The Nordic Conference on Reindeer Husbandry 2025

Contents

Introduction

Reindeer husbandry is an important part of Sámi culture. It also contributes in many ways to the Nordic bioeconomy, food industry, and tourism. The Nordic Joint Committee for Agricultural and Food research (NKJ), on behalf of the Nordic Council of Ministers, is tasked with promoting and supporting research, innovation, and policy development in the reindeer husbandry in the Nordic region. One of the focus areas in NKJ's strategy is to "Strengthen the knowledge base for a sustainable reindeer husbandry".

The board of NKJ has established a working group for reindeer husbandry, in which Finland, Norway and Sweden each have one representative. The foundation of this working group is a memorandum of understanding between the three countries, to develop and promote cooperation on reindeer husbandry in the Nordic region. It is the responsibility of the working group to initiate and support activities that meet this goal, together with the NKJ secretariat.

Reindeer husbandry in the three Nordic countries faces common challenges, but there may be different solutions to the challenges. It is crucial to learn from each other, and to exchange views. The working group aims to involve practitioners, researchers and government administration.

The latest activity funded by the NKJ secretariat and the reindeer husbandry working group was the Nordic Conference on Reindeer Husbandry 2025, organised by NIBIO in Alta, Norway, 12-14 February.

This report gives an overview of the topics and the views presented at the conference. As an introduction, we provide a brief description of reindeer husbandry in Finland, Sweden and Norway, to show differences and similarities.

The NKJ reindeer husbandry working group will continue to accommodate exchanges of experience and knowledge between the three Nordic countries, and between the practitioners, government administration and the research community. The reindeer husbandry group encourages all interested parties to suggest issues for discussion, and to share information on relevant events and research projects.

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Nordic perspectives

Reindeer husbandry in the Nordic region

Finland, Sweden and Norway have many similarities when it comes to reindeer husbandry, but also important differences that are crucial for how reindeer husbandry is structured and organised in the three countries.

Both the organisation of the reindeer husbandry sector, and the governance differ between the countries.

The terms ”reindeer herding cooperatives” and ”reindeer herding communities” does therefore not have the exact same meaning in the three countries.

The next pages will give an overview of the situation for reindeer husbandry in Finland, Sweden and Norway. The information is organised under the headlines ”Number of reindeer and annual production”, ”Organisation and governance” and ”Economic measures”.

Finland

Number of reindeers and annual production

The number of reindeer in Finland varies between 185,000 and 195,000 in the winter herd. The maximum number of living reindeer confirmed by the Ministry of Agriculture and Forestry is 203,700. The maximum amount is confirmed every 10 years, and the most recently decree of the Ministry of Agriculture and Forestry was issued in June 2020. Reindeer meat production during the 2022-2023 reindeer husbandry year was about 1,730,000 kg and the average price of meat was 12.23 €/kg during the same year.

Organisation and governance

The Reindeer Husbandry Act (848/1990) regulates reindeer husbandry and defines the area where reindeer husbandry may be practised regardless of land ownership. The reindeer herding area is divided into 54 herding cooperatives.

Reindeer herding cooperatives (known as paliskunta in Finnish and renbeteslag in Swedish) are reindeer herding units of different geographical scale and reindeer numbers. Each herding cooperative is a community formed by its partners and is responsible for reindeer husbandry in its area. Each reindeer owner belongs to one reindeer herding cooperative. The activities and organisation of herding cooperatives are regulated by the Reindeer Husbandry Act.

A cooperative is headed by a chief of district chosen by a general meeting of the cooperative. In addition, the general meeting chooses a vicechief of district and a fourmember board. The board is selected for a threeyear term. The chief of district represents the co operative and is responsible for its operations.

The reindeer herding cooperatives are organised by an umbrella association called 'Paliskuntain yhdistys' (the Reindeer Herders' Association), whose tasks include acting as a link between reindeer herding cooperatives, developing reindeer herding and the reindeer economy and promoting research in reindeer herding.

Reindeer husbandry in Finland falls under the administration of the Ministry of

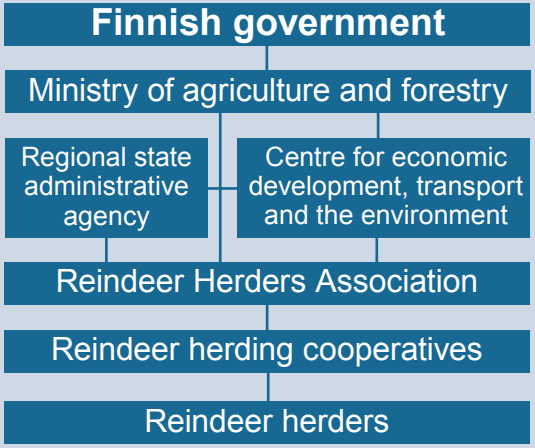


Figure 1. Organisation map of Finnish reindeer husbandry governance

Agriculture and Forestry. The Regional State Administrative Agency of Lapland supervises compliance with and implementation of the Reindeer Husbandry Act. The Centre for Economic Development, Transport and the Environment of Lapland is responsible for the performance management of the Reindeer Herders' Association. See Figure 1 (previous page).

Economic measures

According to the Commission decision (EU) 2021/2312 Finland is authorised to implement the long-term aid scheme for agriculture in its northern regions. The aid scheme includes an aid to reindeer herders. The aid is granted per animal and is limited to the traditional number of reindeers in the northern regions of Finland. According to the aforementioned decision, aid for reindeer husbandry shall not lead to overcompensation in conjunction with the aid granted under Article 213 of Regulation (EU) No 1308/2013.

Furthermore, according to Commission implementing decision C(2016)1752 final, Finland is also authorised to grant national aid for the production and marketing of reindeer and reindeer products falling within CN codes ex 0208 and ex 0210.

