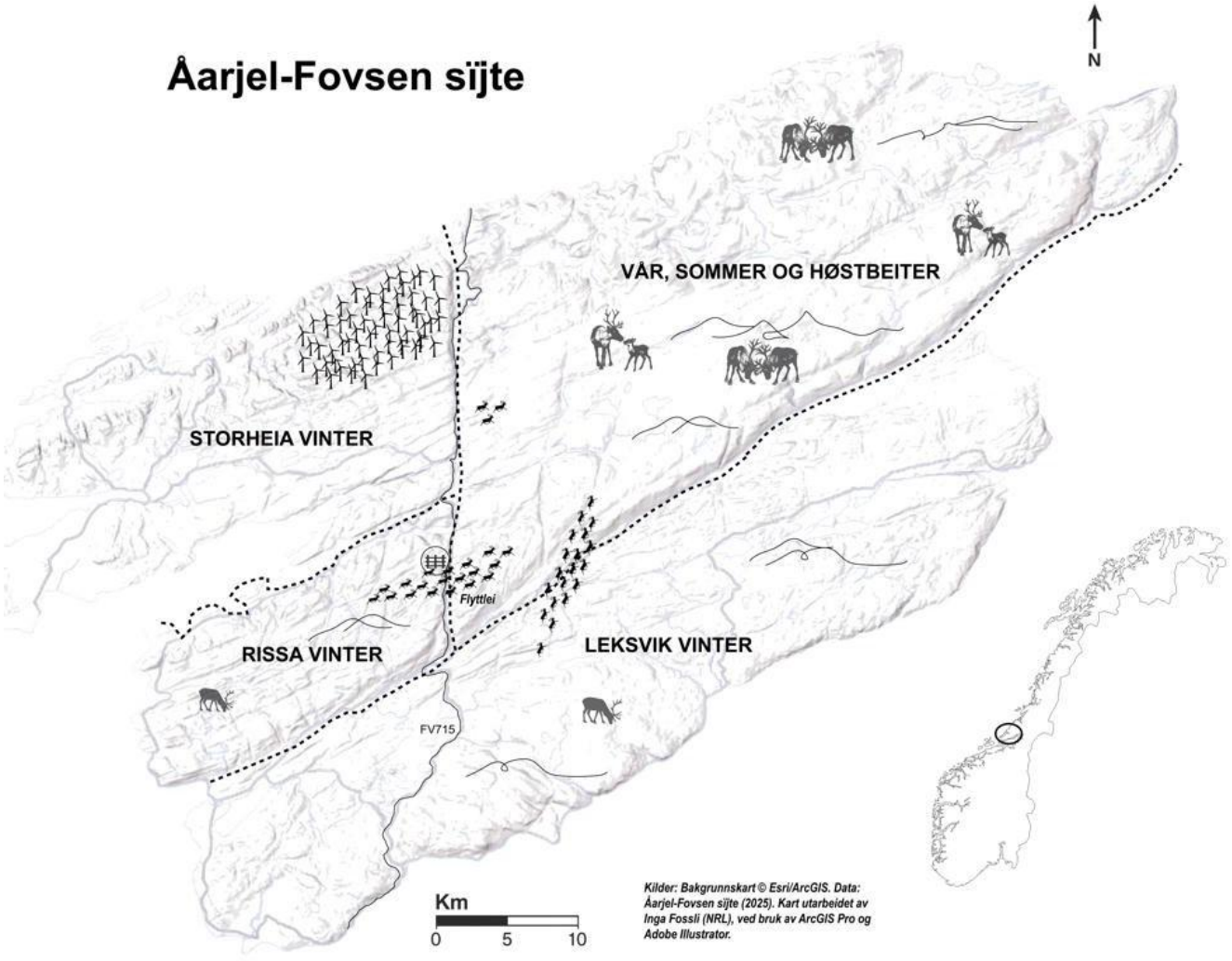
Possible effects of a new 420-kV power line for reindeer herding in Sør-Fosen

Åfjord-Aunfjæra. Reindeer herding's perspective



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Cover illustration: Inga Fossli, NRL.

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Preface

This report is an assignment carried out on behalf of Sør-Fosen sijte in connection with Statnett's application for a new 420 kV power line Åfjord-Snilldal. The report has been carried out as a collaborative project between Sør-Fosen sijte, the Norwegian Reindeer Herders' National Association's area unit and JÅRISETH AS. The report is partly financed with financial support from the Sami Parliament.

Leif Arne Jåma has a dual role as both client and co-author. Jåma has laid a significant part of the foundation for the report with his extensive practical professional knowledge of reindeer husbandry at Fosen. Crucial parts of the text are based on Jåma's descriptions and explanations. Jåma's participation in group interviews with other reindeer herders has also highlighted important knowledge. Jåma's redrawing of the reindeer herding maps is also crucial for much of the assessment basis for the report. He has also contributed with both photography and computer technical assistance.

Jåma has discussed his assessments and analyses with his colleagues. They agree and support Jåma's presentation.

Both Marit Østby Nilsen and Jan Åge Riseth have contributed with research and management expertise, but also with insight into traditional knowledge. Marit Østby Nilsen has particularly contributed with her broad professional insight into the University of Copenhagen and is responsible for both most of the pictures in the report and for technical assistance. Jan Åge Riseth has the main responsibility for the scientific contributions, the writing and the entirety of the report. We have worked as a group and strived to co-create knowledge based on the fact that different forms of knowledge can complement each other and provide a broader picture and deeper insight.

We greatly appreciate that Inga Fossli in NRL's area unit has designed the beautiful overview map of the area that also adorns the front page of our report.

We are grateful that we were able to interview six reindeer herders; Arnt Ove Toven, Hans Jakob Toven and Lars Toven, in Åarjel-Njaarke, Stig Lifjell and Tom Lifjell in Ildgruben reindeer grazing district as well as Idar Bransfjell in Saanti sijte, and learn from their experiences with a 420 kV line through their reindeer grazing districts, and that we also received permission to use interview material from Skarfvággi reindeer grazing district.

Several research colleagues have contributed important input and are thanked for this. A special thank you to Hans Tømmervik, Anna Skarin, Yngvar Gauslaa and Svein Morten Eilertsen.

We thank each other and all partners for the cooperation!

Sør-Fosen sijte thanks the Sami Parliament for the grant that made this study work possible.

The first draft of the report has been commented on by both Professor Emerita of Reindeer Husbandry at the Swedish University of Agricultural Sciences, Birgitta Åhman, and Professor Emeritus of Reindeer Husbandry at the Norwegian University of Life Sciences, Øystein Holand, We are very grateful for their contributions. We have made adjustments and corrections to the report as a result of the comments they have provided. The report has become both clearer and more nuanced. Remaining errors and omissions are our own responsibility.

JÅRISETH AS thanks for the assignment.

Follafoss/Tydal/Narvik, 01.On October 09, 2019,2025

Jan Åge Riseth

Leif Arne Jåma (sign.)	Marit Østby Nilsen (sign.)	Jan Åge Riseth,
Leader Sør-Fosen sijte	Head of NRL's area unit	JÅRISETH AS
Client/co-author	Co	Project Manager/Main Author

Summary

Statnett has applied for expropriation of land to build a new 420 kV power line right through Sør-Fosen sijte's winter grazing areas. The Norwegian Water Resources and Energy Directorate (NVE) said no to expropriation because it believed there was considerable uncertainty associated with the overall negative effects on reindeer husbandry of a new power line. Seen in the context of negative effects from other infrastructure, the NVE does not rule out that the new line may entail a violation of the UN Covenant on Civil and Political Rights (ICCPR), Article 27 for reindeer herding at Fosen. The case has been appealed to the Ministry of Energy.

This report is a technical report commissioned by Sør-Fosen sijte. Sør-Fosen sijte makes up half of the Fosen reindeer grazing district (Fovsen-Njaarke), which we sometimes also refer to as Fosen reindeer herding. Sijten believes that the present impact assessment (KU) in the case does not adequately safeguard the reindeer herders' own perspective. Sijten believes that this KU underestimates the expected effects the planned power line will have on reindeer herding. Sør-Fosen sijte has therefore commissioned a study that aims to integrate the reindeer herders' own knowledge and assessments with updated research to get answers to what effects the planned 420-kV line is expected to have. The report proposes alternative power line routes as well as mitigation measures.

In Chapter 2, the report provides a general introduction to reindeer husbandry as nature and culture, with a general review of the reindeer herding year with its eight seasons, largely based on written traditional knowledge. The purpose is to contribute to an understanding of the distinctive challenges of each of the seasons and how the entire annual cycle is connected. We also explain the meaning ofpasturero and some other key concepts.

In Chapter 3, we review the formal requirements for the knowledge base for interventions in reindeer herding countries, point out the challenges associated with current practice, and further the requirements this places on the choice of method. We point out that a main problem in the current UCA system and practice is that the traditional knowledge of the reindeer herding Sami is usually not allowed to play the role prescribed by the Nature Diversity Act and the Impact Assessment Regulations. Like the work group that has evaluated the current UC system for reindeer husbandry, we believe that satisfactory assessments of intervention effects in reindeer husbandry require co-creation *of knowledge.*

In Chapter 4, we present the method we have used in this report. In addition to using established research, we have strived to co-create knowledge by integrating reindeer herding Sami knowledge both from Sijten itself, but also from other reindeer herders and written contributions, where we have seen a need for it. The report is a group work in which the entire presentation is discussed together. Jåma has contributed with his extensive knowledge of tradition and local knowledge. Østby Nilsen has particularly contributed with his broad insight into the field of UCPH. Jåma and Østby Nilsen have collaborated on images and technical figure design. Riseth has had the main responsibility for the scientific contributions, the writing and the entirety of the report. As a group, we have strived to co-create knowledge based on the fact that different forms of knowledge can complement each other and provide a broader and deeper insight.

Chapter 5 deals with the effects of technical interventions and power lines. We summarize and comments on the development of intervention and power line research. Since the 1980s, there has been a paradigm shift in intervention research, where the research community now takes a broad landscape ecological perspective on interventions and disturbance effects, in both time and space. However, current power line research related to reindeer and reindeer husbandry, which also forms the basis for UC practice, is varied. The published results show that the reindeer avoid

power lines in some areas and surveys, while in others they do not. A number of studies that conclude that there is a lack of avoidance are sharply criticized by other researchers.

Reindeer herders have limited confidence in impact assessments in general, partly due to inadequate/inadequate treatment of the overall effects of interventions. The reindeer herding administration has also expressed concern that many KU do not meet the standards of reindeer husbandry, and that a certain professional environment with little trust among the reindeer herders has received a disproportionately large part of the reports concerning energy facilities. The Ministry of Agriculture and Food (LMD) has initiated a major study that has now proposed a new assessment methodology for KU for reindeer husbandry. The proposed methodology aims at both better integration of reindeer herding Sami knowledge and places greater emphasis on the overall effects of interventions in the studies as well as better involvement of reindeer husbandry in the assessment processes themselves.

We point out that new physiological research on reindeer vision and hearing opens up for a deeper understanding of intervention effects that have previously been registered, but not fully understood and explained. It has been revealed that reindeer can perceive ultraviolet light (UV light) in winter when the eyes are increasingly sensitive to light during the winter months. This may provide explanations for avoidance and variation in avoidance that have not previously been explained, but this needs further research. More targeted research based on Global Positioning Systems (GPS) and other modern methodologies, which is carried out in close cooperation with the reindeer herders concerned, will provide a basis for clarification of topics that are constantly controversial both in development processes and in the legal system.

In the absence of well-documented research that identifies the conditions under which avoidance can be expected, we have collected reindeer owner experiences with power lines from four reindeer grazing districts and used these as indications of effects that appear to be reasonably well justified. For example, avoidance can be masked by physical fencing and edge herding, avoidance is usually greater in open landscapes than in forests, avoidance is amplified by both sound and light effects, wind and storms and other sources of disturbance, avoidance can destroy grazing peace, Avoidance can also lead to migration to terrain that is dangerous to humans or to agricultural areas.

Chapter 6 provides a brief overview of South Sami culture and language and the importance of reindeer herding as the heart of South Sami culture. Chapter 7 is an introduction to reindeer herding in Sør-Fosen, while chapter 8 goes in depth on the winter pastures, with a particular focus on Rissalandet. We describe the distinctive grazing landscape where reindeer herding is dependent on migration and organized migration between "islands" of bare mountains in the broken landscape. We present a hitherto undescribed winter grazing dynamic with rotational grazing between bare mountains and mountain forests. We suggest that this dynamic provides extra flexibility, and that this helps to explain why reindeer herding in Fosen and in other districts along the coast has been more stable than many would expect. In support of this description, in addition to Sijten's own traditional knowledge, we also build on new research on both hanging lichens and vegetative propagation of ancient spruces, in South Sami known as framhte, in Norwegian as spruce crow.

Chapter 9 reviews Fosen reindeer grazing district's business economic situation based on the County Governor of Trøndelag's report of concern from 2022 and expands this with data from the public sector Business statistics through three tThis year. From and with 2016 has Fosen Reindeer grazing district Hat serious negative development. The County Governor has expressed strong concern about the overall sustainability of Fosen. The resource accounts show that the loss figures, especially for adult females, are disproportionately high, several times higher than the slaughter figures. This means that the Fosen reindeer herding *is in the midst of a collapse.*Sør-Fosen sijte is even worse off than the total figures for the entire district show. Without fundamental changes, this reindeer herding cannot be expected to survive further.*The County Governor considers that the sustainability of reindeer husbandry at Fosen in particular is threatened by the intervention situation. including wind power development, but also predator losses and increasing traffic/tourism.*It is against this background that a new comprehensive intervention in the form of a new 420 kV power line through Rissalandet and the winter grazing areas further north must be considered.

In Chapter 10, we follow the path of the power line route through the winter grazing landscapes and look in particular at how the route goes in relation to the collection areas and the migratory and migration routes in Rissalandet. Self-power line streets directly occupy about 1.5 km2. The route runs mainly where it will be easiest to navigate, over marshes and through valleys, but also goes over some hills and up hillsides for reasons of wiring.*The problem is that moving reindeer herds with snowmobiles depends on exactly the same kind of landscape as where it is easiest to carry a power line.*In the broken landscape, the migration and migration routes constitute the basic basis of reindeer herding

transport arteries that provide a connection between the many bare mountain islands. In many cases, there are no alternatives if they can no longer be used.

Rissalandet has two large collection areas with migration routes in several directions. One is located centrally, around Storsalen. The second lies in northeast and includes Blåheia. Both collection areas are welfare land, i.e. areas where the reindeer like to be and stay still. This is a good starting point for gathering smaller reindeer herds for a larger and active migration along the migration routes out of Rissalandet. In both areas, the planned pipeline route crosses several migration routes, in the Bismar Valley it runs directly into the migration path, and otherwise runs openly and visibly along migration paths over several kilometers.

We consider that the current UC underestimates the effects of this, as the recommendations are limited to considerations during construction work and the placement of mast points. Based on the reindeer owner experience we have obtained, we expect significant evasion from the power line. This can mean that moves are prevented or, in the worst case, blocked. The grazing area that characterises well-being land can also be destroyed and cause reindeer to retreat from areas close to the power line. We propose to distinguish between primary and *secondary avoidance zones.*Primary avoidance is in the landscape zone where the immediate avoidance occurs, where one can expect a reindeer herd to avoid suspicious objects, such as something that may resemble predators, e.g. Corona discharges with sound and light, but it can also be people with dogs. Based on an assessment of the landscape, an expected zone has been outlined in a width of less than one to about two kilometres on each side of the power line. The secondary avoidance occurs in the landscape zone where frightened reindeer from the primary avoidance zone pass through, before it feels safe enough to calm down and resume grazing. The secondary avoidance zone can extend to include over the next valley and up to the hill that follows. In practice, evasion could then cover up to half the width of Rissalandet.

In addition to this, it is important that Rissalandet must be used as a collection area for the movement of reindeer until Winter pasture outside Fosen, Compare mediation agreement between Fosen Wind THEN The Ministry of Energy and Sør-Fosen sijte. This area alone is large enough, and it is the access to the fencing facilities in Haugsdalen that makes assembly and transport practically possible. The ongoing climate change makes winter gathering of reindeer in Rissalandet more vulnerable than before. If the gathering has to take place on bare ground, you are dependent on a helicopter. Helicopters cannot fly close to power lines. This may mean that transport of reindeer to areas outside Fosen cannot be carried out. The climate scenarios indicate that we must increasingly expect winters where it is suddenly not snowmobile. A new power line in accordance with the proposed route can also lead to new conflicts with agriculture, as evading the power line can lead to smaller herds and especially bull reindeer migrating down on unfenced inland both along the Stjørnfjord, Sørfjorden and Skaudalen.

In Chapter 11, we start from the premise that the Fosen reindeer herding has been well-ordered and stable, but that it has suffered disproportionate losses since 2016 and is in the midst of an ongoing collapse. This requires that new winter grazing outside Fosen must be realized as quickly as possible, and that new interventions and disturbances must be avoided. In addition, harm reduction measures should be implemented.

Chapter 12 summarises and concludes the report. We mention that Norwegian management of Sami reindeer herding areas has to a considerable extent overlooked the requirement of the Cow Regulations that overall effects must be assessed. We conclude that if the new 420 kV line is built in accordance with the route requested, there is a real risk that the ongoing collapse of the Fosenrein operation will not be stopped. It will entail a new human rights violation. New winter pastures outside Fosen represent an opportunity to stop the collapse so that the two sijts at Fosen can re-establish themselves and once again build up a robust reindeer herding. A new power line through Rissalandet will most likely destroy the possibility of achieving this for Sør-Fosen sijte.

In Chapter 13, we launch several alternatives to the planned route, both with subsea

cables, a land-based route, and combination solutions. The proposed solutions have different degrees of impact on reindeer husbandry, but all have a clearly smaller impact than the planned route. The optimal choice would be an alternative with a submarine cable.

In Chapter 14, we propose the establishment of a game bridge/reindeer crossing over FV715 in Haugsdalen.

Content

Content

1. Background

On 26.On October 08, 2019,2013 licence and expropriation permit for Statnett to build and operate a new 420 kV power line between Åfjord and Snilldal in the municipalities of Åfjord, Indre Fosen and Orkland in Trøndelag county, see figure 1.

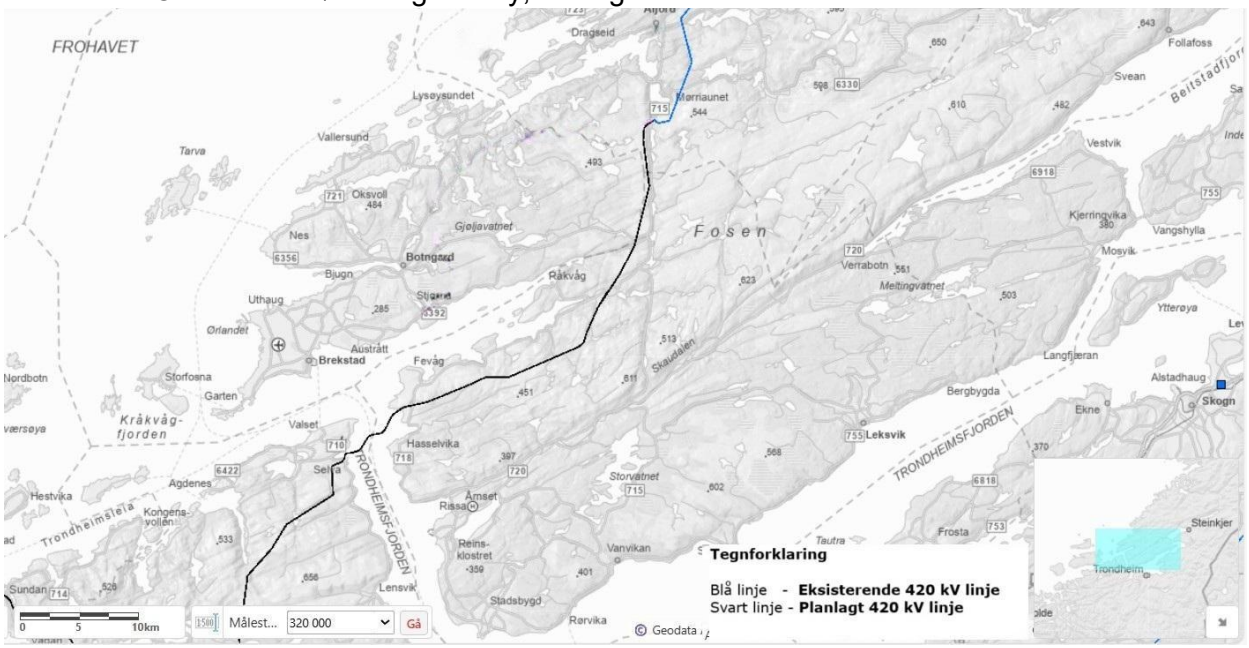


Figure 1. Existing 420 kV power line and planned route for a new 420 kV power line (NVE).

In order for the expropriation permit to be valid, Statnett had to have requested an assessment within one year of the permit being granted, which Statnett did not do and the expropriation permit lapsed. Statnett applied for a new expropriation permit for the pipeline on 11 October.On October 10, 2019,2022. The licence application with impact assessment, and the application for expropriation and pre-accession were sent out for consultation on 13 October.On October 12, 2019,2022. NVE held a consultation meeting with Sør-Fosen sijte on 16.On October 05, 2019,2024.

On 28.06.2024, the NVE rejected Statnett's application for a new expropriation permit for the facilities. The NVE assumed that there is considerable uncertainty associated with the overall negative effects on reindeer husbandry of a new power line through the area to Sør-Fosen sijte. NVE could not rule out that the new pipeline, seen in the context of already negative effects on reindeer husbandry from other existing facilities, may entail a violation of the UN Covenant on Civil and Political Rights (ICCPR), Article 27 for reindeer herding at Fosen. The NVE therefore found that it has not been established that the advantages of the expropriation intervention are undoubtedly greater than the disadvantages.

On 29.08.2024, Statnett appealed NVE's rejection of the expropriation permit. Statnett stated that the decision contained both material errors and procedural errors. At the processing of appeals in the NVE on 18.On October 03, 2019,In 2025 , the rejection was upheld for reindeer husbandry. The appeal is being processed by the Ministry of Energy.

There are several previous reindeer husbandry studies that deal with the effects/overall effects of power line and wind power projects at Fosen (Colman et al. 2008, 2009, Eftestøl and Colman 2011). Nature restoration (Eftestøl 2022). This is because this report can be considered a summary and update of previous reports and is the one that follows the case. In the minutes of the consultations with the NVE, this report is described as follows:

"Sør-Fosen sijte actively contributed to the dialogue with the investigator, and they believe that the

report in a good way highlights the reindeer herders' use of the area. They are therefore puzzled as to how the report nevertheless concluded that a new power line is not expected to have any particular effects on reindeer" (NVE 2024:24).

When you read this statement, you can sense that there is more to the statement than wonder. It seems that something has been lost between the description of use and the assessment of effects. It may seem as if the investigator has put the reindeer owners' assessments in parentheses and has failed to enter into deeper dialogues. In the consultation with NVE, Sør-Fosen sijte informed that they planned to have a separate technical report prepared on the effect of the pipeline on reindeer husbandry.

In July 2024, Sør-Fosen sijte requested the company JÅ RISETH AS to conduct such a professional study. After reviewing the case's documents, JÅ RISETH AS entered into a verbal agreement with Sør-Fosen sijte to take on this assignment, and we started the active collaboration with a helicopter inspection on 23.09.2024.

The overall purpose was to write a report that integrates the reindeer herders' own knowledge and assessments. It became clear early on that this had to be implemented by using a methodology of co-creation of knowledge (Sandstrõm 2015, Hausner et al.etc. 2020, Hovelsrud m.etc. 2021, Skarin m.etc. 2021, Yua m.etc. 2022), Our report is supplementary to the current KU (Eftestøl 2022) and constitutes a corrective that aims to present a reindeer herding Sami perspective on the issue.

The research questions for this report are:

(1) What effects can the planned 420-kV line be expected to have for Sør-Fosen sijte if it is built along the planned route?
(2) What mitigation measures can reduce the negative effects for Sør-Fosen sijte?

We omit to go into a broad presentation of the construction work and the considerations that must be taken into account if the planned power line is to be built as planned, as the purpose of this report is to contribute to the choice of another route alternative. At the end of the report, we introduce four different alternatives, all of which are clearly better for Sør-Fosen sijte than the applied route.

Furthermore, in Chapter 2, we provide a broad introduction to reindeer husbandry, with particular emphasis on the presentation of challenges throughout the various phases of the reindeer husbandry's annual cycle. In Chapter 3, we start with a presentation of the formal requirements for the knowledge base that lie in national laws and regulations and international law, continue by pointing out challenges in practice, demonstrate some knowledge encounters and point to co-creation of knowledge as a necessary prerequisite for balanced assessments of nature interventions in reindeer husbandry. Chapter 4 describes how we as a group have sought to realise the intention of co-creation of knowledge. In Chapter 5 on power lines, we comment on research on natural encroachment and power lines. As the first, as far as we know, we also make an attempt to summarize the reindeer herders' experiences with 420 kV power lines based on interviews and experiences from four reindeer grazing districts. Based on this, we also provide some input for further research on reindeer husbandry and power lines.

Chapter 6 provides a brief introduction to the South Sami and their relationship to reindeer herding, while Chapter 7 provides an overview of reindeer herding in Sør-Fosen. Chapter 8 provides a broad review of Sør-Fosen sijte's winter pastures, with particular emphasis on Rissa winter pastures. The presentation includes a description of a hitherto undescribed winter grazing dynamic in which forest grazing and hanging lichen play a critical role. In chapter 9 on the current situation, we highlight with the support of official industry statistics (the Resource Accounts) and a note of concern from the County Governor of Trøndelag that reindeer herding at Fosen is in the midst of a persistent collapse. The chapter summarizes that new winter pastures outside Fosen must be realized as soon as possible, that no new major interventions must be made and that mitigation/damage reduction measures must be implemented. In chapter 10 on interventions, we go through specifically how the planned power line comes into contact with

and must be expected to work in relation to reindeer herding, especially in Rissalandet. Chapter 11 is the discussion chapter where we gather the threads, while chapter 12 summarizes and concludes. Our conclusion is that in order to avoid a collapse in reindeer herding at Fosen and thus a new human rights violation, it is necessary to choose a different route for the planned 420 kV power line. In Chapter 13, we identify possible alternative routes for the power line. In chapter 14, we propose a wildlife crossing over FV715 in Haugsdalen.

2. Reindeer husbandry as nature and culture

2.1 The reindeer, people and the landscape

The reindeer (*Rangifer tarandus tarandus*), more precisely the Eurasian tundra reindeer, is widespread over large parts of Fennoscandia.[1] In Norway, a smaller part of the reindeer population is managed as wild reindeer in southern Norwegian high mountains, about 20.000 animals, while domestic reindeer make up about 215.000 pr. On October 31, 2019,On October 03, 2019,2024 (Norwegian Directorate of Agriculture 2024). The prefix "tame" is strictly an exaggeration, as domestic reindeer are not domesticated in the same way as our livestock.[2]

Reindeer have been exploited by humans as far back as the last ice age; partly first as prey during hunting related to large hunting burrow systems, and eventually for transport purposes (driving reindeer and cloven-hoofed reindeer). The reindeer have characteristics that facilitate domestication. It is docile, with a trusting nature that can be used to being groomed, milked, even to being dehorned and neutered. It can be trained to pull sleds and sleds and collaborates with experienced riders. Domestication has taken place at different times in different areas (Nieminen 2018). Cultural researcher Sverre Fjellheim describes the shift as a transition from hunting-based to nomadic reindeer herding. For the Røros area, he dates the start of this to the mid-1500s (Fjellheim 1999).

In South Sámi, it is called reinenbovtse (Bye and Jåma 2013). The Northern Sami language distinguishes between boazu, swhich are reindeer controlled by humans, and goddi, which is wild reindeer (Bjørklund 2013). Sami thinking aboutanimal welfare is the basis for the reindeer herders' work with the reindeer:

> *"The reindeer are in an intermediate position between totally free animals and livestock. Ideally, the pastoral nomad should only follow the reindeer and protect them from external threats, and disturb the reindeer as little as possible for the sake of themselves and the reindeer"* (Magga m.etc. 2001:3).

Since the reindeer have no need for humans when they are undisturbed in their natural environment, humans must work to direct and control the reindeer's movements. Reindeer are herd animals that tend to flock together in large herds. Historically, there is much to suggest that the need to control larger reindeer herds is the background for the emergence of the Sami reindeer herding, a working community between several nuclear families, (Bjørklund 2013).

The reindeer have a unique combination of behavioural mechanisms and physiological characteristics that give them a good adaptation to the demanding habitat. It makes maximum use of the summer for growth, while it lives on the back burner in the winter. *The finely tuned balance between these extremes makes the reindeer very sensitive to disturbances by humans or predators.*

It is an opportunistic herbivore and has great flexibility in relation to what it eats. It is highly selective when it has the opportunity and has a preference for lichen, which is highly digestible and high in energy, but it can also live on grass with less efficient nutrient absorption. The reindeer are constantly moving when they graze and find the most nutritious and easily digestible plants or plant parts. Like all cervids, the reindeer is a ruminant (Danell and Nieminen 1997). The reindeer have extensive land use. It is dependent on large areas, but does not use most of the area intensively.

Reindeer are creatures of habit. The reindeer calf learns the annual migration route by following the simla, who in turn has learned it from its mother. In a major quantitative study of GPS-monitored wild reindeer in southern Norway, the researchers used a large number of archaeological finds to uncover the wild reindeer's centuries-old migratory beds as a basis for GPS research that showed the wild reindeer's present-day avoidance of newer man-made

[1] Norway, Sweden and Finland

[2] In English, the term semi-domesticated, i.e.semi-domesticated, is used.

structures (Panzacchi m.etc. 2012). Today's reindeer were allowed to follow the ancient migratory beds if they were not disturbed by modern interventions.

Reindeer prey and have good hearing (Perra et al. 2022). They react with alertness and eventually flight when exposed to the sound of predators and other disturbances (Bõrs 2023). They also have good eyesight and, unlike humans, also see ultraviolet light that radiates from power lines during so-called Corona discharges (Tyler m.etc. 2014). The reindeer always pull against the wind so that it can getrid of dangers. It also prefers to get up in height to get an overview, and prefers to avoid being driven down hills.

Sami reindeer husbandry is based on the interaction between landscape/pasture, reindeer and reindeer herders (Skum 1955, Ruong 1964, Paine 1972), see figure 2 below. If reindeer husbandry is to be sustainable, there must be a certain balance between them.

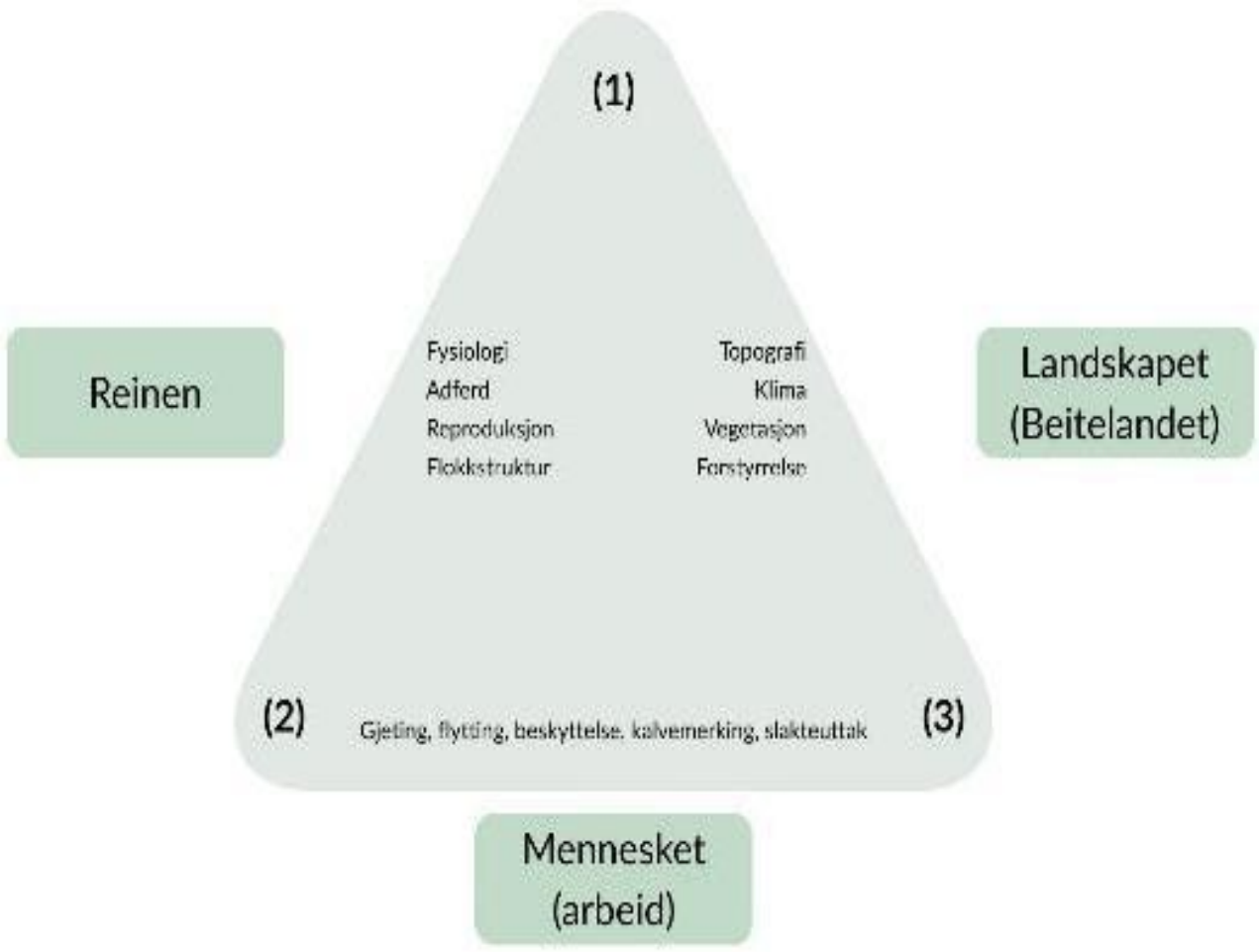


Figure 2. The reindeer herding triangle. The Relations Between Man, Landscape and Reindeer in Sámi Reindeer Husbandry (Freely after Ruong, 1964). ¨

The relationships between these factors are specified in Table 1.

Table 1. Concretisation of the relations between the factors of production (Riseth 2015)

Relasjon	Behov	Krav	Institusjon	Aktivitet
Rein–landskap	Mattilgang og livsfunksjoner	Funksjonsområder og årssyklus Beitebalanse/-belegg	Rein som er vant med området Naturlige grenser	Trekk, kalving, brunst, lufting (ved insektplage)
Menneske–rein	Kunnskap og kontroll	Kunnskap og teknologi Tamhetsgrad	Siida (driftsgruppe)	Gjeting, flytting
			Baiki (hushold)	Merking, slakting
Menneske–landskap		Kjennskap Tilgang Utforstyrret	Beite- og driftsrettighter Beskyttelse mot inngrep og forstyrrelser	Politikk/ lovgivning Sosiale relasjoner Rettskamp

The reindeer's relationships with the landscape are the basics. In order to take care of the animals' physiological needs, there is a need for grazing areas for all seasons, migratory and migratory areas and functional areas for calving, rut and exercise mountains, among other things. In order for reindeer husbandry to become a source of subsistence, people must have sufficient knowledge of the reindeer and its characteristics to steer it in a controlled manner through the annual cycle. Associate Professor Inger Marie Gaup Eira at Sami University of Applied Sciences puts it this way:

> *"Those who engage in reindeer herding must know the landscape, the course of the year, the weather and climate and other life in the surroundings. The way the reindeer behave provides the reindeer herder with important information. The reindeer herders say that a reindeer herder must think just like a reindeer"* (Eira 2017:1).

The South Sami culture and organisation man Ingwar Åhrén (1988) theorises the relationship between the reindeer, the landscape and the human being in the concept of *"the Sami space".* He compares the reindeer herding land to a rum: *"The Sami space has its boundaries in the form of mountains, lakes and watercourses in order to indicate the elements that can be most typical and tangible"* (Åhrén 1988:117).

The starting point is to look at the Sami space from the reindeer herder's point of view.*«Roughly speaking, these denote the patterns or laws and rules – those of nature/reindeer – that a reindeer herder has internalized, unconsciously learned and accepted, and that control his movement in space*" (Åhrén op.cit.). Such norms can be formulated as: *"move you in a definite relationship to the wind"* (Åhrén op.cit.), but often they are more complicated and concern the relationship between man, reindeer and landscape and the proportions between different parts of space, i.e. marshes, lakes, rivers, ridges, etc.

From their constant contact with nature, the Sami have built up special knowledge and Åhrén asks the question: *«.. it may be that we can be said to have our own code that governs us and that has governed the development of the Sámi society* (Åhrén 1988:118). Åhrén believes that reindeer herders assess places in much the same way, and that this is because it is based on the fact that they know how the reindeer assess the place.

2.2 The annual cycle of reindeer husbandry

It is a fundamental challenge for all reindeer husbandry to have sufficient available pasture in all seasons. The reindeer's natural movements in, and use of, the terrain are important for understanding grazing use and grazing utilization. The interaction between animals and landscapes is different for different times of the year. We will illustrate this by describing some main points for grazing use and landscape use through eight seasons. The descriptions are illustrated by Mikkel Nils Sara's (1997, 1999) sketches of the reindeer's main direction of movement in relation to the terrain.

2.2.1 Spring and calving season

In the spring, the crowd is usually so hard that digging in the snow to find pasture is impossible, and the reindeer become dependent on seeking pasture where there are bare spots. It can be on windswept slopes and hills that the reindeer will then move up into the terrain, but it can also be in marshy areas that are low in the terrain. Herbs and roots can be available in the marshes before other plant growth. When thawing, the bare spots (*bievllat) gradually become* larger. The period between when it is possible to burrow under the snow and when the bare spots become large is a critical period for reindeer herding. In Figure 3 and the subsequent sketches, the solid line depicts a cross-section of the terrain, while the arrows indicate the reindeer's main direction of movement.

