. De olika grupperingarna i bygden enades till följd av ett yttre hot, i det här fallet jägarnas syn på CPR:n och hur de nyttjade den. I Ammarnäs fanns det redan ett råd som arbetade för utvecklingen av bygden och de lyfte frågan om ripjakten upp på agendan. En arbetsgrupp tillsätts som består av en representant för samebyarna och en för företagarna/ ortsbefolkningen, vilka arbetar fram ett förslag om nyorganisering av småviltsjakten. Förslaget skickas till länsstyrelsen i Västerbotten och Sorsele kommun som konstaterat att ripjakten måste stramas upp så att inte 2003 års okontrollerade småviltsjakt återupprepas. Bägge instanserna var välvilligt inställda och ett gemensamt arbete för att organisera småviltsjakten tar vid. En form av samförvaltning mellan de olika parterna inleds.

Kill rates of Eurasian lynx on semi-domestic reindeer in Norway and Sweden

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It is widely recognised that predation is a major cause of mortality for domestic reindeer in the Nordic countries. However, there is considerable controversy about the extent of predation and as to which predatory species are responsible for the predation. This is particularly important for the issue of paying fair levels of compensation, an equal challenge if the system is based on paying for losses or paying for predator populations. The last two years more than 20 lynx of different age and sex classes were captured and fitted with a new type of Global Positioning System (GPS)-collars in northern Sweden and Norway. These GPS-collars allow us to receive GPS positions continuously over the GSM-net, and kill rates on reindeer were be obtained by collecting prey remains found at GPS-positions as soon as the lynx has left the area. The project has seen a continual development of methodology with respect to data sampling protocols (especially location frequency) to optimise our chances of detecting all semi-domestic reindeer killed by lynx. The results obtained so far indicate that while there is considerable variation between individuals and sexes the rates of depredation on reindeer can be very high. However, these kill rates are considerably influenced by how far the location of a lynx territory is from to the seasonal migration routes of the reindeer prey.

Drapsratene på tamrein for gaupe i Norge og Sverige

At gaupa dreper tamrein er udiskutabelt. En del av den sammensatte konflikten mellom reinnæring og gaupe går på hvor mange tamrein gaupa dreper. En full forståelse av konflikten krever studier av atferden til individuelle rovdyr. Til nå har få eller ingen studier tallfestet gaupenes drapsrater på rein gjennom hele året, sjøl om dette er viktig for utvikling av rettferdige kompensasjonssystemer. De siste to årene er mer enn 20 gauper utstyrt med en ny type GPS sendere i nordlige deler av Sverige og Norge. GPS senderne tar posisjoner ved hjelp av satellitter, og vi får tilsendt posisjonene per SMS et par ganger per uke via mobil-nettet. Gaupenes drapstakt på rein beregnes ved å gå inn i GPS-punkter gaupa har oppholdt seg i. Prosjektet er i startfasen, og innsamlingsmetodikken har blitt utviklet kontinuerlig for å kunne få best mulig estimat på antall drepte reiner. Dette gjelder særlig antall GPS posisjoner i løpet av døgnet. Så langt viser resultatene viser at gaupenes drapsrater på rein synes å være avhengig av hvor gaupereviret ligger i forhold til de sesongmessige forflytninger til reinen, og at hanngauper har de høyeste drapsratene.

Slaughter records as indicator of changes in reindeer herd condition

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We have investigated possibilities to use slaughter records and some additional carcass measures as indicators of body condition status in the reindeer herd and thereby of pasture resources in the summer ranges. Long-term fluctuations in grazing resources affect the nutritional status and production of the reindeer herd. It is important to detect changes in quality of the grazing resources as early as possible to be able to adapt the use and management of the resources to the fluctuations. Slaughter records for the years 1994-2007 including information on herding district, carcass weight, fatness and conformation classification according to the EUROP system and animal type (age class and sex of adults) were used. Linear and mixed models were used to estimate the effects of month, year, winter population density, and lag effects of previous year's body condition of slaughtered animals as well as lag effects of population density. We also used records from 696 reindeer slaughtered in the winter 2002/2003 (Olofsson *et al*., 2008) with additional recordings of calf sex, yearling or adults, reproductive status of the females and three body size measures (back, radius and jaw lengths). These data were analysed with linear models, principal component analyses (PCA) as well as structural equation models (SEM) with body condition and body size as latent variables. The results showed age and sex dependent differences between body size, carcass weight, conformation and fatness. Differentiation of animal age and sex improved the precision of models. Adjusting weight for body size also improved weight as a body condition indicator in adults. Conformation and fatness showed strong relationships with weight and body size adjusted weight and should preferably be included together with carcass weight and body size measures when estimating body condition from the carcass information. Our analysis showed that using non-invasive slaughter records is a practical and inexpensive method of estimating body condition in reindeer.