This national aid includes investment aid and maintenance of traditional reindeer husbandry systems, compensation for damage to reindeer husbandry caused by weather conditions and animal diseases and compensation for damage caused by large carnivores.

Map

The Reindeer husbandry area is demarcated for reindeer herding (Reindeer Husbandry Act 848/1990). The area covers 122,936 sq kilometres, 36 % of Finland's total area. The reindeer husbandry area covers Lapland region and northern parts of Northern Ostrobothnia and Kainuu regions.

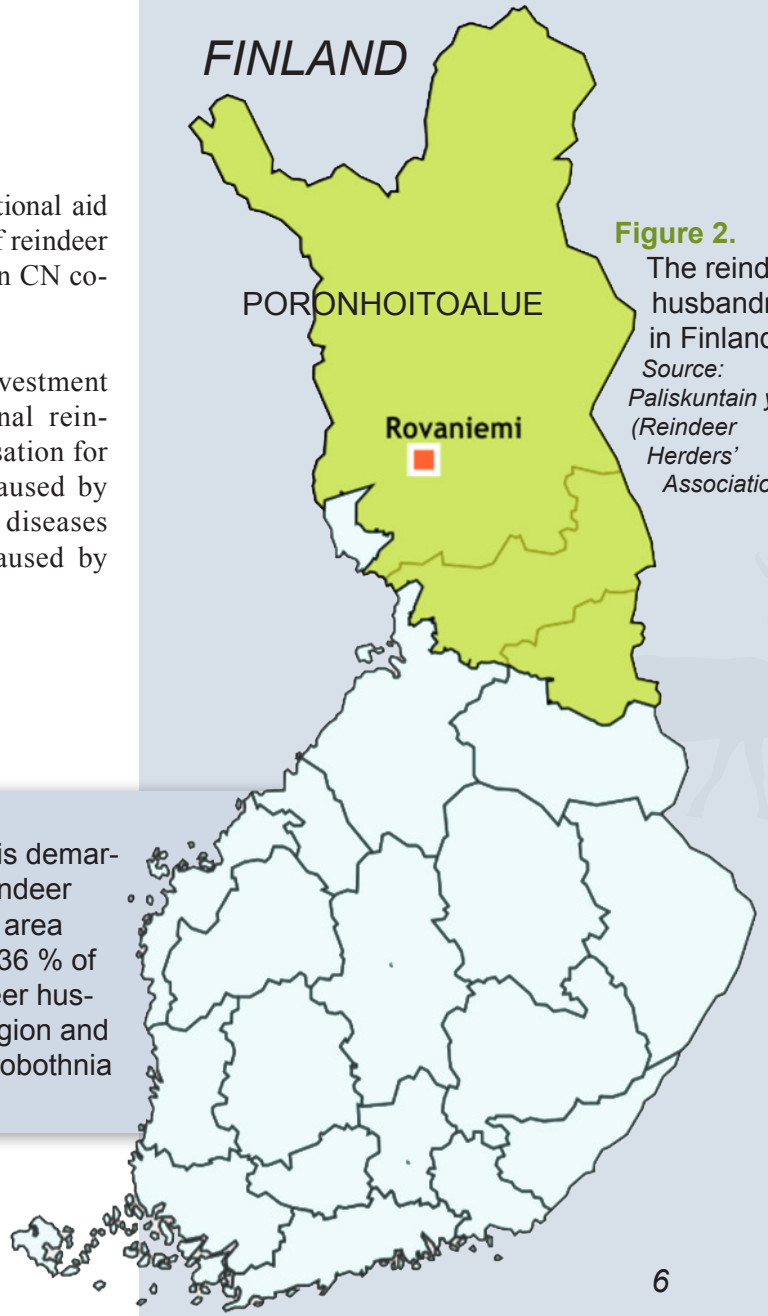


Figure 2. The reindeer husbandry area in Finland. *Source: Paliskuntain yhdistys (Reindeer Herders' Association)*

Norway

Number of reindeer and annual production

The number of reindeer in Norway is around 215,000. The reindeer husbandry year runs from April 1 to March 31.

The annual production of meat in 2023 was 1,773 tons. The average price to the producer was 104.28 NOK/kg, and the total value of meat production 184,835,000 NOK.

As a basis for the annual negotiations of the Reindeer Husbandry Agreement, an annual overview of the economy in the reindeer husbandry sector is developed by a working group appointed by the Ministry of Agriculture and Food and the Sámi Reindeer Herders Association of Norway. The publication Totalregnskapet for reindriftsnæringen is published in December. Totalregnskapet – Landbruksdirektoratet

The Agricultural Authority also develops Ressursregnskapet for reindriftsnæringen annually, which comprises production, composition of the herds, loss of reindeer as well as the number of reindeer. Ressursregnskapet for reindriftsnæringen – Landbruksdirektoratet

Organisation and governance

Sámi reindeer husbandry mainly occurs in mountain pastures and rangelands in the counties Finnmark, Troms and Nordland, and in parts of the counties Trøndelag, Møre og Romsdal, and Innlandet. The area is divided into six reindeer pasture areas: Eastern Finnmark, Western Finnmark, Troms, Nordland, Northern Trøndelag, Southern Trøndelag and Hedmark.

In southern Norway there are four reindeer herding cooperatives: Lom, Vågå, Fram and Filefjell Reindeer Associations. In addition, Rendal Renselskap and Hardanger og Voss Reinsdyrlag operate a particular form of reindeer husbandry, with privately owned animals managed by hunting.

The Reindeer Husbandry Act provides the legal framework for reindeer herding. However, the rights to own reindeer and develop an individual reindeer mark is reserved for the Sámi people, based on their traditional land use. License to own reindeer can also be granted to others outside the Sámi reindeer herding area.