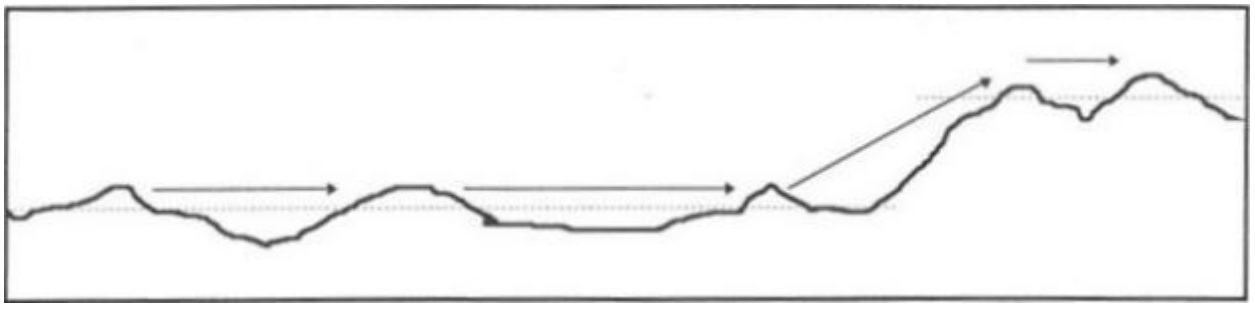


Figure 3. Cross-section of terrain. The reindeer search for bare spots in the spring (Sara 1997:55). The arrows indicate the reindeer's main direction of movement.

Calving usually takes place in the second half of May, and by then the bare spots have usually become so large that there is plenty of available pasture. The calving land must be open and clear areas where the sheep feel safe, but it must also be warm to provide protection from bad weather, and there must also be plenty of grazing. Good calving land is often located in early areas just above the tree line. The females are particularly vulnerable to disturbances during the calving period and can, in the worst case, abandon the newborn calf if it is frightened (Ruong 1982, Svonni 1983, Sara 1999). In districts with a lot of predators, the small calves are particularly vulnerable.

2.2.2 Spring summer and greening

"With spring summer, there is a single pasture transition from lichen to leaf bud and fresh sprouts. This means that the reindeer now let go down into the terrain" (Sara 1999:100), see also Figure 8. After calving at the end of May, the females are relatively stationary for the first few weeks until the calves become strong enough (Ruong 1982, Skarin m.etc. 2010). This is the so-calledimprinting timewhen the calves learn to follow their mother.

The reindeer have a great need for, and prefer, healthy protein-rich sprouts, and therefore follow *the "spring in the pasture",* throughout the summer, to take care of this (Skogland 1978). The greening normally starts from below and spreads up through the vegetation zones from spring and out through the summer. In areas with coast-facing summer pastures, the greening often

starts down on the beach surface, while in continental areas it starts in the forest zone; often on the marshes or south-facing hills that have first become snowy. The movement in the terrain thus occurs first downwards, as Figure 4 shows, and then upwards as the summer progresses.

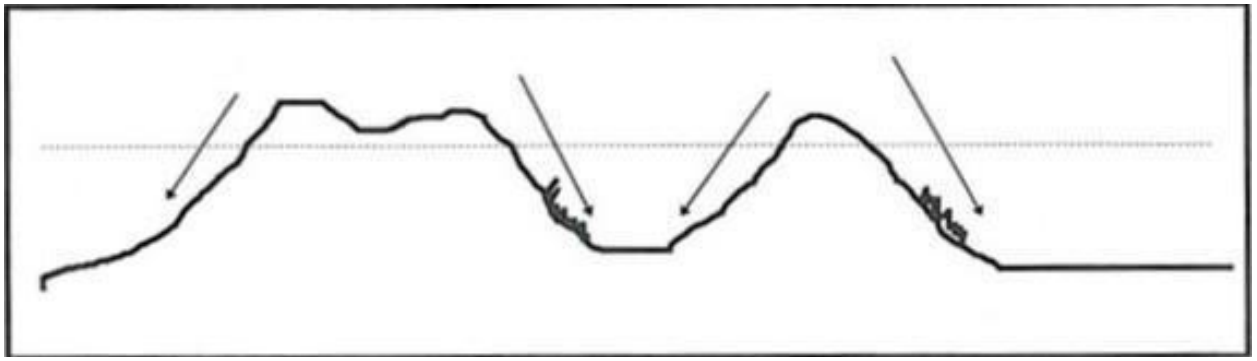


Figure 4. Cross-section of terrain. The movement of spring-summer downwards in the terrain to reach green sprouts (Sara 1999:100). The arrows indicate the reindeer's main direction of movement.

2.2.3 High summer with shedding and aeration

When summer comes at its peak, there are several phenomena; *shedding, insect nuisance and weathering*, which interact with the animals' foraging and affect the vertical movements of the reindeer. Shedding begins around midsummer and the reindeer then become extra sensitive to insects; both brakes and bloodsuckers such as mosquitoes and gnats. During the moulting season, the reindeer are exposed while the new coat grows. It then has increased sensitivity to insects and the sun, as well as heavy rain and colder weather. This means that it needs to move up and down in the terrain depending on the weather conditions. Ruong (1982) refers to the mosquito as *"the Lapp's best farmhand"* because it drives the reindeer up from the forest and up onto the bare mountain so that the herders can then gather the herd for calf marking.

Calf tagging is usually carried out in high summer, preferably at the beginning of July, but this can vary for different districts, depending on when the reindeer are gathered and put in a fence. Some districts have also taken up old techniques of carrying out calf marking on a snow patch that is suitable. On warm days, the reindeer are usually high up in the terrain where they seek snow patches (*jassat*), snow beds, glacier tongues or nuts (or on the shore in areas with coastal pastures (Riseth m.etc.2010)) to avoid the insects and on days with colder weather conditions further down in the terrain.

> *"If there are no snow patches or higher nuts, the reindeer will be able to spread out and run around or seek down dense birch forest. It can also be left out in water, rivers and along streams to avoid the brake"* (Holand 2003:72). ....."*In case of rain and temporary coolness, the reindeer also go down to adjacent forest areas, where there is the most abundant food and protection against storms, but turn back up to the mountains when the warmth returns"* (Svonni 1983:67: 257).

In addition to movements due to the type of weather, the reindeer in warm weather also have a diurnal cycle where in the evening and towards night they migrate down from hiking mountains and snow patches down to vegetation-rich lower ones such as *vuopmi* (wooded valleys) or vaggi (mountain valleys). A sketch of principles is shown in Figure 5. Skarin et al. (op. cit.) has demonstrated a good correlation between the reindeer's vertical diurnal movements and the types of weather in which the various insects fly. That is, when it is cool and windy, the reindeer migrate down to better grazing duck.

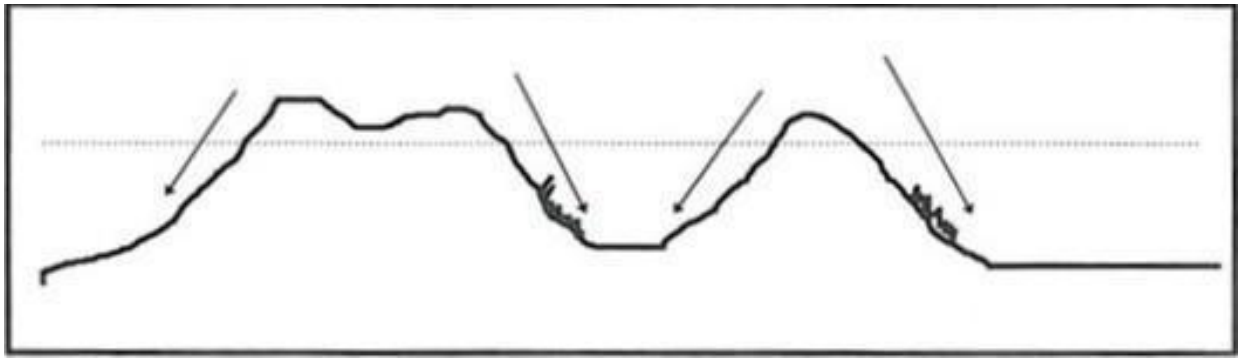


Figure 5. Cross-section of terrain. The vertical movement pattern of the reindeer (diurnal migration) in high summer (Sara 1999:101). The arrows indicate the reindeer's main direction of movement.

Skarin et al. (op.cit.) assumes that the high summer lasts until the daily mean temperature falls below 6 ºC, as this coincides with reduced insect activity.

2.2.4 Autumn summer and dispersal time

In autumn summer, the reindeer's grazing choice is neither limited by insect pests nor snow, allowing it to choose the most preferred plants. The main pattern is that the reindeer seek downwards in the terrain (see figure
6) where there are plenty of grazing plants, preferably to forests and thickets where it begins to sweep its horns. In late summer and early autumn, the reindeer will search for mushrooms, and then they will also roam around a lot to find mushrooms, but the amount of mushrooms can vary greatly from year to year. The reindeer need free movement to and from the (forest) areas where they can find mushrooms.

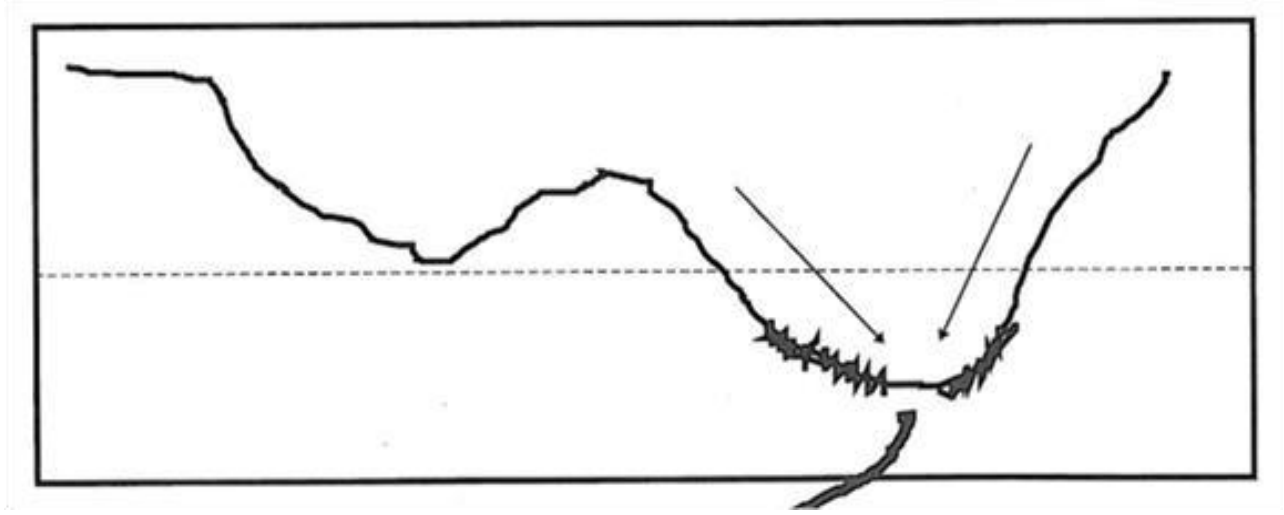


Figure 6. Cross-section of terrain. The reindeer's grazing movement in the autumn summer (Sara 1999:96). The arrows indicate the reindeer's main direction of movement.

2.2.5 Autumn: Viewing, yellowing, rut and snowfall

Autumn begins when grass and herbs begin to wither and yellow while the ground surface begins to freeze. This is conditioned by lower temperatures and reduced nutrient input, starting at altitude and spreading downwards in the vegetation zones. This means that the food supply is best low in the terrain. Wet vegetation types such as marshes and marshes have a steady supply of nutrients and play an increasingly important role throughout the autumn. This applies to both underground stems and roots of marsh plants and above-ground parts of common and evergreen plants such as smyle, sedge sedge and peat wool (Holand 2003).

The first snowfall comes on the ridges and will also force the reindeer down into the terrain and reinforce the tendency for the reindeer to stay low in the terrain. Throughout the autumn, as the offer of

Green grazing is declining, lichens are becoming an increasingly important share of the reindeer's grazing uptake. Since there is snowy or little snow, low-lying vegetation types are vulnerable to hard grazing and trampling:

> *"The ground, especially dry heaths, ridges and the dry slopes of the mountains, are particularly sensitive to wear and tear in early autumn. It is therefore very important not to have to hard-graze the mountains in the autumn"* (Svonni 1983:69:259).

Figure 7 aims to illustrate that the reindeer during the autumn mainly move along the valley floors, and gradually lower in the terrain. The rutting season lasts from late September to mid-October. The reindeer then stay relatively stationary within a limited area, and it is important that the herd is not disturbed. Slaughter of bucks must be carried out before heat.

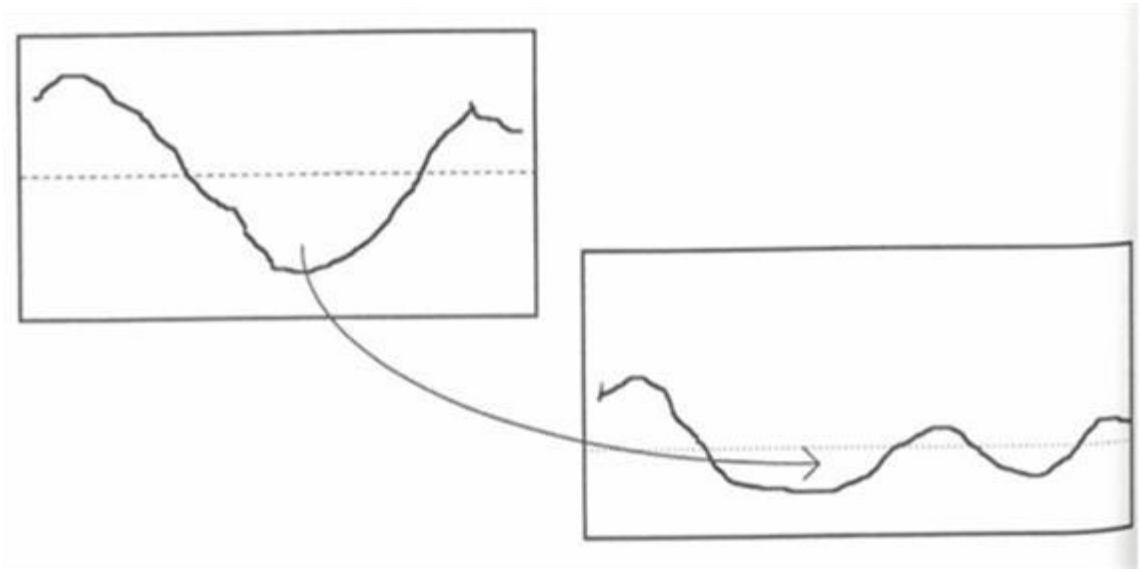


Figure 7. Cross-section of terrain. The reindeer's grazing movement in the autumn (Sara 1999:97). The arrows indicate the reindeer's main direction of movement.

2.2.6 Autumn winter

"When the rut lets go, rivers and water are frozen, the brakes and obstacles to the reindeer's movement are also gone" (Sara 1997:59). The reindeer still move low in the terrain, see Figure 8, and like to graze on marshes and in thickets where there may still be herbs, fungi and perhaps lichen. If snow has settled, it is usually not an obstacle to the reindeer's grazing. For reindeer husbandry with long migrations, the herds are separated and smaller herds are moved to the winter area.

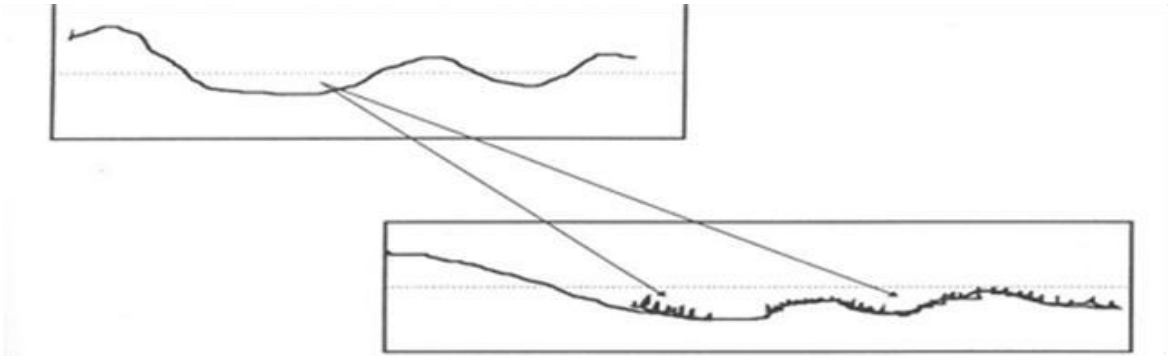


Figure 8. Cross section of terrain. Autumn winter (Sara 1997:53). Arrows Specifies Reinens main direction of movement.

The first permanent snowfall is important for grazing conditions for the rest of the winter. Ideally, the first permanent snow falls on frozen ground, see figure 9.

Figure 9. Gustav Labba explains to Elina Helander-Renvall about the significance of the first permanent snow. In his left hand he holds a gåajvoe klaahka/goaivesoabbi. Photo: Hans Tømmervik.

If it is instead wet and warm, later frost will cause a layer of ice (*bodnevihki, cuohki*) to form against the field. In the worst case, this layer of ice can freeze the vegetation (skilži) and block access to the pasture all winter. It can also lead to mould formation in the winter pasture and give rise to both stomach problems in the reindeer and the loss of calves (Turi 2011 [1910], Svonni 1983, Riseth et al.etc. 2011, 2012).

2.2.7 Winter

It is the snow cover, its amount and consistency, that determines which localities are available for grazing. It is best if the snow cover is not much more than half a meter. If it is one meter or more, the reindeer will not be able to dig. The best snow cover is grain snow (*seaŋáš*), which is easy to dig in; *goaivvesgguohton3* («good pasture», Heikkilä 2006), se Figure 10.

[3] perhaps the most used term in Sámi winter reindeer herding

Figure 10. Reindeer digging. Photo: Hans Prestbakmo.

Both wind and mild weather in winter help to transform the snow. The reindeer can dig through some wind-packed snow (*ceavvi*), but rain or mild weather and subsequent frost can cause later ice layers/ice crusts to form, on top of the snow as a crust (*geardni,cuoŋu*), as a layer of ice in the middle of the snow pack (*gaskageardni*), se figure 11 or even all the way towards the marka as described front (Riseth et al. 2011, 2012).

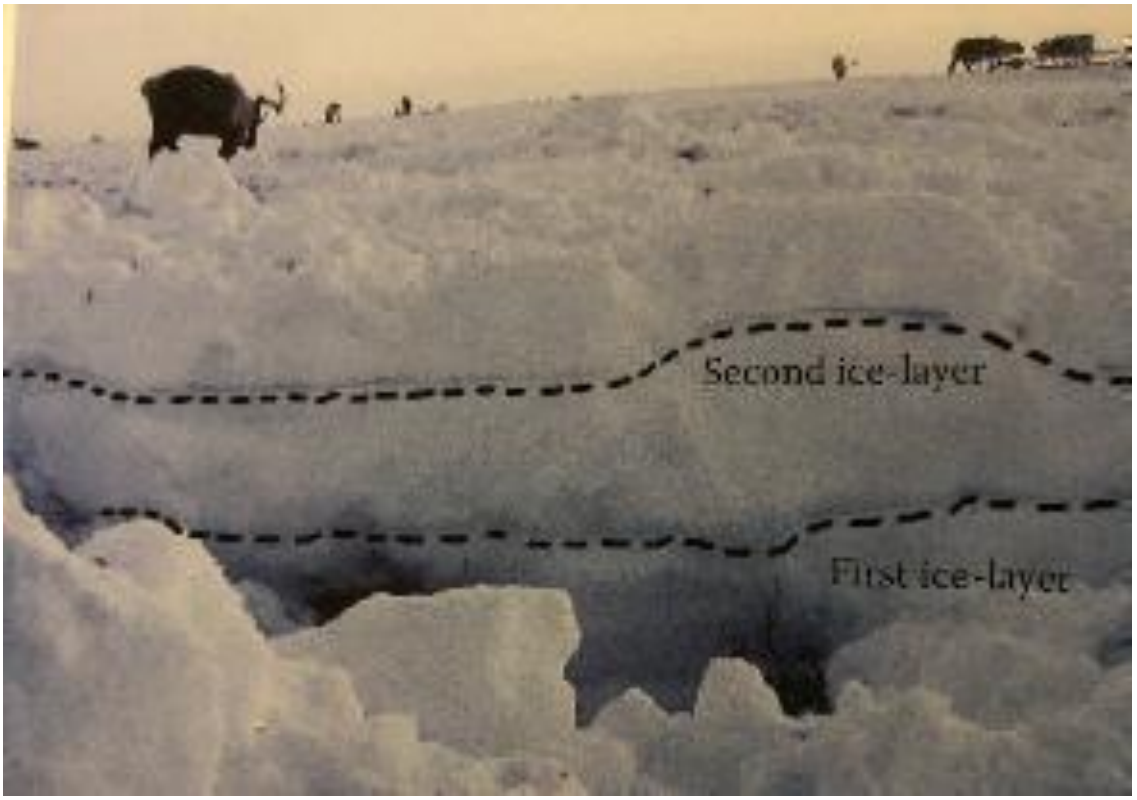


Figure 11. Layers of ice in the snow pack. Photo: Florian Stammler.

Such conditions have become increasingly common as a result of climate change, and have forced many reindeer grazing districts to use additional feeding, either permanently for parts of the winter or as emergency feeding. Even with good conditions, it becomes increasingly difficult to find grazing sites where the snow is loose enough, and there is not too much of it, especially in denser forests.

In winter, the reindeer thrive in marsh scrub and low-grown, relatively dense forest, see Figure 12.

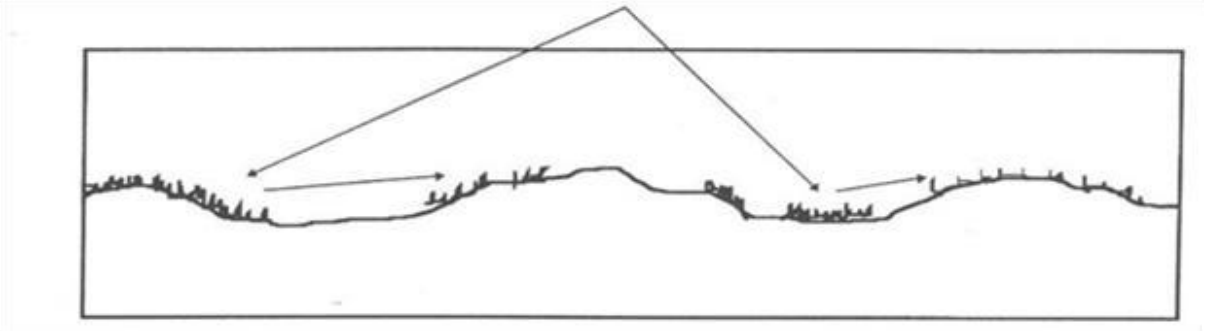


Figure 12. Cross section of terrain. Winter (Sara 1997:54). Arrows Specifies

2.2.8 Spring-winter

In early winter, grazing is normally only available around tree trunks in pine forests, and in open terrain, especially hilly or sloping terrain may provide opportunities for available grazing. As Figure 13 suggests, higher and exposed areas can provide opportunities as the wind may have blown away the snow. When thawing hard-packed snow, exposed locations at height can also become accessible.

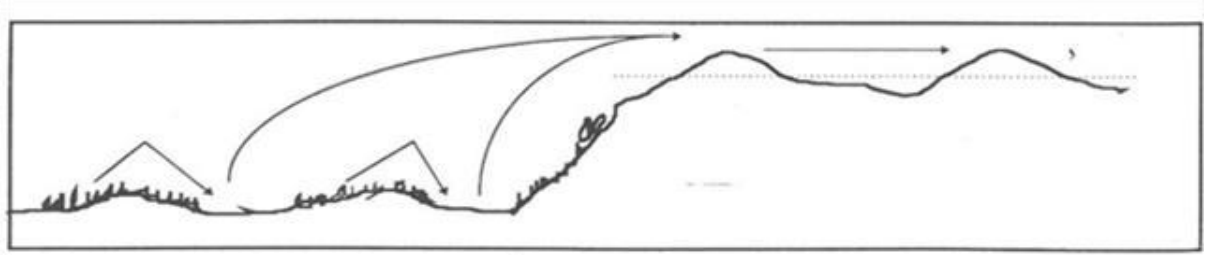


Figure 13. Cross section of terrain. Spring-winter Sara 1997:54. Arrows Specifies Reinens main direction of movement.

If there have been good conditions in early winter and it has been possible to save areas with low snow such as open areas in forests and marshes with mounds of lichen, then it will still be possible to exploit lower-lying forest areas (*vuopmi*). At this time of year, there is a lot of snow that does not carry (*sievlla*) so that the flock will usually be at rest a lot. Yearling calves are the most vulnerable part of the herd and can weaken, in the first case die, if it becomes hard trodden and difficult to get down to the pasture. Wide marshy areas may also be accessible (Sara 1997). Coniferous forest areas with hanging lichen are an important resource that can be exploited, when it has become so hard that the snow surface bears and the reindeer can migrate on top of the snow.

2.3 Grazing balance, flexibility and annual variations

In the foregoing, we have gone through season by season and described opportunities and limitations. Individually, the seasons can be good or bad, depending on how temperature conditions, wind directions and precipitation conditions affect what would be favorable or optimal conditions. Weather conditions and phenology4 vary from year to year. It is therefore also necessary to have grazing areas that provide room to safeguard this variation. In addition to the most intensively used areas, there is also a need for areas that are used year after year when the need arises. There is a need for*flexibility in* grazing use.

A farming area's total grazing capacity will be conditioned by the overall balance between the different seasonal pastures. The most important element in the grazing balance is the seasonal balance between available winter pastures and bare pastures. These two main seasonal pastures have different growth patterns and different dynamics between reindeer and grazing (Riseth et al. 2004).*Winter pastures usually determine possible herd size, while summer pastures determine production* (Klein, 1968). In winter, the reindeer walk "on the back burner" and is in a deficit of energy and important nutrients when spring arrives. The reindeer will usually tolerate little food in early winter, but it is important to have had the opportunity to build up reserves in the summer, and to have hiking mountains to pull away the insect nuisance and cool down on snow patches (*jassat*). A difficult spring winter may also be exacerbated by a late spring (Lie et al. 2008).

In general, the nutritional status and condition of the animals are transmitted from sub-season to sub-season throughout the annual cycle, both in a positive and negative direction. The relationships between the seasons can be thought of aslinks *in a chain in which the effects of what happens in one are amplified or equalized by what happens in the next.*The overall result of a year in the form of calf growth, reindeer condition and slaughter yield appears as a sum of all these effects (Svonni 1983). In Northern Sami, this is referred to as enjahkodat, how the year has been. Mikkel Nils Sara definesthe concept as follows: *"Jahkodat ….. is an aggregate of how season follows season, how the effect of these builds up over time"*(Sara 1997:62). We bring in this term because it can also be used to understand intervention effects. Interventions and disturbances can have an impact in the same way as difficult weather and grazing conditions. The effects of the intervention on the reindeer herd can also be transferred from season to season, and if the effects are not compensated for, they may contribute to weakening a jahkodat, similar to a difficult spring winter.

This is the basic pattern. Land encroachment, predators, disturbances due to human activity and climate change can contribute to a predominance of partial seasons where the biological requirements of the animals are not met as they should. Depending on the extent, this leads to loss of weight and nutritional surplus, fertility, miscarriage and possibly even survival. The same may apply to the reindeer owners' necessary work such as calf marking, relocation and slaughter removal. If they are prevented or not carried out as they should, within the different time periods required by the annual cycle, it means additional work and increased costs, loss of control and income, and a reindeer herd of poorer quality.

2.4 Land of well-being and pasture5

Land of well-being is a widely used term in reindeer herding. Åhrén defines it as follows: "*Trivselsland, as it is now used, does not indicate what qualities the area has, but rather that it is only stated that the area is good for the reindeer"* (Åhrén 1988:119). As a concrete example, he uses a mountain in the neighboring Sami town. They lose reindeer there every summer because the animals seek it out. It is a land of well-being. In Northern Sámi, there is also the term oktilaš *eatnamat, which* can be translated as unifying *terrain*. It is a terrain that is such that when you move the reindeer there, you know that it will stay there (Kvaløy 2018, Riseth and

Johansen 2019).

[4] The course of nature as early or late spring and autumn.
[5] Based on Leif Arne Jåma's presentation

When you think of a Sámi village or a reindeer grazing district's area as a Sámi *space,* you can describe the area based on the composition of the most important landscape elements and how the reindeer move in the landscape from season to season. Within such a space, there are a number of important sub-areas that Åhrén refers to as power centres that the reindeer spend during certain seasons, so that together they form a functional unit. He points out that it is important that people make sure to keep their settlements and activities on the outskirts of these powerhouses so that the reindeer can have peace, i.e*. grazing peace*. Lydia Heikkilä (2006) emphasizes that predators, other people with vehicles or dogs, as well as interventions can threaten the grazing environment (in North Samiguohtun *ráfi*).

Leif Arne Jåma links grazing to the dynamics and differences between the different seasonal pastures throughout an entire year (cf. the previous paragraph):

> "In the assessment of whether the quality is good enough in all the seasonal pastures, it is the general condition of the reindeer herd an indicator of the condition of the seasonal pastures.*A reindeer herd that has good reproduction ability and has a good calf production is a reindeer herd that has good quality in all seasonal pastures.*Good quality of pastures depends on both available food and grazing peace.
>
> If spring is late, it is all the more important that the animals come as soon as possible to nutrient-rich bare pasture and get grazing rest in the summer. A bad summer6, on the other hand, can to some extent be compensated for by a good harvest.[7] If, for example, the summer grazing areas have quality deficiencies, the winter grazing areas must (over)compensate for this in order to maintain expected production."

Jåma defines grazing calm as an *interaction between grazing and resting*. When reindeer graze, it moves slowly in the landscape where it gently nibbles up the soft parts of the plants they prefer. It is good at selecting in the mosaic between plant species. When the reindeer have eaten and swallowed enough food and the feeling of satiety occurs, the equally important **part of** grazing begins.

We humans observe that the reindeer herd gathers in a clear place such as a ridge, open marsh or plain. To us, it looks like they lie down to rest, but what is the real reason is that now the rumination/ear period starts. It regurgitates coarsely eaten plant residues that it chews/finely grinds again.

In the latter part of the breeding season, reindeer also use the time to sleep. Such a grazing period normally lasts three to four hours, eventually a reindeer gets up and begins to migrate on to the next attractive grazing place. The rest of the reindeer herd gets up and follows in turn.

The grazing season starts at dawn with a weevil period in the middle of the day, before a new grazing period starts in the afternoon with a new deer period towards the evening. There may also be a more frequent frequency between grazing time and period. But at the darkest of the night, there is always nap and rest time.

Text Box 1. On the reindeer's grazing and heifering time (Turi 2011:39 [1910:128-129].

"The reindeer lie and rest when it starts to dawn in the morning. And it's called the dam quality. Then it grazes until midday, and then it rests midday, and then it rests twilight. And then it goes and grazes until midnight and quails midnight hibernation (our italics).

It is only when there is a good grazing year that all the reindeer have such regular resting at the same time.....because when there is an emergency year, the reindeer do not get food at the same time, and therefore they rest separately when they have been fed. And the reindeer also do not have time to and cannot tolerate resting for long in distress years - even if they have grazed - but when there is a lack of moss [lichen], the reindeer cannot survive if they rest for a long time. But when there is good moss, it rests for so long that you

To point out that this knowledge is something all reindeer herders have grown up with, we have in box 1 included a small quote Johan Turi. Leif Arne Jåma comments on Turi's description as

follows:

[6] For example, a hot summer with few "escape opportunities" in relation to the insect plague

[7] For example, a lot of mushrooms in early autumn

"Yes, [I] agree that when there is a good grazing year, the rest period occurs at the same time. And with good grazing, the number of animals in a herd is also higher. When the availability of pasture is poorer, the number of animals in a herd decreases. That is, there will be many small flocks. However, topography and fragmentation of grazing landscapes also affect the number of animals in herd size.

In Norway, the topography, especially in the winter grazing areas, probably determines the size of the herds. If there are fewer animals in each herd, the rest period will probably occur at the same time in this herd, but if the grazing conditions are poorer, the alternation between grazing time and rest time will have a more frequent frequency."

New experimental research based on registration of brain activity with the help of encephalograms shows that rumination is a large and important part of the reindeer's rest. *The reindeer therefore have a physiological need for grazing peace, not only when they graze, but also when they lie down and secure their cud* (Furrer et al. 2014). This appliesto all ruminants. The research confirms thiswith traditional Sami reindeer herding knowledge described already by Johan Turi over a hundred years ago and confirmed by Leif Arne Jåma today.

Table 2. Influence of grazing beets8

Natural causes	Man-made causes
Annual events: calving and oestrus	human traffic in the grazing areas.
season, weather conditions, grazing access	man-made installations lead to reindeer dodge.
insect nuisance, predator activity	
topography	

It's timely to ask questions like:
What happens when grazing is interrupted?
What happens when the grazing is repeatedly interrupted for a period of, for example, 1 week? What happens when grazing is continuously interrupted in an area?
What measures can be taken to maintain grazing peace?

Leif Arne Jåma himself answers as follows:

"Reindeer can tolerate being disturbed every now and then. But when it happens more often f.eg. 1-2 gof regret a day over several days, the negative effect will also increase in line with the number of disturbances in the pasture over time."

"What would have been interesting to know is when, at what point, do the negative consequences of such a nature occur that it affects fitness and reproductive ability. I think that the negative effect starts quite early. Maybe already in the course of a few days/days of unrest in the grazing area?"

3 Knowledge base and methodological requirements

In this chapter, we will first describe the requirements of the laws and regulations for the knowledge base, then point out the challenges of current practice, and further the requirements this places on methods for exploring the effects of interventions on reindeer husbandry.

[8] Based on Leif Arne Jåma's presentation

3.1 Requirements for the knowledge base

The Public Administration Act (§17) requires that "the case is as well informed as possible". We would like to point out that when the reindeer herders' own knowledge is only included to a limited extent in the reports that form the basis for decisions in the case, it may mean that the requirements of the law are not met.

3.1.1 The Impact Assessment Regulations (KU Regulations)

In Appendix A to the background letter for its decision, the NVE (2024) clarifies that even though power lines are not covered by the planning part of the Planning and Building Act, the Act's requirements for impact assessments and requirements for mapping still apply. For our part, we would like to point out that the KU Regulations in section 17, paragraph 3 require that:
"[T]he investigations and field investigations shall follow recognised methodology and be carried out by persons with relevant professional expertise".

The same regulations require in section 21 that factors that may be affected, e.g. *The natural basis for Sami culture* [9]
must be described and assessed. Regarding the description, it is stated, among other things, in paragraphs 2 and 3:

> "*The description shall include positive, negative, direct, indirect, temporary, lasting, short-term and long-term effects.*
>
> *The overall effects of the plan or measure in light of already implemented, adopted or approved plans or measures in the area of influence shall also be assessed.* ***Where reindeer herding interests are affected, the overall effects of plans and measures within the reindeer grazing district in question must be assessed"*** (our emphasis).

Section 22 of the Regulations also requires that an account must be given of both the use of methods and the uncertainties that exist in connection with the assessment.

3.1.2 The Nature Diversity Act

In its overview of legislation and processing process, the NVE (2024) also clarifies that the principles of the Nature Diversity Act shall be included in the discretionary assessment of licences under the Energy Act, and that the principles of Sections 8 to 12 of the Nature Diversity Act (NML) shall be used as guidelines in the exercise of public authority. This is in accordance with the MPE's administrative practice (NIM 2021:72-73). "The environmental consequences of the measure must be assessed in a holistic and long-term perspective, where consideration for the planned measure and any loss or deterioration of biodiversity in the long term are weighed" (NVE 2024:21). In particular, we would like to point outthat section 8 requires that:

> *"[T]he public decisions that affect biodiversity shall, as far as is reasonable, be based on scientific knowledge ....., as well as the effects of pressures*....., but also that *"[t]he authorities shall also place emphasis on knowledge that is based on the experiences of generations through the use of and interaction with nature, including such Sami use ...*

In other words; science's previous monopolies of knowledge have been broken. This means that the Sami reindeer herders' traditional knowledge must also be emphasized.

Section 9 of the same Act formulates the precautionary principle, which states that:

> *"[When] a decision is made without sufficient knowledge of the effects it may have on the natural environment, the aim shall be to avoid possible significant damage to biodiversity ...".* This means that uncertainty about effects must be taken into account in order to avoid damage.

If the authorities perceive the knowledge of how power lines affect reindeer husbandry to be

insufficient, the precautionary principle must be applied according to Section 9 of the Norwegian Forest Safety Act. As stated in the section, this principle requires that the aim must be to "avoid possible significant damage" to biodiversity. Lead-

[9] Incorrectly formulated as "Sami natural and cultural basis" in the KU Regulations. The wording of the regulations must be understood on the basis of section 3-1 of the Public Health Act, where the wording is "secure the natural basis for Sami culture, business and social life"

The VAR principle applies when two conditions are met: (1) there is a lack of sufficient knowledge about biodiversity/effects, and (2) the aim must be to avoid significant damage to biodiversity (KMD 2016). This means that the authorities must make a discretionary assessment based on available knowledge, even though it may be uncertain.

3.1.3 International law

In its justification for rejecting Statnett's application for expropriation, the NVE has referred to the risk of a new violation of international law through Article 27 of the UN Covenant on Civil and Political Rights (ICCPR). When the authorities are to decide whether to grant an expropriation permit, the authorities must therefore consider whether the planned power line constitutes such a major interference that, together with other interventions, it violates the rights of the Fosensamenes to exercise their culture.

In the Fosen judgment (HR-2021-1975-S), the Supreme Court established that reindeer husbandry is a form of protected cultural practice. The judgment is a guideline for how the administration should safeguard the rights of the Sami. The entire SPC Convention is incorporated into the Human Rights Act and has been given precedence over other Norwegian legislation in the event of a conflict of rules. Through practice in the Human Rights Committee, a number of assessment topics have been established to clarify whether an intervention may be a violation of SP27;

(1) *the material cultural basis*, which may include nature,
(2) the issue of individual or collective rights, (3)*effective participation* (consultations);
(4)*free and prior informed consent* (FPICP),
(5)*cumulative effect*(cumulative effects),
(6)*mitigation measures, and (7)threshold assessment*(significant adverse impact).

SP27 is structured as a threshold provision where the question of whether the threshold has been exceeded is based on an overall assessment of these metrics (NMI 2021, Strømgren 2022).