Reference

Olofsson, A., Danell, Ö., Forslund, P., & Åhman B. 2008. Approaches to estimate body condition from slaughter records in reindeer. – *Rangifer* 28 (1): 103-120.

Slaktregistreringar som indikator för förändringar i renhjordens kondition

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Vi har undersökt möjligheten att använda slaktregistreringar och några extra slaktkroppsmått som indikatorer för renhjordens konditionsstatus och därigenom för sommarbetesresurserna. Fluktuationer i betesresurserna påverkar hjordens kondition och produktion. Det är därför viktigt att upptäcka förändringar i beteskvalitén så tidigt som möjligt för att kunna anpassa användning och förvaltning av resurserna till fluktuationerna. Slaktregistreringar från åren 1994-2007 inkluderande information om sameby, slaktkroppsvikt, fett- och formklassificering enligt EUROP-systemet och djurkategori (kalv, vaja, tjur och oxe) användes. Linjära och mixade modeller användes för att skatta effekter av månad, år, populationstäthet i livhjorden, samt fördröjda effekter av tidigare års slaktkondition och populationstäthet. Vi använde också data från 696 renar som slaktades vintern 2002/2003 (Olofsson *et al.*, 2008) med extra registreringar av kalvarnas kön, åringar eller vuxna, reproduktiv status för vajor, samt tre kroppsmått (rygg-, käk-, och radiuslängd). Dessa data analyserades med linjära modeller, principalkomponentanalys (PCA), samt strukturekvationsmodeller (SEM) där kroppsstorlek och kondition var latenta variabler. Resultaten visade att renarnas ålder och kön ger skillnader i kroppsstorlek, fett- och formklassificeringen och vikt, samt att modellernas noggrannhet ökar om djuren grupperas med tanke på ålder och kön. Att korrigera slaktvikten för kroppsstorlek ökade precisionen för vikt som konditionsindikator för vuxna djur. Fett- och formklassificeringen överensstämde väl med storlekskorrigerad slaktvikt och skulle med fördel kunna inkluderas tillsammans med slaktvikt och storlek för skattning av kroppskondition från slaktkroppar. Våra analyser visar att användning av slaktregistreringar är en praktisk och billig metod för att skatta kroppskonditionen hos renhjorden.

Olofsson, A., Danell, Ö., Forslund, P., & Åhman B. 2008. Approaches to estimate body condition from slaughter records in reindeer. – *Rangifer* 28 (1): 103-120.

Lynx-wolverine interaction and predation on reindeer

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Reindeer is an important prey for both lynx and wolverine. The lynx is a more efficient predator than the wolverine and wolverines frequently use lynx-killed reindeer. Wolverine reproduction is influenced by availability of reindeer carcasses in winter. Therefore, wolverines might benefit from the presence of lynx. Furthermore, the total predation pressure from wolverine and lynx together might be lowest at a certain ratio of the two species. We used GPS-marked wolverine and lynx to estimate the lynx kill rate on reindeer and wolverine use of reindeer carcasses. There was a very large variation in lynx kill rate on reindeer among lynx individuals, seasons and area, partly dependent on the availability of reindeer. The lynx stayed at the carcass on average 2.4 ± 2.3 days. During late summer 60% of the carcasses were found and used by wolverines. There was large variation in the time of arrival of wolverine at the carcasses, sometimes the lynx had left and sometimes the lynx was still in the surroundings. Simulations of the lynx-wolverine interactions indicate that it is unlikely that the total predation pressure on reindeer from wolverine and lynx together will have a minimum at a certain ratio of the two species. The estimated wolverine predation was so much lower than the lynx predation that the wolverine use of lynx killed reindeer could not compensate for the higher lynx predation. Consequently the estimated total predation pressure was lowest in an area with only wolverine. However, from a conservation point of view the co-occurrence of wolverine and lynx might still benefit the wolverine. Furthermore, even if the estimated total predation pressure was lowest with only wolverines, reindeer management might still benefit from a mix of wolverine and lynx if the disturbance of the reindeer herd is lower when lynx kill reindeer and if availability of lynx-killed reindeer results in decreased wolverine predation.