The Sámi reindeer husbandry area is defined by the Reindeer Husbandry Act. The main administrative structure is the reindeer herding district. There are around 80 reindeer herding districts. In each district, there

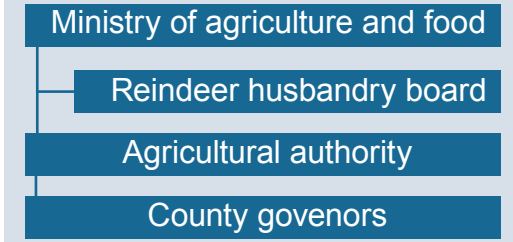


Figure 3. Governmental structures – reindeer husbandry Norway

are herding groups called siida and sijte in North and South Sámi, respectively. Within the siida, the ”siidaandel” is the production entity. The ”siidaandel” may consist of several families.

Regulations and decisions which will affect Sámi reindeer husbandry, such as landuse planning and development of energy installations, will be subject to consultations with the Sámi Parliament and the relevant reindeer herding districts. The obligation to consult applies to all government levels.

The Ministry of Agriculture and Food is responsible for policy developments for the reindeer husbandry sector.

The Agricultural Authority is responsible for implementing policy and decisions related to reindeer husbandry, as well as supervising compliance with the Reindeer Husbandry Act. County Governors of Troms and Finnmark, Nordland and Trøndelag are the first-line contacts for reindeer herders within the government authorities.

The Reindeer Husbandry Board is an administrative body established by the Reindeer Husbandry Act. The members of the board are appointed for four-year terms. The Ministry of Agriculture and Food appoints four members including the board leader, and the Sámi Parliament appoints three members. The Agricultural Authority carries out secretariat functions for the Reindeer Husbandry Board.

Economic measures

In 1976 the Norwegian state entered into an agreement with the Sámi reindeer herders' organization of Norway to negotiate annual agreements on economic measures for the reindeer husbandry industry. The agreement is, in addition to the Reindeer Husbandry Act, the most important measure for achieving the objectives of the reindeer husbandry policy.

The Reindeer husbandry agreement for 2024/2025, which applies to the budget year 2025, amounts to 225 million NOK.

Prop. 98 S (2023–2024) – regjeringen.no

Sweden

Number of reindeer and annual production

The number of reindeer in Sweden varies between 225,000 and 280,000 in the winter herd. The estimated value of meat production per season differs from year to year. In 2019/20 the value reported by the Sámi Parliament was 85,509,000 SEK.

Organisation and governance

Anyone of Sámi origin (i.e. anyone who is Sámi) may, under the Reindeer Husbandry Act (1971:437), use land and water to sustain themselves and their reindeer. According to the Act, that right is based on prescription from time immemorial and accrues to the Sámi people. The reindeer husbandry right can be exercised by those who are members of a reindeer herding community (sameby).

A reindeer herding community is an economic and administrative association with its own board which, for the common good of the members, manages reindeer husbandry within its designated geographical area. There are 33 mountain reindeer herding com-

munities, 10 forest reindeer herding communities and 8 concession reindeer herding communities where reindeer husbandry is carried out with a special permit, for a total of 51 reindeer herding communities.

The reindeer husbandry right consists not only of rights connected to reindeer husbandry such as setting up necessary buildings and related activities, but also hunting and fishing. These rights apply on state-owned land as well as privately-owned land. The rights are exercised via membership in a reindeer herding community. Reindeer herding should be conducted so that it provides a reasonable number of reindeer husbandry entrepreneurs with a secure livelihood. Reindeer husbandry should be conducted in an ecological, economic and equal manner to be culturally sustainable in the long term. The Ministry of Rural Affairs and Infrastructure is responsible for policy developments for the reindeer husbandry sector.

The Sámi Parliament is the central administrative authority and expert authority with

Figure 4. Map of reindeer herding communities (samebyar) in Sweden. *Source: Sametinget 2022*

REINDEER HERDING COMMUNITIES
Könkämä
Lainiovouma
Vittangi
Saarivouma
Talma
Gabna
Laevas
Girjas
Baste cearru
Unna Tjerusj
Sirges
Gällivare
Jåhkågaska tjiellde
Slakka
Tourpon
Luokta-Mávas
Semisjaur-Njarg
Ståkke
Udtja
Östra Kikkejaure
Västra Kikkejaure
Maskaure
Mausjaur
Svaipa
Gran
Ran
Ubmeje tjeälddie
Malå
Vapsten
Vilhelmina norra
Vilhelmina södra
Voernese
Ohredahke
Raedtievaerie
Jijnjevaerie
Jovnevaerie
Njaarke
Kall
Handölsdalen
Tässåsen
Mittådalen
Ruvhten sijte
Idre

CONCESSION REINDEER HERDING COMMUNITIES
Muonio
Sattajärvi
Tärendö
Korju
Pirttijärvi
Ängesö
Liehittäjä
Kalix

responsibility for issues affecting reindeer husbandry. It is, among other things, responsible for handling of reindeer marks, including their registration and de-registration.

Economic measures

The allocation in the yearly budget bill, is at the Sámi Parliament's disposal and directly affects reindeer husbandry. Expenses charged to allocations for the promotion of reindeer husbandry include for example:

- Maintenance of national border fences and maintenance facilities
- National interests regarding land that is valuable or sensitive to reindeer husbandry
- Nature/cultural environment conservation
- Price supplement for reindeer meat for the reindeer industry
- Compensation for certain additional costs and losses due to the Chernobyl accident that can be given to agricultural companies, reindeer husbandry companies and to those who fully or partially make a living from fishing for household needs or for sale
- Catastrophe damage protection can be paid for a certain part of the feed costs

The government subsidies that may be relevant for the reindeer industry are, among other things, rural funds, the possibilities of applying for project funds for projects that are co-financed with EU's structural funds, nationally funded projects and other investments such as equality support. Predator compensation is not state aid, but compensation for loss of property.