Cooperation

The Norwegian Reindeer Herders' Association (NRL) has commented on the study programme for the power and industry boost in Finnmark (NRL 2025). Paragraph 2 of this statement refers to ILO-169:

> "ILO-169 Article 7.3 sets out requirements for participation in the impact assessments. There is a significant difference between the legally valid English original text and the Norwegian translation (not legally valid)" (NRL 2025:4).

The difference that is demonstrated is that in the original English and legally valid text, the main point is that the investigations must be carried out in cooperation with the people concerned. Reference is also made to the UN Expert Mechanism on the Rights of Indigenous Peoples (EMRIP), which has stated that no KU should be approved without the free and informed prior consent of the Sámi rights holder. EMRIP also recommends:

> "the state to ensure that Sámi licensees have a right to demand a "second opinion" or a new assessment of the impact assessment both during and after the assessment has been completed, if the licensees believe their point of view is not sufficiently safeguarded" (NRL 2025:4).

3.2 Challenges

The area unit in NRL has summarized the main challenges in reindeer husbandry's area issues (NRL 2023). Two out of seven formulated challenges are particularly relevant in this case. The first of these two concerns the knowledge base:

A. "The knowledge base before decision-making both at the administrative level and in the legal system in reindeer husbandry land use cases is often inadequate. The reason for this is often that;

> ➢ The Norwegian system of impact assessments for reindeer husbandry indicates that a private law counterparty in an area case, i.e. the developer, is responsible for preparing the knowledge base for reindeer husbandry. This means that it is not a neutral player.
> ➢ UCPH is often deficient both methodologically and in terms of content regarding effects on reindeer, landscapes and reindeer herders. The assessment model focuses on the effects locally and in isolation only on the development measure, not regionally and also not cumulatively together with previous, ongoing and other planned land interventions and disturbances in the area
> ➢ The traditional knowledge of reindeer husbandry and the technical language of reindeer husbandry are often absent both in the acquisition of knowledge and in the investigator's conclusions.
> ➢ Research studies on the effects of land encroachment on reindeer in Norway are often carried out on behalf of the industry itself or that they have provided part of the research funding (similar to the tobacco industry's own health research). In the next round, the same actors carry out impact assessments for the same industrial sector" (NRL 2023:4-5).

The essence of this can be summarized in two points:

-(1)*The system allows for connections between the investigator and the developer, i.e. reindeer herding's counterpart, and a*
"The goat and the oatbag" situation.

-(2) "*UCPH is often deficient both in terms of content and methodology. This means, in particular, that the traditional knowledge and technical language of reindeer husbandry are often absent and that the reports become too narrow thematically and do not take into account the overall effects as required by the Regulations on Sexual Conduct."*

With regard to the first point, the Norwegian Institution for Human Rights refers to the fact that the UN Human Rights Committee in a crucial case (Poma Poma) emphasised that an AD had not been made by an *independent and competent investigator* and suggests that this may be a basis for evaluating the system whereby the developer is responsible for the AD (NIM 2021:72-73). Holth & Winge (2024) discuss two possible measures to strengthen the quality of and trust in impact assessments. First, the possibility of introducing a system of independent control of impact assessments is being considered. Secondly, the possibility of introducing a requirement for an independent investigator is being investigated.

In relation to the second point, the research institute NIBIO received an extra allocation of NOK 5 million through the revised national budget for 2023 to, among other things, carry out a project that will assess whether the current regulations for impact assessments and the follow-up of this related to reindeer husbandry are working as intended. The mandate included both an assessment of (a) whether there are obstacles in the regulations for impact assessments in order to obtain good assessments and (b) how traditional knowledge can be used in the impact assessments, as well as (c) preparing a proposal for a methodology for assessing reindeer husbandry in impact assessments. The proposal (Eilertsen et al. 2025) has been submitted to the LMD, and we can expect that updated regulations will strengthen the role traditional knowledge will play in future studies.

B. The second challenge concerns the case processing system with prior accession:

> "The pre-accession mechanisms in land-use cases disadvantage the developers in the case process and contribute, among other things, to the developers being able to conclude a dialogue-based approach with reindeer husbandry already early in the case process. Pre-accession is used as a tool in the intervention actors' overrun strategy to pressure the reindeer grazing districts into entering into bad agreements" (NRL 2023:4 -5).

The NVE's rejection of Statnett's application for an expropriation permit has so far changed the relationship between the parties in this case and (re)opened up the possibility of a dialogue-based approach. This also means that the process can be brought back on a track in accordance with international law so that any development can take place in accordance with an agreement based on (FPIC) *free ofprior informed consent* (NIM 2021, Amnesty International and the Saami Council 2025).

3.3 Intervention effects

The challenge for Sør-Fosen sijte is part of the challenge complex that NRL's area group describes; more specifically, that the traditional knowledge of reindeer herding is not found in the investigator's *conclusions*. At the same time, we note that NVE allows for power lines to have more extensive negative effects on reindeer herding in Sør-Fosen than what has so far been well documented by research. It is also open to the possibility that these effects may be so extensive that it violates international law, more specifically SP 27.

In order to investigate this further, we would first say that it is not very relevant to focus on whether the research can demonstrate a general logdirect relationship between power lines and avoidance. It is then more relevant to investigate the *specific conditions under which one* can expect avoidance, see e.g. Lindberget et al. (2024):

> *"All in all, it shows that there is a large variation in how reindeer react to power lines in the landscape and that the degree of impact depends on the season, weather, proximity and impact from other infrastructure and what the landscape looks like. There may be site-specific conditions that affect and hinder the movement of reindeer in the landscape, while in other places it does not affect the reindeer at all"* (Lindberget et al. 2024:295).

Research has focused on this to a remarkably small extent through comparative studies comparing the reindeer's reaction patterns under different conditions. An exception seems to be the study of the Ildgruben reindeer grazing district, where the reindeer's habitat use on three different lines has been studied and compared using GPS data as a knowledge base (Eftestøl m.etc. 2021). We will therefore investigate this study in more detail.

As NVE has also mentioned (Berg m.etc. 2018, NVE 2024) will point outthat such research should be based to a much greater extent on the experiences of reindeer herders. One should, for example, listen to the experienced Alaska-based researcher Henry Huntington as an argument for direct cooperation between those who possess indigenous knowledge and researchers. (Huntington 2011). The same researcher states:

> *"Traditional ecological knowledge [TEK] should be promoted on the basis of its merits, and be scrutinized as other information is scrutinized, and applied where it makes a difference in the quality of research, more efficient management, and involves resource users in decisions that affect them. On that basis, there is plenty of evidence for the usefulness of TEK. What is needed is a greater willingness to assess its relevance, safeguard that information and include the available expertise"* (our translation, Huntington 2000: 1273).

This is a well-balanced point of view, which we would recommend based on where relevant, such as in research on reindeer husbandry and nature intervention. In continuation of this view, it may also be worth noting that research results should also be assessed *"on the basis of their merits".* Research is an ongoing process in which what is established as accepted knowledge in different fields changes over time. Researchers are constantly working to challenge established truths and in this way contribute to developing the understanding of various phenomena in nature and society.

3.3.1 Perspectives on intervention effects

From the 1980s onwards towards the turn of the millennium, research on reindeer husbandry and encroachment effects has expanded the perspective in both time and space from assessing short-term effects on individual animals in an enclosure to a landscape perspective. The effects on entire reindeer herds or reindeer grazing districts are now being assessed in a long-term perspective (Skarin & Åhman 2014, Danell 2016). Skarin and Åhman (2014) have illustrated in Figure 14 that reindeer and reindeer husbandry operate at different scale levels in both time and space.

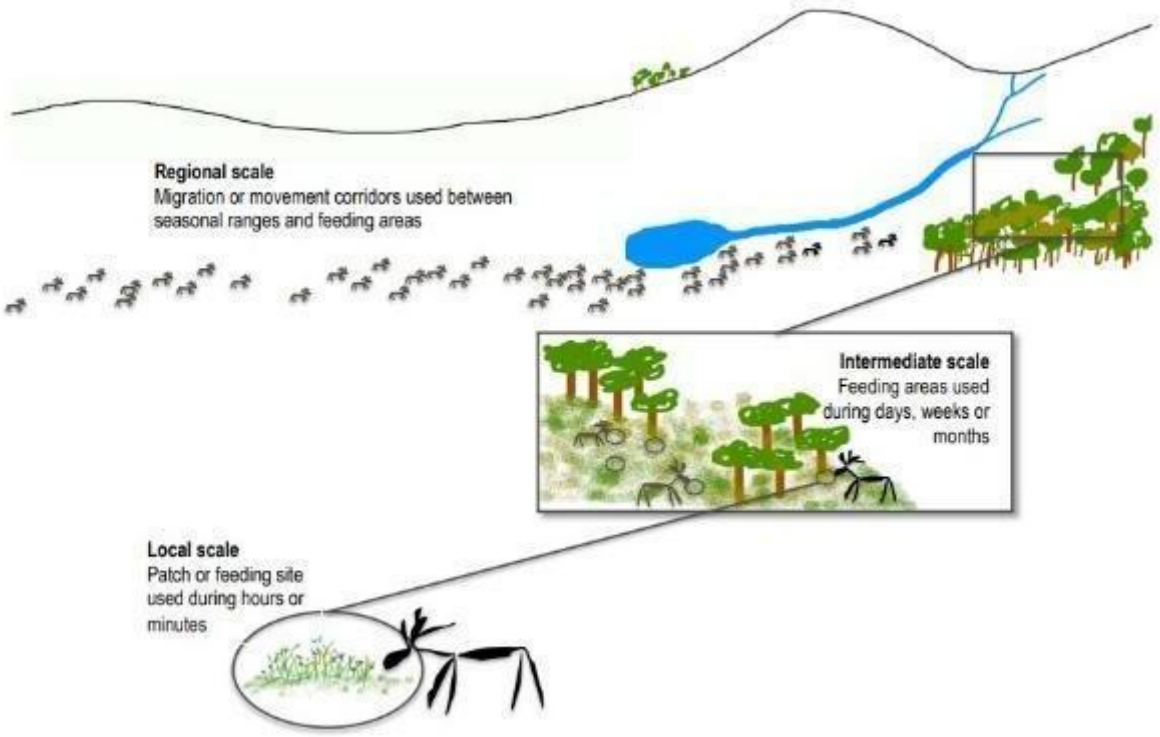


Figure 14. Reindeer grazing choices at different scale levels (Skarin and Åhman 2014).

Studies at the regional scale level include at least entire seasonal grazing areas and areas at least 2 km from the source of the disturbance. These should include the entire population in question and have a time perspective of at least months or years.*Intermediate studies* include habitat selection at landscape level and areas at least 2 km from the source of the disturbance with a time perspective of at least months.*Local studies include* plant communities or grazing sites that are used in a short time perspective and that are also less than 2 km from the source of the disturbance.

From today's perspective, the scientific studies that were carried out on disturbance effects on reindeer from the 1980s are considered too limited both in time and spatial perspective to be able to provide a basis forfor representative assessments of how a reindeer herd would adapt to its own disturbance. The emergence of landscape ecology as a discipline led to a paradigm shift in this field of research from the mid-1980s (Vistnes & Nellemann 2008).The research thus also came into better accordance with the reality that the reindeer herders themselves experienced on the basis of their own *traditional knowledge*.

The new understanding of disturbance effects gave rise to the concept of avoidance and a general classification of the harmful effects of interventions at different levels. This is now used worldwide (Danell 2016). Intervention effects can be divided into*direct effects, indirect effects and cumulative effects* (Tsunokawa & Hoban 1997). The direct effects of natural interventions usually include physical loss of land and disturbance of animals in the vicinity of the intervention. A lot of research has been conducted on the effects of direct disturbance of both reindeer and other ruminants. Most studies show that direct disturbances near interventions with subsequent escape reactions have small and short-term effects on individual animals (Vistnes, Nellemann & Bull 2004).

Indirect effects include avoidance effects at a longer distance than where the animals are exposed to direct disturbances. Behavioural studies show that if reindeer are exposed to continuous and long-term disturbances, such as animals that are constantly encountering traffic, these animals will use more energy and have a lower body weight than unexposed

animals. This will be especially critical in the spring when the animals are in poor condition and the females have a high energy requirement (op. cit.). A new review of the research on which

The effects of human activity and infrastructure on domesticated reindeer support the view that such effects must be seen on a largescale to avoid them being underestimated (Skarin & Åhman 2014).

Text Box 2. What really happened in the reindeer fence? (Brattland and Hausner, 2022:3).

Jonathan Colman presented several different examples of research on theimpact of methods from the project «VindRein» (Colman m.etc. 2019). During the discussion after the presentations, the research method with GPS and observation of the reindeer's stress level should be a particular topic. A reindeer owner ... [Ole Johan Eira, current district manager in Gielas, Troms, JÅR's comment] raised the issue of interpretation of the reindeer's behavior during a study conducted by Colman and colleagues in 2008 where both Colman and the reindeer owner himself had been present. The result of the study was that no effects of the wind power plant were found on the reindeer.

The example concerned an episode where a herd of reindeer had broken out of a fence where it was kept together. The reindeer owner believed to observe a higher stress level in the animals in connection with this episode, while the report from the project stated that the animals also grazed inside the wind farm. Where the reindeer owner, based on his experience-based knowledge, believed that the reindeer were stressed and avoided the wind turbines, Colman referred to the results of the measuring instruments and the hypotheses tested in the study. Such conflicts where the reindeer owner's statements stand against scientists' findings are repeated in this field, which is also pointed out in a synthesis report made by NVE in connection with the study of the proposed frameworkplan for wind power on land (Strand et al.etc. 2017).

3.4 Knowledge base and choice of methods

In this case, the NVE bases its assessments on existing research results, but at the same time conveys that it acknowledges a certain uncertainty as to whether the effects may nevertheless be more extensive than can be established with certainty. Taking uncertainty into account obviously seems to be in line with the precautionary principle (nml §9). The NVE also allows for taking reindeer herders' experiences and assessments into account. This will be to emphasize experience-based knowledge in accordance with nml §8, 2nd paragraph. Overall, we believe that this opens up for a broad dialogue on the knowledge base for what can be foreseeable effects of the planned 420 kV power line for reindeer herding, as the route is planned.

Other actors in this case have different approaches to the knowledge base. Statnett's complaint (2024) is striking. When it comes to possible negative effects on reindeer herding of power lines, they only seem to acknowledge published research results. They do not provide an opening for the experiences of reindeer herders to be relevant. They nevertheless present their own experiences with power lines and argue strongly against the NVE being able to adjust practice as a result of a Supreme Court ruling that unequivocally states that established practice violates human rights.

We discussed the KU (Eftestøl 2022) in the introduction and suggested that it could seem as if the reindeer owners' assessments have been put in parentheses. Instead of entering into a dialogue with the reindeer herders' knowledge, what they say is presented as views, while at the same time basing themselves on research and their own views. *One can then question whether such a practice is in accordance with the Nature Diversity Act.* Section 8 of the NML means that science's monopoly on knowledge has been abolished. The text of the law clearly states that one must build on scientific knowledge, but also that one must *"emphasize knowledge that is based on generations' experience....., including Sami use..."*

3.4.1 Knowledge meetings

In the present case, Sør-Fosen sijte considers itself to have been correctly referenced by the investigator, but investigators/researchers on the one hand and reindeer herders on the other hand, may also disagree on *what has been observed*, see text box 2.

The example referenced in text box 2;*What really happened in the reindeer fence?*brings to a head the differences in what bearers of traditional knowledge, such as reindeer herders, and researchers tend to observe. While researchers tend to focus on measurable indicators, reindeer herders, among others, tend to notice shifts, changes and unusual events (Krupnik et al. 2004). In the reindeer herding Sami community, observation seems to have a special status.

> *"It is a culturally valued skill that is closely woven into cultural interaction and practice ..... Stream Studying nature includes observing and evaluating the pastures and weather, snow and ice, and the sequence of changes that determine access to food and the behaviour of reindeer (*our translation, Heikkilä 2006:86).

Riseth has himself experienced as a researcher that reindeer herders with their observations of changes in weather patterns brought in new understanding that led the researchers at Abisko Scientific Research Station to reinterpret their meteorological data with, and with new results as a result (Riseth m.etc. 2011, 2012). American researcherson theirside understood observed changes in weather patterns better by taking the observations of local Inuit as a starting point (Weatherhead et al.etc. 2010).

A published example of how documented reindeer herding Sami knowledge can change the course of a development case concerns the Gran Sami village in Västerbotten, Sweden. The Sámi community had digitized its migration routes and argued for the necessity of a plan-free solution for crossing the main road E4 without reaching the Traffic Administration. When they had the opportunity to show a video of the deadly chaos that arose when a herd of reindeer steered by a reindeer herder on a snowmobile tried to cross a high-traffic three-lane road with a speed limit of 90 km/h, it changed the entire dialogue and the solution was to build a so-called renoduct, i.e. a wildlife crossing over the dangerous road (Sandström et al. 2020).

3.4.2 Co-creation of knowledge

Text Box 3. Co-creation of knowledge

Science and traditional knowledge are usually defined as separate knowledge systems with distinct characteristics. The Indian-American political scientist Arun Agrawal (1995) argues for dismantling the distinction between science and indigenous knowledge. Although there are different types of knowledge and it can be classified in different ways, the most important characteristic of knowledge is that it is useful to some. In order to carry out deeper analyses, it may therefore be necessary to co-create *knowledge.*

It can be defined as an intentional process to produce applicable knowledge about the combined effects of both biophysical and social phenomena. Such processes require collaboration between different knowledge systems. Typical of such processes is that they are based on different practices, understandings and types of knowledge being brought together to develop common knowledge across the differences (Hovelsrud et al. 2021).

"By combining scientific and traditional knowledge, we value the importance and relevance of the reindeer herders' knowledge. In this way, we challenge the privileged role of science in the decision-making process" (our translation, Hovelsrud et al.etc. 2021:119). It is also a characteristic that both types of participants take part in all stages of the knowledge process (Berkes 2009). Yua et al. et al. (2022) emphasise that all stages of the process must be characterised by reciprocity and equity.

In recent years, it has become increasingly common in the Nordic countries to use the co-creation of knowledge as a basis for projects that aim to understand the effects of intervention and disturbance in Sámi reindeer husbandry (e.g. Sandstrõm 2015, Hausner et al.etc. 2020, Hovelsrud m.etc. 2021, Skarin m.etc. 2021),

We note that NVE is open to the possibility that power lines may have more extensive negative effects on reindeer herding in Sør-Fosen than what has so far been well documented by research. We take this as a challenge to shed more light on this question. We will do this by retrieving partly new, or rather not *generally known, knowledge, but also by "reinforcing" known knowledge through* new contextualisation. We will do this both in terms of the Fosenrein operation and its operating conditions, and in terms of the effects of power lines and other interventions. Our methodological approach is the co-creation *of knowledge10* (Yua m.etc. 2022), see text box 3.

In research where a combination of qualitative and quantitative data is built, it is important to ensure that the most suitable methodology is used to collect and process data of different nature. This entails high demands on the assessment of data sources, observation, competence and use of methods. In their method description in a project to assess the effect of wind power on reindeer husbandry, Skarin et al. (2021):

> *"Together with the reindeer herders, we have evaluated the effects of wind power on reindeer behavior and reindeer husbandry by using both qualitative and quantitative information. We collected knowledge about how the reindeer moved in the landscape by exchanging knowledge with the reindeer herders and by studying GPS data from the reindeer. In order to quantitatively describe how the reindeer's choice of grazing area has changed in relation to the expansion of wind power, we performed habitat choice analyses where GPS data were statistically related to various external factors (including wind power) to describe the reindeer's habitat choices"* (Skarin m.etc. 2021:21).

Figure 15 provides an overview of the data types Skarin m.etc. (2021) used and how they shouldbe used in the analysis.

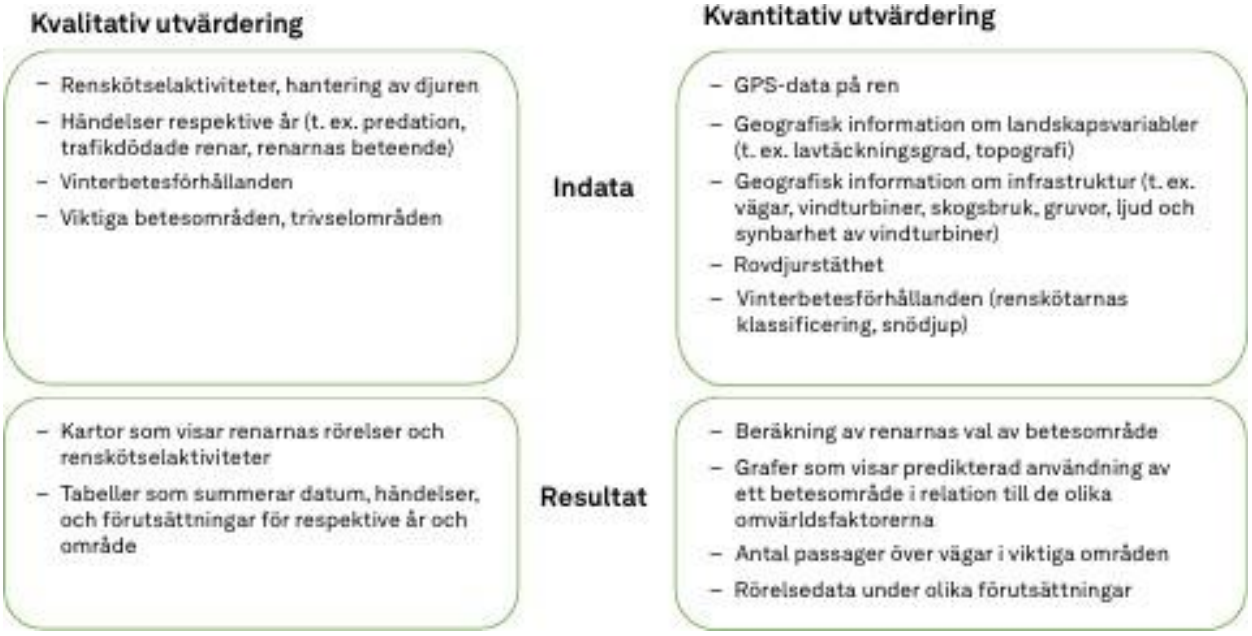


Figure 15. Data types and data use used by Skarin et al.(2021:21) in research on effects on reindeer grazing choices and grazing behaviour.

In this case, the researchers have given an accurate account of the points at which the reindeer owners' knowledge contributed to the analysis. This knowledge is critically important to ensure that the research is based on data as a basis for elucidating the issues (*validity*). It is crucial to be able to distinguish between when the reindeer move freely and when they are driven by the reindeer owners, to know whether the reindeer are roaming due to insufficient winter pastures and to know whether the reindeer's behaviour is due to various external circumstances. If the research had only been based on GPS positions, there is a significant risk that the results would have been misleading in relation to what are real wind power effects.

[10] The English-language term 'co-production of knowledge' is usually directly translated as co-production of knowledge. We prefer to refer to this as the co-creation of knowledge without there being any difference in meaning in this.

4 Method

While the previous chapter discussed what kind of method should be used for a task such as ours, this chapter describes how we have approached the task.

4.1 Sør-Fosen sijte's perspective on knowledge11

For Sør-Fosen sijte, it is a completely new situation to have the opportunity to be an active contributor to a reindeer husbandry report that describes the consequences that interventions in grazing areas have for spring reindeer. This has been an extensive work arrangement, and which requires that those involved in the report understand and complement each other with their fields of expertise. This way of working is the only correct approach, so that we can be sure that the future consequences are assessed on the right basis. In previous UCPH reports, we have only been informants to investigators, where our knowledge has not necessarily been emphasized. We are the ones who know our reindeer's way of life, area needs and the landscape. The working group in the report has, among other things, collected reindeer owners' experiences from other areas of the country with the same type of intervention. The experiences of other reindeer owners weigh heavily when we assess the consequences of the same type of intervention. When we combine this with our knowledge of local conditions regarding reindeer and grazing areas, we have a good starting point for predicting the consequences of the intervention in the long term.

4.2 Our expertise

Leif Arne Jåma (b. 1966) grew up in reindeer herding at Sør-Fosen and has been a reindeer herder all his adult life. Since the restart, he has been leader, and is still a member of the examination board for the apprenticeship scheme for reindeer husbandry in Trøndelag county municipality.

Jåma is the leader of Sør-Fosen sijte and deputy leader of the Fosen reindeer grazing district. He has led Sør-Fosen sijte through legal processes and subsequent negotiations with the state and Fosen Vind DA. In the course of the most recent process in particular, Jåma has experienced how other actors' attitudes after the Supreme Court judgment in 2021 changed from a position thatSámi academics have described as both "*a black sea of ignorance*"[12] (Somby 2019) and "*strategic ignorance*" (Fjellheim 2024), to respect and recognition as an equal dialogue partner.

Marit Østby Nilsen (born 1982) has a bachelor's degree in nature management from the University of Oslo and a master's degree in

natural resource management from NTNU as well as several additional educations, including in traditional knowledge from the Sami University of Applied Sciences and in Norwegianization and reconciliation from Nord University. Østby Nilsen has extensive field biology experience; both as a predator contact and as a field manager for the arctic fox project. She is the general manager of Fjelldriv AS, has been a senior advisor and is now the head of NRL's area service.

Jan Åge Riseth (born 1953) is a nature management graduate and dr. scient. in natural resource economics, both from NLH. He also has special special subjects in legal history from the University of Oslo, education in public management and administration from NTDH and education in municipal planning and impact assessment from AHO. He has been a municipal land use planner, environmental science teacher for engineering students, state consultant in reindeer husbandry and contract researcher for over 20 years, most recently as chief scientist at NORCE. He has published widely within reindeer husbandry and nature management and has carried out a large number of impact assessments for interventions in reindeer herding areas. Since 2023, he has carried out research work through his own company, JÅ RISETH AS.

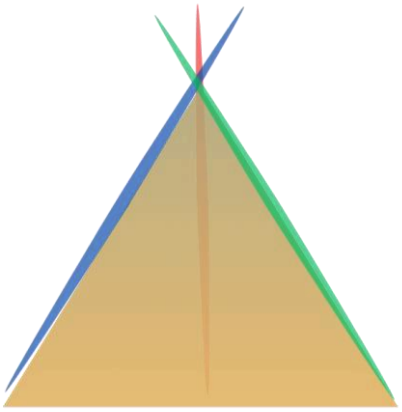
Both Østby Nilsen and Riseth made important contributions to NIBIO's assignment for LMD on a new methodology for impact assessments (Eilertsen et al. 2025, Riseth 2025).

[11] Formulated by Leif Arne Jåma

[12] "There is a vast ocean of ignorance out there, and it provides a breeding ground for prejudice" expressed at the NAISA conference 2019, Hamilton, New Zealand (Riseth 2020:96).

4.3 Our approach

We chose a work scheme that aims at co-creation of knowledge (see 3.4.2 and text box 4), in order to draw on our different, but to some extent overlapping, competences as far as possible by bringing together different forms of knowledge as a basis for further dialogue. The working group's complex background and expertise are the basis for the work. The working group itself is a knowledge meeting in practice. The working method is symbolized by a låavtege/lávvu where the working group has met to collect, process and interpret knowledge. In the barn, the group has invited other knowledge bearers to gain insight into their experiences with power lines in the reindeer's landscape and then process this further in the group's study.



I know this

A lávvu is built like this

Of three strong poles A

sister, a brother

And then the best friend (are all friends)

Sofia Jannok

Figure A. Co-creation of knowledge symbolized by a låavtege/lavvvu inspired by Sofia Jannok's lyrics.

The members of the working group are the three lavvuraijs who hold the lavvu upright. Låavtege in itself is the room" where knowledge gathers/meets. Other knowledge bearers have been invited in and contribute to making the lavvu steadier and more diverse.

Eva Fjellheim (2023) has developed her own research methodology based on a barn avtege as a framework

Our study is nevertheless structured as an ordinary scientific study with an extensive literature review and references to previous research and reports. We have drawn in a wide range of disciplines to cover the possible effects of the planned power line in the best possible way. What is special about our approach is that we have expanded the knowledge base by drawing on reindeer herding Sami traditional knowledge to a greater extent than is usual. We have made the contributions visible by stating the names of the knowledge bearers, in most cases Leif Arne Jåma.

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4.3.1 Investigation programme

In principle, we have followed this programme for our study:

1. Review of research results and reports on the effects of nature interventions on reindeer and reindeer husbandry with a focus on power lines.
2. Identification of contradictory/uncertain results and knowledge gaps in the reviewed material.
3. Search for traditional knowledge/reindeer herding experiences that can shed light on and complement the shortcomings in research and reports. Main method: Interviews of other reindeer herders who have a 420 kV power line through their grazing and herding areas.
4. Summary: a preliminary state of knowledge regarding the effects of power lines and other interventions on reindeer husbandry.

5. Describe and analyze the reindeer herding and grazing system in Sør-Fosen with emphasis on the winter pastures, especially Rissalandet.
6. Analyze the current situation for Sør-Fosen sijte (zero alternative).
7. Assess the expected effects of the planned power line along the entire route
8. Summarise the power line effects seen in the context of other interventions and disturbances and assess the consequences in relation to the situation of reindeer herding
9. Conclude for the expected effects of a power line that is being built as requested.
10. Prove alternative power line routes that are less harmful to reindeer herding in Sør-Fosen

In practice, the work has been carried out in such a way that we have gone back and forth between these points with several repetitions and adjustments.

4.3.2 Inspection

We started our joint work in earnest on 24.09.2024 with a helicopter inspection of the parts of Sør-Fosen sijte's grazing land that the power line route is planned to pass through, see figure 17. We landed at Storsalen to also get an overview from a high ground level (figure 16).

Figure 16. Helicopter used for inspection. Here landed at Storsalen (Inspection photo MØN/LAJ).

The intention of the inspection was to make Riseth in particular, but also Østby Nilsen as familiar with the landscape as possible in an effective way. The flight route was laid out so that we would have the best possible overview of both the power line route and Storheia winter pasture with the wind turbine facilities and Rissa winter pasture, which will be most affected by the planned power line route. A large number of photographs were taken during the inspection, which have later been used in landscape descriptions and assessments of the effects of intervention.

We started with Storheia winter pastures and continued with Rissalandet winter pastures, see figure 17.

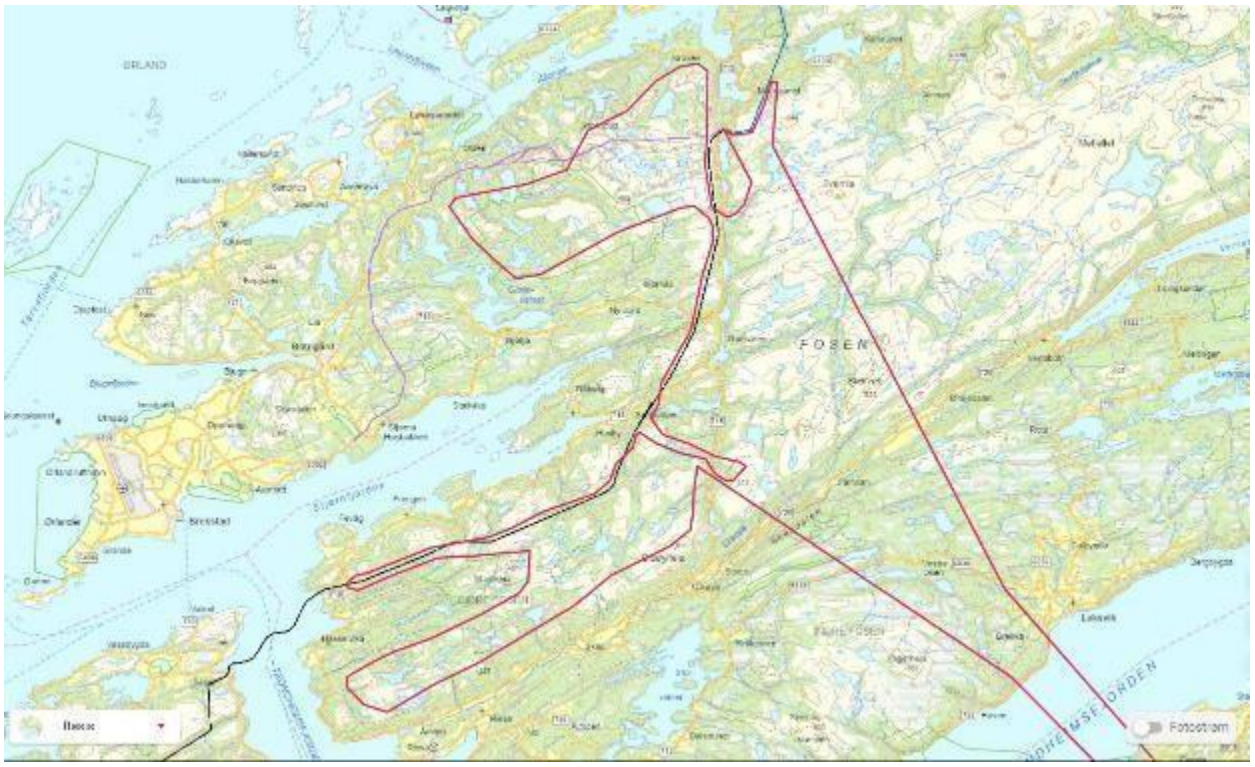

Figure 17. Flight route Storheia-Rissalandet. Red line flight route. Black line - planned route for 420 kV.

Jåma continuously commented on what we saw and what it meant. Østby Nilsen photographed and Riseth took notes. Notes and photos were circulated in the group and form the basis for key parts of the report.

4.3.3 Teams meetings

Separate meetings

Throughout the project work, we have held internal team group meetings where we have discussed draft texts and the plan further. We also made recordings and transcriptions of the meetings to ensure that the knowledge conveyed was taken care of in the best possible way. At a meeting, Jåma also presented a virtual flight, based on Google Earth, along the pipeline route made from to illustrate the expected effects.

Interviewer

We also conducted group interviews (focus group) with Teams both with three reindeer owners from the neighboring district of Åarjel-Njaarke (Vestre Namdal), two reindeer owners from the Ildgruben reindeer grazing district in Nordland and a single interview with a former district manager in Saanti sijte (Essand reindeer grazing district) in Sør-Trøndelag/Hedmark. In addition, we have been given permission to use interview material from the Skarfvággi reindeer grazing district in North Troms. All four districts have relevant experiences with 420 kV power lines through their districts.

5 Effects of Technical Intervention and Power lines

5.1 Research on technical interventions and impact on reindeer

There are many summaries of research on the effects of technical installations and disturbances on reindeer and reindeer husbandry (see Strand et al. 2017, Skarin m.etc. 2019). The summaries state that technical interventions can often lead to reduced access to grazing land, loss of important grazing areas, and that migration routes become difficult to use or completely useless for the reindeer. Since the mid-1980s, there has been a scientific paradigm shift inthe field of interventions research (Vistnes, Nellemann and Bull 2004, Danell 2016, Tømmervik etc.etc. 2022), where disruption and avoidance were established as relevant explanations and indirect losses and barrier effects, and not least cumulative *effects* (combined effects of several different interventions/disturbances), have had an international breakthrough (Tsunokawa & Hoban 1997).

This means that in order to get a comprehensive picture of how the reindeer use their grazing area, it is important to study the reindeer's depth and migration patterns over a long period of time and over their entire grazing area, and not just within the local area near an intervention as was common in the past (Vistnes and Nellemann 2008; Skarin and Åhman 2014).

The three scale levels at which intervention effects are usually assessed are shown above in 3.3, see Figure 14 (Skarin and Åhman 2014). Ona regional scale, knowledge is gained about how the reindeer use farmingareas and migration routes in relation to landscape and infrastructure. On an intermediate *scale, knowledge can be* gained about how the reindeer choose areas within the landscape and in which areas they choose to stop to graze in. In cases where only the local scale is studied, as was common in the past, it is difficult to assess how reindeer in general relate to the infrastructure in the area, as one can often only study a part of the population on a local scale (Vistnes and Nellemann 2008).

The impact of interventions can be understood in terms of how different structures affect animal movement and ecological dynamics. An important type of structure is defined as barriers. Barriers are possible to cross, but not Possible stream circumvent (Beyer m.fl. 2014), for example Roads and power lines. Both The permeability and proximity effects of barriers can be statistically estimated. Beyeret et al. (op.cit.) built a model that was used to study how roads affected wild reindeer in southern Norway on summer grazing. They found that reindeer avoided areas near roads and the roads were semi-permeable (partially permeable) barriers. Four out of five animals had strong avoidance up to 1 km and the probability of crossing was reduced by about 2/3 on average.

The effect of constructionwork can also be studied with the help of GPS data. Skarin m.etc. (2015) conducted a study of construction work in an already fragmented reindeer herding landscape, Malå Sami village in Sweden, with an emphasis on the use of migration sites and habitat selection. As far as we have been able to register, two of the main findings have been widely understood and accepted and used as a basis in investigation and legal processes concerning reindeer husbandry and intervention/disturbance:

(1) During the construction period, the reindeer almost stopped using the migratory beds, and they moved faster (registered stride length increased significantly) for up to 5 km from the construction work.
(2) The use of grazing was changed so that the animals did not settle down to graze closer than 3 kilometers

from the construction work.

However, a third main finding still seems to be to some extent misunderstood by both some researchers and actors in the assessment and legal processes:

(3) Established infrastructure that already had a negative impact on grazing use before development continued to have such a situation that construction activity reduced movement and led to waiting patterns on both sides of previously used migration and migration sites. This means that an apparent accumulation of reindeer on one side of a barrier can lead to misunderstandings that the reindeer do not avoid development, but on the contrary increase their use in some cases. Skarin m.fl (2015) describes with reference to Preisler m.etc. (2006) this as:
"Waiting patterns of reindeer 'piling up on both sides of barriers reflect unwillingness or fear to cross, not an increased use (our translation)" (Skarin m.etc. 2015:1537).

We will return to this in 5.3.

In a pooled study of 85 studies of the effects of the development of different types of infrastructure and disturbances on reindeer (Vistnes and Nellemann 2008), the majority of the studies (83 %) showed harmful effects in the form of disturbances, avoidance and loss of pastures, typically with 50 - 95 % loss within a zone of 5 km around the intervention. The extent of avoidance varied with the type of disturbance, landscape, season, herd sensitivity and the sex and age structure of the animals. The same pooled study also summarized that before-after studies confirm the main tendency of these findings. A historical review of the individual studies also shows that the scale in which the studies were conducted has a strong impact on the likelihood of detecting effects. In a table, Vistnes and Nellemann (2008:402) show that before 1985, a large majority of the studies were short-term in time and with a local perspective, but after 1985 it was the other way around; A large majority of the studies were long-term and with a regional perspective. This led to a sharp increase in the proportion of studies that demonstrated negative effects.