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Interaktionen lodjur-järv och predation på ren

Renen är det viktigaste bytet för både lodjur och järvar inom renskötselområdet. Lodjuret är en effektivare jägare och järvar tycks regelbundet utnyttja lodjursdödade renar. Järvhonors reproduktion påverkas av tillgången på renkadaver under vintern. Därför är det sannolikt av positiv betydelse för järvar med förekomst av lodjur. Dessutom är det tänkbart att det totala predationstrycket från lodjur och järv på ren är som lägst vid en särskild fördelning av antalet individer av de båda arterna. Vi studerade järvar och lodjur som försetts med GPS-halsband för att studera predationstakten på ren och järvars utnyttjande av lodjursdödade renar. Vi observerade en stor variation i lodjurens predationstakt på ren, med stora skillnader mellan individer, årstid och områden, delvis beroende på tillgången på ren. Lodjuren stannade vid dödade renar 2,4 ±2,3 dagar. Under sensommaren besöktes 60% av de lodjursdödade renarna av järvar. Tiden från att renen dödades av ett lodjur till den besöktes av en järv varierade avsevärt. Simuleringar av interaktioner mellan järvar och lodjur indikerade att det är osannolikt att det totala predationstrycket på ren är som lägst vid en viss fördelning av antalet järvar och lodjur i ett område. Den beräknade järvpredationen var så mycket lägre än lodjurspredationen att järvarnas utnyttjande av lodjursdödade renar inte kunde kompensera för den högre lodjurspredationen. Följaktligen var det totala predationstrycket lägst i situationer med bara järvar och inga lodjur. Hursomhelst kan samexistens mellan järvar och lodjur sannolikt gynna järvpopulationen via en ökad tillgång på kadaver. Även om predationstrycket är lägst i en situation med bara järv kan man tänka sig att förekomst av båda arterna i samma område kan vara gynnsamt för renskötseln om störningen av renhjordar blir lägre när lodjur dödar renar och lodjurspredationen resulterar i minskad järvpredation på ren.

Use of land consolidation procedures in reindeer husbandry areas

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Land consolidation procedures have been used for a long time to facilitate rational use of pastures in farming areas. For Sami Reindeer herders, their user rights have been considered to be of a peculiar character falling outside the provisions of The Land Consolidation Act. In 1996 there was adopted an amendment to the land consolidation act, opening for land consolidation between reindeer herders and farmers.
The regulations concerning reindeer husbandry in this act have not been much used. In the lecture, which is based on the lecturer's doctoral thesis *Rettsutgreiing og bruksordning i reindriftsområder* (*Clarifying legal relations and prescribing rules of use in reindeer husbandry areas*), Faculty of law, Tromsø university 2008, it is shown that to employ the land consolidation act for use in reindeer husbandry areas, raise problems that have not been taken into consideration by the legislator. The analyses show that land consolidation can be applied to make purposeful use of pastures in reindeer husbandry areas, by changing in laws and procedures. In such way can land consolidation procedures be employed to reduce conflicts, distribute pastures proportionally between the right holders and facilitate rational use of pastures.

Bruksordning etter jordskifteloven i reindriftsområder

Rettsutgreiing og bruksordning etter jordskifteloven har lenge vært nyttet for å skape tjenlig beitebruk i den sørnorske fjellheimen. De samiske reinbeiteområdene har ikke vært omfattet av slike ordninger. I stortingsmeldingen *En bærekraftig reindrift* fra 1992 ble det foreslått å utvide jordskifteloven til å omfatte slike områder. Dette ble en realitet i 1996.
I foredraget, som er basert på foredragsholderens doktoravhandling *Rettsutgreiing og bruksordning i reindriftsområder* (Det juridiske fakultet, Universitetet i Tromsø 2008), blir denne lovgivningen undersøkt. Det påvises at å gi jordskifteloven anvendelse på forhold mellom reineiere og bufeholdere, skaper problemer som ikke har vært overveid av lovgiver. Analysen viser imidlertid at reglene *kan* bidra til å løse konflikter og skape mer tjenlige forhold i reindriften. Slik sett kan bruksordning være et bidrag til å styrke reineiernes økonomi, og dermed også det materielle grunnlaget for samisk kultur.