Summary

of the Nordic Reindeer Husbandry Conference 2025

The conference was organised by NIBIO (Norwegian Institute for Bioeconomy) and co-funded by NKJ (The Nordic Joint Committee for Agricultural and Food Research) via the working group for Reindeer Husbandry, and Reindriftens utviklingsfond. A scientific committee set up a program and published a booklet of abstracts from the conference which can be found here: Nordic Reindeer Husbandry Conference 2025 – Program and abstract booklet

The conference consisted of eight sessions with different topics, divided into a scientific part (Part I) and a part intended for reindeer herders, management and other parties which are affected and have interest in Scandinavian reindeer husbandry (Part II). Part I was held in English while part II was translated from the presenter's preferred language to Samii, Finish, Swedish and Norwegian. Take home messages from the different sessions are presented in the following pages.

Organizing committee:

Erlend Winje (NIBIO), organizing coord.
Jo Jorem Aarseth (NIBIO)
Tor-Arne Bjørn (NIBIO)
Gabriela Wagner (NIBIO)
Stine Harila (NIBIO)
Per Hansson (SLU/NKJ)
Sofie Andersson (SLU/NKJ)

Program committee:

Norway
Gabriela Wagner (NIBIO), scient. coord.
Camilla Risvoll (Nordlandsforskning)
Svein Morten Eilertsen (NIBIO)

Finland
Sirpa Rasmus (ULAPLAND)
Kirsi Muuttoranta (ULAPLAND)
Jouko Kumpula (LUKE)
Mikko Jokinen (LUKE)
Antti-Juhani Pekkarinen (LUKE)

Sweden
Anna Skarin (SLU)
Heidi Rautiainen (SLU)
Ragnhild Nilsson (MIUN)

Tarandus network
Anna Omazic (SVA, Sweden)
Ingebjørg Nymo (VI, Norway)
Juha Kantanen (LUKE, Finland)

PART 1

Reindeer health and welfare I *(chair: Anna Omazic)* *and II* *(chair: Ingebjørg Numo)*

This session featured a keynote by **Ingebjørg Helena Nymo** on the first detection of cervidpoxvirus in Europe, with confirmed cases in semi-domesticated Eurasian tundra reindeer (Rangifer tarandus tarandus) in both Norway and Sweden. Additional presentations included data on poxvirus cases in Swedish reindeer, pestivirus detection and characterization from reindeer in Norway, and the increased risk of brainworm (Elaphostrongylus rangiferi) infections in the context of climate change. A study on gastrointestinal parasite loads in soil from reindeer feeding sites and evaluation of recovery efficiency across soil types was also presented.

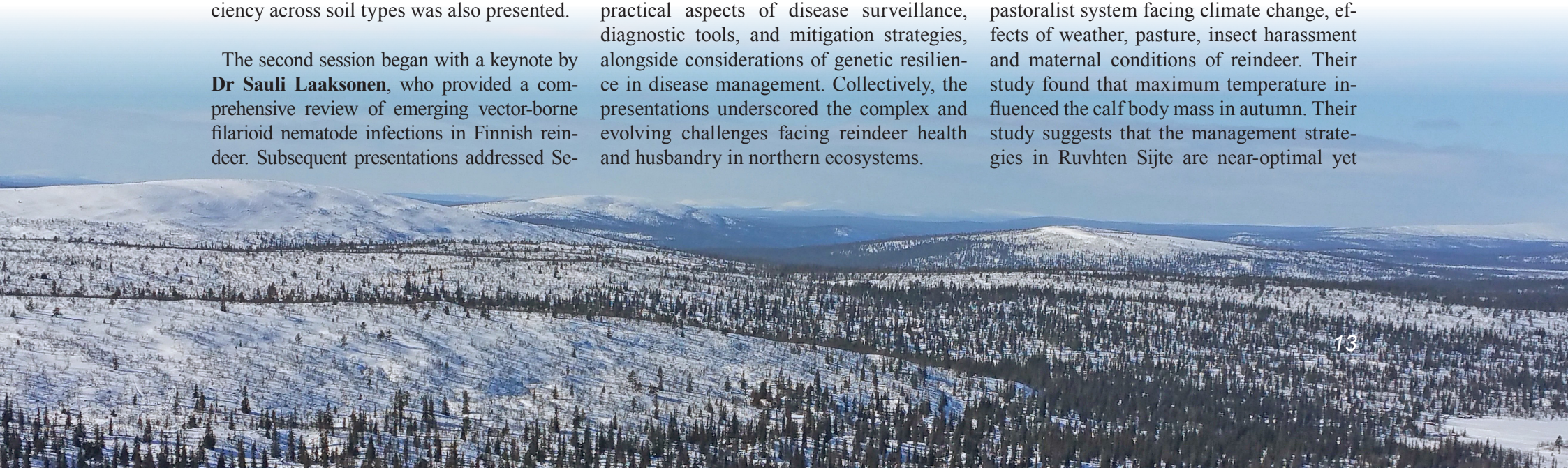
The second session began with a keynote by **Dr Sauli Laaksonen**, who provided a comprehensive review of emerging vector-borne filarioid nematode infections in Finnish reindeer. Subsequent presentations addressed Setaria tundra as a climate-sensitive parasite, the potential threat of Chronic Wasting Disease (CWD) to reindeer husbandry, and the possible genetic consequences of breeding for CWD resistance, particularly in terms of variation and fitness. Further contributions included findings from post-mortem examinations of Finnish reindeer (2020-2024) and research on how winter-feeding practices influence the gut microbiota composition in reindeer. The session concluded with a summary of the main outcomes from the broader TARANDUS event.

Across both sessions, emerging and re-emerging infectious threats to semi-domesticated reindeer in Fennoscandia were highlighted. The sessions also addressed practical aspects of disease surveillance, diagnostic tools, and mitigation strategies, alongside considerations of genetic resilience in disease management. Collectively, the presentations underscored the complex and evolving challenges facing reindeer health and husbandry in northern ecosystems.