5.2 Research on the effect of power lines on reindeer

Research on power lines' effects on reindeer has been a topic since the 1980s. Several studies show that the reindeer change land use and avoid the power lines during the construction phase (Strand m.etc. 2017). The research includes studies on both domestic reindeer, wild reindeer and caribou (in Canada and Alaska). Studies of the reindeer's degree of shyness have shown that the original wild reindeer have a longer escape distance and greater shyness than domesticated reindeer and wild domestic reindeer (Reimers et al. 2000, Reimers et al. 2006; Nieminen 2013). The results from the early studies have largely been varied, with some publications (Vistnes m.etc. 2001, Vistnes m.etc. 2004) concludes that power lines can lead to a reduction in the reindeer's land use several kilometres from the power line, while other studies (Reimers et al. 2000, Strand et al.etc. 2017) does not show any effect of power lines. The studies that demonstrate avoidance also show increased avoidance when the power line is close to other infrastructure. Power lines alone provide evasion of 2.5-4 km, while they together with other infrastructure provide evasion of up to 5 km (Nellemann m.etc. 2001, Vistnes and Nellemann 2001,2008).

The reason for the divergent results may in many cases be that the different researchers have had different approaches to the problem, and that they have carried out studies of the behaviour of reindeer and land use at different scales and time periods, and also for different seasonal grazing areas. Some studies have examined reindeer in enclosures or only locally around the power line itself, while other studies have examined the reindeer's land use several miles from the power line.

In addition, many of the early studies have used indirect variables as an indicator of the reindeer's land use. Examples of such indirect variables are that the researchers have

measured lichen thickness as a variable for grazing wear, and the use of aerial photographs and direct observations of the animals in the field, and concluded which areas the animals have used based on this. Such indirect variables can also be influenced by factors other than those initially studied, thus providing inaccurate data and unreliable conclusions about how power lines affect reindeer.

Tyler m.etc. (2016) has summarised 13 studies on power lines in Norway, seefigure 18. Only one study concerns domestic reindeer. The others are wild reindeer studies.

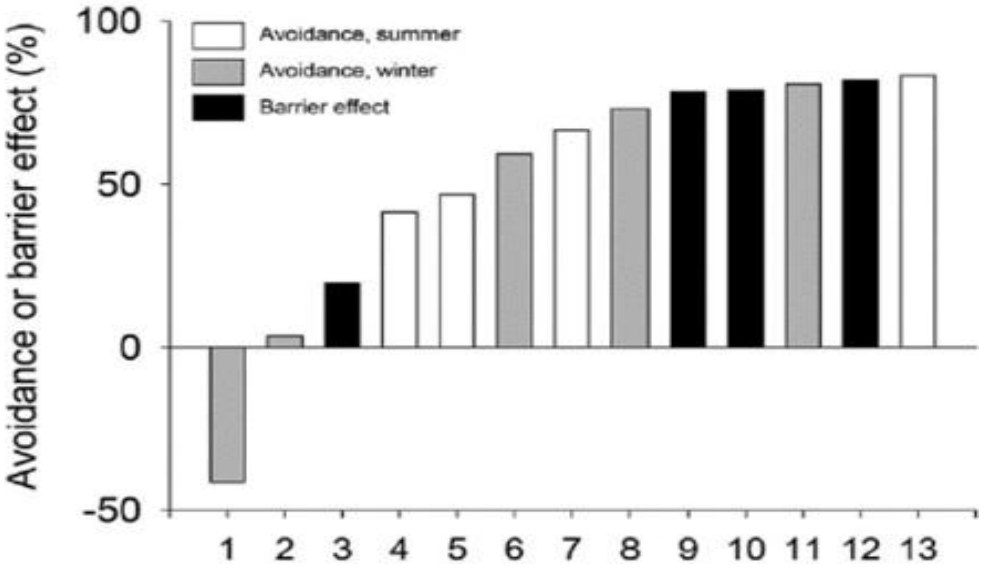

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Figure 18. Barrier effects and avoidance in studies of power lines (Tyler et al. 2016.51).

11 out of 13 studies demonstrated barriereffects or avoidance effects. For 10 out of 13 studies, the barrier or avoidance effect is between 41.5 and 83.4 percent. Avoidance can be caused by both direct and indirect effects. The indirect effects include environmental changes in parallel with the establishment of the power line. e.g. vegetation changes in power line streets. Such changes may explain negative avoidance (case 1 in Figure 18). Evasion in the open may indicate direct effects of the power line itself (Tyler et al.etc. 2016). We will return to this in the 5th grade.On October 2, 201On October 2, 201

Later studies have largely used GPS transmitters to study the reindeer's land use. In his summary of the effects of power lines onreindeer (Berg m.etc. 2018) also considers that it is natural to place the greatest emphasis on GPS-based studies This is a method that can provide greater accuracy and legitimacy than the use of indirect variables as a measure of the animals' response to power lines, but as we will show, the reliability of such studies can also be questioned.

5.2.1 Research status and UCPH

Skarin m.etc. (2019) points out that several studies have been conducted on how both domestic reindeer (Eftestøl m.etc. 2016, Vistnes and Nellemann 2004) and wild reindeer/caribou (b.eg. Plant w.etc. 2018, Panzacchi m.etc. 2012, Nellemann et al. 2001, Colman et al. 2015) are affected by power lines. Different results have also been reached in different studies, which can partly be attributed to the fact that different methodologies have been used and that different types of areas have been investigated.

Two new impact assessments on planned power lines in the Åarjel-Njaarke reindeer grazing district (Eftestøl, 2024 a, b) conclude that the new power lines will have minimal effects on reindeer husbandry. The reports report on the state of knowledge for avoidance distances of power lines in the operational phase and comment on previous UCIs that are based on studies that have shown grazing avoidance of several km (Vistnes and Nellemann 2001, Nelleman et al.FL 2003) as follows:

> *"Today, we consider that the causal relationships for the correlation between few observed reindeer and the distance to the power lines in these studies are unclear, and we therefore do not place particular emphasis on these results in our assessments* (Eftestøl 2024a:25, Eftestøl 2024b:29).

It goes on to say that:

> *"In general, we place greater emphasis on recent studies based on GPS data, and not on older studies with data from direct observations, wear and tear on low-lying pastures and flight counts. This is because recent GPS studies are based on methodology where other explanatory variables are better included in the models. To the best of our knowledge, no research based on GPS data, neither national nor international, has found clear isolated negative effects of power lines in the operational phase" (Eftestøl 2024a:25, Eftestøl 2024b:29).*

Both UCPHs refer in particular to the two studies Skarin m.etc. denominator (Eftestøl m.etc. 2016,13 Colman m.etc. 2015, Plante m.etc. 2018) in its justification. In our context, these studies are therefore particularly interesting to investigate. One of the studies concerns domestic reindeer, while the other two concern wild reindeer and caribou, respectively. Eftestøl et al. (2016) is a study that concerns Saanti sijte (Essand reindeer grazing district) in Sør-Trøndelag/Hedmark. We will return to this case later on the basis of a reindeer owner interview, but we will first review Skarin m.etc. (2019) their criticism of the study:

> "[In a study in which] the effects of a reinforcement of a 300kV line to a 420kV line were studied, *the authors believe that the reindeer are not adversely affected by the operation of the new 420kV line*(our emphasis). They believe that the reindeer are only negatively affected during the construction phase. However, results indicate that the reindeer avoided the 300 kV line during the calving period even before the construction phase started, this avoidance was not significant, but in the operational phase of the new line, the avoidance seems significant" (Skarin m.etc. 2019:7).

The quote thus states a safer evasion after upgrading to 420kV. This contradicts what Eftestøl (2024a, b) states. In addition to this , Skarin m.etc. (2019) several objections to this study. Firstly:

> "However, there is no GPS data from the time before the first power line was built, so it is not possible to calculate exactly how land use has changed. This means that it cannot be ruled out that both the new and the old power line have or had an effect on the reindeer's land use" (Skarin m.etc. 2019:7).

In other words, there is no basis for comparison. Second:

> "In addition, the reindeer herders in the area have on several occasions described that the reindeer have no alternative grazing area to this area. Their bare ground grazing is like one big pasture where the landscape, the reindeer herders' edge guarding and fencing/steering arms keep the reindeer in this area. It may thus be that the reindeer, if they had the opportunity, would choose a different area than the one around the power line (Skarin m.etc. 2019:7).

Professor Emeritus Öje Danell, who was an expert in one of the court cases about this development, expresses this even more clearly:

> "In the Essand case, a sub-area of a delimited summer grazing district was studied where the reindeer are "trapped" by topographical barriers, border fences and intensive continuous surveillance, as well as by wind conditions that keep the reindeer in the area. The studied power line runs through the middle of the grazing area and forces the reindeer to frequently cross it to access the pasture and try to move against the direction of the wind. When they have crossed the power line, they must be forced back again so as not to leave the grazing area. In the interpretation of the study, this has not been taken into account despite the fact that responsible reindeer herders have emphasized it. The case is known to me because I investigated it in connection with a court case. In my firm opinion, there are strong barrier effects of the power line, but the reindeer are still forced to defy it through the external circumstances and are therefore no evidence that power lines do not cause barrier effects" (Danell 2016:14).

[13]Skarin m.etc. refers to Eftestøl m.etc. 2015 which is the online version of the article. The final version in the journal is Eftestøl m.etc. 2016

Thirdly , Skarin m.etc. (2019) also demonstrated an irrelevant use of a reference range and concludes that this approach does not add anything:

> "The study has also investigated whether the reindeer have had the opportunity to use the pasture in an optimal way and compared the choice of vegetation types in the study area with a reference area. It is located in the high summer area NW of the study area and is practically completely outside the main bare ground grazing and is only used to some extent as a high summer land during warm periods and is also not comparable to the study area in terms of vegetation, which is why it can be questioned why it has been chosen as a reference area. The fact that the reference area has been given the same geometric shape as the study area does not reasonably add anything (Skarin m.etc. 2019:7).

As mentioned, we will return to this case later on the basis of a reindeer owner interview and the court documents, see 5.3.4.

The other two studies that Eftestøl (2024 a, b) is based on concern wild reindeer in southern Norway and caribou in Canada. That first of they two are Colman m.FI. (2015) like has Studied Wild reindeer vAlg Av calving sites and grazing areas in relation to both existing and newly built power lines in two calving areas in Setesdal, Vesthei and Austhei.*According to The authors do not show the results that the reindeer Avoided they New 420 Kv–the power lines below operation.*Skarin m.FI. (2019) points toOh at in This study area is located in the 420 kV power line that was built, on the outskirts of the reindeer's main calving areas and in the forest in a valley under the mountain. [14]

Skarin m.etc. (2019) also points outthat there were only two years of advance data from seven individuals in Vesthei and one year from six individuals from Austhei. Both the location of the power line and the very limited amount of pre-data indicate that one should be cautious about drawing conclusions about long-term effects from this calculation of differences in habitat choices before and after the construction of the power line.

In Plante et al. (2018), the effects of several different types of infrastructure (power lines, mines and roads) have been calculated on Caribou. During one winter, it was found that the reindeer avoided the power lines in the region by 5 km, but not in the other 4 winters. These authors, like the fourth study on Skarin m.etc. denominator; Panzacchi m.etc. (2012) that power lines *at least have a reinforcing effect on other disruptive effects.*When roads and/or cabin areas were located together with power lines, the reindeer avoided a larger area than if there was only one road and/or cabin area. This was despite the fact that the direct effect of the power lines had great local variation; in some areas, the reindeer avoided areas with power lines, while in other areas they did not (Panzacchi et al. 2012).

With regard to the two new reports concerning Åarjel Njaarke (Eftestøl, 2024 a, b), there is little to suggest that the Essand study (Eftestøl m.etc. 2016) demonstrates a lackof avoidance; The most important thing is that there is no preliminary study, and that fencing systems and edge herding meant that the reindeer herd had no opportunity to escape passing the power line. The two wild reindeer studies from Setesdal are also weakly founded. The Caribou study seems to be stronger, but here we know little about local conditions.

Skarin m.etc. (2019) summarizes its review of research results in relation to power lines as follows:

> "In summary, it can be stated that in some areas and surveys, the reindeer avoid power lines while in other areas they do not, so there is no general evidence that reindeer get used to power lines and are unaffected by them. One can with statistical analysis show that an effect exists (and most likely is not due to chance), *but the fact that one has not been able to demonstrate an effect is not proof enough that the effect does not exist* (our emphasis)" (Skarin m.etc. (2019:8).

[14] As we shall come back to, the experiences of reindeer owners in several of the districts we have examined are unequivocal that avoidance is much greater in open areas (in the mountains) than in forests.

The italics are important and are based on basic philosophy of science. It may seem that some researchers think the opposite and assume that when no *effects have been demonstrated, there are no effects.*

Reindeer herders, managers and other researchers have expressed concern in relation to intervention research and the UCA system for reindeer husbandry, see text box 4.

Textbox 4. KU, quality and trust

'A survey of the reindeer grazing districts in Norway showed that more than half of the district managers believed that previous interventions were not taken into account enough. More than half of the responses also saw UCPH as a tool to get cases through. Only 24 per cent of the respondents believed that UCPH helped to «shed light on the case» as required by the Public Administration Act (Riseth & Winge 2015). On behalf of the Ministry of Agriculture and Rural Development, a working group led by NIBIO has now proposed a new UCPH methodology for the reindeer husbandry sector that aims to both integrate the knowledge of the Sami reindeer herders and involve the reindeer grazing districts throughout the assessment process (Eilertsen et al. 2025).

The administration's concern was expressed when the Ministry of Agriculture and Food (LMD) asked the five county governors' offices responsible for reindeer husbandry administration a number of questions about the application of the Planning and Building Act tothe reindeer husbandry area (LMD 2016). When asked about the application of the KU provisions , all the responses expressed that the studies were often deficient or absent, and that the quality of the studies often did not measure up to reindeer husbandry, especially when it came to the overall load. However, the most remarkable thing is that three out of five county governors' offices, without being directly asked, also pointed out that it was *very unfortunate that a particular research environment with little confidence in reindeer husbandry*

A reindeer grazing district asked Professor Emeritus Öje Danell to review the document *"Knowledge status of effects of wind power plants and power lines on wild and domestic reindeer"* (Nature Restoration 2015). Danell (2016) Submits one hand Points dare This dThe Occult Differ from the vast majority of scientists, both internationally and in Fennoscandia, agree as avoidance effects. As Danell's critique continues the discussion above, we will refer to some points here, first whether avoidance is linked to physical installations or only to human activity:

> "In the Knowledge Review, there is an extensive argument in various forms that reindeer have little or no fear of physical facilities of various kinds and that the possible fear is instead linked to the degree of human presence in various forms. In the case of wind turbines and power lines, it is acknowledged that avoidances occur during the construction phase but not during the operational phase, except possibly if the reindeer have had time to acquire experience of human presence in the area during the construction period.*It is even suggested that avoidance during a construction phase with noisy machinery is mainly caused by the presence of people and not by the noise, the machines and the physical installations, and that animals may return after the construction phase when there are fewer people in the area* (emphasis added). To the extent that negative experiences have arisen during the construction period, it is believed that these will "probably" ebb through habituation" (Danell 2016:12).

The views criticised here are relatively widespread, and have also gained traction in the legal system, so that the criticism would also apply to more than just the group being criticised. Danell also emphasizes the importance of scale; 3.3.1, 5.1 and Figure 14:

> 'As regards avoidance and barrier effects associated with wind farms and
> power lines are referred almost exclusively to their own studies ..... The referenced studies are mainly conducted in local *scale*Either by delimiting the study area to a nearby area around the source of the disturbance or because external barriers limit the area. In some cases, the study areas extend so far that they can in principle be characterized as intermediate.*A few studies carried out by others, often of a regional nature, are mentioned very briefly and often ..... in marginalising terms with suggestive criticism of implementation or alleged overlooked aspects*" (Danell 2016:13).

He also refers to the explanation of other people's results:

> "A significant part of the presentation is devoted to explaining away the results of studies other than the authors' own instead of reporting them. These are emphasized, for example. may be affected by overlooked factors other than the source of the disturbance itself, contain uncertainties or shortcomings in the methodology used, or that it is primarily human presence in the disturbance area that has caused the measured avoidances" (Danell 2016:13).

.. and claims about other people's methodological errors:

> "With the support of a genetic study (Eftestöl et al. 2014) it is argued that methodological errors would be the reason why otherstudies have shown barrier effects. The study consists of computer simulations of "random walk" where longer random movements automatically have higher probabilities to cross fictitious barriers per unit of time and thus could be misinterpreted as longer movements being caused by barriers (= higher movement speed between GPS positions*). However, studies with real barriers show that animals generally show holding* patterns *before crossing it, and that the passage itself then occurs faster than movements before and after the passage* (emphasis added)..... This is not taken into account in the study and it therefore does not seem to depict reality in a realistic way" (Danell 2016:14).

Waiting patterns have already been introduced by Skarin m.etc. (2019),

s e 5.On October 1, 201 After the review, Danell concluded as follows:

> *"My summary assessment after the review of the current Knowledge Review is that it in no way meets the necessary requirements for objectivity and objectivity and does not reflect the state of knowledge in the research area in a correct and honest way. It should therefore absolutely not be used as a basis for decisions in development matters in reindeer grazing.*(Danell 2016:16).

5.2.2 Corona effect, vision and hearing

In previous studies on both wild reindeer and domestic reindeer, it has been found that the reindeer avoid power lines in winter (Nellemann et al. 2003), sometimes there have also been conflicting results from the same area (Reimers et al. 2007).

Relatively recent research has shown that the eyes of large mammals such as reindeer are sensitive to UV light in winter when the eye's sensitivity to light increases and is sensitive to ultraviolet (UV) light during the winter months (Hogg m.etc. 2011, Stokkan et al. 2013, Tyler m.etc. 2014). One hypothesis about possible negative effects of power lines with voltages above 300 kV is that avoidance may be due to UV light and a so-called Corona effect. Larger power lines (300 kV and more) will emit electrical discharges and cause UV light to radiate from the power lines (Corona effect). Reindeer may perceive the coronal radiation from power lines as flashes of light, which may explain some of the avoidance effect from power lines in winter (Tyler et al. 2014).

It has not yet been documented how, under what conditions, or at what distances reindeer perceive UV light from power lines, but Tyler m.etc. (2016) has put forward hypotheses that reindeer at least perceive Corona light at a distance of several hundred meters, furthermore that reindeer can perceive flashing lights as movement and thus as danger (predators), and that the documented variation in avoidance in older studies can also be attributed to the fact that the discharges vary with weather conditions and seasons, among other things. UV light may be the reason why some older studies have found avoidance effects in winter (Tyler et al.etc. 2014, 2015, 2016).

Reimers m.etc. et al. (2015) criticize these authors for having gone too far in claiming that UV eruptions from power lines can lead to evasion and refer, among other things, to a study where reindeer have continued to cross under a 66 kV, later 132 kV, power line for four decades (Reimers et al. 2007) and another which is claimed to show that power lines do not have an

independent effect, but they are instrumental (Panzacchi m.etc. 2012). In a

In response , Tyler m.etc. (2015) that the critics misunderstand the book and also disagree with the interpretation of the two studies referred to.

Recent GPS studies have not looked at the effect of power lines in winter grazing areas, and in order to test Tyler et al.'s hypotheses and clarify why older studies differ, there is a need for further studies of Corona effects. Both Corona effects and crackling/noise from high-voltage power lines seem to depend on a number of factors, especially humid conditions and unsettled weather. In addition to the Corona effect, noise will disturb reindeer when passing and especially when driving the reindeer. Here, more knowledge should also be obtained from thereindeer grazing districts, such as Berg m.etc. (2018) writes in the wind power report in collaboration with GPS studies (Strand et al. 2017).

In addition to the visual effects of power lines, the sound effects are also important. The importance of the reindeer's hearing has previously been underestimated, see Box 5. New research in Fairbanks, Alaska, using electroencephalogram (EEG) measurements, has tested reindeer for a series of frequencies in the range of 20-20000 Hz; approximately equivalent to human hearing, see Figure 19.

Text Box 5. The reindeer's hearing

"Nor can hearing mean much to the reindeer when it is assessing a situation" (Skjenneberg and Slagsvold 1968:29). Previous research at the University of Oslo (UiO) and the Norwegian School of Veterinary Science (NVH) with measurements of noise from 300 kV and 420 kV power lines was based on audiograms showing that reindeer can only hear sound with a frequency above 63 Hz (Flydal m.etc. 2001), while people hear sound down to 32 Hz (Fay 1988). Comparison of the audiograms with measured noise from power lines concluded that reindeer could only hear power line noise with frequencies above 250 Hz, and that humans hear power line noise better than reindeer, at least at low frequencies (Flydal et al. 2003). However, this proved inconsistent when reindeer bucks make noise at an average frequency of 55 Hz (Frey et al. 2007). From an evolutionary perspective, it is unlikely that the females would not be able to hear the bucks during the rut, i.e. the reindeer's audiogram needed to be reassessed (Charlton et al.etc. 2019).

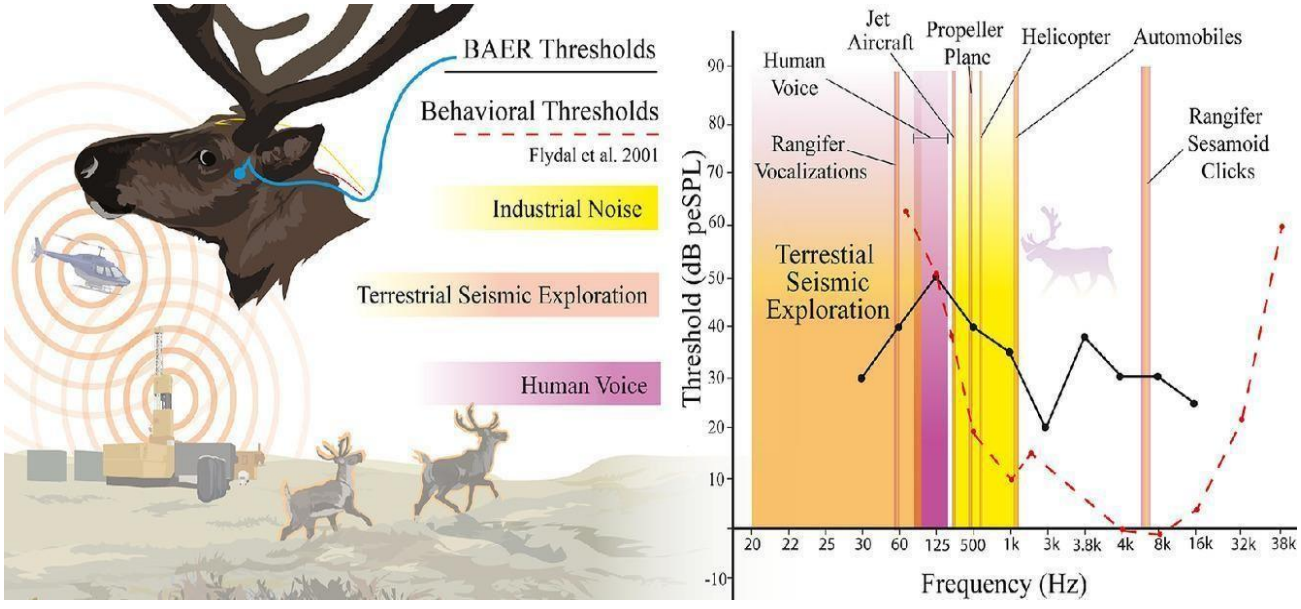


Figure 19. Audiogram for Rangifer by Brainstem Auditory -evoked Response (BAER) testing. Stimulating frequency on the X-axis and sensibility threshold on the Y-axis (Perra et al. 2022).

The researchers demonstrated that Rangifer can hear sound down to 30 Hz, perhaps lower, provided a sound level of at least 30 dB (Perra m.etc.2022). This is in contrast to Flydal m.etc. (2001) found a lower limit of 63 Hz with at least a sound level of 60 dB. A comparison of the audiograms shows that Rangifer hears low-frequency sounds much better than Flydal et al. et al. (2003) took as its basis. Controlled experiments also show that reindeer react with vigilance

and eventually flight, when exposed to the sound of both predators and other disturbances (Börs 2023). The exploration of reindeer's voice use and its importance in

The rut is in an early phase, but research in northern Finland has revealed that the sound of reindeer grunts can be differentiated according to age and weight (Boucher et al. 2024, Puch et al. 2024).

5.3 Reindeer herding's experiences with power lines

As already mentioned, NVE (Berg m.etc. 2018) established that affected reindeer grazing districts possess important experience-based knowledge about operating conditions in their grazing areas both before and after the establishment of infrastructure, including power lines. Although peer-reviewed research constitutes the most important basis for the authorities (NVE), it is assumed that the experiences and observations of reindeer husbandry must also be included in the assessment related to the effects on reindeer husbandry. The differences between parts of the published research and statements from reindeer husbandry indicate that it should be assumed that there may be considerable uncertainty about the effects, and that more research should be done on the establishment of power lines and reindeer husbandry. Local knowledge from the reindeer herding industry can be crucial to be able to fill out GPS-based studies.

In this sub-chapter, we will also discuss the experiences of four different reindeer grazing districts. The first district we study the experiences from is the summer grazing district of Skarfvággi in North Troms. Here we have been given access to and permission to use an interview that NRL's area service has conducted with the leader and deputy head of the district. We supplement this with the court documents and an expert report. The other district we study experiences from is Åarjel-Njaarke in Trøndelag, which is the neighboring district in the north to Fovsen-Njaarke (Fosen reindeer grazing district). Here we have conducted a larger Teams interview with the three reindeer owners in a sijte, Tovengruppen, Also here we have compared the material with an expert report and court documents. The third district is Ildgruben in Nordland, where a GPS-based research study has also been conducted. Here we have conducted a larger Teams interview with both sijteandelsleder in the district. We present the interview material, the research study and other documentation for this district in context. The research study will have its own subheading. The fourth district we have gathered experience from is Saanti sijte (Essand reindeer grazing district) in Trøndelag/inland. Harden has carried out both a research study (see above in 5.2.1) and that there are legal documents from there. Here we have conducted a Teams interview with the former district manager so that we have the experience from the time around the establishment of the current 420 kV line.

5.3.1 Cormorant

Skarfvággi is a small and high-lying summer grazing district in North Troms with winter pastures in Western Finnmark. The upper reindeer number was set at 1650 in 2011. As shown in figure 21, the new 420 kV line runs straight through a large collection area in the central summer district. There it also passes through a pasture. Interviews clarify that this particular area is a natural gathering place for reindeer as well as a calving site (Eira 2025).

The construction work was carried out in the period March 2017-May 2018. The discretionary case washeard in Nord-Troms District Court in 2018 and in Hålogaland Court of Appeal in 2019. The district court assumed that there would be an extensive evasion from the power line that would result in both grazing loss and loss of meat production based on an expert report presented in court (Nord-Troms District Court 2018, Riseth and Johansen 2018). The Court of Appeal 's discretion disagreed with this. The Court of Appeal relied on research results that concluded that it was human activity, not permanent installations in themselves, that affected the reindeer. The district was therefore not awarded compensation for either grazing loss or loss of production, nor additional work (Hålogaland Court of Appeal 2019).

In the winter of 2025, the head and deputy head of the district were interviewed by NRL's advisory

service to map the consequences of the power line (Eira 2025). We have received the district's permission to use the results. Perhaps the most important thing that emerged was that a lot of traffic and human activity has meant that the reindeer herd's natural adaptation to the landscape has changed.

"The reindeer are unable to find peace and in a small district, the herd is pushed towards the outer edges of the district .....
The construction phase has entailed several years of work to prevent them from moving towards the outer edge of the
district and to prevent confusion with reindeer to other districts (Eira 2025:1).

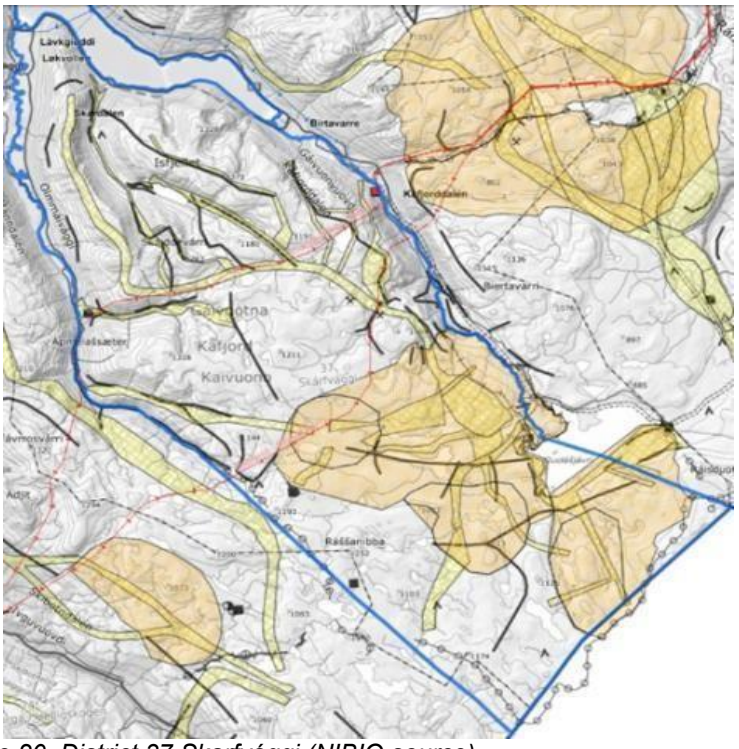


Figure 20. District 37 Skarfvággi (NIBIO source)

Furthermore, the district leaders point out that it was a significant challenge to restore the herd's adaptation to the landscape as the calves born during the construction period eventually grew up and became females. It took at least three years to re-establish the operating pattern.*Although the construction work was completed seven years ago, unrest in the reindeer herd is a persistent challenge. The herd is still being pushed towards the outer edges of the district.*This requires additional herding and gathering of the flock. Extra additional feeding of the reindeer has also been necessary to keep the herd together. This also includes feeding reindeer on bare ground (Eira 2025). On the current situation, the leaders further say (our numbering):

(1) The 420 kV power line has been established in an area that traditionally serves as a natural gathering place for the reindeer. After the construction of the power line, the reindeer no longer gather in these areas.
(2) In the area where the power line is built, there are no trees, which leads to significant wind exposure. The combination of wind and the presence of the power line creates considerable noise, which contributes to unrest in the herd and makes it difficult to keep the reindeer together and calm, as well as to carry out moves past the power line. The reindeer must be pushed under and past the wire.
(3) The power line has divided the summer and calving areas in two, and it is also visible throughout the district
(4) Construction roads, which have not been returned as intended, attract traffic that can negatively affect the reindeer during calving.
(5) Grazing land about 100 meters in diameter around the masts has been destroyed by extensive driving.'
(6) Predators and the reindeer herd are squeezed together when the grazing areas are reduced. The mating season is disturbed.

We note that most of the points here refer to the self-power line, not activities, such as during

construction work. The overall challenges today are therefore the overall effect of the after-effects of the construction work as well as avoidance and additional work of the power line.

As a small check, we have entered the Resource Accounts and retrievedsome keyfigures for the period 2012-2024, see Chart 21.

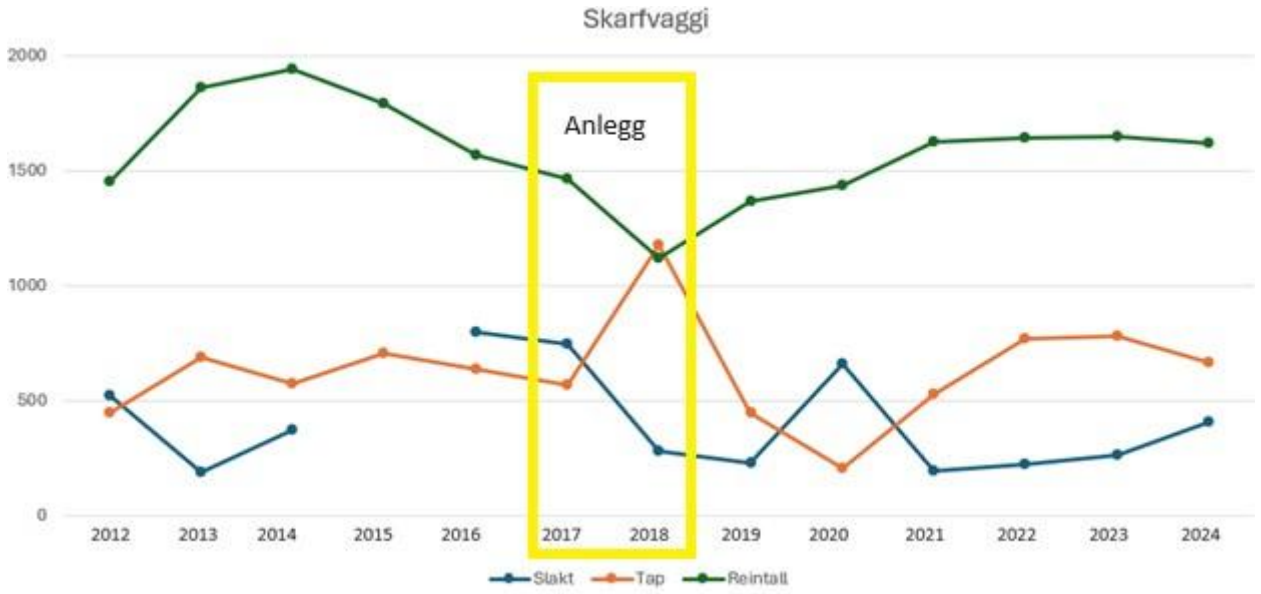


Figure 21. Sredfish. Reindeer numbers, slaughter and loss figures 2012-2024 (Reindeer husbandry administration, Norwegian Directorate of Agriculture
2012-2024).

Figure 21 shows that relatively little was slaughtered a few years before the transmission line was built, so that the number of reindeer was somewhat higher than the established upper number of reindeer in the period 2013-15, while the level of loss then varied around 600 reindeer. During the plant, losses doubled in 2018, while harvest numbers were low in both 2018 and 2019. The reindeer number grew from 2018 to 2021 and now seems to have stabilized just below the established rednumber. The losses in retrospect are slightly above the "old" level, and the harvest is on the rise. These figures as a whole, they are compatible with the fact that reindeer herding in Skarfvággi was exposed to a shock during the construction work, but seems to have stabilised since 2021. It is also consistent with the district saying that it took at least three years to re-establish the operating pattern. We must also take into account that additional lining, also on bare ground, must be expected to have mitigated the consequences of the power line.

*Strictly speaking, it is remarkable that the overestimate totally rejected compensation for grazing loss, loss of production and additional work.*There are many factors that indicate that this district is vulnerable to encroachment. As Figure 20 shows, the 420 kV line runs right through the most central parts of the district where relocation routes within a collection area meet in a pasture. The district is small in area. In the part of the 420 kV line is laid, it is about a mile across. In the open mountain landscape, the wire is visible everywhere. The district also has a dramatic and tragic development history. The Goulaš development, which started in 1964, led to a total collapse of the entire reindeer herding siida in Skarfvággi.

> "Damming, blasting and road construction scattered the reindeer in all directions, and it was very difficult to keep control. …… The number of reindeer in the district was reduced from 900 to 145 in the course of five years. The district chairman was not present ..... when the assessment of the damage was recorded [He did not] speak Norwegian due to
> lost their schooling during the war, and since the Lapp bailiff did not speak Sami, the families did not know how the assessment should take place (SFK 2023:542-543).
>
> The original reindeer herding families in Skarfvággi were never able to rebuild their operations after this. They applied for severaldifferent compensation schemes without success . At the end of the 1970s, a new operating group took over the district (SFK 2023:543). It is this group that still runs the reindeer herding

in Skarfvággi today.

Historical experience should indicate that those who are considering encroachment on this summer grazing district are open to the vulnerability to encroachment that an overall view of the landscape can provide.

However, the Court of Appeal's assessment appears to be based solely on the position taken in a paradigmatic research dispute about whether the reindeer's reaction and movement patterns are exclusively influenced by human activity or whether physical infrastructure also has an independent role (cf. 5.2.1). As referred to in the introduction and pointed out by the NVE, the general summary of recent years' research in relation to power lines is that it has not been proven that power lines alone affect the reindeer's landscape adaptation, but that it can occur under special conditions.*Obvious special conditions here would, as mentioned, be the open landscape and the limited size of the district.*

The district's post-evaluation shows strikingly large consequences of a construction work that lasted just over a year.[15] The effects must be understood as a combination of (1) *the reindeer being so frightened by the construction work that they are still trying to avoid the area around the power line and (2) that the power line itself has a frightening effect, so that only (3) natural borders, fences at the district boundaries and the active work of the reindeer owners are holding back the reindeer.*

The district also claims that GPS data is being misinterpreted as it focused on how much time the reindeer spent in the area where the power line is located. The district manager points out that there should have been more attention paid to how much the reindeer have moved away from the area, which indicates how uneasy the herd was and how often reindeer owners in the district have had to drive the herd back to the area under the power line.