Use of reindeer habitat selection models in environmental assessment

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A problem within environmental assessment in relation to reindeer husbandry can be to evaluate the value of the ranges for the reindeer herding. The purpose of this study was to investigate the possibility to use resource selection models to objectively value different parts of a reindeer herding district. Habitat selection models were estimated using either reindeer feacal pellet-group counts or positions of reindeer collected via GPS-collars as dependent variables and vegetation type, topography and distance to hiking trails as independent variables (Skarin, 2006). The fitted habitat models were then used to predict the reindeer habitat use of an area with the given habitat variables. The two data collection methods showed similar results. However, the GPS data provided more detailed information of the use during different periods of the summer than could be predicted from the pellet-group count data. From the predictions of the reindeer use of a range, different areas within a range were given values relative each other. The habitat selection models need to be further developed by including roads, infrastructure, water bodies and other barriers influencing the logistics of range use.

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Värdering av renbetesmark till hjälp i markförvaltning

Syftet med denna studie är att föreslå metoder för värdering av olika delar av en samebys marker ur resurssynpunkt baserat på renens preferenser. Förslaget går ut på att dela upp markerna i mindre områden som är homogena med avseende på olika faktorer som påverkar renens preferens för markerna baserat på habitatanvändningsmodeller Sådan har tidigare skattats av Skarin (2006) på grundval av spillningsinventeringar resp data från GPS-utrustade renar. Beroende på delområdenas karaktär ges de olika värdetal, som i relation till värdetal för andra delområden inom betesområdet indikerar områdets relativa betydelse eller värde som betesmark. För kalibrering av värdeskalor behövs verkliga data, som avspeglar renars nyttjande av olika typer av marker. I framtida tillämpningar behöver värderingarna kompletteras med andra aspekter, t.ex. olika typer av barriärer som påverkar möjligheterna till åtkomst av markerna

Reindeer husbandry adaptation strategies for loss of grazing land and climate change

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In the last decade, northern Norway has received increased economic and political interest due to the opening of petroleum development in the Barents Sea, in addition to a growing demand and development of infrastructure, wind and hydro power, mining, and recreational resorts. Northern Norway historically contains grazing grounds for semi-domestic reindeer, and increased development leads to extensive avoidance of developed areas by reindeer, especially females and calves. Loss of grazing land is considered the largest threat to future reindeer husbandry.
Throughout the last century, temperatures have risen significantly in Sami reindeer husbandry areas. The season without snow or ice cover has subsequently become longer, and freeze-thaw cycles have appeared more frequently in winter. Most scenarios predict that temperatures will continue to rise both in summer and winter. In addition, more severe storms and winds are expected, as well as increased precipitation. For reindeer grazing conditions, this will lead to more unstable winters in continental areas, with a further increased frequency of freeze-thaw cycles and subsequent icing of pastures. Summer pastures may change from open to shrub-vegetated land, and temperatures will likely become more favorable for parasites and diseases.
The impacts of loss of land due to development and climate change will vary locally, likely leading to greater inequity and differences between siidas (groups of reindeer herders) and their resource bases. Internal conflicts among siidas may become more common, as poor grazing conditions in one area may lead to increased pressure on neighboring areas. A central challenge for research will be to quantify and model possible separate and synergistic effects of development pressures and climate change on seasonal pasture use, foraging efficiency and production. Which areas are likely to be impacted, and how? Will this affect seasonal pasture use and husbandry practices? How has reindeer husbandry responded historically to sudden changes in climate or loss of grazing grounds? It is important to identify critical areas and regions where herders may become exposed to multiple stressors and evaluate their potential need for moving herds into other areas, with subsequent increased competition for forage and grazing rights.
Projected changes may have wide consequences for siida-relationships, pasture zone organization and large management sectors. External conflicts between reindeer herders and other stakeholders are also likely to increase, stakeholders being i.e. local and regional authorities and developers. Changing resource conditions raises a series of questions about how well the current institutions and policies are suited to deal with foreseeable changes. For reindeer herder organizations, a central challenge will be to create a common understanding of land use rights and responsibilities for each siida and each grazing zone. If a common understanding can be reached, development projects can be fronted by the entire grazing region, not only the affected siida, as loss of land for one siida eventually will affect neighboring siidas. A unified understanding within a region can also enable the development of regional systems for handling extreme weather conditions, such as supplementary feeding or more flexible systems of pasture use. Most importantly, it is vital to create forums and meeting places where neighboring siidas can discuss solutions to challenges that affect the entire region.