Climate change *(chairs: Sirpa Rasmus and Antti-Juhani Pekkarinen)*

The first talk was given by **Sirpa Rasmus**. She talked about emerging new summers in northern Fennoscandia showing that increasingly extreme and uncertain summer conditions challenge reindeer husbandry through droughts and increasing temperatures, causing changes in pastures and vegetation. Adaptation is challenged by new conditions, and the fact that reindeer are generally grazing freely during summer – herders cannot impact through herding that much. As commented later during the session, solutions should be found within the next ten years.

Léonie Duris talked about Sámi reindeer pastoralist system facing climate change, effects of weather, pasture, insect harassment and maternal conditions of reindeer. Their study found that maximum temperature influenced the calf body mass in autumn. Their study suggests that the management strategies in Ruvhten Sijte are near-optimal yet



inherently fragile. She concluded that broader research across herding communities is needed to develop and refine adaptive strategies for sustaining productivity under changing environmental conditions.

Antti-Juhani Pekkarinen presented his work titled ”Extreme winter conditions may lead to a collapse of reindeer husbandry economy – Results of a bioeconomic analysis”. He concluded that supplemental feeding becomes crucial for maintaining the economic sustainability of reindeer husbandry during extremely difficult winters, especially when natural forage is insufficient. Without feeding, income from reindeer husbandry may decline dramatically, highlighting the importance of adaptive management under worsening winter conditions.

Topic was continued by **Jouko Kumpula**, who presented the exceptionally difficult winter 2019-2020 and factors affecting the extent of losses experienced in the reindeer herding in Finland. He showed that the exceptionally difficult winter of 2019-2020 caused severe losses in Finnish reindeer herding, particularly in cooperatives relying on natural grazing without supplemental feeding. As climate change increases the likelihood of such winters, adaptive herding and feeding strategies will be critical for sustaining reindeer health and productivity.

Then **Tim Horstkotte** talked about the method to study these difficult topics with the title ”Tales that really matter: Tracing causalities of weather and climate impacts on pastoral landscapes through a storyline approach”. He showed how the storyline approach offers a practical and meaningful analysis framework for understanding how climate change affects reindeer pastoralism. Storyline approach can capture the complex, place-based interactions between multiple factors affecting pastoral landscapes and reindeer herding. He concluded that this method, grounded in both scientific analysis and herders’ knowledge, could better inform climate adaptation actions and policies. It is important to give meaning to climate scenarios, locally. If you only have data and scenarios, these ”zdetach knowledge from meaning”.

The session was closed by **Maret Heahtta** and the **CITE project team**. They presented the ongoing and recent work ”Co-designing an observation system to monitor climate change impacts on Sámi Reindeer Herding husbandry”. They showed how indigenous-led, co-designed monitoring systems – such as the CITE platform – can help herders to document and respond to climate change impacts that are currently poorly captured by conventional observation networks. Collaborative knowledge production ensures that monitoring tools are both scientifically robust and practically relevant for climate adaptation in Sápmi.

Overall, the session showed how climate change is increasingly disrupting reindeer husbandry across Sápmi, with impacts on both summer and winter conditions, reindeer health, and economic sustainability. Extreme weather events, such as difficult snow and ice conditions, heatwaves, and droughts, are becoming more frequent, increasing the challenges faced by herders, particularly when natural pasture resources are insufficient. Adaptive management strategies – such as

selective breeding, supplemental feeding, and flexible herding practices—help mitigate some impacts, but reindeer herding may remain vulnerable to climate extremes. To develop more effective and locally relevant adaptation strategies, it is essential to integrate scientific analysis with local and Indigenous knowledge, through approaches like storylines and co-designed monitoring platforms. Collaborative knowledge production is likely to be essential in ensuring that reindeer husbandry can remain resilient in the face of accelerating climate change.

Cumulative impact *(chairs: Anna Skarin, Mikko Jokinen and Gabriela Wagner)*

In the cumulative impact session, the five presentations covered a variety of studies. In the introduction talk **Bernardo Brandão Niebuhr** from NINA, Norway gave a talk on how to use reindeer GPS-data to model and consider cumualtive pressures of other land use on both wild reindeer and reindeer in reindeer husbandry. He presented a workflow combining habitat selection modeling, movement analysis, and visual tools to assess these impacts. He illustrated how the models can be used to do scenario-based forecasting, which have potential to inform conservation and land-use decisions in both wild reindeer areas and the reindeer herding area.


Anna Skarin, professor at the Department of Applied Animal Science and Welfare.

In the second talk **Mikko Jokinen** from LUKE, Finland explored how Finland's expanding wind energy sector affects reindeer husbandry in legally protected grazing areas, where the cumulative impact of multiple developments remains poorly understood. Through interviews with herders, municipal officials, and energy companies, their study underscores the importance of early, transparent communication to prevent conflict. Jokinen advocated a more holistic and regional land-use planning model that incorporates the specific needs of reindeer herding and balances environmental, cultural, and political considerations.

In the thrid talk **Erik Cronvall** from SLU, Sweden presented a method for improved estimation of ground lichen cover and biomass, a key resource for reindeer that is declining due to forestry and climate change. The approach integrates drone-based NDVI and tree height data with a strategically de-

signed sampling framework, enhancing accuracy and cost-effectiveness. He also presented how to estimate lichen biomass from lichen volume using data from earlier studies. Combining the new method and lichen volume estimations, he showed that it is possible to assess grazing capacity in terms of reindeer grazing days.

After this **Sophia Zielosko** from UiT, Tromsø, Norway gave a talk on an investigation of whether decades of varying reindeer grazing intensity affect soil carbon storage in the tundra biom across 20 reindeer herding districts in Northern Norway. Despite large differences in reindeer densities, topography, and climate, their work showed that it is mainly the amount of organic soil that predicts carbon stocks and that these increases with warmer temperature.

In the last talk of this session **Fanny Berthelot** from UiT, Tromsø, Norway presented on how plant nutrient and defense compound concentrations change over summer in relation to temperature and grazing intensity.