5.3.2 Åarjel Njaarke sijte (Vestre Namdal reindeer grazing district)

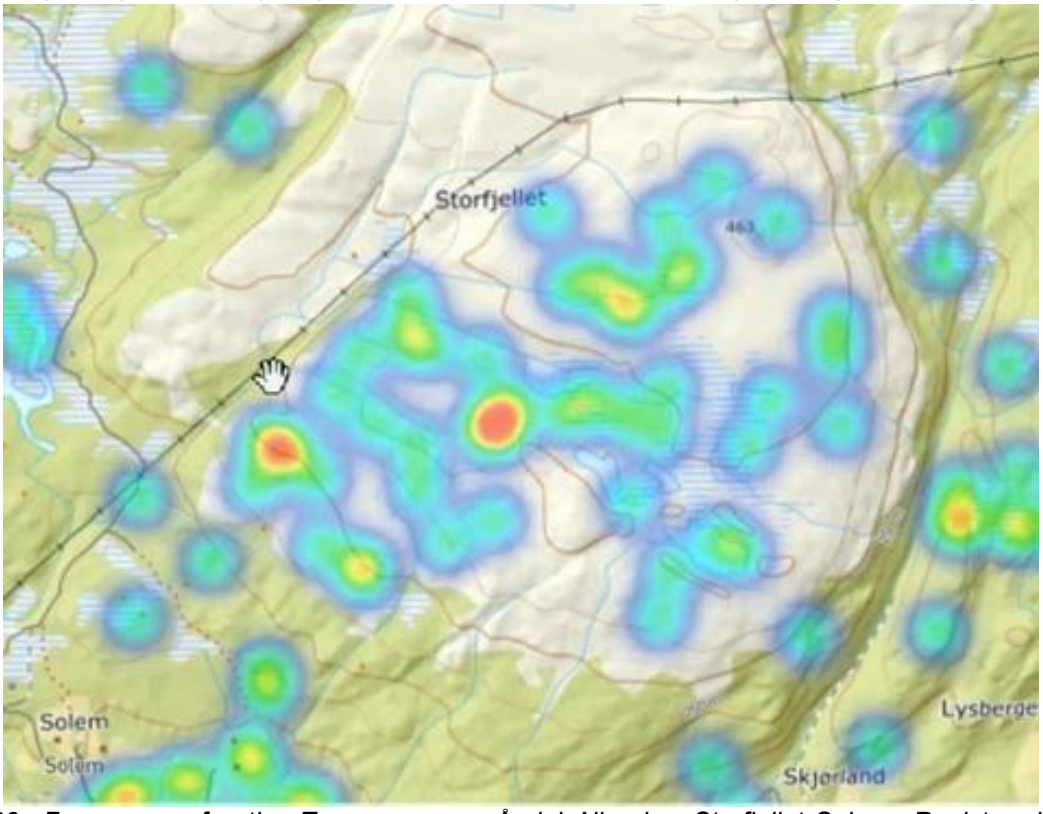


Figure 22. Focus area for the Tovengruppen, Åerjel Njaarke. Storfjellet-Solem. Registered grazing pressure. (Teams meeting)

We have interviewed three reindeer owners (Tovengruppen) from Åarjel Njaarke sijte (Vestre Namdal reindeer grazing district), which is the neighboring district of Fovsen-Njaarke sijte (Fosen reindeer grazing district) about their experiences with upgrading a power line through

their early winter grazing land from 300 kV to

[15] For large, long-term projects, it may happen that the construction period with converted land use lasts so long that there are hardly any females that have grown up before the construction began.

420 kV. Before the interview, we had been sent video films with the sound from the pipeline, recorded in December 2024 at three distances from the pipeline; (1) close by, (2) approx. 300 meters distance and approx. 800 meters distance. The sound was very strong at close range, still strong at 300 meters distance and was also clearly heard at 800 meters away. It was damp and snowy when it was filmed. Mads Kappfjell in Åarjel Njaarke has also sent us a small video from Namsskogan where the 420 kV line crosses the E6. The noise from the wire is strong and clear.

The Tovengruppen has been using GPS transmitters on reindeer continuously since 2010. Due to technical problems with Find My Sheep, we were not presented with historical and additive track logs, which would have been optimal, but only grazing pressure maps that provide snapshots, see Figure 22. The interview focused on the power line's effect on grazing use in the Storfjellet-Solem area, which is a core area as an early winter grazing area for the Tovengruppen. It is desirable to use this area early before there is too much snow.

In summary, the district has registered the following effects of the upgraded power line:

1. In older times, Solemsfjellet/Storfjellet was a collection area for reindeer from several districts for moving further west towards the coast.
2. The line now divides Storfjellet so that Grøtåfjellet, which initially has very good pastures, in early winter, but is northwest of the conduit, and is now hardly visited by reindeer anymore.
3. The reindeer are resistant to passing under the wire on the bare mountain, especially where they hang low. It passes more easily under the wire in forests, and where it hangs high.
4. The reindeer will not migrate along the old migration and migration routes by the line, but will find others
   roads, often in steep, terrain, impassable for humans. The consequence is also that in some places you are forced to use new relocation sites that can be dangerous and perhaps even indefensible. The ripple effects of interventions are therefore much more extensive in a broken landscape than a more uniform one, e.g. a mountain plateau
5. The wire acts as a barrier fence one way. The reindeer migrate, in the forest, relatively easily under the wire from the bare mountain and down into the forest and like to migrate further down from the wire.
6. The pine forests are what make this area most attractive as grazing, but it is difficult to get the reindeer to stay there because it is close to the pipeline. The grazing area in the area has largely been lost.
7. The reindeer do not move upwards under the lead by themselves. If the reindeer owners actively chase them up, they still tend to come back down.
8. Disturbances from hikers, along an upgraded forest road, or skiers, easily frighten the reindeer, and therefore reinforce the tendency for the reindeer to pull down. The reindeer migrate further down from the forest and towards the infield. This leads to a great deal of additional work for the reindeer owners and a new and unwanted conflict with agriculture and further to division in the village. People do not understand the connection between the upgrade of the pipeline and reindeer on inland. The conflict is exacerbated by the fact that:
   a. Precipitation, snow in the mountains and rain in the lowlands, amplify the noise from the power line and thus the problems.
   b. Reindeer herding conducts rotational grazing by using areas relatively intensively for a number of years,
      and then let the pastures rest and build up while using other areas. When you then return perhaps a few decades later, the reindeer herding is no longer part of the collective memory in the village. One then encounters resistance and unsubstantiated claims such as:
      "The reindeer should not be here". "There have never been reindeer here."

9. The forest areas are and will remain vital for the reindeer, at least for a period in winter, when there is a lot of snow on the south side of the mountain range, and there is first mild weather and then freezing on the north side. Some individual reindeer, especially bucks, but also some females, periodically migrate down into the forest to graze.

Box 6 (statements in the interview)

When it comes to the Corona noise, you should really be on top of Storfjellet when there are conditions for noise, because there the line is not so far above the ground, and you can see the discharges with the naked eye. It is so uncomfortable also for a human being to come against that line and pass it. You can feel it on your body when you get there, because there the 420kV line goes so low against the ground. It's like the door is completely closed. It's a very special place after the upgrade.We should have had an inspection in an afternoon when it is humid in the air in that place, when it starts to get a little dark in the evening, so that you get darkness in the background and see with the naked eye. The more current it runs, the greater the discharges will be, and easier to see and hear.

We have also gone through both the reindeer husbandry report and the discretionary decision. Our interview with the reindeer owners complements the presentation in the expert report. We should also note that the report was to a considerable extent based on the Frostating Court of Appeal.

> The expert assessment of the effects emphasized that problems with driving under the line and evasion in the autumn and may be due to Corona noise and discharges. The reindeer owners feared that the combination of increased voltage and lower-hanging cables after the upgrade would lead to further rearrangement of the reindeer's migration beds. GPS logs were presented which showed that an old move and trekking path that passes under the line in the bare mountain (Storfjellet) was no longer used, but that the reindeer instead pass under the line down in the forest. The assessment was based on full evasion in a 50-metre zone under the line,
> 50% avoidance during construction time, 25% during the operating period in a 0-1km zone, as well as 25% avoidance during construction time and 10% during the operating period in a 1-2km zone s county at least 6 days of annual additional work in the future (Tømmervik 2018).
>
> The estimate was based on previous research showing that high-voltage power lines have a disturbing effect on reindeer and that higher voltages will have a further disturbing effect. Furthermore, power lines also act as barriers and that higher voltages will cause greater unrest in the herd. The court assumed that the upgrade will not result in further grazing losses, but found no basis for assuming that the reindeer would get used to the power line. The court did not comment on the effects of Corona noise. In the compensation assessment, the court assumed that the upgrade would entail 10 days of work for 10 years and 5 days peryear. years for the next 10 years. The court also stipulated a discretionary production loss of 50% per year. day for as many days as the additional work, and provided that 10% of the herd is not affected (Frostating Court of Appeal 2020).

Since this judgment, there is also new research on the reindeer's hearing (Perra et al.2022) that strengthens what the reindeer owners in Åarjel Njaarke say about the sound effects of the 420 kV line.

5.3.3 Ildgruben reindeer grazing district

The fire pit reindeer grazing district is located in Nordland county and reindeer grazing area, east and southeast of Mo i Rana. The district has an upper reindeer number of 900, an area of 2706 km2 and two sijte shares that work together all year round. The district has a significant degree of overlapping grazing between seasons (see Figure 23) and , due to extensive natural interventions since the 1960s and disturbances due to human activity, has gradually become challenging operating conditions, also due to climate change (Riseth m .etc. 2021). The 420 kV Rana-Røssåga line, completed in 1992, crosses three mountain ridges in the district (see figure 24).

We have interviewed the two cooperative managers about their experiences with the power line and will eventually also compare their experiences with the previously published results from a GPS-based research study (Eftestøl m.etc. 2017, 2021). The use of the three mountain ridges is different.*Rostafjellet* (southernmost) is mainly a summer pasture, but also autumn pasture. *The Storfjell area* (in the middle) is a spring area and calving land, while Mofjellet is an

autumn/early winter grazing area. Stig Lifjell who has been a reindeer herder in Ildgruben for 50 years states that the grazing pattern in the district is now completely different from before the power line came. There are much fewer reindeer in the bare mountain areas than before.

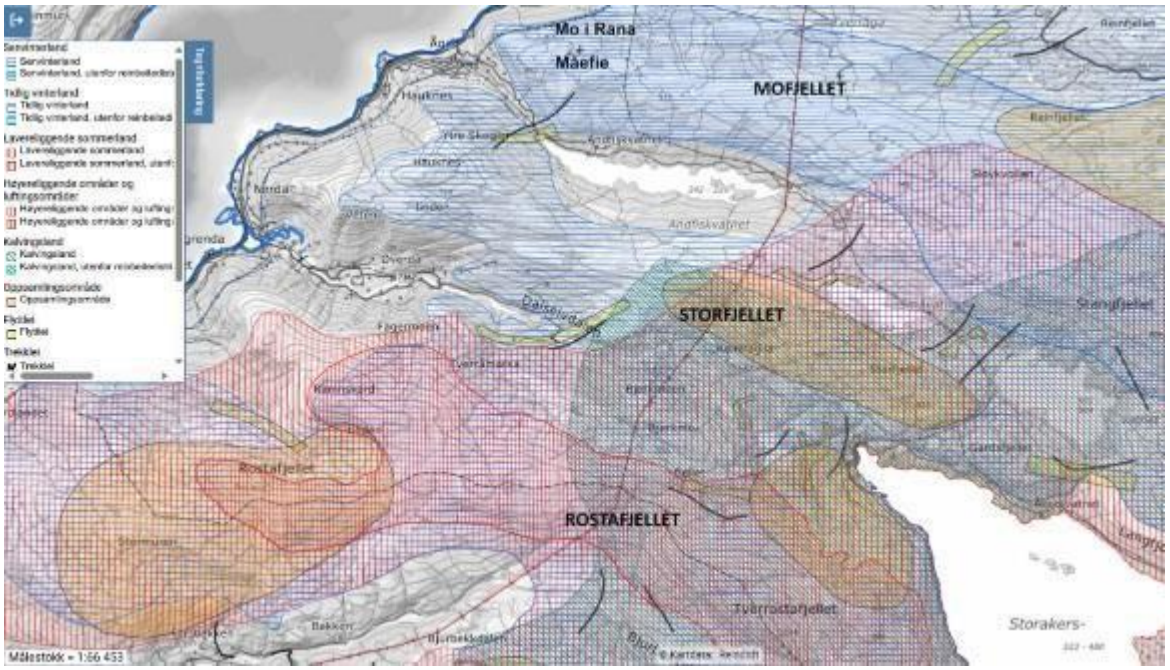


Figure 23. Ildgruben reindeer grazing district. The 420 kV Rana-Røssåga line crosses three mountain ridges in the district.

The reindeer's reactions to the power line also differ in the three areas. At Rostafjellet, the reindeer owners initially experienced problems with moving from west to east. They managed to solve this by rearranging the move so that they came lower and less directly on the power line. At Storfjellet, they have calved relatively close to the power line, the closest could perhaps be 300 meters, but then the terrain was such that the power line was not visible from the calving site. "*There was a bit of forest, so it was protected with vegetation and at the same time there was a small hill or mountain hill in between"* (Tom Lifjell). It is at Mofjellet that avoidance is greatest. The reindeer owners explain that the reindeer often stand against the wire, before they suddenly move over to the other side, in this case from the east and west. Tom Lifjell describes, see also Figure 24:

> *"You see the path where it says Hammertjønna* [1.2 km east of the line*]. They kind of pass that path and stop there. And then when they can, they are not to be stopped not until they reach where it says Vestre Mofjellet. It is the pond there* [3.2 km west of the power line]*.... all the years we've been doing that, the GPS data shows this.*»

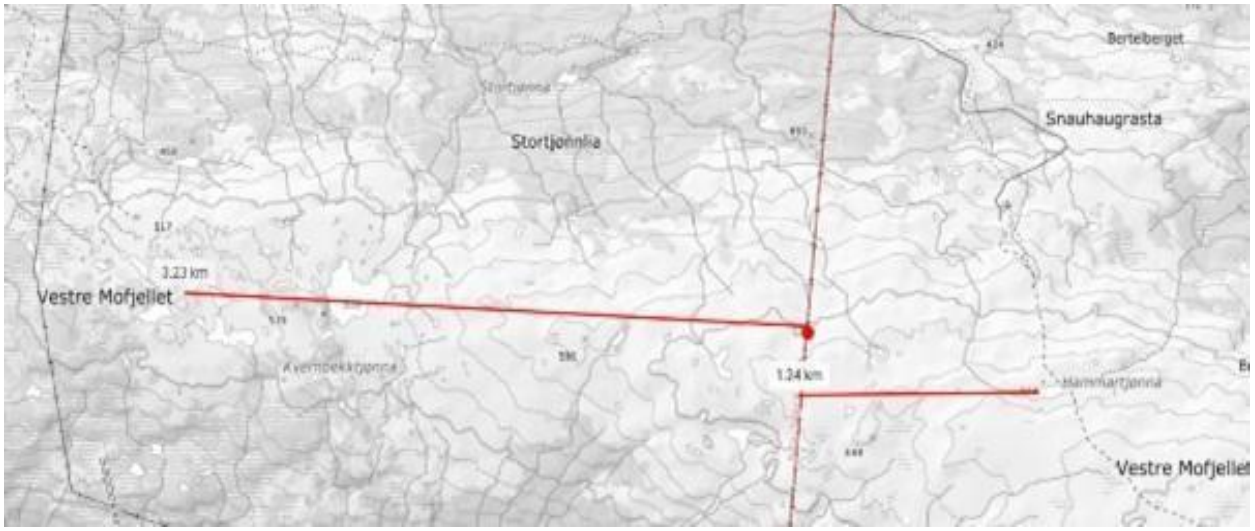


Figure 24. Passing the Mofjellet power line described by Tom Lifjell. Map of Norway.

What Lifjell describes here is known traditional knowledge among reindeer herders and described as waiting patterns by the research (Preisler m.etc. 2006, Skarin m.etc. 2015, Danell 2016). Tom and Stig Lifjell explain that such passes often happen when the weather is favorable in relation to Corona noise and discharges . When the wind direction turns, the reindeer pull in the opposite direction, and a similar pattern of action repeats itself. The 420-kV line comes from the south towards the three mountain ridges up through the forested Bjurbekkdalen. They find that the power line is far less of a problem in the forest than in the mountains.

Research in the Ildgruben reindeer grazing district

A research group at the University of Oslo and NMBU studied the reindeer's habitat use along the 420KV line through the district on the three mountain ridges Rostafjellet, Storfjellet and Mofjellet with a study area 4 km on each side of the power line (Eftestøl m.etc. 2017, 2021). The study is based on GPS data from 2011 to 2020 with posions for approximately 100 GPS tags at 2-hour intervals during the study period and:

> "We have also excluded data where the movement speed has been more than 2 km/h. This is to avoid effects from drifting, as well as possibly other reactions due to fear/flight as it is unlikely that a power line in itself would trigger such reactions."

Results from the project have been published in two different publications. The first (Eftestøl m.etc. 2017) is an interim report that summarizes the first six years of the project. It is stated that, among other things, the reasons for different land use in the winter months on the three mountain ridges will be studied. An overview of relative land use (kernel density) is shown in Figure 25.

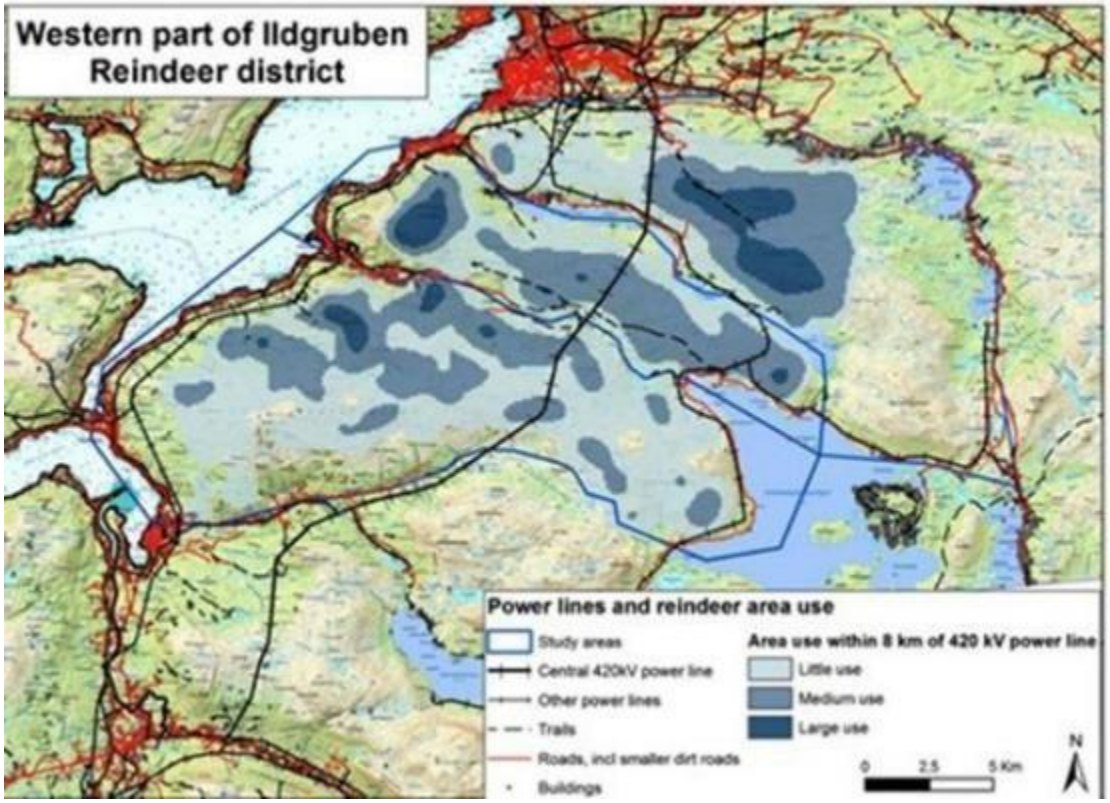


Figure 25. Relative land use November-April on three mountain ridges 2011-2016 (Eftestøl et al. 2017).

The figure is a summary and covers considerable variation between years, but nevertheless appears representative. Methodologically, the project will both quantify barrier effects of different infrastructure elements and natural structures, as well as conduct qualitative studies based on interviews and diaries from the reindeer herders. For Mofjellet, it is referred to that the reindeer herders experience that the reindeer stop or move more slowly towards the line. [16] This leads to less efficient land use west of the line. For Storfjellet, it is similarly referred to that

[16] As commented in connection with Figure 24.

Moving back east presents difficulties, while apparently there are no problems for free grazing. For Rostafjellet, the reindeer herders do not experience any problems.

We are somewhat questioning both the choice of position interval and the limitation in speed, as these assumptions may exclude both normal grazing behavior of reindeer, but especially any special behavior associated with power lines.

Text Box 7. Position intervals and movement speed

According to Pepin et al. (2004), two-hour intervals are expected to underestimate movement speeds by 40 per cent, compared with hourly intervals by 30 per cent. With today's technology, it should be possible to enter more frequent intervals when reindeer appear near the power line (for example, a few hundred meters). 2 km/h is also a very low speed when you consider how restless reindeer are during grazing searches. This is also a question of net displacement. If the movement described in figure 24 (> 4km) takes less than 2 hours, it will not be registered. This means that the researchers will have a much more limited data material than they could have.

The second publication (Eftestøl m.etc. 2021) is a report in the Swedish Vindval project, where the study of the power line in the Ildgruben reindeer grazing district constitutes a separate chapter. In their reproduction of the reindeer herders' experiences, the researchers place a lot of emphasis on discussing terrain conditions in relation to the line, but mention that problems with passing the power line on Mofjellet may be related to high Corona discharge due to temperature and humidity as well as turbulence due to wind. Based on the collected GPS positions, the researchers discuss whether the reindeer's movement pattern may be due to barrier effects: [17]

> *"That is, the reindeer's migration/grazing patterns stop towards the power line if a herd moves over one of the mountain ridges where the power line is located. Here, therefore, we present individual complementary GAM analyses that reflect the details of habitat use on both sides of the power line.... We also see how movement speeds correspond to distances to the power line .....**It is possible that the power line has an effect even if it does not generally lead to avoidance***(our emphasis).*For example, there is a sudden change in habitat use around the power line in winter ..... for Mofjellet At a distance of 1 km, this becomes even clearer... Then it's*
> *Also seemingly smaller trends also on the other ridges/seasons right near the power line.**However, these trends are so small that, even if the effects were real, they probably have no*** biological significance ***(emphasis*** added).etc. 2021:77).

Further in the discussion, it is said:

> *The changes in habitat use on .... Mofjellet in winter, with a sharp decrease in animals from Approximately where the power line is located and further west, may have been caused by barrier effects, but it can also be topography and distribution of snow.*
>
> *If there are real barrier effects, in addition to changes in habitat use, an impact on directed movement would also be expected in that the animals move at a lower net speed the closer they get to the line. We have analysed data west and east of the pipeline separately because reindeer herding has experienced different effects depending on which side the reindeer are on.*
>
> *By looking at individual results for Mofjellet compared to Storfjellet and Rostafjellet, we saw a tendency for the speed of movement away from the power line to be slightly higher compared to **the speed of movement towards the line for Mofjellet"*** (our emphasis). (Eftestøl m.etc. 2021:77).

Despite the limitations that have been made in the dataset, the researchers confirm that the reindeer owners' direct observations, as Tom Lifjell and Stig Lifjell have explained to us in interviews, are supported by the collected GPS data. Nevertheless, the researchers say in the discussion:

[17] references to figures that are being discussed in relation to have been removed.

> *"The effects that have been documented on the reindeer's habitat use in areas affected by a 420 kV line in Ildgruben point in different directions. Some slight negative effects with reduced use of habitat near the pipeline have been found, but also opposite tendencies with increased use near the pipeline"* (Eftestøl m.etc. 2021:82).

On the basis of this, it is concluded:

> *"In summary, our study on reindeer habitat use and movement rates at the 420 kV line has shown that such a line usually does not have a significant negative effect."*(Eftestøl et al. 2021:82).

Even if there is a long discussion of barrier effects (above), it is not continued in the discussion. It is only mentioned as interesting:

> *"In this respect, it is of interest that the GPS data shows the greatest negative barrier effects in the winter at Mofjellet, where reindeer herding has also experienced negative effects on free-range animals* (Eftestøl m.etc. 2021:82).

The moststriking thing in this discussion, however, is that Eftestøl. etc.(2021) fails to discuss whether what is observed at Mofjellet are waiting patterns (first described by Preisler et al. 2006 and cited by Skarin et al.etc. (2015:1537). In our opinion, Tom Liog Stig Lifjell's description of what happens with waiting and quickly crossing the power line at Mofjellet, is precisely an apparent accumulation of reindeer on one side of a barrier; which can lead to misunderstandings that the reindeer do not avoid the development, but on the contrary increases its use in some cases. It may seem as if Eftestøl m.etc. (2021) have misunderstood.

5.3.4 Saanti sijte (Essand reindeer grazing district)

The court record from the estimate states that the Essand reindeer grazing district consists of 9 siida shares with a gross area of approx. 2300 km2. The area is mainly used for summer grazing, which in this context means spring/summer and autumn grazing. Essand has its winter pasture at Femunden, about 70-80 km further south. The winter pasture is used together with Riast/Hylling reindeer grazing district (Frostating 2010).

The discussion of the case begins as follows:

> "The power line covered by the estimate is 25 km long. It runs from Nea in Tydal municipality, via the north end of Lake Essandsjøen and into the national border with Sweden. The power line crosses a central part of the summer pasture for the Essand reindeer grazing district.
>
> The new power line replaces a 300 kV line that wasbuilt in 1960 and upgraded in 1976. The old line, which ran parallel to the new one, was demolished in the winter of 2010 after the new line was completed.
>
> The new power line has a significantly larger dimension than the old one. The mast height of the new line is on average about 27 metres up to the lower edge of the traverse, while the old line had an average height of about 20 metres. The new power line also has more live lines than the old one. The distance between the masts varies, with an average of about 3 masts per kilometre, whilean old one had about 5 masts per kilometre" (Frostating 2010:3).

Construction work started in May 2008 and was completed in August 2009. The construction activity consisted of foundations, mast installation and cable laying. Traffic in and out of the area went along a construction road that is close to the old power line. In addition to trucks and construction machinery, helicopters were used to transport materials and erect masts. Some of the mast assembly and cable laying took place in winter. However, most of the construction work was carried out during the summer season while there were reindeer in the area. Above we have referred to Skarin et al. (2019) criticism of the research study by Eftestøl m.etc. (2016).

We have interviewed former district manager Idar Bransfjell about the power line and how the reindeer owners have experienced the effect of it in relation to reindeer herding:

"There were a lot of lies out and about.... We were told that all the noise that the 300 kV line gave, it came away when the 420 [line] was installed, but the truth is that it was a loud noise in the rain, snow and wind at the same time, so it can be heard very far.... It's a buzzing sound, not [crackling].... I was so surprised, what a sound? when I was on a moose hunt and sat at the post... I eventually realized that it came from the power line, and it was many kilometers away at least 2.5-3 km .. , so it's not true that the noise is brushed away. … and at least in areas where there is a lot of rainfall or wind. so can ... A new wire can be very disturbing to the reindeer."

"And if .. the construction period and ... the report .., [we] had not .. some control over what was written and said.... In retrospect, one may wonder how they got a report that really everyone believes, because there were no more than 18-20 GPS transmitters on a winter herd of 4500 reindeer, so it is a small percentage,.. one should probably have had 10 times, one should have come up with a correct result.»

"We were not told in advance about what that GPS study would be used for. We didn't have any insight into that until a couple of years passed. That it should be used as a counterweight, for the developer and it is difficult for a researcher to go against his employer. …»

Figure 26. The power line through Saanti sijte's summer pasture (Kilden reindriftskart.no) [18]

[18] Former district manager Idar Bransfjell points out in an interview that the east-west migration routes are no longer in use

Bransfjell also confirms that there was a clear evasion effect during the construction period. Because of this, Statkraft paid for a new fence installation in Skarpdalen. It is this system that sijten still uses.

Bransfjell explains how the reindeer move in relation to the power line:

> "We have a situation [in our district] where there is relatively plenty of space ... for the reindeer. If one is to leave one [sub] area, then there is room in another [sub] area. In retrospect,... one can see that in the spring, during calving and after calving- we have such a north-south pattern in the district - that wire acts as a barrier in May and half of June ,....until the calves are big enough and can join..."

This is the *new power line thus acts as a barrier fence in a limited part of the bare ground season*. Bransfjell elaborates on this with an example. In early spring, the reindeer migrate down Tydalen instead of migrating down Skarpdalen where it greens the fastest, but where it also meets the power line, Then he also explains:

> We have seen this in retrospect when we study, we have never done that before. Otherwise, ...the reindeer spread out a lot in late summer and autumn, so that it is difficult to study effects. It is difficult to see when there are only some animals that are gone with the power line and pass back and forth north-south. In early summer, we are mostly north of that power line, When autumn comes, during the spreading season, from the end of July and in August, our reindeer herd spreads throughout the district.
>
> ,,,,When we know that the reindeer will move south, ...in midsummer, and before that time, we see that the wire blocks the females, because they will not pass. They run along. They come from the east and intend to go south, but then they turn away, then they run west and then they go north again. Later, in the dispersal period, they go one and one and four and five, but it's hard to see this.

Bransfjell also says a little about the operating pattern in the summer:

> The reindeer usually come to Øyfjellet [Øfjellet on the map] at the end of June/early July,... And then the calves are big enough. Then they migrate there and are all the way towards Nesjøenlandet and the mountain peaks there when it is hot. This is the pattern in early summer and before calf marking. Then we take it from Øyfjellet and north to Skarpdalen [see figure 27] where we have the pasture.

… and during the time of dispersion:

> We try to look after the southern edge, because in the autumn we have a lot of pressure in the reindeer herd, it is going south and into the neighboring district. So we look after the east and south sides, between Essand and Nesjøen, towards Tydalen and Stuggudalen [see figure 27] .... We do not have much control further north because we have enough to look after the reindeer herd further south, except when we are going to slaughter. Then we gather the reindeer herd from the south and pass the power line and take them into the pasture in Skarpdalen [see figure 26].
>
> When the spreading time comes, it spreads throughout the area. You can see it's a bit broad. When it then spreads, it is a bit difficult to keep track at the same time as we have to edge herd so that it does not travel south and into the neighboring district.

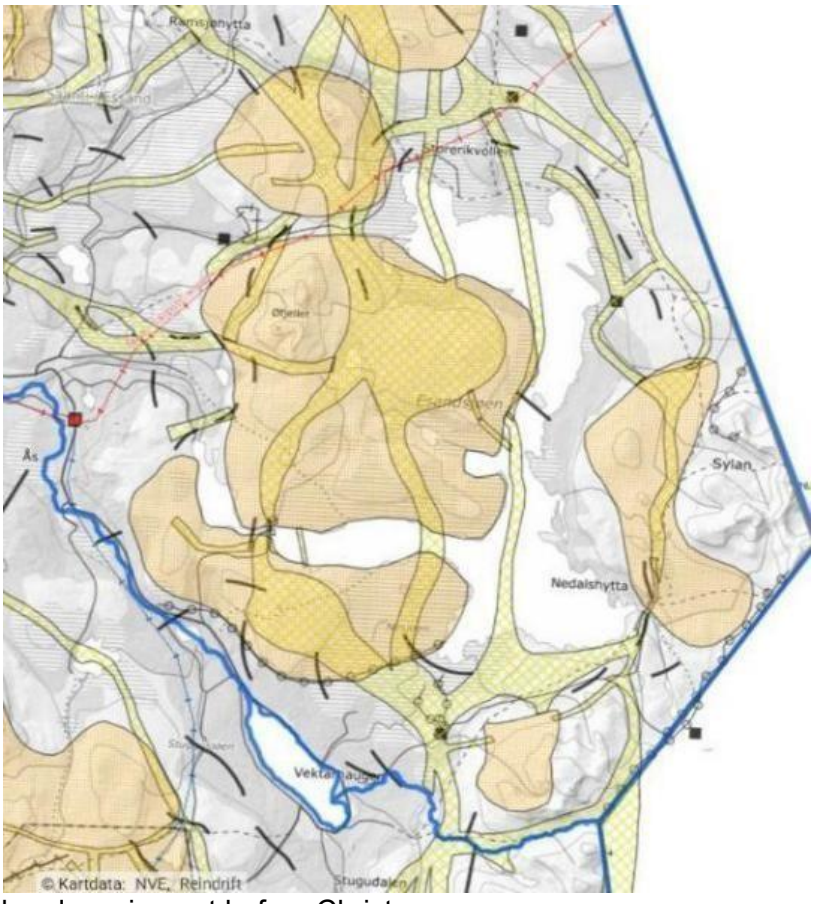
We asked what they will do if the reindeer come to Nedalen:

> We are looking after there in the Sylan area, in the far southeast- there is a lot of tourism in that area, so the reindeer are restless- so we are there every day from the end of July to in September, then we take the reindeer back and drive it north past the power line and take it into the fence in the pasture for slaughter in September - and some calf marking - if we have any calves we have not tagged in the summer.
>
> And when we take it out in September... we are trying to get .. [the reindeer herd] .. to graze westwards, northwest of where we have the slaughter, and likewise from Øyfjellet we go north in September and past the power line and in the same way we settle it west and into Skarvan and Roltdalen national park. In the autumn again, in the same place in October, we have calf slaughter in the same place, after heat. We then try to slaughter as much as possible before we enter the winter pastures at Fæmund.

Saanti sijte is formally a year-round district. In practice, it is used throughout the bare ground season. It is mainly a fairly flat mountainous area where the reindeer's main movement takes place in the north-south direction.

Moving in in the spring takes place in April before calving. The power line runs across the main direction of movement and acts as a barrier fence for females with small calves until mid-June. For the rest of the summer, the reindeer have a migratory movement southwards towards the neighbouring district and the reindeer owners herd in the south to keep the herd back.

This agrees with Skarin m.etc. (2019) cited in 5. On October 2, 2011 that the entire bare ground district functions as a large grazing pasture, where the reindeer are limited by fencing and the reindeer owners' edge herding, and that we do not know how the reindeer would move in the area around the power line if they could move freely. What is new is that the power line acts as a barrier fence in early summer. No problems have been reported with organized relocation under the power line, which takes place five times a year; three times during the bare ground season, the reindeer herd is gathered and driven north to the fence facility in Skarpdalen, as well as when



moving in in April and moving out before Christmas.

Figure 27, southern part of Saanti sijte (Kilden.no)[19]

5.3.5 Summary of reindeer herders' experiences with power line effects

In this section, we will try to summarize mainly reindeer owners' experiences about power lines, reindeer and reindeer husbandry in general points.

1. When reindeer are frightened by noise and activity during construction work and thus the evasive construction area
   and, to the extent practicable, they retreat to what they perceive as safe areas.
   a. There is usually extensive evasion during the construction period. All researchers also seem to agree on this.
      i. Some reindeer are so frightened by the construction period, that they have to be forced back (Stig Lifjell,
      Cormorant).

[19] Former district manager Idar Bransfjell points out in an interview that the relocation lanes in the east-west direction are no longer in use

ii. The generations of calves born during the construction period and growing up to be adult females will be accustomed to a different landscape adaptation than the reindeer herd had before the construction work. Depending on how long and intense the construction period has been, it will take several years and require a lot of extra work to get the herd used to the "old" landscape use, possibly an adapted use based on new conditions (Skarfvággi).

iii. Getting reindeer used to a new landscape takes no less than 3 years (Stig Lifjell).

2. Avoidance can be masked by the fact that fences and active edge herding force the reindeer back to areas they would otherwise avoid (Skárfvaggi, Saanti sijte).
3. The avoidance effects seem to depend on whether the reindeer see the power line.
   a. The avoidance effects are strongest when there is an open mountain plateau and least when there is dense forest (Åarjel-Njaarke, Ildgruben).
   b. The tolerance for clearly visible power lines is possibly greater in an open landscape without bottlenecks (Saanti sijte). A good overview of the landscape can mean greater security. This is uncertain. Apparent tolerance can also mask coercion as the reindeer have no alternative to passing the power line.
   c. It is also easier for the reindeer to pass where the wire hangs above the ground (Åarjel-Njaarke, Ildgruben).
   d. Evasion or resistance to passing is reinforced downhill.
   e. Avoidance is enhanced by both sound and light effects (Corona).
      i. Corona effects are strongest in humid weather in autumn and winter (Åarjel-Njaarke, Ildgruben), but also occur in summer in humid weather (Saanti sijte).
      ii. Strong winds/storms amplify noise from power lines (Åarjel-Njaarke, Ildgruben, Skárfvaggi))
   f. The avoidance effects are amplified by other disturbances, such as human disturbances such as hikers (Åarjel-Njaarke, Panzacchi et al.etc. 2012).

4. The effects include resistance both to passing under and staying near the line.
   a. Reindeer can be left standing against the wire, perhaps as close as 500 meters, but when they do pass (preferably in a weather window), they migrate very far away on the other side, up to 4 km (Ildgruben).
   b. A power line can act as a barrier fence one way, while the reindeer pass more easily in the opposite direction (Åarjel-Njaarke)
   c. A power line can act as a barrier fence for a limited period of time (May to mid-May). June), while any avoidance is unclear otherwise (Saanti sijte).
   d. Reindeer often do not settle close to the pipeline, even in otherwise attractive grazing areas. This means that grazing peace is lost, poor grazing utilization and additional work (Åarjel -Njaarke, Ildgruben).
   e. Reindeer can find new routes, even in dangerous terrain, to avoid proximity to the power line or to be able to pass at points where it is perceived as less threatening (Åarjel-Njaarke).
   f. Avoidance can lead to migration to undesirable areas (agricultural land) and new conflicts arising (Åarjel-Njaarke).
   g. This may necessitate the reorganisation of migratory paths and, in the worst case, lead to grazing areas being made inaccessible in practice.

5. When reindeer on free migration or grazing pass under the wire, they tend to quickly move away from the line to the opposite side, varying from a few hundred meters to up to several kilometers (Ildgruben). This means:
   a. Reduced grazing peace
   b. poor utilisation of the areas closest to the power line

These points have different empirical foundations, but they constitute a first attempt to systematise reindeer herding experiences.

5.3.6 Our understanding of avoidance and barrier effects

In order to understand and predict barriers and avoidance effects, we must start from what we know about reindeer behavioural patterns, both based on traditional knowledge and research. We'll use text box 8 as a starting point.

Text Box 8. Reindeer behaviour in case of possible danger. Experiential knowledge from Sør-Fosen sijte (Leif Arne Jåma)

The reindeer herd moves calmly grazing in the landscape. When the first reindeer detects something that deviates from the normal such as sound, smell or sight, or in combination of these three, the first one stops and lifts its head, stands still, listens and looks.

When the other reindeer discover that the reindeer that reacted first and stopped grazing, they also stop and stand "and look" for possible danger. Finally, after approx. 30 seconds. all reindeer stand still and sense.

If a reindeer then sees and/or hears and/or smells something, it stands and considers what it is. In open flat terrain, it will sometimes try to use the terrain so that it comes into position in the direction of the wind from the object to sense any smell from the object.

If it considers this to be dangerous, it starts walking/trotting/galloping away from the object.

The other reindeer gather and follow. They then seek out the terrain. Often, some of the other reindeer have also seen and located the dangerous object.

Reindeer are in flocks, often stopping at the first height or open space, and turning towards the dangerous object for reassessment. They can stand still for a few seconds or up to a minute.

If the dangerous object is still in the same place, and the reindeer perceive it as still dangerous, the reindeer herd will move in a (brisk) walk away from the dangerous object.

Reindeer usually choose the straight path where they came from grazing, but will follow the heights as much as possible.