Reindriftens tilpasningsstrategier i forhold til tap av beiteland og klimaforandringer

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I løpet av det siste tiåret har det vært økt økonomisk og politisk interesse for Nord-Norge på grunn av åpningen for petroleumsvirksomhet i Barentshavet, samt på grunn av en økende utbygging av infrastruktur, vind- og vannkraft, gruvedrift, mineralleting og hyttebygging. Størsteparten av landsdelen er tradisjonelt brukt som reinbeite, og økt utbygging fører til at reinen reduserer bruken av utstrakte områder nær inngrep. Dette gjelder spesielt simler og kalv. Tap av beiteland blir karakterisert som den største trusselen mot reindrift i framtiden.
Gjennom de siste hundre årene har temperaturen økt signifikant i samiske reindriftsområder. Barmarksesongen har blitt lengre, og perioder med vekslende mildvær og frost har blitt vanligere om vinteren. De fleste scenarier viser at temperaturene vil fortsette å stige både om sommeren og vinteren. I tillegg ventes det mer vind og flere stormer, samt økt nedbør. For reinens beiteforhold betyr dette at vintrene blir mer ustabile på innlandet, med en fortsatt økning av mildværsperioder og nedising av beitene. Sommerbeitene kan endre seg fra åpent til busk- og skogkledd landskap, og temperaturene vil trolig bli mer gunstige for parasitter og sykdom.
Konsekvensene av klimaforandringer og tap av beiteland på grunn av utbygging vil variere lokalt, og dette vil trolig føre til økte forskjeller mellom de enkelte siidaenes (reindriftsgruppenes) naturgrunnlag og beiteområder. Interne konflikter mellom siidaene kan bli mer vanlige siden dårlige beiteforhold i ett område kan føre til økt press på naboområder. En stor utfordring for forskningen vil være å kvantifisere og modellere mulige atskilte og synergistiske effekter av utbyggingspress og klimaendringer på beitebruk og produksjon. Hvilke områder blir berørt, og hvordan? Vil dette endre beitebruken gjennom året og driftsmønsteret? Hvordan har reindriften tidligere respondert på plutselige endringer i klima eller tap av beiter? Det er viktig å identifisere kritiske områder der reindriften kan bli utsatt for flere negative konsekvenser samtidig, og der det kan oppstå et behov for å flytte reinen til andre områder med påfølgende økt konkurranse om beiter og bruksrettigheter.
De skisserte endringene kan få store konsekvenser for forholdet mellom siidaer, innad i beitesoner, og i overordnet forvaltning. Eksterne konflikter mellom reineiere og andre interessegrupper vil sannsynligvis også øke, for eksempel i forhold til lokale og regionale myndigheter eller utbyggere. Det blir aktuelt å spørre om dagens regimer og politikk er forberedt på å takle de forventede endringene i ressurssituasjonen. For reineiernes styrer og organisasjoner blir det en stor utfordring å skape en felles forståelse av bruksrettigheter og plikter for hver siida og beitesone. Hvis man når en slik felles forståelse kan utbyggingssaker bli behandlet av hele beitesonen, ikke bare av den berørte siidaen, siden tap av beiteland for en siida vil ha konsekvenser også for nabosiidaene. En felles forståelse innen et område kan også danne grunnlag for felles strategier for å møte vanskelige klimaforhold, f.eks. gjennom tilleggsfôring eller mer fleksibel beitebruk. Det viktigste er å danne arenaer og møteplasser der nabosiidaer og beitesoner kan diskutere løsninger til de utfordringene som angår hele regionen.