They found that warmer conditions accelerate the seasonal decline of essential nutrients in tundra plants, while compounds associated with plant defense increases. The study raises concerns about how climate change could reduce the availability of high-quality forage for reindeer during critical summer months.

PART 2

Land use conflicts *(chairs: Mikko Jokinen and Gabriela Wagner)*

Presentations by **Anna Skarin** and **Per Sandström, Peder Ingar Hansen Buljo, Emma Luoma** and **Sanna Hast** and **Svein Morten Eilertsen** highlighted the area conflicts that arise in Samii reindeer husbandry grazing areas. These conflicts occur because of the societal need for either increased green energy production (e.g. wind power plants) or other industrial and development constructions. Also, increased use of land areas by tourists, building of cabins and wildlife activities by locals and others have effects on the traditional reindeer husbandry areas.

Presently, wind power is regarded as the best and fastest way to establish new green energy on land. Constructions of wind power plants are now progressing at such a high pace in Norway, Finland and Sweden, that there is serious concerns regarding both the ability for reindeer husbandry to continue in some areas, but also the loss of nature and effects on wild animals and plants raises concerns. In many regions of Scandinavia, Sami people are now mobilizing to stop these constructions, and the raise of conflicts is rapid.

Results presented by **Anna Skarin** and **Per Sandström** indicate that reindeer and reindeer husbandry are negatively affected by wind power expansion and mining, and that the degree of impact and the way in which it affects varies with area and season.

Both mines and wind power hindered reindeer from moving between different grazing areas. The opportunity for optimal use of the pastures was also often negatively affected over several kilometers. Wind power establishments on winter grazing lands coincide with grazing areas, located at higher elevations.

These sites have become particularly important for reindeer husbandry due to climate change, when repeated freezing and thawing events in winter cause ice crust formation in the snow at lower elevations, hindering the reindeer from grazing. Expanding wind power to remedy climate change thus means that reindeer husbandry is affected in multiple ways, partly by cli-

Sanna Hast, senior adviser at Reindeer Herders' Association.

mate change and partly by the loss of the grazing areas which are more needed when the climate changes.

Emma Luoma and **Sanna Hast** presented a positive initiative from Finland, where a new emerging collaborative forum for reconciliation between wind power companies and reindeer husbandry, with active participation from authorities, have developed since 2019. Parties work together to formulate good practices for the operation of wind power projects in the reindeer management areas, including creative ways to assess, mitigate and compensate for the adverse effects of wind power. By 2024, the actors, supported by a professional neutral third party, established a forum for an on-going collaboration where they identify and address common issues beyond singular projects.

Svein Morten Eilertsen presented a revised methodology for impact assessments in reindeer husbandry areas, developed by NIBIO and co-workers, and delivered to the Norwegian Ministry of agriculture and food. The proposed method states the need for active involvement from reindeer husbandries from the start of the assessment, the possibility for quality control of produced text and use of traditional knowledge in all parts of the assessment. Also, an assessment of cumulative burdens for the reindeer husbandry, including all present and future constructions and area use of various parties, must be included in the assessment. Important in the new proposed method is the lands overall function through the reindeers annual grazing patterns provided by the reindeer herders, should be emphasized.

Peder Ingar Hansen Buljo told the story of the challenges, anxiety and worries that his reindeer herding family have experienced before, during and after a big construction in their grazing lands. There is now doubt that this is something that many Sami reindeer herding families experience in Scandinavia today.

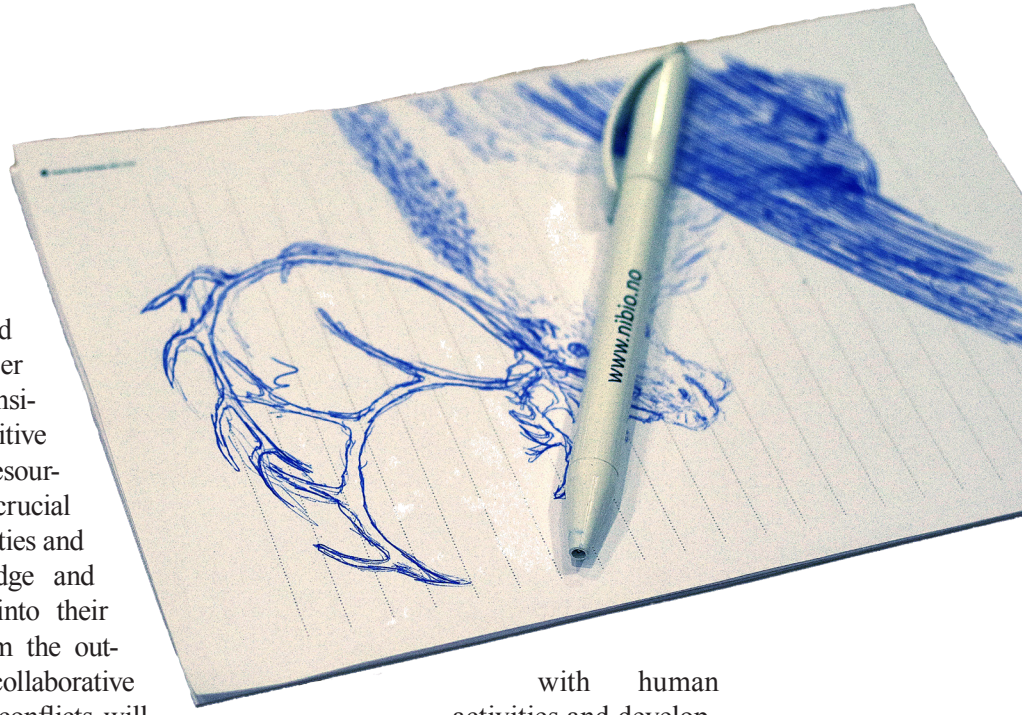
The POROTUULI project, presented by **Mikko Jokinen**, studied how wind power and reindeer husbandry could be reconciled through fair and trust-based planning and negotiation. Case studies across three herding cooperatives and wind projects highlighted the need for early engagement, cultural sensitivity, open information sharing, and mutual understanding. Ultimately, human relationships and respectful communication play a greater role than formal systems. Even with good communication, poorly located turbines can significantly harm reindeer herding. If geographic and spatial conditions are fundamentally incompatible with herding practices, reconciliation may be impossible. Therefore, regional and up-to-date land use planning is essential to determine which areas are suitable or unsuitable for wind energy development.