Depending on how large the reindeer consider the danger potential of the dangerous object, determines how far the reindeer move away from the danger object. If reindeer associate the danger object with predators, the escape distance will be long, often several kilometres regardless of the topography. The form of movement in reindeer will then be trot and canter. Dogs, dogs and humans together are just as frightening to reindeer as predators.

If the reindeer does not consider the dangerous object to be predatory, it will still retreat away from the dangerous object, and the escape distance will not be so long. The reindeer will move away until it does not see the dangerous object, i.e. over a ridge and down into the lee on the other side and up into clear terrain. That is, as far as it has to get away from the dangerous object until it feels safe.

BUT this is situational and depends on the topography of the area where the reindeer spotted the danger object and started the escape reaction. Is the detection distance between the reindeer and the danger object the less, i.e. 30-150 meters, it will put more shock in the reindeer.

If the topography is slightly hilly, reindeer will cross several mounds and hills before they calm down. If the reindeer discovered the dangerous object close to them, it will also affect the reindeer's escape distance, i.e. it will be longer.

If the topography in the direction of flight is a large wide wooded valley, then reindeer will cross this and seek up the bare mountain on the opposite side of the dangerous object until it gets an overview, until it feels safe enough to calm down.

In the escape route, new hazard objects may be/arise, then reindeer will be affected by this and the escape distance will be extended from the original hazard object.

We can imagine a herd of reindeer that comes migrating or actively migrating along the ridges in a hilly winter pastureland. If the reindeer sees a power line and perceives it as threatening, it will refrain from approaching it, and either continue on the ridges or turn back to where it came from. The nearest zone around the power line that the reindeer then avoids can be referred to as the zone of primary avoidance. If the reindeer are not frightened by the power line, the herd will just continue and then graze under the power line, which we also know that

reindeer can do.

If the reindeer is properly frightened, e.g. by Corona discharges with a loud sound and flashes of light and it interprets it as predators or unknown people with dogs, a stronger escape reaction is triggered where the reindeer flee across the next valley and up into the height on the opposite valley side. We can call this *secondary avoidance*. We will use this as a basis for our analysis of the potential avoidance effects around the power line route.

In addition to this, we expect that so-called waiting patterns will emerge (Preisler 2006, Skarin et al. 2015, Danell 2016) and described by Stig and Tom Lifjell from Mofjellet (5.On October 3, 2013). When such effects occur, we can also expect that reindeer may end up several kilometres away on the opposite side of the power line.

5.4 Expectations for further power line research

As also mentioned at the beginning of 5.3, the NVE is also concerned with linking reindeer husbandry's experiential knowledge and GPS-based research. In an interview, Tom Lifjell pointed out that research based on electronic tracks has its limitations, and that researchers are therefore dependent on the traditional knowledge of the reindeer owners. In the proposal for a revised methodology for impact assessments for planned measures in reindeer grazing areas (Eilertsen et al. 2025), it is stated that the new ideal for impact assessments should be the co-creation *of knowledge*. We would recommend that this is also used as a basis in power line research in relation to reindeer husbandry.

Robust estimates of which areas are important for thereindeer can , according to Skarin m.etc. (2021) is achieved by analyzing GPS data. The more data you use, the better the estimates. Currently, there are reported studies on wild reindeer in Norway where all available GPS data have been used to quantify which areas are important for the reindeer's ecological niche (Panzacchi et al. 2015).

In ongoing studies, calculations are being worked on for both wild and domesticated reindeer in order to obtain as accurate calculations as possible of which habitats are important for the reindeer in different seasons. In addition, it is also calculated where it is possible for the reindeer to pass over roads and other infrastructural obstacles in the landscape (Panzacchi et al.etc. 2016). The more data you have to feed these models with, the better calculations of the reindeer's best area can be made. Only data from one study area cannot provide answers to how the reindeer react in general. When data from several areas are analysed simultaneously from several areas, the results clearly show that power lines have an indirect impact up to 5 km away on reindeer's choice of grazing area (Panzacchi m.etc. 2012).

Skarin m.etc. (2019)'s summary demonstrates that there isgreat potential in GPS research. BothSkarin and others. (op.cit.)'s criticism and our review of reindeer owner experiences show that it is necessary to critically assess GPS research on reindeer and reindeer husbandry. Among other things, we have demonstrated a lack of pre-studies, too poor temporal resolution and inadequate or missing understanding of the landscape and the involvement of the reindeer herders' knowledge. In many cases, there is therefore reason to question the results of the research. As we pointed out at the beginning of this report, there is a need for research, including GPS research, that not only searches for general answers, but explores *the conditions under which reindeer avoid* power lines.

The establishment of power lines can lead to major changes in grazing patterns. Research on power line effects must include feasibility studies in order to provide sustainable results (validity [20]). The behaviour of the reindeer differs depending on whether it migrates/grazes freely, and whether it is driven or disturbed by other events. It usually pulls against the wind, but can be disturbed by storms and incidents with both people and predators. To have sufficient knowledge of other factors that may have a decisive influence

[20] Validity is also referred to as validity or durability. The validity shows the extent to which the results of the survey provide a basis for drawing valid or valid conclusions about what the study aims to elucidate (validity–Store norske leksikon). Does the survey measure what it is intended to measure?

on the movements of the reindeer, research on powerline effects in addition to GPS positions of a sufficient number of females over several years (reliability21), should also include:

1. Reindeer herding diary (validity) (Skarin m.etc. 2021).
    a. Date fixing of reindeer herding work, i.e. when the reindeer do not move freely and external influences.
    b. Controlled positioning of reindeer (moving, edge herding).
    c. Qualitative assessment of winter grazing conditions.
2. Weather data (validity)
3. Carnivore data (validity)
4. Information about other disturbances (hiking trails, events, etc.)

In addition to this, it is necessary to develop a systematic Corona research that links Corona effects to landscapes, weather conditions and conditions related to the reindeer herds that are affected.

[21] Consistency or stability of measurements.

6 The South Sami, the landscape and reindeer herding

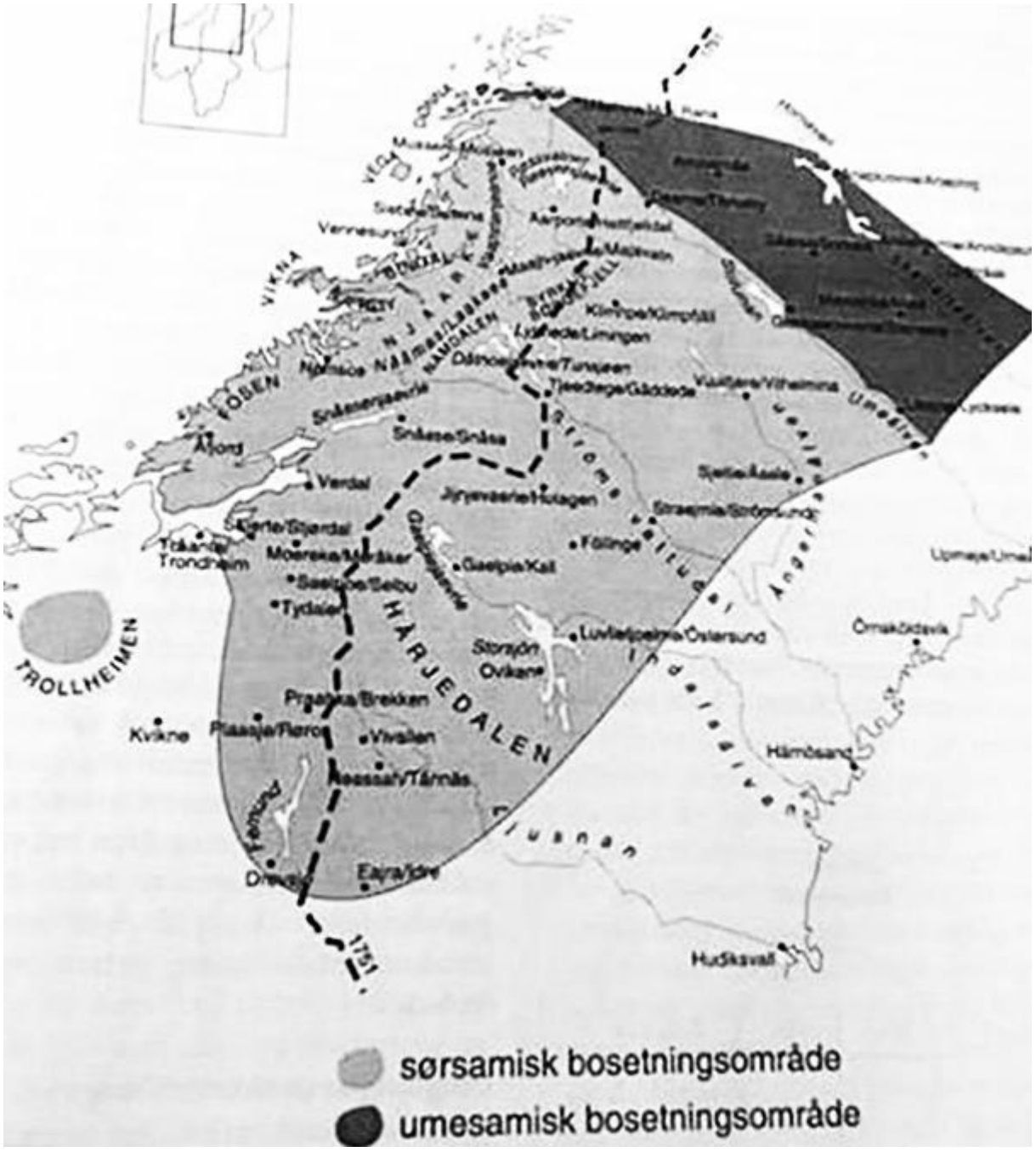


Figure 28. Sørsámi area (Dunfjeld 2006:11).

6.1 Culture and language

The land of the South Sami stretches from Saltfjellet in the north to Engerdal in the south of Norway and from Arjeplog in the north to Dalarna in the south of Sweden, see figure. The South Sami are a small population of about 3000 people, spread over a large area. This has made the South Sami extra vulnerable to the assimilation processes until well into the 1900s (Bye & Jåma,

2011)."*The South Sami culture distinguishesitself from cultures in the other Sami societies through its own language and cultural forms of expression*" (Dunfjeld 2006:7).

Maja Dunfjeld (2006) describes the South Sami area as a social space that binds people together in a network. The entire South Sami reindeer herding community was characterized by reindeer nomadism with intensive dairy farming until the beginning of the 1900s. Around the turn of the century, a process began with the conversion of reindeer herding to meat production and the liquidation of the dairy farm. This was fastest in the districts in the inner regions, while the coastal districts held on to the dairy farm for a long time (Fjellheim 1995).

Dunfjeld describes Njaarke (Vesterfjellene),[22 the neighbouring areas] north of Fosen as protected by steep mountains and long fjords, so that *"the Sami way of life [was] maintained continuously without major changes from the first half of the 1800s until the 1960s"* (Dunfjeld 2006:8). At Fosen (Fovsen Njaarke) the dairy farm lasted until 1955, while in Åarjel Njaarke (Vestre Namdal) it lasted until 1964, (Fjellheim op.cit.).

The South Sami language has a number of distinctive features that indicate that it differed from other Sami languages very far back in time (Magga 2013). In the 1960s, South Sami was threatened as a living language, but it survived in strong families. With pioneers such as Ella Holm Bull at the forefront, significant language revitalization work has been done up to the present day. However, UNESCO still considers South Sami to be seriously endangered and states that the language has only 300 users in each of the countries of Norway and Sweden (Moseley 2023).

6.2 Understanding nature

Text Box 9. South Sami understanding of nature
(Nanni Mari Westerfjeld, in Aune m.etc. 2009:218)

".. [A]n person [is] born into the lands of his ancestors – is linked to this country via family lines–**Maadtoe.** They name their lands medmaadtoej **daajve**... ancestral areas. … When it comes to where the South Sami originally come from, it was said from ancient times;**mijjie libbie vaereste tjuetjielamma**... We have risen from the mountains.**Saavje is** a term that concerns the ancestors, but it also refers to the fact that their spirit is still in the landscape, even though they have passed away.

The South Sami have a very strong connection to their areas. Today, we still find a perception that saajveh is present and ensures the well-being of people and animals.

For humans, this means that they have a duty to relate to nature in such a way that future generations will also have their residence and livelihood here (emphasis added). Without such a form of use, one could not have protected such large "unused" outlying areas in the Sami areas.

The South Sami have a great love and close connection to their areas. A telling example is the recently deceased Dan Jåma who, after travelling all over the world as a film worker, acknowledged that he felt an ownership of the mountains on the basis of his upbringing and heritage:

> *"I perhaps feel an even greater affinity for the mountains now in good adulthood, and with a profession that means that I am far from home. It is an enormous wealth that dad said "these are our mountains" - it is fantastic that he said that! You don't have to own something to love it. This is my country because I*
> *love it, not because it's written on a piece of paper"* (Bye and Jåma, 2011:233).

There are probably many South Sami who recognize themselves in these strong feelings. In addition to this, the South Sami understanding of nature also has a spiritual dimension. The core of this is that previous *generations are still present in the landscape and oblige today's South Sami to take care of the land for the future*, see text box 7. In her doctoral thesis (2009), the historian of religion Jorunn Jernsletten has explored South Sami relational understandings of landscape. Based on interviews with older South Sami in Voengelh-Njaarke sijte and literature studies, she

has uncovered how traditions and ritualized patterns of action are part of a collective, social memory that provides a sense of security that one is not alone in the landscape.

[22] area south of Vefsnfjorden and Mosjøen, west of the rivers Vefsna and Namsen and north of Namsos and Namsfjorden

6.3 Cultural Significance

Being few and living scattered means that the South Sami usually live with families surrounded by majority Norwegians on all sides. This is a great contrast to the majority areas in inner Finnmark where Sami language and culture are alive everywhere. The minority situation necessarily leaves its mark on the interaction with both the neighbors, the village and the larger community. For the reindeer herders, this can mean that when you are in the summer country, drinking coffee with people is an important conflict prevention measure. It is important to build bridges where you can.

It is also of great importance how rural communities and municipalities choose to relate to a minority population. It is not difficult to find negative examples (Riseth and Nygaard 2018). However, Snåsa municipality was the first municipality in the South Sami area to choose to be incorporated into the administrative area for the Sami language (2008). This was not on the basis of any initiative from the South Sami community, but on the contrary, it was the municipal politicians in Snåsa who, based on an assessment of the potential advantages the municipality had, chose to invest in the Sami, also because the municipality was already a Sami center with several Sami institutions (Sigbjørn Dunfjeld, pers. med.). At Fosen, on the other hand, the reindeer herders experienced that Åfjord municipality in the wind power issue played them off against the majority population in a game to achieve jobs and benefits for the inhabitants (Otte, Rønningen & Moe 2018, Karam & Shokrgozar 2023).

"The reindeer are the very heart of the South Sami culture. Although only a few South Sami have their own reindeer, the reindeer and reindeer herding are one of the pillars of South Sami culture" (Bye and Jåma 2011:44).

This is evident, among other things, in the fact that even though there are few full-time practitioners in reindeer herding, there are many others, primarily family and relatives, but also other Sami and interested non-Sami who help out when there is a need for extra labour. A district manager who carried out a count of everyone involved during the year came to a figure that was three times as large as the number of family members registered in the Resource Accounts. Leif Arne Jåma says that it is common for many relatives to plan their holidays to see this year's event, the calf marking. Many South Sami outside the reindeer herding are also interested in duedtie. Reindeer herding is a cultural anchor *or the glue that holds the South Sami community together.*

An acknowledgement of this is obviously the basis for the MPE's decision in 2016 to reject wind power development at Kalvvatnan in the areas of Åarjel Njaarke and Voengelh Njaarke. In addition to the fact that

> "The sum of established interventions in the district together with the establishment of the wind power plant may prevent reindeer husbandry in the district from being maintained to the extent it has today" (MPE 2016:13). .

states that the Ministry

> "the preservation of the vulnerable South Sami culture and language is a consideration that must also be emphasised when assessing the wind power plant" (MPE 2016:13).

The Supreme Court's ruling on Fosen in 2021 explicitly states that reindeer herding according to SP27 is a form of "protected cultural practice" (Norwegian SupremeCourt 2,021).

7 Reindeer herding at Sør-Fosen

7.1 Overview

Reindeer herding at Fosen is the southernmost of the coast-oriented reindeer herding found from Trøndelag northwards to Troms, see figure 29.

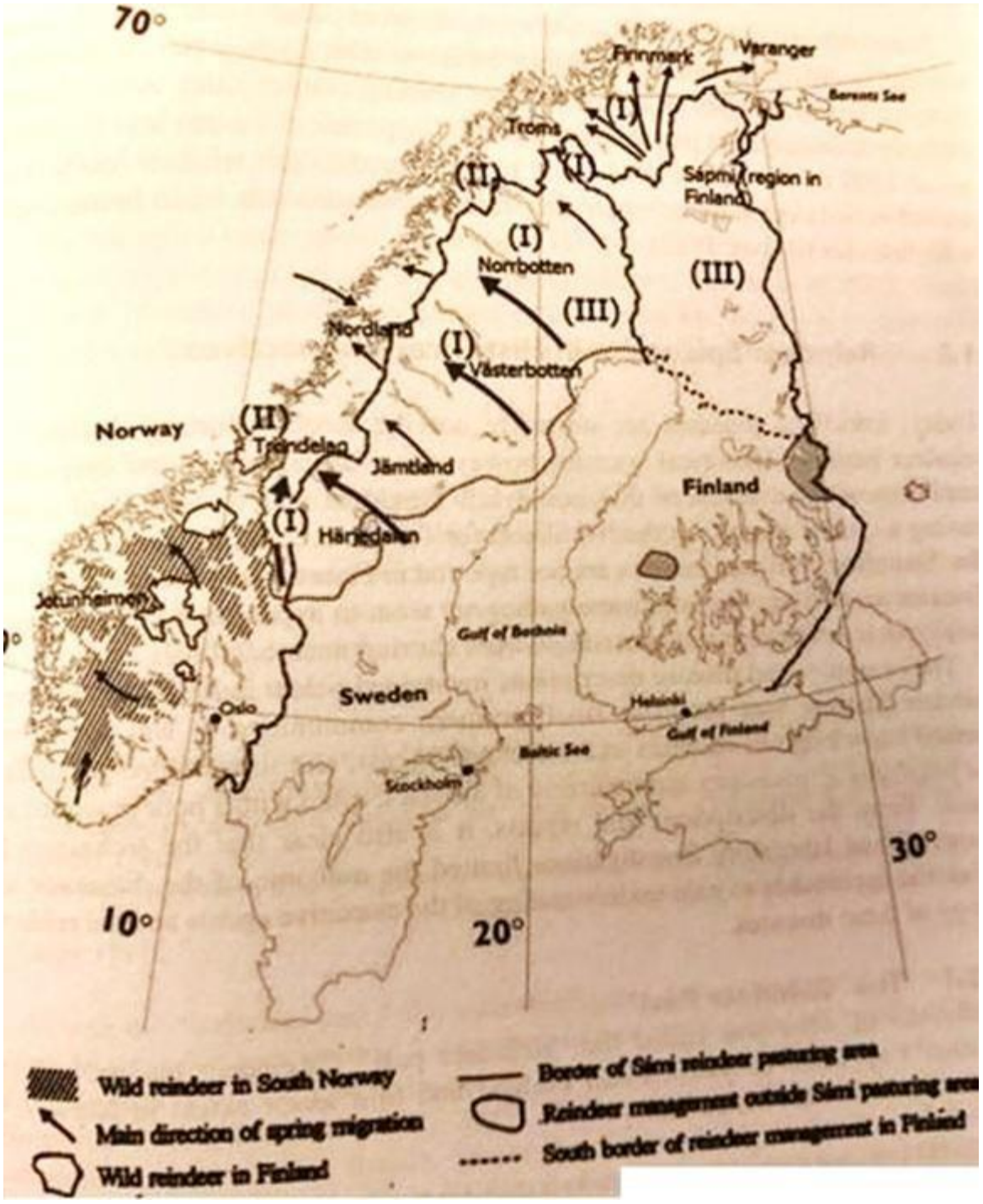


Figure 29. Reindeer and reindeer husbandry in Fennoscandia. (I) is tundra reindeer herding with long migrations. (II) is coastal reindeer husbandry with short migrations and (III) is taiga reindeer herding without migrations (Tryland et al. 2022: 417).

As the figure shows, the continental tundra reindeer herding (I) and coastal reindeer herding (II) have the opposite direction of spring migration, but perhaps just as importantly, the winter grazing landscapes are completely different. While the continental winter pastures are open, often undulating tundra with large landscapes or deep pine forests, coastal reindeer herding has broken landscapes with sometimes dramatic shifts on a small scale.

Figure 30 shows the reindeer grazing districts in Nord-Trøndelag. The Fosen reindeer grazing district is bounded by the Trondheimsfjord, Beitstadfjord, Namdalseidet and Namsfjorden as well as the Norwegian Sea to the west.

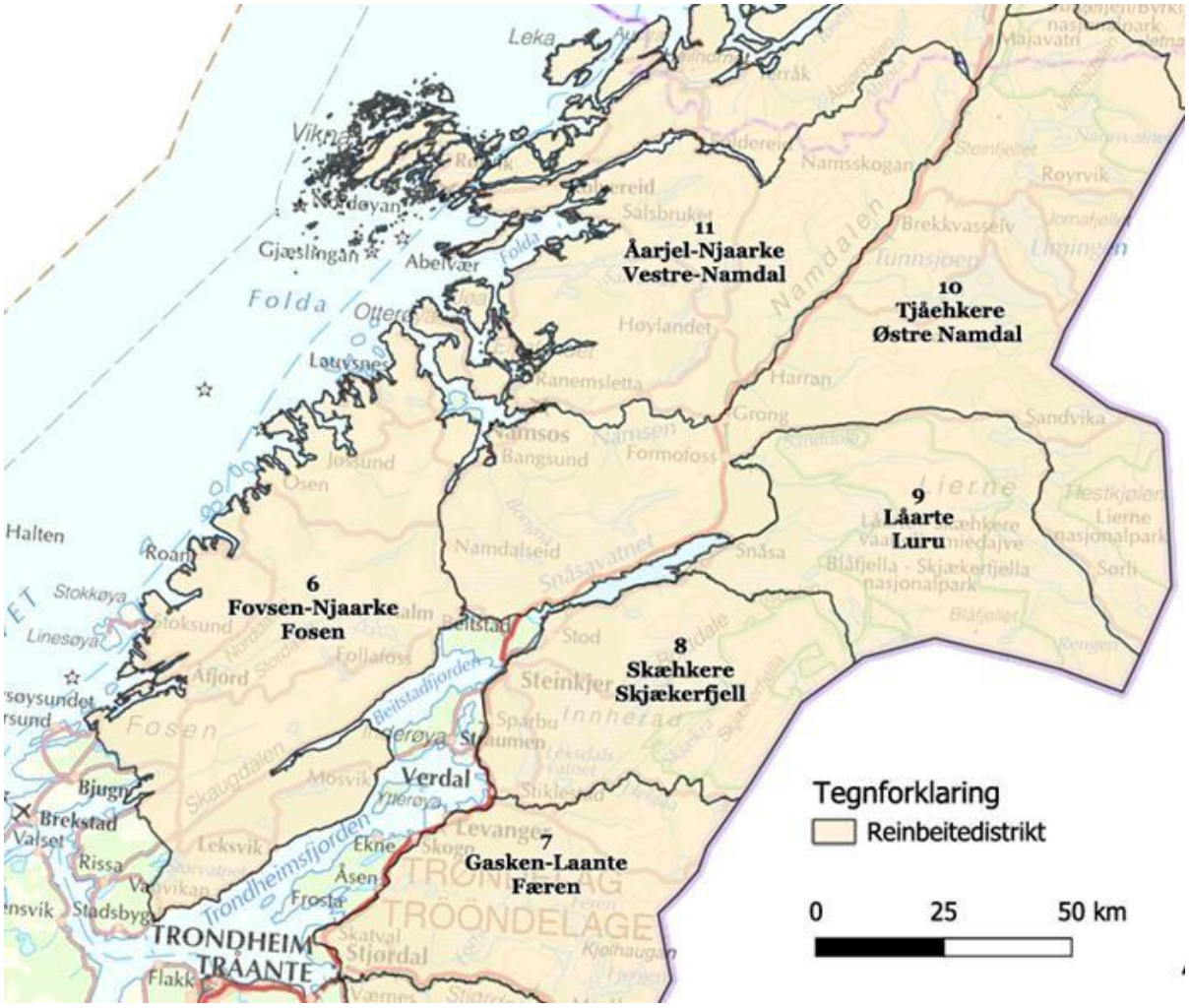


Figure 30. Reindeer grazing districts in Nord-_Tr Øndelag (Norwegian Directorate of Agriculture 2024).

7.1.1 Fosen Reindeer Grazing District23

Fosen Reindeer Grazing District is divided into two districts; Nord-Fosen and Sør-Fosen. They operate separately all year round. The district has a total area of approx. 4,200 km2, divided into approx. 2,200 km2 in Nord-Fosen and approx. 2,000 km2 in Sør-Fosen. The upper reindeer numberfor the district is set at 2100 reindeer and is distributed with 1050 on each of the sijts. Sør-Fosen sijte includes all or parts of the municipalities of Steinkjer, Inderøy, Åfjord, Indre Fosen and Ørland in Trøndelag county.

On the Fosen peninsula, it is the middle areas of the peninsula that are the summer pastures. This is because the highest continuous mountains that are coolest in the summer are here. The summer pastures are lush and species-rich, a variety of grazing plants such as grasses and herbs provide the necessary energy and nutrients for growth and reproduction. These plants are rich in protein and essential nutrients that give the reindeer a good starting point for rearing calves and storing fat reserves for the autumn rutting season and the coming winter.

[23] Leif Arne Jåma's presentation and official statistics

7.1.2 Sør-Fosen sijte

Sør-Fosen sijte consists of three sijte shares with a total of 33 family members. One sijte share has Inderøy as the municipality of residence, while the other two sijte shares have Steinkjer as the municipality of residence.

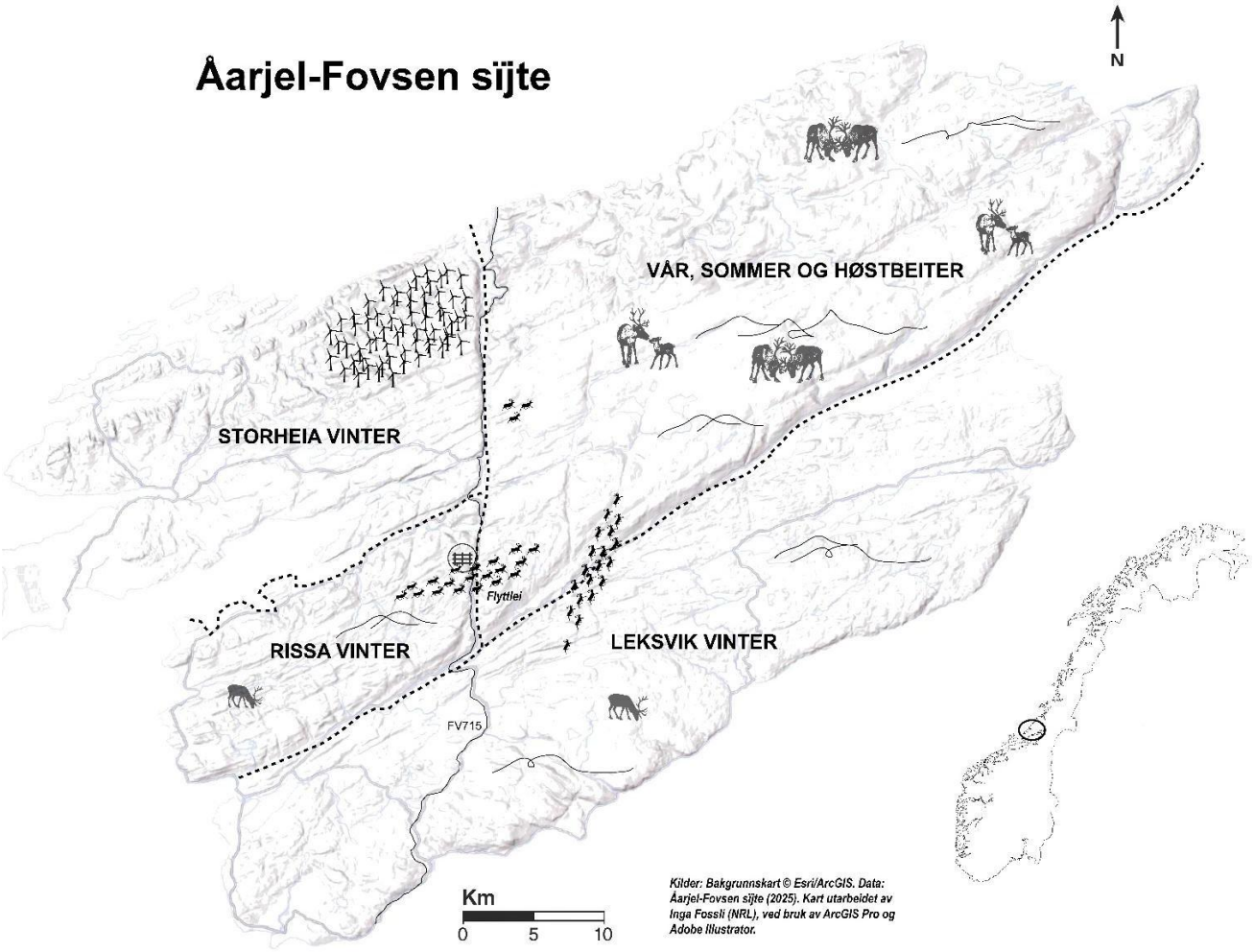


Figure 31. Overview map Åarjel-Fovsen sïjte prepared by Inga Fossli (NRL). Esri/ArcGIS basemap ©using ArcGIS Pro and Adobe Ilustrator.

7.2 Bare ground pastures

Grazing use in Sør-Fosen sijte is approaching a year-round district with a significant degree of overlap between seasonal pastures. In this respect, it is somewhat reminiscent of forest reindeer husbandry in Sweden and Finland (see Figure 21). The exception is the winter pastures; only a small area by the Beitstadfjord around Follafoss overlaps with bare pastures. The other winter grazing areas must be actively moved to.

7.2.1 Spring:[24]

The migration back from the winter pastures normally takes place at the end of April, but varies from year to year depending on the conditions. After the move, the areas east and north of Skaudalen and Austdalen respectively in the municipalities of Indre Fosen and Åfjord, and

[24] Beskrivelsen er hentet fra Eftestøl (2022) som refererer videre til Leif Arne Jåma

towards the calving areas east of Tverrlia and north of

[25] Beskrivelsen er hentet fra Eftestøl (2022) som refererer videre til Leif Arne Jåma

Mefjellet. In the spring, the areas east of Verrastranda towards Follaheia on the south side of Gotvatnet in Steinker municipality are also used.

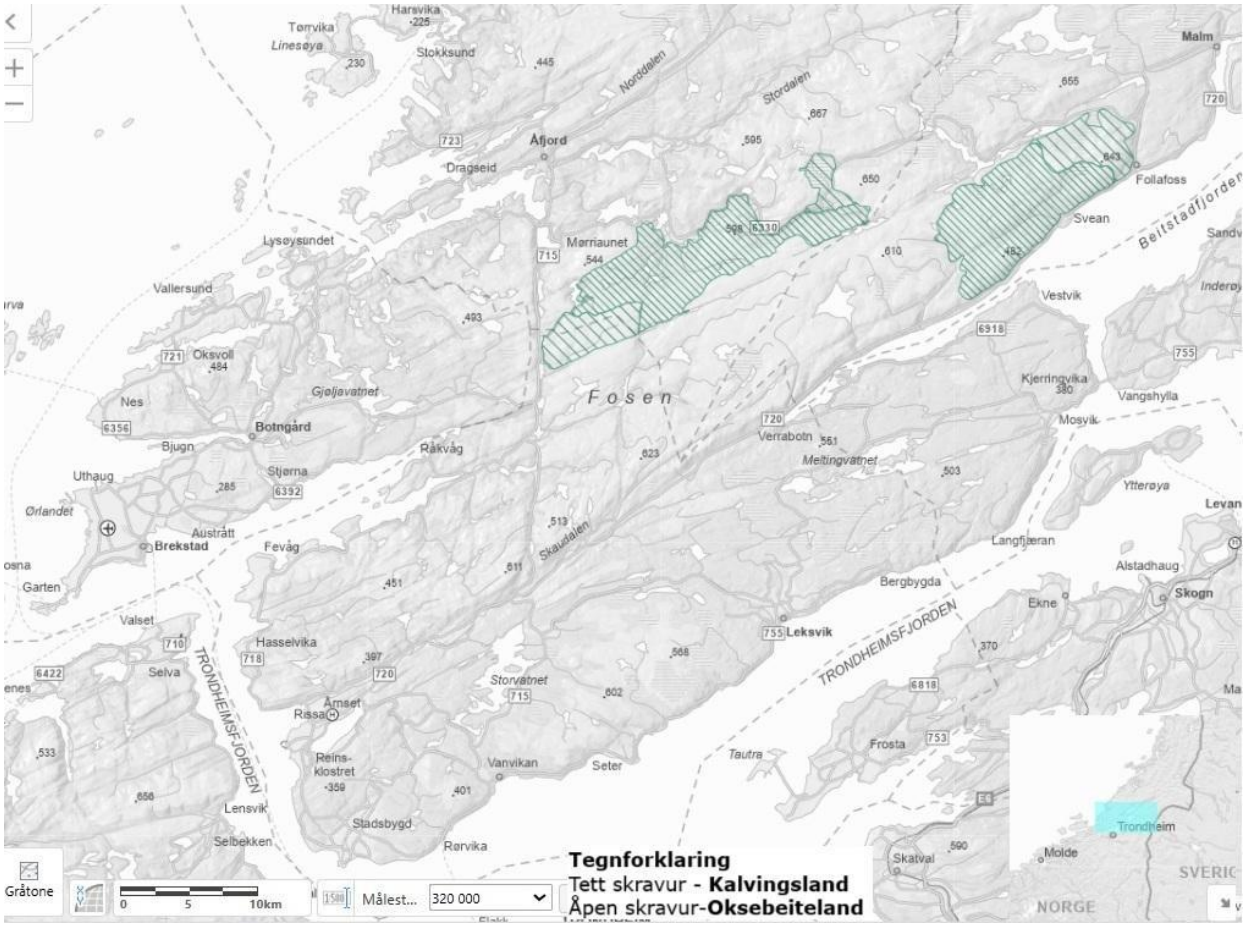


Figure 32. Spring pastures (NVE-Atlas).

7.2.2 Summer: [25]

The traditional summer pastures are in the central parts of Operation Group South's areas, bounded by FV720 to the south, Skorven to the west and Tressvassheia and Storfjellet to the east and north. The areas north of FV 6330 and towards the border of Operations Group North are also used. The calf marking takes place at Heitjønna, at Gurben and at Fiskløysa. In recent years, the bulk of the calf marking has been carried out at Fiskløysa and Mefjellet in Steinkjer municipality. After marking, the herd is driven to the areas north of FV 6330.

[26] Beskrivelsen er hentet fra Eftestøl (2022) som refererer videre til Leif Arne Jåma

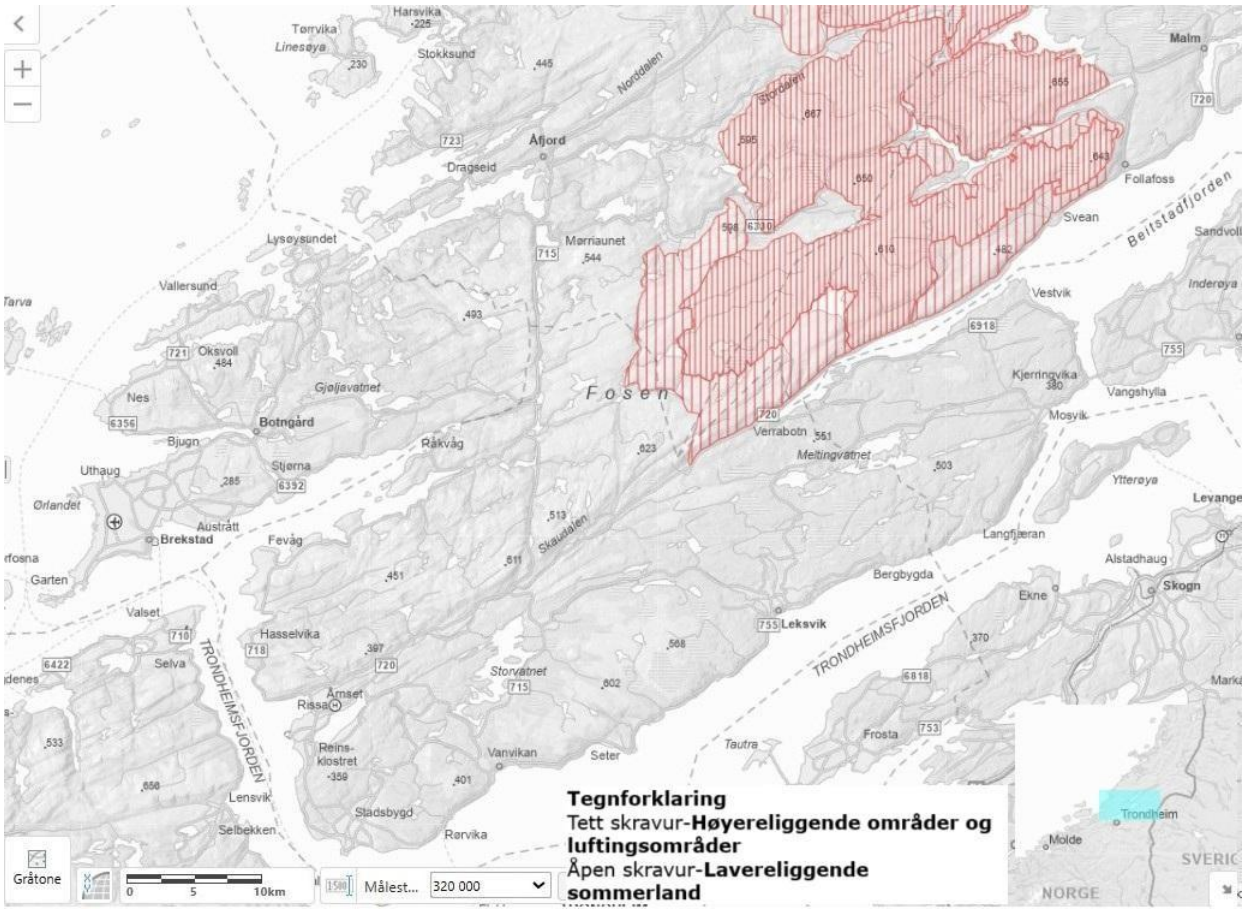


Figure 33. Summer pastures (NVE-Atlas).