Resonance strategies of Sami reindeer herding during climatically exceptional years in 1960-2007

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The resonance strategies of Sami reindeer herders during climatically exceptional years were studied in four reindeer herding cooperatives in northernmost Finland. The study was conducted by using interviews of reindeer herders, statistics of reindeer numbers and weather data. Serious losses of reindeer occurred in 1962-1963, 1965-1967 and 1972-1974. The study indicated that the resonance strategies are different in "fell herding cooperatives" from those in "forest herding cooperatives", and greatly depend on the practical knowledge of soil and pasture types, microclimate, topography and socio-ecological factors affecting reindeer herding. Before 1960s the reindeer herders were able to resonate with the changing conditions due to intensive herding techniques together with semi-tamed reindeer and the smokes and shelters for inhibiting insect harassment. In 1960s and 1970s the reindeer herders did not have sufficient means to prevent the serious reindeer losses, because pastures could not be used freely due to the border fences that were build around the reindeer herding cooperatives, and the use of snowmobile in herding had started. In 1990s the reindeer herders of the "fell herding cooperatives" Kaldoaivi and Paistunturi avoided consequences of bad weather conditions such as ice crust and mold by resonating with pasture rotation and leaving summertime calf markings out. In "forest herding cooperative" Hammastunturi reindeer herders coped with the long snowy springs of 1990s by using calving corrals, and in Ivalo, pasture rotation was taken back into use. In 2000s all four herding cooperatives have utilized supplementary feeding of reindeer as a strategy for coping with the most critical months of the late winter. This research showed that the resonance strategies in the studied herding cooperatives are both heterogenic and dynamic – they change constantly and include both old and new ways to cope with changing weather conditions.

Saamelaisen poronhoidon resonanssistrategioita poikkeuksellisissa sääolosuhteissa vuosina 1960-2007

Tutkimuksessa käsitellään Suomen saamelaisalueen paliskuntien: Kaldoaivin, Paistunturin, Hammastunturin ja Ivalon resonanssistrategioita poronhoidollisesti poikkeuksellisina vuosina. Tutkimusmetodeina käytettiin poronhoitajien haastatteluja, Paliskuntain yhdistyksen porotilastoja ja Ilmatieteenlaitoksen säädataa. Tutkimuspaliskunnissa oli katovuosia vuosina 1962-1963, 1965-1967 ja 1972-1974. Tutkimuksen mukaan vaikuttaa siltä, että tunturipaliskunnilla ja metsäpaliskunnilla on erityyppisiä resonanssistrategioita, jotka ovat suoraan verrannollisia poronhoitajien inhimilliseen tietoon mm. maa- ja laiduntyypeistä, mikroilmastosta, topografiasta ja sosio-ekologisista tekijöistä. Aina 1950-luvulle asti poronhoitajat kykenivät resonoimaan muuttuvissa olosuhteissa intensiivisen laiduntamisen ansioista, heillä oli käytössä muun muassa räkkäsuojat ja –savut. 1960-1970 –lukujen aikana poronhoitajat olivat murroksessa, sillä porot saivat laiduntaa jo suhteellisen vapaasti rajatuilla alueilla. Moottorikelkan käyttöönotto lisäsi poron "villiintymistä" eli vapaata laidunnusta. 1990-luvulta lähtien Paistunturissa ja Kaldoaivissa jätettiin kesämerkitys kokonaan pois ja poroja alettiin ohjaamaan heinillä sopiville talvilaitumille, minkä ansiosta vältettiin ne vaikeudet, jotka olisivat tulleet paanteisesta maakerroksesta. Hammastunturin paliskunnassa siiryttiin aitavasotukseen, joka takasi poroille vakaat olosuhteet pitkinä lumisina keväinä. Ivalon paliskunnassa siirryttiin vakaisiin ruokintajuontoihin kevätkuukausina. 2000-luvulla kaikissa neljässä paliskunnassa on käytettyn laidunnukseen liittyvää ruokintaa kevään vaikeina kuukausina. Tutkimus osoittaa sen, että resonanssistrategiat ovat hyvinkin hetoregeenisia ja dynaamisia – ne muuttuvat jatkuvasti ja niissä käytetään hyväksi sekä vanhaa että uutta tietoa suhteessa säihin ja ilmoihin.