Environmental impact assessments (EIAs) often fall short – they typically include maps showing reindeer infrastructure and proposed wind projects but lack meaningful quantitative analysis or conclusions. There is a clear need for better verbalization and interpretation of these impacts.

In conclusion, aligning wind energy development with reindeer husbandry requires comprehensive planning and culturally sensitive processes. It takes more time, resources, and cooperation – but it is crucial for sustainable land use. Authorities and municipalities must acknowledge and integrate cumulative impacts into their decision-making processes from the outset. Without a holistic view and collaborative dialogue, trust will erode, and conflicts will deepen. Taking the time to get it right benefits both renewable energy goals and the cultural and economic sustainability of reindeer herding.

Herders, pastures and regulation *(chair: Sanna Hast)*

Solveig Øye Bjørdal and Camilla Risvoll presented the role of experience-based knowledge and knowledge exchange in supplementary feeding in reindeer husbandry. Changing weather and pasture conditions caused by climate and environmental change together



with human activities and development challenge reindeer husbandry.

Herders have a long history of responding well to changing conditions, but this is now at stake with the continued multiple pressures.

Supplementary feeding has traditionally been a strict practi ce to alleviate pasture crises. With the changing herding conditions, however, supplementary feeding has become increasingly needed as an emergency measure to buffer the lack of pastureland. Supplementary feeding changes the material

Gabriela Wagner, Research Scientist at NIBIO, and audience.

foundation of reindeer husbandry and herders point to several factors related to economic losses, threats of losing rights to pastoral land and risk of losing traditional knowledge about pastures.

Feeding changes the practical execution of reindeer husbandry as well as the relationship between herders, reindeer and the landscape. There is also an increased risk of diseases directly and indirectly related to feeding.

The presentation highlighted results that show the importance of traditional and experience-based knowledge for good and successful supplementary feeding practices. Supplementary feeding was further discussed by **Heidi Rautiainen** who presented a study on effects of winter-feeding on reindeer's future ability to utilize natural pastures, which if negative, can drive changes in the traditional way of herding reindeer.

Herders have raised concerns that fed reindeer, especially calves, do not utilize natural pastures as efficiently as other reindeer. There are several unintended effects of feeding that may compromise reindeer's ability to use natural pastures efficiently. The effects identified by herders were related to physical traits or behaviors; the reported effects varied between herders, as did the perception of whether an effect was positive or negative. They found that reindeer calves which were fed in enclosures during their first winter of life were less likely to select areas with higher lichen abundance when on natural pasture compared to reindeer that had spent their first winter on natural pasture.

Juha Joona elaborated on the position of the Sami people in Finland's reindeer husbandry. In Finland, unlike many other indigenous peoples, the Sámi do not have any specific rights related to the use of land and water areas. This also applies to reindeer husbandry.

Reindeer herding is not restricted to the Sámi as an exclusive right, nor does the Finnish Reindeer Husbandry Act provide any special provisions for Sámi reindeer husbandry. However, the Sámi have historically held a special status concerning reindeer husbandry. For example, in Sweden, where reindeer husbandry rights are almost exclusively reserved for the Sámi, reindeer husbandry is considered a land-use right protected under property law.

The legal framework surrounding reindeer husbandry in Sweden is also more comprehensive than in Finland. This raises the question of whether Sámi reindeer husbandry should be more robustly protected legally compared to reindeer husbandry practiced by those who do not meet the requirements for immemorial usage.

Another perspective concerns the human rights of Sámi reindeer herders. Reindeer husbandry is protected not only by Finland's Constitution but also by several human rights treaties ratified by Finland.

This issue has become particularly relevant due to the recent construction of numerous mines and wind farms in Finland's reindeer herding areas. In some regions, these development projects are in areas critical to reindeer husbandry. If reindeer husbandry were explicitly understood as a Sámi livelihood – rather than merely an occupation – having a say in such projects would undoubtedly be easier. The Fosen wind farm project in Norway serves as a related example.

The wellbeing of young Sami reindeer herders is extremely important for securing generational shifts and continuation in reindeer husbandry. **Arja Rautio** presented a study that has looked into young Sami reindeer herders who are facing challenges related to work that have further effect on their lives.

There is an increased need for comprehensive understanding of mental health and well-being and further developing new actions to support holistic well-being of reindeer herders, especially at early stage. Results from this study can be applied for, not only increasing an understanding about the well-being of Sami reindeer herding but also providing information to develop new services.

Juha Kujala presented a herder's view on predators. Predators, in general, are threatening the success and wellbeing of reindeer husbandry. There should be an easier way to remove individual predators that have significant negative impact on the herd. Herders should be given more tools to protect their herd.

Sirpa Rasmus, University Researcher at the Arctic Centre at the University of Lapland.

Climate change and adaptations

(chairs: Sirpa Rasmus, Antti-Juhani Pekkarinen and Svein Morten Eilertsen)

The goal of this multilingual session was to discuss ways to improve data collection and sharing to better support climate change adaptation. The discussion focused particularly on monitoring systems and local knowledge. In addition, the session included presentations on the tools authorities need to facilitate adaptation, and discussions on how to ensure that knowledge is both accessible and effectively integrated into decision-making processes.

Sirpa Rasmus and **Antti-Juhani Pekkarinen** opened the session with various examples of citizen science tools and local knowledge platforms. Also, more official data sources were touched upon.