7.2.3 Autumn/early winter[26]

The autumn pastures partly overlap with the summer grazing areas and go north towards the border of Operations Group North and west towards FV715, the areas all the way from Skaudalen in the south to Nonsheian in the north are then used. Gathering for slaughter and marking in September usually takes place at Fiskløysa in Verran (Steinkjer municipality).

[2]7 Beskrivelsen er hentet fra Eftestøl (2022) som refererer videre til Leif Arne Jåma

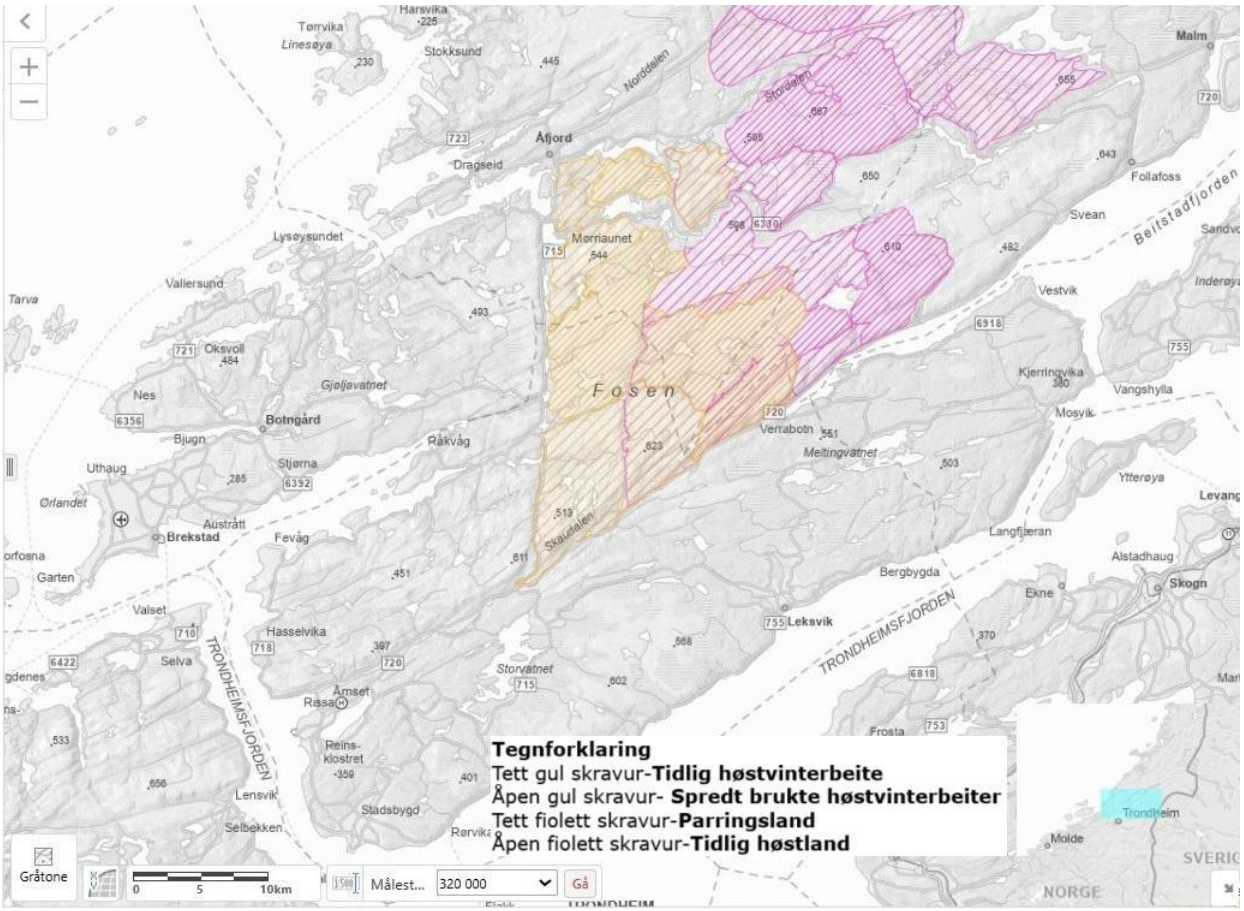


Figure 34. Autumn and autumn winter pastures (NVE-Atlas).

Migration, assembly and relocation27

In the autumn, part of the reindeer herd is on the move from the east. The first to leave are the goats. Rissa winter pasture is a very attractive buck country. Attractive buck land is first and foremost a land where the bucks are left alone for the females. After the rut, they are no longer interested in the females and therefore keep to themselves through late autumn, winter, spring and summer. Once they have reached the winter grazing area, they spread out over the entire area. The females also gradually come migrating in small flocks. The reindeer owners are waiting for snow and snowmobile conditions and suitable mountain conditions. You start the gathering and push those who migrate, all the way east towards Follafoss and from the north from the southern border Nord-Fosen, and follow them so that you gather into a herd, all the way towards Haugsdalen. It is often the case that when the experienced animals have started the self-migration, the remaining herds/animals sense it, and follow the migration direction within a few days. The migration ends up in the areas east of Haugsdalen around Agnetiheian, Kallholtjønnin and Vollaskurven.

Over the years, this migration has become stronger, and the reindeer owners have gradually been forced to monitor along the FV715 over a distance of at least 6 kilometers (Haugstjønnan-Øyan) to guide migrating females so as to limit the possibility of collisions with free-moving females with calves. You try to keep the animals away from the road so that they either get safely across the road and continue west, or retreat east. Incidentally, the reindeer at Fosen never actively migrate towards the roadway due to salt hunger, as is known from Sweden. Leif Arne Jåma believes this may be due to southwesterly winds bringing sea salt with them so that the animals get enough salt.

[27] Based on Leif Arne Jåma's oral presentation

Assembly/moving is many days of work for the sijteandelholders with any helpers. When the sijten expects to have gathered everything, they move across Haugsdalen with a suitably large herd. This migration can include as much as half of the Sijten's flock. It is a demanding operation, and FV715, which is a very busy road, must then be closed. This requires assistance from the police. Helicopters can be used to carry out this move. The reindeer are then put on the fence, and the sijt takes out the slaughter as you should, you parasitize and mark/count. You then move/transport the reindeer to the year's winter pasture.

The accumulation of migration to winter pasture has shifted over the past decades as a result of the change in weather and driving conditions as a result of climate change processes. A number of decades ago, there was stable bare frost from late autumn, so that the first permanent snow fell on frozen ground. Now it is more common for the first snow to fall on ten fields. There can be significant amounts of snow and it can also cause the lakes to be frozen before the ground. This ice is safe and contributes to making early migration to the winter pasture risky.

Gathering and moving takes at least a week and is dependent on stable winter weather. Nowadays, one cannot count on such conditions over time, at least before the New Year. The mountain weather windows you have, are often too short. If you have gathered the herd east of Haugsdalen and there is a storm, you usually have to let up and let the herd go, and then start again when the weather and weather forecast are better. In the worst case, it can be the end of January before you get over.

8. Winter pastures for Sør-Fosen sijte

We have chosen to give the winter pastures a separate chapter because they are the most important, and they are the ones who are directly affected by the development case, so this must be taken extra thoroughly.

8.1 Winter grazing structure28

8.1.1 Items

Figure 35 shows the grazing structure as it would be without human intervention, i.e. seasonal grazing areas and the migratory beds between them. The winter grazing areas (light ice blue) west of Hogsdalen/Austadalen (FV715) while the autumn pastures/early winter pastures (light green) are east of this divide.

[28] Based on Leif Arne Jåma's descriptions

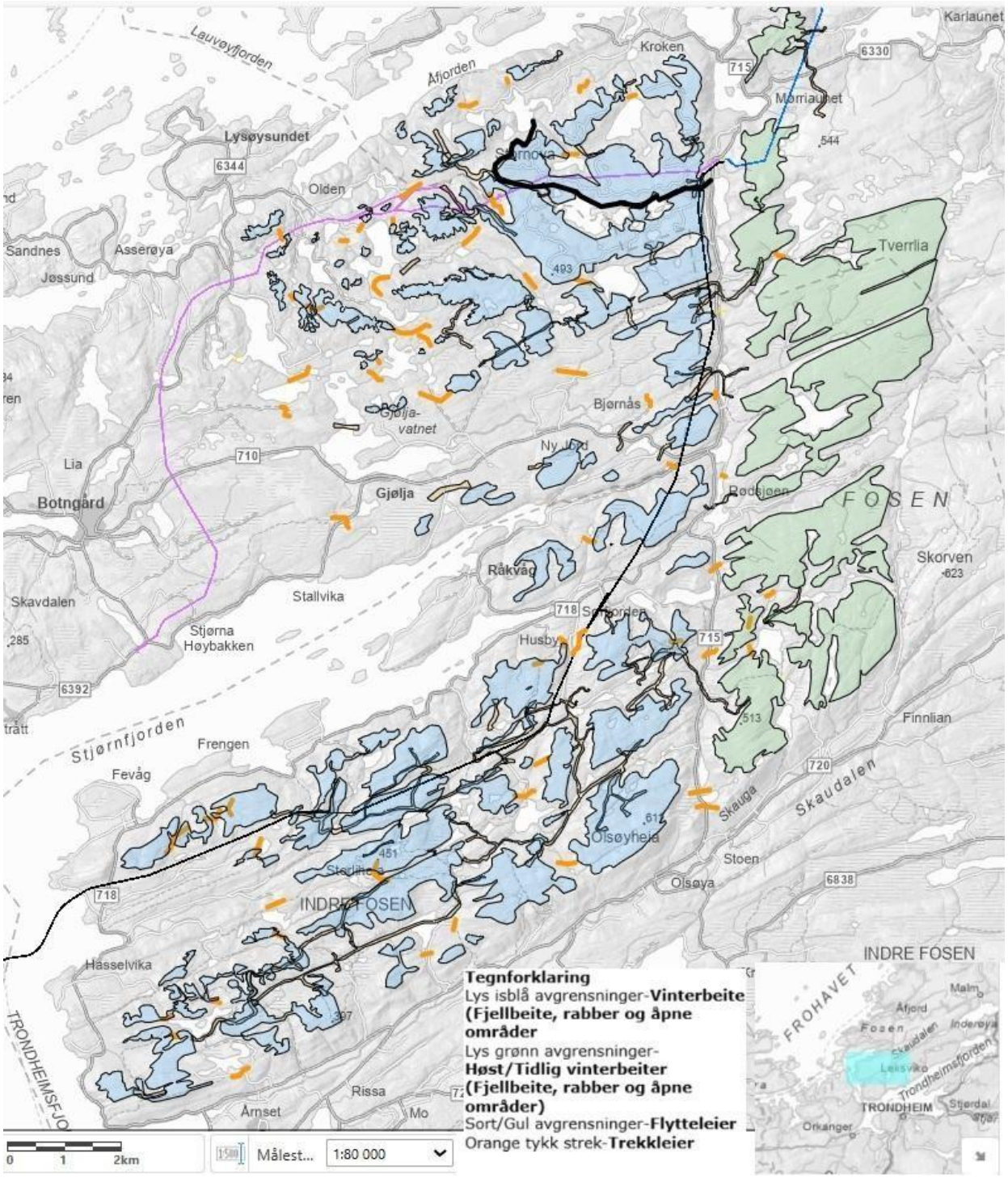
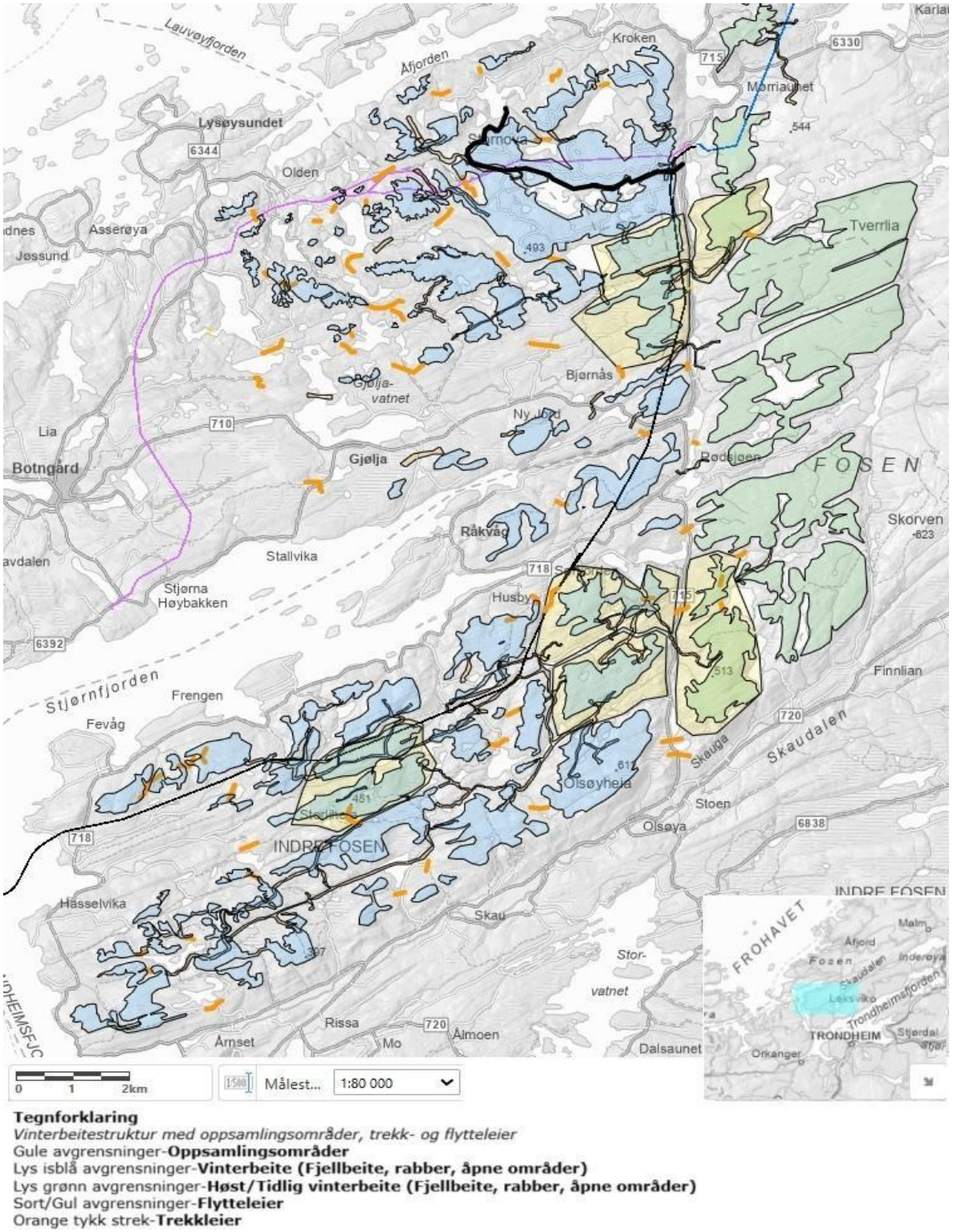


Figure 35. VIntergrazing Structure 1. Grazing areas and migratory beds (LAJ/NVE)

Coastal winter pastures have a landscape that differs greatly from the continental ones, such as in Finnmark and Sør-Trøndelag/Hedmark. The landscape is varied and hilly with some dramatic shifts with many small and large rock cuts and a large difference in height between bare mountains and valley bottoms. This is particularly pronounced in the Storheia winter grazing area. Figure 36 shows bare mountain areas that are divided up by larger and smaller valleys. The valleys have watercourses and marshes and forest slopes up towards the mountains. The many relatively small bare mountain areas appear as "islands" of mountain landscape that jut up above the forest line.

The grazing land itself is the bare mountain islands with adjacent mountain forests. Initially, the "islands" are separate grazing areas, but they are connected by a number of migration beds that allow the reindeer to migrate freely between. The migratory paths are mainly routes that the reindeer themselves choose and use when they want to move in the terrain. A trekklei can be in rough terrain where it is impassable for people with snowmobiles. The people will then have to take a different path to move in the same direction. The marked migratory paths may in cases be the only route that reindeer will use.



Tegnforklaring
Vinterbeitestruktur med oppsamlingsområder, trekk- og flytteleier
Gule avgrensninger-**Oppsamlingsområder**
Lys isblå avgrensninger-**Vinterbeite (Fjellbeite, rabber, åpne områder)**
Lys grønn avgrensninger-**Høst/Tidlig vinterbeite (Fjellbeite, rabber, åpne områder)**
Sort/Gul avgrensninger-**Flytteleier**
Orange tykk strek-**Trekkleier**

Figure 36 Vintergrazing structure 2. Grazing areas with migratory beds, migratory beds and collectionareas (LAJ/NVE).

Migration routes are always where reindeer are easiest to drive forward, depending on the constant shifts in the topography in the direction you want to drive the reindeer. *A migration route is the route where both reindeer and people get around safely*. The location and function of the migration route is also seasonal, i.e. if you move after a lake with strong enough ice in winter, the same migration route is unusable in case of surface water, shiny ice, poor ice or without ice. Open rivers with the size of the water flow (normal or flooded), whether the river is frozen or not, also have an impact on whether the migration route is usable on the days when the reindeer herds are to be moved.

A moving path often has better functionality in one direction and poorer functionality in the opposite direction. This is often dependent on the terrain formation and the reindeer's willingness to be driven and move up the terrain versus the reluctance to be driven down the terrain. The day's wind direction, weather, temperature, snow conditions and season also play a role in the progress of moving the reindeer herd between A and B.

The migration routes that are drawn as long contain several bottlenecks along the way, i.e. the migration route has only one possible passing point in several places along the way. The short migration routes that have been drawn are *bottlenecks*, and often the only place where it is possible to move reindeer between A and B. If, for example, 3 -4 bare mountain areas are one after the other like "pearls on a string", and the only migration route that is the entrance to these 3-4 areas is closed, the consequence is very serious.

The migratory and migratory paths are part of the grazing area, and not a place that is only used for relocation. but also has great grazing value. The migratory beds are also migratory beds.

The staging areas are areas where smaller reindeer herds, here from several "islands", are actively gathered together into a common herd before moving along a migration route. Note that the collection areas are also marked as grazing areas at the same time. The optimal would be if one can use well-being land or unifying terrain (*oktilaš eatnamat*) [29] as collection areas

8.1.2 Overview

Sør-Fosen sijte has three main winter pastures in the west. These are: 1) *Leksvik winter pastures*, i.e. the areas south of FV720, 2) *Stornova/Nyvassdalsheian/Storheia winter pastures*, i.e. the areas west of FV715 and north of Nordelva and 3) *Rissa winter pastures*, i.e. the areas west of FV715 and south of FV718. In addition to these three main grazing areas, Sijten also has a small winter pasture in the west (*Lakshaugan winter pasture*, referred to on most maps as Aunfjellet) that is isolated from the other areas (due to the Nordelva watercourse and FV715) on the south side of Nordelva, see figure 36.

In addition to these western winter pastures, Fosen South also has winter pastures in the far east (around and southwest of Follafoss). Due to barrier effects and distances between the different winter grazing areas, it is difficult to change the use, i.e. move between winter grazing areas, once the animals are within an area. Reindeer herding emphasizes that it is the western winter pastures that are traditionally preferred. This is because these pastures have more flexibility in relation to icing problems and locked pastures.

Before the wind turbine establishment , Sør-Fosen sijte has periodically alternated, often for up to 10 years at a time, between using Leksvik winter pasture, *Storheia winter pasture and Rissa winter pasture.* The fact that one winter pasture is used for several years in a row before it is allowed to rest for a longer period is necessary, as a new tradition must be built in the herd every time such a main shift is made. The first year you are going to a new winter pasture, it can be difficult to get the animals there. It may also be the case that the

animals spread out into unwanted areas after the animals are released because the animals are not known in the area. While the following year, the animals remember to a greater extent that they have been driven here earlier and the drive then becomes easier (the reindeer owners themselves also become more familiar with the animals' reactions and the effect of various bottlenecks).

[29] Terrain that allows the reindeer to stay there (Kvaløy 2018. Riseth and Johansen 2019).

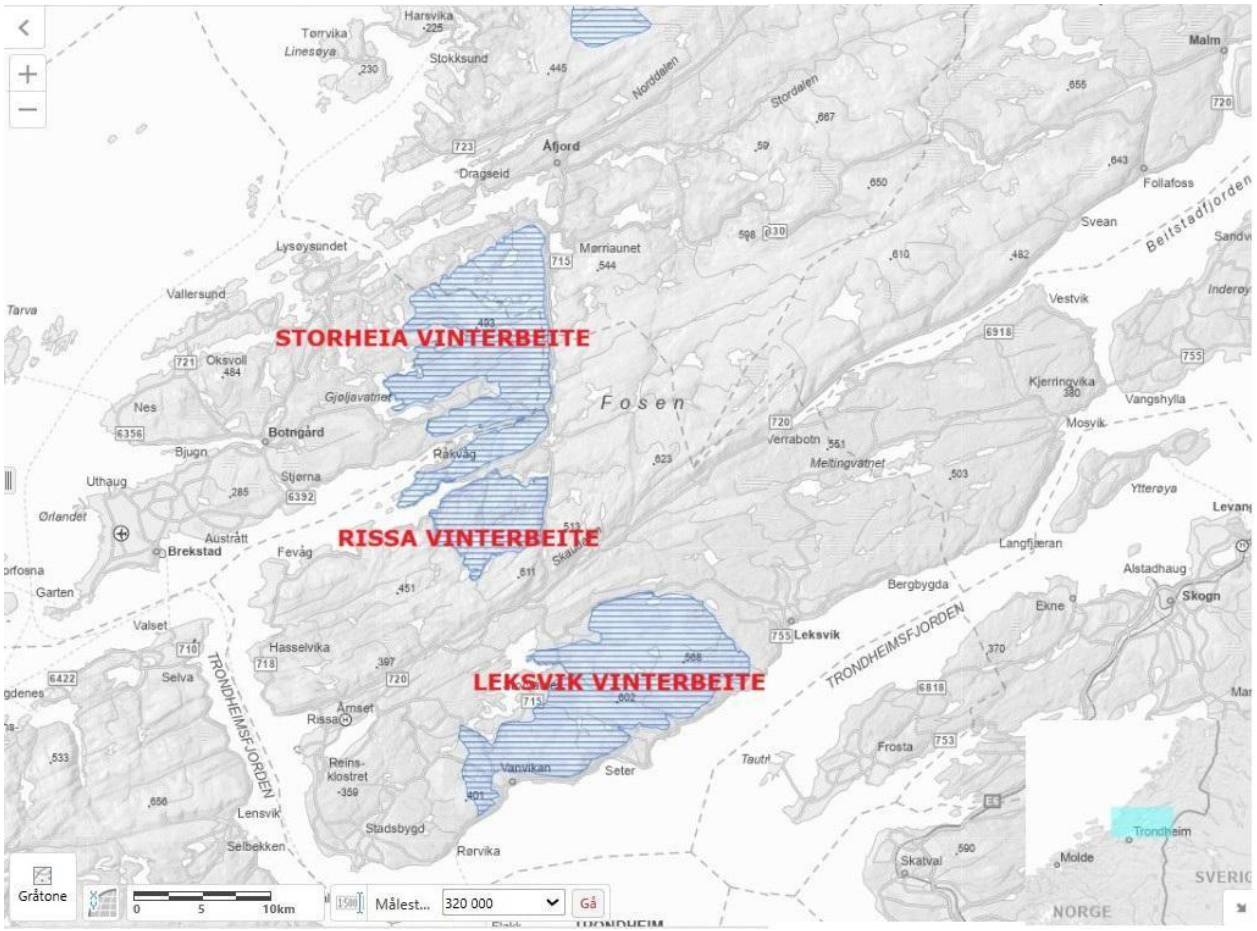


Figure 37. Sør-Fosen sijte its winter grazing areas (NIBIO: Kilden - reindeer husbandry).

Gradually, new traditions are built and both the drive and the general land use of the animals then become significantly more predictable. When the winter pastures are used each year depends on when the snow conditions require it (and make it possible). Usually it is in the pre-Christmas period (but can also take place both before and after). Then the animals are first collected in the autumn pastures and driven to fencing facilities there, usually the slaughter and assembly plant Boernebahke at Skansen in Åfjord or at Haugsdalen at the entrance to the Rissa winter grazing area, right on the west side of FV715. After slaughter/marking, and any separation of the different sijts' animals, the animals are driven over to the winter pastures in a collective herd (different sijts can sometimes be in different winter pastures, this depends on which winter pastures are used and the grazing conditions that year). After the animals arrive at the winter pastures, the animals spread out and the reindeer herding is carried out with supervision throughout the season. The extent to which supervision and edge guarding must be carried out depends on the winter grazing used, the same weather, wind, snow depth, snow conditions, predator activity and human traffic.

It is also important to emphasize that once the animals have arrived at one of the three western main winter pastures, it is very difficult (not possible) to gather the animals again and drive them out and over to another winter pasture. In other words, the animals cannot be moved between the main winter pastures, even if the conditions become poor during the winter where they are. The reason why the animals should not be disturbed on winter pastures is that the food supply is marginal. The females are pregnant and especially the month of March is critical for successful fetal development.

8.2 Rissa winter pastures

We are making an extra thorough description of this winter grazing area as it is this area that will be most affected by the planned power line route if it is established as requested. For the same reason, we also carry out a number of vegetation and grazing descriptions that are assumed to have a more general validity, but with this area as an example.

Large parts of Rissa winter pasture are outside the current district boundary, see figure 38, as the official reindeer grazing district boundary runs in a north-south direction along Fessdalen.

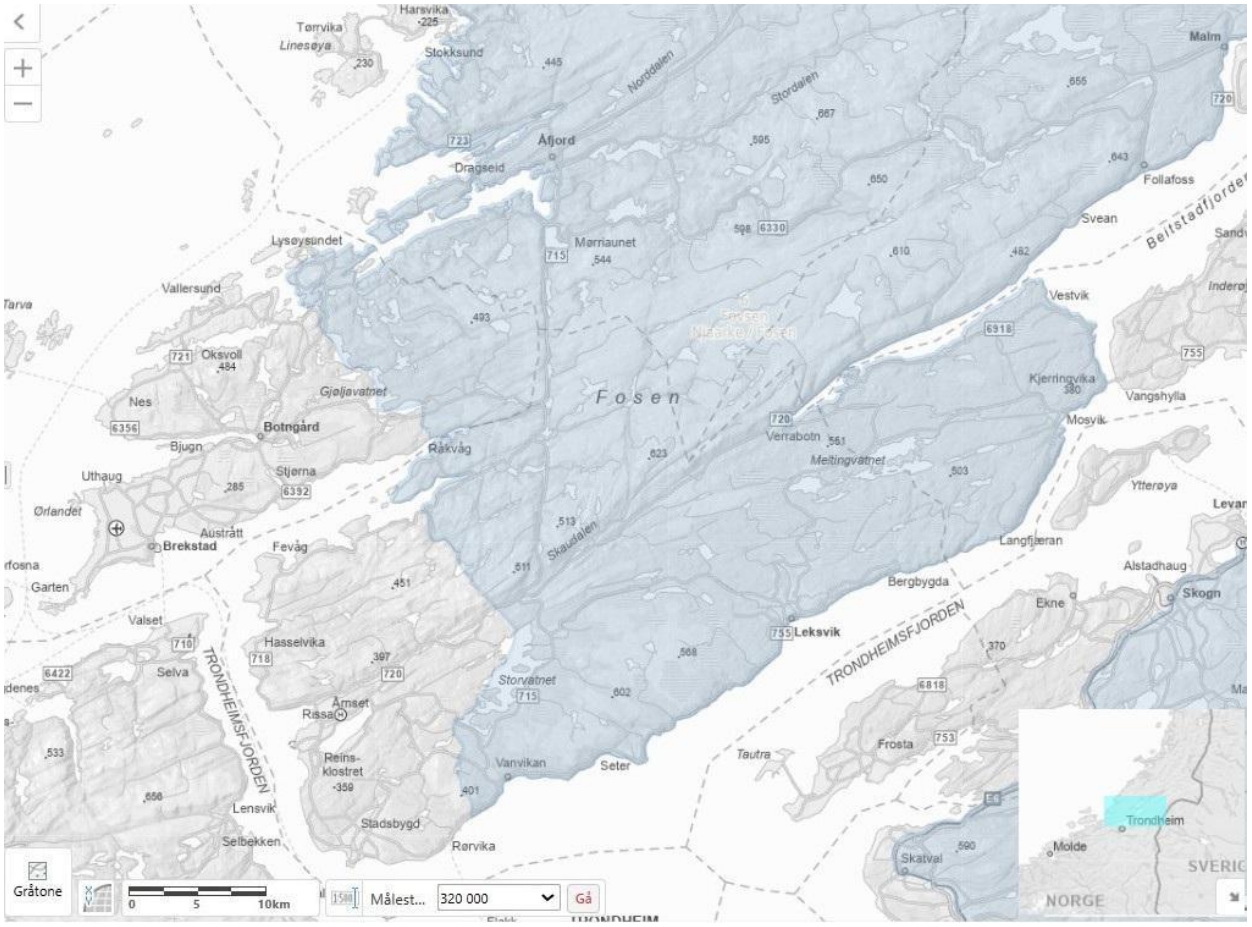


Figure 38. Formal district boundary for the Rissa winter grazing area (Kilden-NIBIO).

However, there is no physical boundary here and the animals migrate further west when the conditions are right for it" (Eftestøl 2022:37). The land southwest of the border has nevertheless been an integral part of Sør-Fosen sijte's farming areas since time immemorial, and the sijten considers that it can claim the right to the area based on ancient use (the district border was established in 1894). Sijten considers it necessary to formalize its right to the entire area of use, but this is an issue that must be addressed when the time is ripe for it in purely procedural terms and is not pursued now.

The exploitable farming area between Stjørnfjorden and Skaudalen is divided in the southwest by the lowland valley Storlidalen, see figure 39, so that Rissa winter pasture is divided into an outer and an inner spit of land of slightly hilly low rock where much of the area is 2-300 metres above sea level with some peaks where Storsalen 489
m.o.h. is the highest in the middle of the area. To the northeastthere is both Jutulheia (521 m.o.h.) and Olsøyheia (611 m.a.s.l.), see figure 41, significantly higher peaks.

.

Figure 39. Storlidalen (Inspection picture MØN/LAJ).

Figure 40. Olsøyheia radar station (Inspection photo MØN/LAJ).

The inner spit of land is somewhat lower in the southwest and, in addition to rabbis, also has extensive marsh areas, see Figure 41. Areas relatively close to the fjord are exploited particularly in the inner south-eastern spit of land (see Figure 42).

Figure 41. Moorland landscape with forest in the depressions (Inspection photos MØN/LAJ).

Figure 42. View of Hasselvika from Årlottheia (Inspection photo MØN/LAJ).

8.2.1 Grazing landscape

Rissa winter pasture can be divided into an inner part, a less obvious middle part, and an outer part, see Fig. 43.

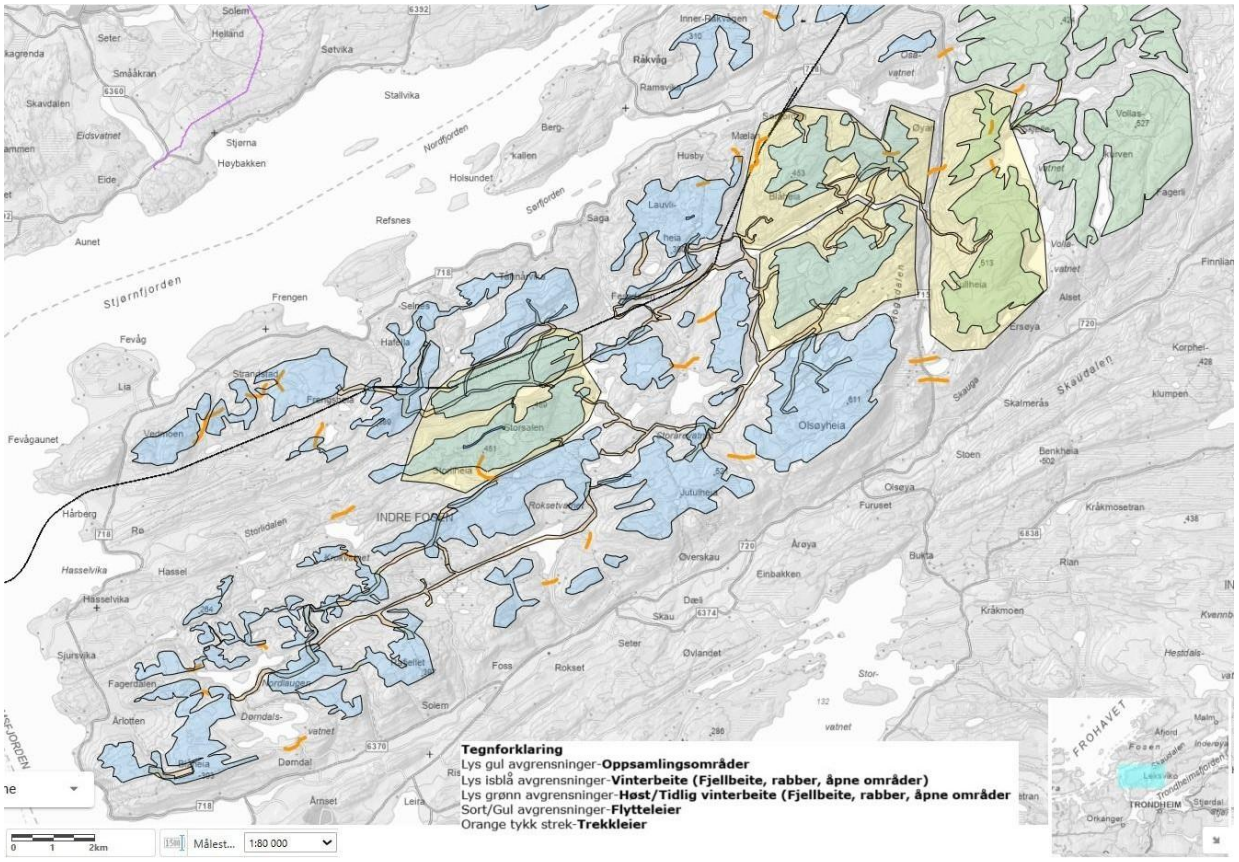


Figure 43. Migratory and migration paths as well as collection areas within the Rissa winter grazing area and the collection area (east of Haugsdalen) used before moving to winter pastures and migration areas over FV715 (LAJ).

Figure 43 shows the Rissa winter pasture as it is used with internal migration and migration paths as well as the collection area on the east side and with the migration path across FV715.

The inner part of the grazing area stretches almost all the way down to the center of Rissa and the Trondheim Fjord. The outer part is divided in two by Fessdalen all the way to Bismardalen so that the southwestern outer part; Slettheia, Blåfjellet and Frengsheia, are partly accessible via migratory beds through Bismardalen and Langvassliheia, parallel migratory beds a little further southeast, i.e. in the middle part, and partly through partly extensive relocation systems from the inner part and a collection area in central Rissalandet.

The inner part is held together by two continuous migration route systems, all the way southwest from Årlottheia to the migration route down to the fence facility in the northeast. The migration route systems from Jutulheia and Olsøyheia lead over to the middle part and Bjørnstokkheia, Brattlandsheia and Ospdalsheia. These migration routes gather in the northeast around Bismardalen and Langvassliheia, where the migration routes gather into a collection area and a migration path down to Haugsdalen and the fence facility and a migration path further over to the collection area east of FV715, see figure 44.

Figure 44. The migration route that crosses Haugsdalen seen from two positions. Note the fence in the bottom picture (Inspection photos MØN/LAJ).

The winter grazing landscape at Fosen consists of bare mountain ravines surrounded by mountain forest. Figure 45 can illustrate this.

Figure 45. Rabber and mountain forest at Nebbesheia (Inspection photo MØN/LAJ).

Central to the picture from Nebbesheia are partly bare mountain ravines, but there are forests in the valleys and marshes with ponds and small lakes lowest in the depressions. At the lowest point in the valleys, we can identify spruce forests. Further up towards the rabbi there is a mixed forest of birch and spruce. The birch is easily identifiable due to its autumn colors. In the rock crevices between the rabbis, shrubs and small trees also grow.

8.2.2 Bare mountains and lichens

Many who have studied ecology have learned that winter grazing for reindeer is found in the open mountain landscape where the wind blows ravines and sloping terrain free or virtually free of snow. We see an example of such rhyme vegetation in Figure 46. However, this does not make up the entire winter pasture, especially on the coast. At Fosen, the uppermost mountain forest adjacent to each of the "islands" constitutes *supplementary winter pastures that are regularly exploited in combination with the mountain ravines.* This is a peculiar dynamic that we will describe in more detail in due course.

As we have described above under Reindeer herding's annual cycle, see 2.2.7, it is the snow cover with its thickness and consistency that determines the grazing conditions in winter. As we have referred to Heikkilä (2006), it is the digging conditions (goaivvvesguohtun) that determine whether the reindeer have access to the vegetation on the ground. In a "normal" winter, the issue is often how long the snow will stay dry so that the reindeer can burrow down to the lichen.

Figure 46. Rabbe vegetation at Storsalen (Inspection photo MØN/LAJ).

The picture from Storsalen shows a grip heath where you can identify both grip heather, *mountain cricket* and *grey reindeer sedge sedge*. While lichen species are most important in winter, sedge sedge is important in spring.

The design of the mountain rabbles on the coast, such as Fosen, is different from that inland. We will return to this in a later section.

As mentioned above, the main challenge for access to the ground lichens is mild weather with subsequent freezing and thus the formation of layers of ice, which can become impenetrable. In moderate mild weather and subsequent winds, the snow can dry up. Climate change means that over time there will be more mild weather, and the question then becomes how many mild weather can be tolerated.

> The reindeer herders at Snåsa, which is inland, but still within the range of the western weather, have previously stated that *"The snow can withstand two to three mild weather periods with rain and cold in between before it becomes too hard and inthe saddle for the reindeer to burrow down to the lichen"* (Bye and Jåma 2011:172).