Seasonal variation in meat quality attributes from Alaska reindeer (*Rangifer tarandus tarandus*) and New Zealand red deer (*Cervus elaphus*)

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Deer are typically found in geographical areas with marked seasons, and different species have to varying degree adapted to this seasonality. Deer species managed by humans originate from areas ranging from temperate to boreal (red and fallow deer) to subarctic to arctic (reindeer), representing environments with moderate and extreme seasonal changes, respectively. Thus, deer have a seasonal growth pattern with maximum accretion of body tissue (muscle and fat) in spring and summer; weight may be lost particularly by males, during autumn with little or no weight gain taking place over the winter. Previous studies have investigated the underlying physiological mechanisms responsible for the seasonal control of growth, but have not related that to possible effects on meat quality attributes.
In this paper meat quality data from two recent seasonal studies are presented; 1) reindeer (*Rangifer tarandus tarandus*) bulls and steers slaughtered at three different times during the year (July, November and March) on the Alaska Seward Peninsula and 2) red deer (*Cervus elaphus*) stags slaughtered at four different times (July, September, December and March) in New Zealand.
In the Alaskan study, 42 reindeer were included in the study (19 bulls and 23 steers). All animals came from the same herd out on the Seward Peninsula, Alaska. Carcasses were gutted and dressed out in the field, and then transported within 24 hours post slaughter to a meat processing facility for further sampling and boning. Seasonal effects in reindeer carcass composition were demonstrated in this study, although the carcasses from the late slaughter (March) had higher weights and a greater proportion of valuable cuts than expected. Proximate composition of the meat was similar between the three groups and two sexes. Seasonal effects were demonstrated in the consumer important attributes meat tenderness and juiciness with the November samples scoring highest for both attributes. Results of this study support the concept of slaughtering reindeer over a greater period of time, which could increase fresh product availability for retail and food service markets.
In New Zealand, 68 red deer stags were included in the study. Animals were slaughtered at a specialized deer slaughter export facility according to standard practices. Meat from deer slaughtered in December was most tender and had the highest drip loss. These results were consistent for samples stored at -1.5 °C for up to 9 weeks post slaughter. Measurements of the tenderising enzymes (calpains) indicated that while the enzyme levels and ratios do vary over the 12 month period there is no clear suggestion that this enzyme system alone is responsible for the variation in tenderness. In conclusion, seasonal effects were found in drip loss and tenderness measurements and overall there was a positive correlation of increased tenderness and increased drip loss. A challenge is to improve the processing of deer carcasses to minimize drip without negatively impact on tenderness.

Säsongsvariation i köttkvalitet hos ren från Alaska och kronhjort från Nya Zeeland

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Hjortar finns huvudsakligen i geografiska områden med markerade årstider och olika arter har i varierande grad anpassats till denna säsongsvariation. Hjortarter som domesticerats/farmas lever i områden som sträcker sig från tempererade och boreala (kron- och dovhjort) till subarktiska och arktiska (renar), som är exempel på miljöer med måttliga till extrema säsongsmässiga variationer i klimat. Följdaktligen har hjortar ett säsongsbetonat tillväxtmönster med hög tillväxt (muskler och fett) under våren och sommaren, viktminskning under hösten i synnerhet hos handjur, och en väldigt liten eller ingen viktökning alls under vintern. Tidigare har de underliggande fysiologiska mekanismer som ansvarar för den säsongsbetonade kontrollen av tillväxt undersökts, men inga studier har fokuserat på eventuella effekter på köttets kvalitet.
I denna undersökning presenteras köttkvalitetsdata från två säsongsrelaterade studier: 1) ren (*Rangifer tarandus tarandus*) sarvar och härkar som slaktats vid tre olika tidpunkter (juli, november och mars) på Seward Peninsula i Alaska och 2) kronhjort (*Cervus elaphus*) handjur som slaktats vid fyra olika tidpunkter under året (juli, september, december och mars) i Nya Zeeland.
I Alaska ingick 42 renar i studien (19 sarvar och 23 härkar). Alla djur kom från samma renägare och renhjord på Seward Peninsula. Slakten skedde i fält och sedan transporterades slaktkropparna (inom 24 timmar) till en styckningsanläggning för styckning och provtagning. Säsongsmässiga effekter i slaktkroppssammansättning demonstrerades, även om slaktkropparna från slakten i mars hade högre vikter och en större andel av värdefulla styckningsdetaljer än väntat. Den kemiska sammansättningen hos köttprover från de tre grupperna var jämförbar både mellan grupperna och de två könen. Säsongsmässiga effekter påvisades i mörhet och saftighet vid en konsumenttest där novemberproverna hade de högsta värdena för båda attributen. Resultaten av denna studie stöder idén att slakta renar över en längre tidsperiod, vilket skulle kunna öka tillgängligheten av färska renprodukter för restaurang- och detaljhandeln.
I Nya Zeeland ingick 68 kronhjortar (handjur) i studien. Djuren slaktades enligt normal rutin i specialdesignade hjortslakterier godkända för export. Kött från hjortar slaktade i december var mörast och hade den sämsta vattenhållande förmågan. Dessa resultat gällde för prover som förvaras vid -1.5 °C i upp till 9 veckor efter slakt. Mätningar av mörhetsenzymer (calpainer) visade att enzymnivåer och förhålladet mellan enzym/inibitor varierar under året, men det gick inte att dra slutsatsen att denna variation i enzymaktivitet är huvudansvarig för variationen i mörhet. Sammanfattningsvis drogs slutsatsen att det finns en säsongsmässig variation i mörhet och vattenhållande förmåga i hjortkött och att mörare kött förlorar mer vätska. En utmaning för slaktindustrin är att förbättra slaktkroppshanteringen för hjortar för att minimera vätskeförlust utan negativ inverkan på mörhet.