Then, **Per Olaf Persen** presented the status of climate change adaptation in reindeer husbandry in Norway, based on a recent report and planning document. This comprehensive document lists adaptation needs and several possible adaptation measures – some more suited for coping through difficult weather events, and could be taken quickly in use, some that are more long-term solutions. For example, the use of technological tools such as GPS and drones to support herding was mentioned, as well as preparedness plans for each herding district.

The talk was followed by a comment by **Päivi Kainulainen** from the Centre for Economic Development, Transport and the Environment (Lapland, Finland). She talked about adaptation in Finland from an administrative perspective and specifically mentioned the act on compensation for damage for reindeer husbandry, caused by exceptional weather and natural conditions. The purpose of the law is to help cope with extensive and unexpected damage. It has been in force since 2016; compensation was paid because of the conditions during the reindeer herding year 2019-2020; the first and so far the only occasion. Applying the law was found slow and difficult, and there was certain dissatisfaction within the livelihood regarding the pace of the process, the compensations paid, and especially the fact that this system cannot support prevention of reindeer losses during difficult conditions.

Then a more practical side of adaptation was disussed. **Anna-Marja Kaddik** talked about how the Gran herding community is adapting to climate change and navigating in new conditions. She presented both challenges and practical solutions. Constant uncertainty bur-

dens herding communities, and the need to be ready for action, always. Her presentation highlighted that by combining Sámi traditional knowledge with Western scientific methods they found practical strategies for adapting to climate change and land-use pressures.

The session was closed by a group presentation by **Maret Heahtta** and the CITE project team. They continued their talk from the day before, by presenting the process co-design, and outreach work. The team concluded that delivering experiences and information to people outside the Arctic and outside the livelihood is important. Local monitoring and co-producing knowledge have value both to the herding community, and also to science. It is difficult to monitor the environment when changes are so fast. Local observers can follow also those developments that are unfamiliar to researchers who do not live in the area.

When the herders themselves do the monitoring and mapping of conditions, it makes it possible for them to show the direct impacts of climate change to administrators and other land-users and also explain the value of certain landscape features and pasture areas. Development of their own monitoring system has also taught them a lot about technical details and user-friendliness of technical systems.

After all the talks and presentations, we also engaged ourselves in a **multilingual panel discussion** with presenters and audience. It was noted that monitoring systems are many, and there is plenty of data. It would be useful to emphasize the use of existing platforms – and collaboration across national borders. Panelists were asked the difficult question: what is missing now, thinking about adaptation of reindeer husbandry to climate change? We got these answers:

Restoration of pasture lands, open societal discussion about the actual meaning of cumulative impacts, flexibility in pasture use, possibility to impact the other land use, communication towards decision makers, legislation that helps to prevent reindeer losses, monitoring conditions during other seasons than winter, trust to local observations, resources at local level – especially more time, time would be needed both for planning and putting adaptation plans in use – and for the good ”core work” in herding.

OPEN TOPICS

Open topics (chair: NIBIO)

GPS TRACKING DATA from reindeer demonstrates that a lichen indicator map strongly predicts reindeer movement during winter compared to other landscape features.

These maps serve as essential tools for understanding reindeer habitat use, mitigating land-use conflicts, and guiding strategic restoration planning (SVEIN ADLER).

THE INCREASE OF CROWBERRY undermines reindeer pasture quality and current management in the Norwegian tundra. Ongoing Arctic greening can increase productivity and reindeer pasture quality in the tundra. However, greening may also entail proliferation of unpalatable species, with consequences for pastoral social-ecological systems.

Here we show extensive greening across 20 reindeer districts in Norway between 2003 and 2020, which has reduced pasture diversity. The allelopathic, evergreen dwarf-shrub crowberry increased its biomass by 60 %, with smaller increases of deciduous shrubs and no increase in forbs and graminoids, the most species rich growth forms. There was no evidence for higher reindeer densities promoting crowberry.

The current management decision-making process aims at sustainable pasture management but does not explicitly account for pasture changes and reduced diversity (KARI ANNE BRÅTHEN).

REINDEER AS DATA Tracking movement and (un)greening the effects of wind power development. Exploring the scientific assessments of impacts of industrial infrastructure on reindeer in Norway and in Sweden amidst land use conflicts can be done by examining how the digital tracking and data therein have shaped animal and human relationships in different ways.

As researchers do less fieldwork, they became more dependent on data collection by those directly working with the herds. The scientific definitions of reindeer sensitivity to infrastructure have been entangled with the back-and-forth travel of impact definitions between research institutions, wild hunting areas, and Sami districts, across borders.

Sensory encounters materialized two divergent hypotheses: Whereas the establishment of new energy production and reindeer activities can be made compatible, energy infrastructure can also be framed as one more negative impact that accumulates in the landscape (DANIELA SANT'ANA).

CLIMATE CHANGE and growing land use are testing the resilience of reindeer herding. With the continuously changing local and global environment, expenses in reindeer herding have been increasing as prices are going up globally. Economic viability of reindeer herding is challenged. In Northern Finland, reindeer herding has for long struggled with high costs and low income.

The economic viability of reindeer herding is a current discussion topic in the Finnish reindeer herding area. Herders need to consider if they can continue their livelihood as climate change has extended the feeding period, predators are charging the herd sizes and extractive industries are reducing pastures. An example farm presents the types of costs and income reindeer herders have and maps the percentages of those expenses and incomes. The economic numbers are telling one story of the viability of reindeer herding and showing the economic imbalance herders face.

However, reindeer herding is still an alive livelihood striving through the economic challenges. Reindeer herding as a traditional livelihood stretches beyond economic numbers, thus describing reindeer herding merely through economic lens can be lacking perspective. The viability of reindeer herding reaches further than economic limitations, as reindeer herding is a holistic livelihood (VIOLA UKKOLA).