Female body mass variation as indicator of nutritional status in the reindeer herd

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In an ongoing project we follow the body mass of about 600 adult female reindeer in two herds. Live body mass has been registered in early winter (late October to December) 2007 and 2008 and, in one of the herds, also in the spring (April) 2007 and 2008. Calves of the females have been individually marked and weighed in July and in early winter. The plan is to continue the study for at least two more years. One aim is to find out whether variations in body mass of individual animals can be used as indicator of variations in body condition and nutritional status of the whole herd, and thus as indicator of variations in the quality of pastures. A benefit of following live reindeer, compared to e.g. using slaughter data, is that the animals could be randomly selected within the herd. The results will be independent of possible changes in slaughter strategy and selection of animals for slaughter. By following known individuals, each animal could serve as its own control.
There were clear differences between years according to the preliminary results on female body mass. The results were in agreement with the herders' own perception of the quality of pastures. In early winter, the body mass of females, that had been observed not having a calf during summer, was considerably higher than for females having a calf. Information on reproductive status is thus crucial. Female age seems not to affect body mass significantly at ages between three and eight years. Weighing of live reindeer involves a great deal of labour. It has to be made when the reindeer are gathered for other purposes and special arrangements may have to be made at the gathering site. It is also important that the weighing does not cause extra stress to the reindeer, which might be detrimental for animals in poor condition.

Viktvariation hos vajor som indikator för nutritionell status i renhjorden

I ett pågående projekt följer vi levande vikter hos omkring 600 vuxna vajor i två renhjordar. Levande vikt har registrerats på förvintern (slutet av oktober fram till december) 2007 och 2008 samt, i den ena hjorden, även på våren (April) 2007 och 2008. Vajornas kalvar har märkts med nummerbrickor och vägts i juli och på förvintern. Planen är att fortsätta studien i ytterligare minst två år. Ett syfte är att ta reda på om variationer i levande vikt hos kända individer kan användas som indikator för variation i kondition och nutritionell status för hela renhjorden och därmed som indikator för variation i betets kvalitet. En fördel med att följa levande renar, jämfört med att exempelvis använda slaktdata, är att djuren kan väljas slumpmässigt. Resultaten påverkas därmed inte av slaktstrategi och slakturval. Genom att följa enskilda individer kan varje djur fungera som sin egen kontroll.
Preliminära resultat på vajornas vikter visar klara skillnader mellan år, vilket är i överensstämmelse med renskötarnas egen uppfattning om betets kvalitet. Kroppsvikten på förvintern var betydligt högre för de vajor som observerats utan kalv på sommaren än för dem som hade kalv. Det är således väsentligt att ha kunskap om vajornas reproduktiva status. Vajornas ålder hade ingen signifikant inverkan på vikt för de vajor som var tre till åtta år gamla. Vägning av levande renar innebär mycket arbete. Det måste göras när renarna samlas och skiljs för andra ändamål och speciella arrangemang kan krävas vid skiljningsanläggningarna. Det är också viktigt att vägningen inte orsakar extra stress för renarna, vilket skulle kunna vara skadligt för djur i dålig kondition.