Leif Arne Jåma comments on this as follows:

> *"At least nowadays, there are more mild weather periods at Fosen than two to three, maybe five to six, but sooner or later the snow layer in the forest becomes completely impenetrable, and then the ground grazing in the forest becomes inaccessible, while there is still tree grazing in the forest. What then happens on top of the bare mountain is .. that the rabbis will be only*[i.e., in late winter] *so that there is available pasture up there, but it will always be in the same places, but they will also be heavily grazed."*

In addition to the ravines in the mountains, there is also, as mentioned, supplementary low grazing in the forest closest to the mountain.

8.2.3 Forest winter grazing

This topic needs a general introduction, both because it is not so widely known, and because it is especially important in Fosen.*Arboreal* (i.e. tree-dwelling) lichens are lichens that grow on branches (hanging lichen) and trunks (crustal lichen) of trees and shrubs. It is well known that they grow on common forest trees such as pine, birch and spruce. In contrast to the ground lichens, they are not very exposed to "locked pastures", i.e. ice formation as a result of alternating thawing and freezing of the snow, which prevents the reindeer from reaching the ground vegetation. [30] Figure 47 shows reindeer eating crustal lichen, probably a twig lichen.

Figure 47. Reindeer eating twig lichen (?) on the trunk of birch (Photo: MØN)

The importance of the hanging lichens is known both from research, recorded traditional knowledge (Ryd 2001) and experiences from other reindeer herding. According to Johan Rassa from Jokkmokk (Ryd 2001), henglav is a supplement and not the reindeer's first choice, but *"it is still good food for the reindeer that can.... ... live almost a whole winter on slahppo*[henglav]» (Ryd 2001:205).

It is also well known that arboreal lichens have been of great importance as emergency grazing in continental areas, especially in late winter. The challenge is often that much of the lichen grows too high up for the reindeer to get hold of it. Rassa says that both spruce and pine have hanging lichen, but that spruce is best as the trees have branches all the way down

30Especially in continental areas with severe cold, hanging lichen can also be highly exposed to encapsulation in snow or hoarfrost (Hel le et al. 1982).

Figure 48. Spruce with ring lichen (Ryd 2001:210)

to the ground (Ryd 2001). In the past, it was also common for reindeer owners to cut down low-bearing trees to provide emergency feed for their reindeer (Helle et al. 1982, Turunen & Vuojala-Magga 2013).

In special situations with large amounts of snow, it may happen that the reindeer stand on top of the snow cover and feed on the lichen. Gabna Sami village, for example, managed through the big snow winter 2016-2017 by moving down to an area of old-growth forest with 2-3 meters of snow so that the reindeer had access to hanging lichen (Erik Anders Niia, pers. med.).

Leif Arne Jåma says that in particularly snowy winters, Fosen can have up to one and a half meters of snow, so similar grazing on hanging lichen with the reindeer standing on top of the deep snow can also occur there.

Common species for hanging lichens are;*beard lichen probably* e.g.*dark beard*(Bryoria fuscescens),*Old Beard*(Alectoria sarmentosa), also hides elkhorn lichen, which is very palatable, and for scab lichens; snow target lichen; and probably e.g.*common Twig lichen* (Hypogymnia physodes) and globular lichen (Hypogymnia tubulosa).

Line Valuation of Henglavrike spruce forest areas in Västerbotten and Norrbotten showed from 0.3 - 34.3 kg/ha for old man's beard (Alectoria sarmentosa) and 16.9 - 35.2 kg/ha for Bryoria spp. Calculated fallout ranged from 0 - 8.5 kg/ha per examination. Calculated compensation with additional costs equivalent to SEK 70-80 per reindeer per year (Sparrevik, 1984).In today's amount, it would be equivalent to 190 -217 NOK. Unfortunately, there are no estimates for this either for Fosen or other coastal areas in Norway.

These lichen types have been very widespread throughout the reindeer herding area in Fennoscandia (Warenberg et al. 1997). In Canada, more specifically in the southern interior of British Columbia, there are forests where a relative of our Scandinavian mountain reindeer (*Rangifer tarandus tarandus*) called Deep-Snow Mountain Caribou (*Rangifer arcticus montanus*) still survives the winter on hanging lichens (Bryoriaspecies and Alectoria sarmentosa) which is an excess that falls from spruce forests (Picea abis) older than 120-150 years. This is called the "Manna effect" (Goward m.etc. 2024).

Figure 49. Examples of arboreal (tree-dwelling lichens). Photo: MØN.

Several researchers havestudied the role of the hanging lichen as crisis food in Finland. Right up until the 1970s , they contributed to reindeer herding in the central and southern parts of the reindeer herding area, which has a lot of coniferous forest, having less than the northernmost part as open tundra. The development of surface forestry and industrially produced supplementary feed has led to increasingly extensive supplementary feeding of reindeer, especially in the southernmost reindeer herding area (Helle m.etc. 1982, 1990, Helle & Jaakkola 2008, Turunen & Vuojala –Magga 2013). The role of the hanging lichen as an emergency feed in Sweden and Finland has now largely been replaced by industrially produced supplementary feed. The terrain in Norway is not as attractive for flat forestry as that of neighbouring countries, so that hanging lichen still plays a role in many districts in Norway, especially along the coast.

Figure 50. A little manna from the birch forest Photo: MØN.

Rassa also describes how strong winds can make hanging lichen accessible: "*If the wind*

blows hard, a lot of hanging lichen comes loose and falls down on the snow..... This is most important if the ground grazing is poor" (Ryd 2001:197). Leif Arne Jåma can confirm that *"we have experienced that when these winter storms pass, there isa lot of lichen that stays on the snow, so if it does not snow down immediately, it will be*

*A lot of food in the forest from it too."*The manna effect thus plays a certain role at Fosen as well. In addition to this, it is the case that in untouched natural forests, the trees grow old and dry up. Finally, they go to the ground. Dry individual trees can have large amounts of beard lichen, which provides a lot of reindeer food.

Nils Johan Kappfjell (pers. med.) in Voengelh Njaarke explains that the coastal winter pastures in Helgeland are often peninsulas with bare mountains at the top and forest below; preferably all the way down to the sea. The forest is often mixed forest with both birch and/or spruce and pine. A lot of lichen grows on the trees and due to high humidity, the hartwood lichens along the coast have good growth. Kappfjell confirms that reindeer on coastal winter pastures can choose to migrate down to forest pastures even if there are good conditions with available ground lichen on the bare mountains. This is especially common in February and March.

> "We may experience coming to a limited grazing area where they know there is supposed to be a reindeer chef, but when we get there, it is completely gone. Then we have to send the dogs down into the forest. They chase them up, and then the jogger is there."

The winter storm reindeer trees are low and the girth accessible to the reindeer. Voengelh Njaarke thus also benefits significantly from the manna effect. In the Røros area, it is also common for the reindeer to go down into the forest twice during the winter (Inge Even Danielsen, pers. med.). In Åarjel Njaarke sijte (Vestre Namdal reindeer grazing district), some reindeer, especially bucks, have developed a habit of migrating down from the mountains to forest pasture occasionally (Arnt Ove Toven, pers. med.). Research colleague Hans Tømmervik (pers. med.) has experience from several districts in Helgeland where the reindeer go down into the forest to eat hanging lichen, especially in early winter. A sign that the reindeer have been in the forest is red urine. Leif Arne Jåma confirms that the reindeer at Fosen also have red urine towards spring. We do not know of any explanations for the color red.

At Fosen, when it freezes up on the "islands" in the bare mountains so that the reindeer do not come down to the ground lichens, the forest also functions as emergency grazing so that the reindeer migrate down into the mountain forest. It then grazes on the hanging lichens until it dries up again in the mountains as a result of fresh snow, wind or increased temperatures. In the last weeks of early winter, before moving out from the winter pasture, it is also these mountain forests that ensure that the reindeer survive even if it freezes and becomes hard in the mountains. In the grazing landscape at Fosen, a special type of spruce has an important role.

Advance/Spruce Egg

,

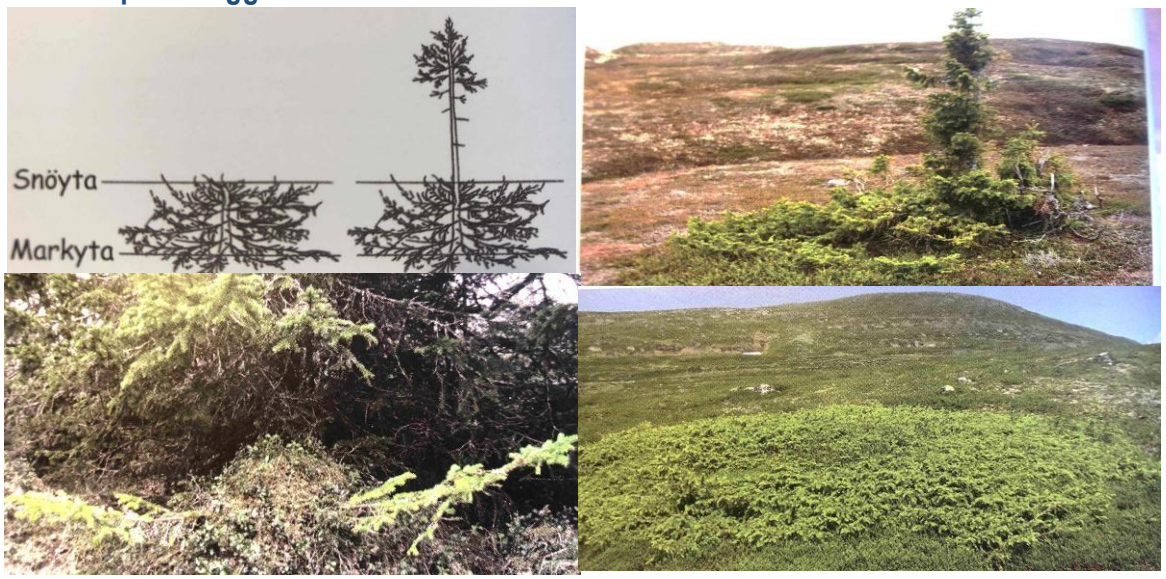


Figure 51. Spruce branches on a turn to take root (left down). The snow protects the lowest branches from mechanical damage (left top). Spruce scrub (right down). Spruce with vegetative offshoot (right above). (Öberg

and Kullman 2013:7, 8,12).

New research on the oldest history of spruce (Kullman 2001, Öberg & Kullmann, 2013) has revealed thatancient klong cranes in the transition zone between mountain birch forest and bare mountains develop special

growth forms. They can be several thousand years old. There are measurements of such trees in the Røros area; They have been documented up to 6500 years old. These are typically tree line vegetation and they have a certain low growth. Similarly, spruces on the edges of marshes are often full of lichen. They are small and tiny, but very old (Ryd 2001:212). In both cases, we are talking about tree individuals living under generally marginal growth conditions. In Southern Sámi, these spruces are called framhte (Bergsland and Mattson Magga 1993) and in Norwegian *spruce eggs.*[31] It is often short-grown or math-shaped. These are trees that grow in depressions where there is a lot of snow for a large part of the year, see Figure 52.

The hard-packed and heavy snow presses the lower branches down. By the lower branches being pressed down by the snow and gradually overgrown by moss and humus, they take root. Eventually, they form new shoots and stems and can "wander" horizontally. In an environment characterized by snow and wind, they continue to grow, guided by the prevailing direction, on the leeside of the original tree. If the original tree trunk is damaged/disappears above the snow surface, trunks and branches that are protected by the snow cover grow further, and can develop into a low thicket that is still the same tree individual.

These growth forms mean that tree-growing lichens can be found relatively close to the ground and are easily accessible to the reindeer. The largest biomass of lichen on such spruces is soybean lichen (Usnea spp.) and bearded lichen (Alectoria spp.), as well as a good number of twig lichen (Hypogymnia physodes) and elkhorn lichen (Pseudevernia furfuracea). There are also rare lichens on such spruces, but they make up very little biomass (Jarle W. Bjerke pers. med.).

Figure 52. Moose horn lichen on the front/spruce edge (Fosen) (Photo: LAJ)

[31] The word is familiar among grouse hunters and in grouse hunting literature as such bushes are a habitat for grouse.

8.2.4 Grazing dynamics around the forest line at Fosen

At Fosen, the exploitation of the hanging lichens and mountain forest pastures is more intense than previously described in Fennoscandia. The forest pastures are not only used when there are difficult grazing conditions on the bare mountains. They are also used throughout the winter, even when there is good grazing on the bare mountains. The animals often have a daily migration where they migrate up and down between the bare mountain and the forest/marshes. To understand winter grazing at Fosen, one must know both the design of the mountain forests along a height gradient and the dynamics of the reindeer's grazing use, see figure 53.

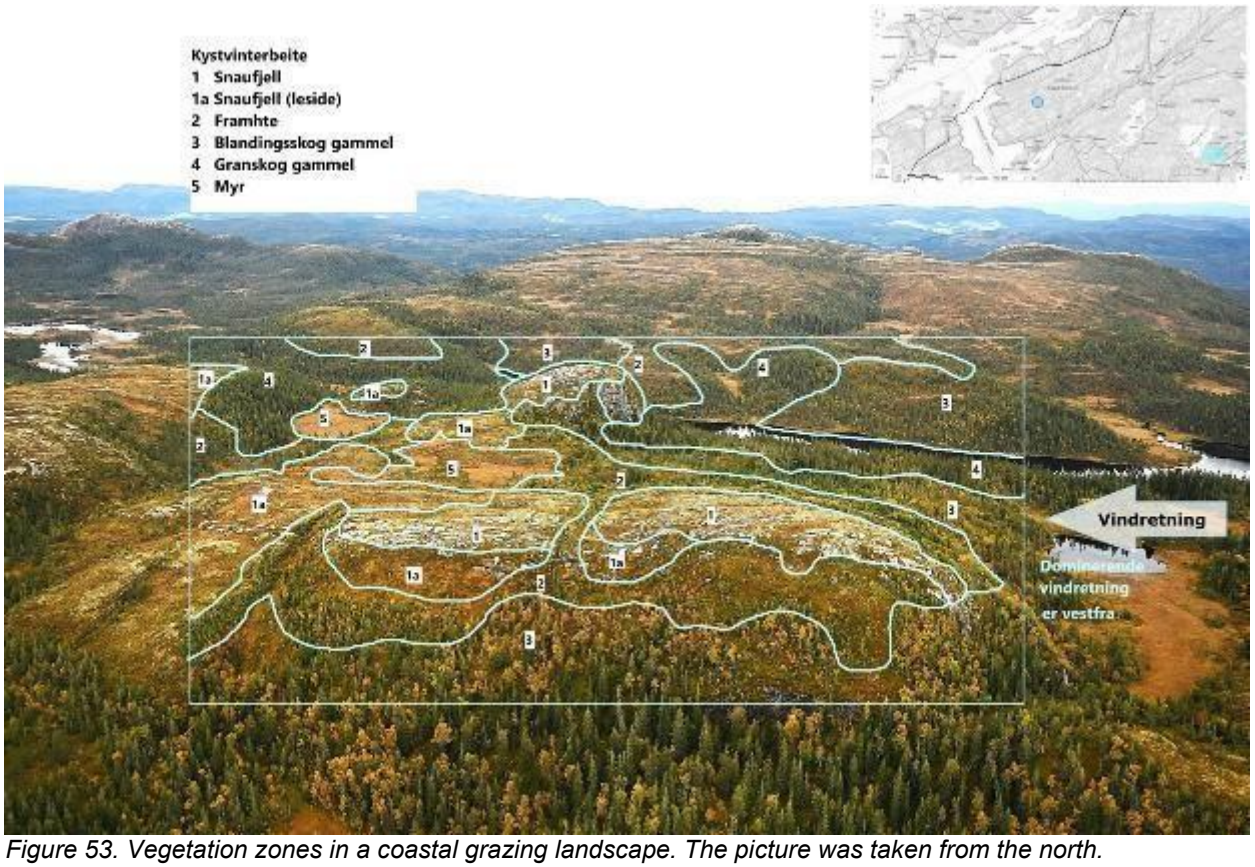


Figure 53. Vegetation zones in a coastal grazing landscape. The picture was taken from the north.

With direct reference to figure 53, coastal winter pastures can be divided into zones along a height gradient:[32]

(1) ***Bare mountains; blown off ravine**, preferably grippy heathland, with available ground lichens and crustal lichens.* Zone 1 is usually accessible throughout the winter, except in periods when the alternation between minus and plus degrees on the snow cover forms layers of ice. The ice layer remains until a longer period of mild weather, over several days of rain and wind, thaws away parts of the ice layer. Such periods of ice occur several times throughout the winter, and the gradually higher winter temperatures over the last ten to twenty years, where the temperature in winter more often varies around zero degrees Celsius, means that the field lichen pastures have a more unstable availability than with temperatures stable on the minus side.

(1a)***Leside ravine**, with greater snow depth and more rice/heather crops and lichens that are less grazed.* Zone 1 a is lowland grazing in lesions. This zone has a larger proportion of heather and various grasses and sedges. This grazing zone is normally accessible in early winter, before more snowfall and wind fill up this grazing zone, so that the pasture becomes inaccessible until the arrival of spring when the snow thaws away.

(2) ***Framhte/spruce eggs**; Low-growing primordial spruce with twig lichen grazing*
These are small and weather-exposed spruce trees in clusters. These spruce trees can be several hundred years old (see explanation above). On these trees, both elkhorn lichen and other lichen

species grow.

[32] LAJ's explanation

(3) ***Old mixed forest of spruce*** *and birch with twigs, crust and hanging lichens*

(4) ***Old spruce forest****, natural forest that is not commercially viable, or that it has been harvested. This ancient forest has twig, crust and hanging lichens*

(5) ***Ants****- are commented below.*

Leif Arne Jåma, with reference to figure 53, describes an example of how the reindeer can exploit this grazing landscape once they have grazed on the rabbles in the foreground of the picture (1):

> "If any reindeer wants to move here [to the rabbis at the back of the picture], .. Then they walk in the forest here [a small forest valley between the bare mountain crags]. when they have finished grazing ... then they move on, then they can graze down here [a part with (2)] and over here [a valley with (3)], then the next foraging period will be over here [a rabb further back in the picture],
>
> **..**We get a smooth transition between bare mountain pastures, forest pastures and rest periods, before they move on again. They probably eat at night, because when they wake up and get up, they start grazing, then they go out during the day, then they lie down and take a "siesta" with trout in the middle of the day, but if they are disturbed then, e.g. by a skier who is going by. and up to Storsalen, to write himself into the book, then this period of time is interrupted. so that at least the digestion will be interrupted."

Jåma also describes what it can be like when they come and collect reindeer from one of the "islands":

> "*We often see that there are tracks down in the forest, we have to go down into the forest and make noise and cackle to get them up on the bare mountain. … If they are left alone in the woods, if they are going to rest and take the next part of the digestion process, to eat, then either they pull up on the snaula and lie and eat there, or that*
> *They find an open marsh in the forest and lie there.."*

This can be somewhat reminiscent of the pattern known from summer grazing on high summer grazing mountains; grazing down on the slopes at night and trampling at altitude during the day, preferably on snow patches/glaciers to avoid insects.

Leif Arne Jåma states: **"All these types of grazing zones in coastal winter pastures are absolutely necessary for the survival of the reindeer and the maintenance of their production capacity.*The reindeer graze rotationally in all the grazing zones, regardless of whether the ground lichen pastures are available or not*."**

As far as we know, this particular type of rotational grazing between several grazing zones in coastal winter grazing has not been described previously. It is hardly unique to Fosen as the topography and climate are more or less similar in several districts northwards along the coast. We have received indications that forest grazing is used as more than emergency grazing in both Åarjel Njaarke and Voengelh Njaarke.

However, an intensive study of the winter grazing behaviour of reindeer on low pastures in the inland pasture of the Kyrö reindeer herding cooperative in northwestern Finnish Lapland has revealed a different type of rotational winter grazing. The reindeer graze on a well-accessible low-lying pasture with dry and light snow from October to April, but from January on, they still regularly go to marshes or lake beaches to eat sedge and grass. This increases towards spring when the supply of lichen decreases (Helle 1984).

Lack of nitrogen and minerals

It is possible that the rotation between mountain and forest pastures can be explained by the physiological needs of the reindeer. Ground lichens are a one-sided carbohydrate feed with a low content of protein and minerals. In a traditional knowledge report on the importance of bogs for reindeer husbandry, the challenge is described as "*mineral hunger*".

> "[It] increases at the end of winter when many minerals have been consumed for the growth of the foetus, among other things. They seek out plants with green areas under the snow cover and like to graze shoots of sedges. This is valuable for the scuba during the calving season and a few weeks afterwards."(Blind m.etc.2014:20).

Feeding experiments show that reindeer fed on a one-sided low diet both lose body mass and develop negative protein balance (Jacobsen & Skjenneberg, 1976, 1979, Bøe, & Jacobsen 1981, Storeheier et al. 2002a).

Other feeding experiments show that reindeer that can choose freely prefer a mixed diet of lichen and evergreen vascular plants (Storeheier et al. 2002b).

At Fosen, the reindeer have two main sources to compensate for the mineral and protein deficiency: (1) *green plant (parts) and (2) crust* and hanging lichen. The first is well-known and applies to all reindeer. Many grasses and sedges preserve their nutritional value in winter and help the reindeer maintain their nutritional status. The protein content is up to 3-5 times higher than in the ground lichens (Storeheier et al. 2002a). The other mineral and protein source is the tree-growing lichens that we have introduced up front. Finnish studies establish that these lichens differ from ground lichens by a much higher nitrogen content (Ophof et al. 2013, Kumpula 2001, Kumpula m.etc. 2004). Precisely nitrogen is what the reindeer also get by eating buds and fresh shoots in the spring. One could perhaps say that the hanging lichens give the reindeer a foretaste of spring, as the spring's new shoots of sedge-grass plants in turn have several times as high a protein content as the hanging lichens have (Ophof m.etc.2013).

Leif Arne Jåma confirms that at Fosen, the field grazing in the forest is also important when the snow conditions allow it. The reindeer also graze on evergreen plants.

Johan Rassa states that low-growing snow-free rocks *(sagŋa gierge*) can be emergency grazing in the mountains. Low-vegetatedlakes are much more often snowed in the forest as they are often sheltered from the wind (Ryd 2001). LeifArne Jåma explains that there are nevertheless important exceptions: "*In the forest under small rock slopes, boulder fields and large stones, there is free-hanging lichen*. Reindeer graze on this if they get hold of this."

Jåma also has a couple of more piquant examples of what the reindeer can eat:

> "Under large old spruce trees on steep slopes, deep down in the pine needle layer under the trees, reindeer find a type of fungus that looks like a hazelnut both in shape and size. Reindeer must find it delicious because they dig these out and eat them.
>
> [I] have often seen reindeer go beyond grouse docks and eat grouse droppings."

The first example seems to be a type of sac spore fungus called runner balls (*Elaphomyces*). They resemble nuts and are also eaten by small rodents that are attracted to the smell (snl/en/rennkule). Hans Tømmervik learned about these mushrooms from Ole Martin Renberg. They are called "the truffles of the North". The reindeer also eat winter mushrooms, snow-covered funnel chanterelles and other bag-spore mushrooms (Hans Tømmervik, pers.med.).

Marshes and wetlands

Figure 54.Bogs with unfrozen spring water. Laponia, Sweden (Photo: Tor Lundberg Tuorda)

Blind m.etc. (2014) explains reinen's movements in early spring:

> *"The reindeer seek out wetlands early on, before they have become completely snow-free. The marshes offer the reindeer the rhizome (rootstock), which they eagerly dig for and which provides them with a valuable nutritional supplement. Many of the species that grow on the bogs have strong roots where a lot of nutrients have been stored.* In addition to the succulent roots of the water clover33, Menyanthes trifoliata, the rhizome of several sedge species,.. is of great value" (Blind m.etc.2014:20).

Marshes with cellars that are unfrozen all winter are extra valuable. It thaws around them extra early in the spring, see Figure 54.

Leif Arne Jåma confirms that there are such cellars in Rissalandet. He also says that when the snow layer on the mues is thin (max. approx. 10 cm), the reindeer are eager to eat the top of the peat wool (*Eriophorum vaginatum*). In early winter, the axis may protrude through the layer of snow, see Figure 55.

Figure 55.Peat wool on wet meadow in spring snow. Tussøya, Tromsø (Photo: Hans Tømmervik)

Torvulla is grazed both in early and late winter and in spring (Warenberg et al. 1997). It is an important plant:

> "When the reindeer, guided by their well-developed sense of smell, kick themselves into the snow to find green plant parts, peat wool is one of the most sought-after plants. The snow thaws early around the peat mounds, and the reindeer can get a valuable supplement of healthy plants in early spring" (Warenberg et al. 1997:34)

The combination of forest and mountain grazing with additions of the marshes contributes to the winter grazing capacity at Fosen being significantly greater than one gets the impression by looking at the bare mountain areas. Forest grazing is also a security in relation to grazing crises. Climate change has reinforced the need for intact forest zone pastures, as the lowland pastures on bare mountains have become more unsafe.

For coastal winter pastures in Northern Norway, it is also known that there are areas close to the lake *that never, or almost never, freeze*. The winter grazing areas at Fosen freeze and get ice formation to varying degrees depending on which winter grazing area it is. The icing problem is usually short-lived, but can occur several times during the winter. . The highest "islands" freeze first.

[33] The Norwegian name is buckleaf.

8.2.5 The bogs that move

Bogs land with moisture-intensive and peat-forming vegetation. The deterclimate and topography that determine where bogs and peatlands are formed; climate is most important (Moen 1998). Fosen has a coastal climate with a lot of precipitation and therefore there is a significant element of marshland. For the overall use of the area, it is important to be aware that the terrain in the lower-lying forest and marsh areas limits access to the mountains so that one is dependent on migratory and migratory beds to get between the "islands". Blind m.etc. et al. (2014) explain the connection:

> "A migration route can be likened to a corridor in the landscape that is used for the movement of reindeer between different grazing areas. The migration route can consist of forest areas, marshes with surrounding forest, ice-covered watercourses or valleys. Some parts of the migration route may need to be cleared, i.e. the landscape is opened up by cutting down some trees. To facilitate the migration for the reindeer, a track is usually driven up along the migration trail with a snowmobile on the marshes.
>
> *The bogs are good to use as migration routes during the autumn, winter and spring instead of moving through a thick forest as they are open spaces and provide a good overview of the land and reindeer. The bogs are tree-free, which is good as you often move in the dark. The bogs are usually smoother and harder to drive with a snowmobile in winter conditions than in the forest. In the spring when you move, it can be better crowds out on a bog than in the forest* (our emphasis). (Blind m.etc. 2014:23–24).

Leif Arne Jåma specifies why it is necessary to use peatland as a migration site at Fosen:

> "In coastal winter pastures, the topography is very hilly and there is a lot of forest, the bare mountain sections become like islands in the landscape. Migration and migration routes between the islands are often tortuous (bottleneck), and many migration routes only have 1 possible passage between A and B. The bogs are free of forest. The reason why a bog has become a bog is because it is a flat or slight slope.
>
> Some forest slopes have the bogs placed "by floor", upwards/down the hillside, and the connection between these bogs is perfect migration routes in forest slopes. (Imagine Trollstigveien for example). We must remember that a migration path has reindeer traffic in both directions, and with active migration, it is always more difficult to get reindeer to go down a migration path than to get it to go up. But if reindeer are allowed to move freely of their own volition, it will be less important whether the terrain goes up or down in the direction of the reindeer's movement."

8.3 Leksvik winter pastures34

This area is much smaller than both Rissa and Stornova/Nyvassdalsheian/Storheia. Leksvik winter grazing area has grazing euros due to human traffic. Fosen Vind has improved a drift path that makes the pastures here easier to access than before, but Sijten emphasizes that these measures have not increased the carrying capacity. The Leksvik area is best suited for winters that are snowy, cold and dry. Then central pastures are well accessible and the animals have good grazing peace. In addition, the conflict with agriculture is reduced. In short, the area is less robust against different weather and grazing conditions compared to the other two main winter pastures in the west. If the pastures become completely or partially inaccessible, the animals spread out greatly. They have poorer grazing peace and higher energy use, which in turn leads to reduced slaughter weights and production. In addition, it leads to considerable additional work in connection with supervision and measures to reduce conflicts against agriculture.

[34] Based on Eftestøl (2022)

8.4 Eastern winter pastures35

The eastern winter pastures are not affected by the intervention, but it is used differently and is therefore not described in detail. The eastern winter pastures largely consist of the areas northeast of Leksvik and northwest of Follafoss. The areas northeast of Leksvik have a lot of active forestry and consist of a lot of planted forest. The real value is therefore much smaller than what the size of this area would indicate. The winter pastures northwest of Follafoss are dependent on cold and dry winters for optimal use. If this is not the case, then the animals migrate west. There is also a lot of human activity here. There are daily visits by hikers throughout most of the winter. Human activity is generally increasing, which has led to a poorer level of grazing compared to before. The Armed Forces also have activity here. There are also marked winter pastures west of Follafoss, but they are less often used.

8.5 Stornova/Nyvassdalsheian/Storheia winter pastures36:

Before Storheia wind farm was built, this was traditionally the best winter grazing area. There has always been little human activity here, both in central areas and along the outer edges. There are almost no cabins in the area, and it was not adapted for traffic. In terms of vegetation, the area also has both fine early winter (lower-lying areas) and typical late winter pastures (the Storheia plateau). When the various pastures have traditionally been used depends on snow and icing conditions, but this is the winter grazing area that, according to reindeer herding, "always" has pastures available. The reason for this is that higher altitude areas consist of a lot of hilly terrain, which means that there are "always" ridges with pastures that are available to the animals in difficult grazing conditions. This was also an area that required relatively little supervision. The animals calmed down here and generally had good pastures in the area.

8.5.1 Barrier and relocation camps37

The animals have traditionally been driven into Storheia via the collection area at Blankheia. They are then operated over FV715 at Torsengdalen. See the migration paths from slightly different angles in Figure 56.

[35] Based on Eftestøl (2022)
[36] First paragraph based on Eftestøl (2022)
[37] New text after inspection and interview with Leif Arne Jåma

Figure 56. Migration routes over FV715 from Blankheia (east) and up to Storheia and further west towards Laugen (Inspection photos MØN/LAJ).

Figure 57 shows Storheia with its immediate surroundings as a collection area divided into three by natural barriers. These can only be overcome via marked relocation routes. The northernmost part, Storheia itself, is a high-lying hilly plateau with many small peaks. The terrain contributes to the fact that there is almost always available grazing in late winter. The topography and watercourses block access to the Storheia plateau along the entire southern edge.

Access to the entire elevation plateau is dependent on open migration routes (Figure 58).

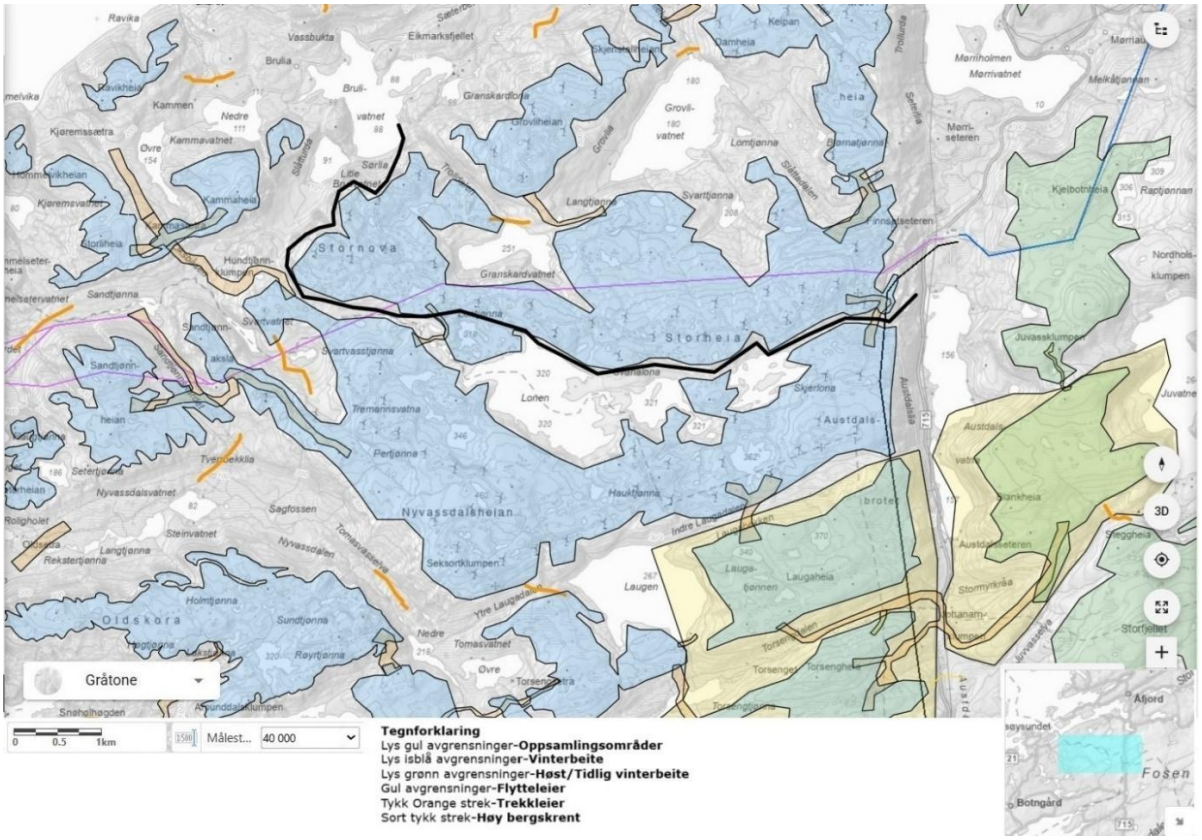


Figure 57. Storheia overview map (LAJ/NVE). The high slope is impossible to pass outside the migration routes.

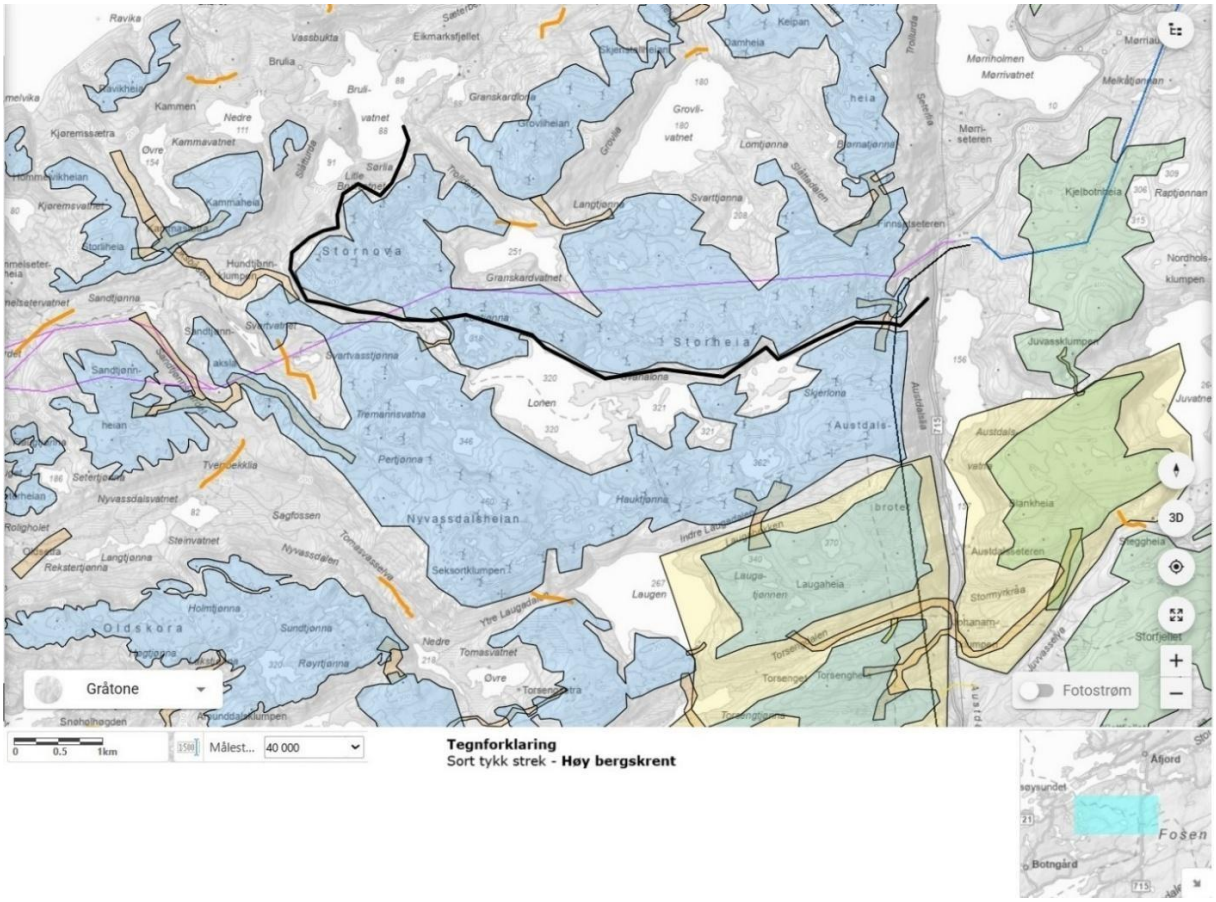


Figure 58. Map of the cliff and the relocation of Storheia. Thick black lines on the map indicate a high slope (LAJ/NVE).

There are only two more migration routes in the Storheia plateau and the northernmost part of Sør-Fosen sijte's area. Both migratory beds are shown in figure 58 together with the rock cliff. Statkraft has made terrain interventions in both of these relocation areas. The eastern migration route has always been used, because it was the most natural and easiest topographically. Now it has been completely rebuilt by Statkraft with a service building, transformer station and power line, see figure 59.

Figure 59. Statkraft's service building, transformer station and power line are located in the middle of the eastern migration route to Storheia. Outline of Moving bored i oRange FAngry. (Inspection photo MØN/LAJ, processed av LAJ).

Figure 60 provides an overview of the Storheia plateau seen from the south.

Figure 60. The Torheia plateau with the facilities seen from the south (Inspection picture MØN/LAJ).

The western migration route is quite tortuous, crossing watercourses, around rock cuts, through gorges and over ice-covered ponds, see figure 61. It has been so barely accessible, so that it has just passed. In this western migration route, Statkraft built its road. In practice, the relocation route to Storheia has now been blocked to the east, the relocation route to Stornova has deteriorated, and Nyvassdalsheian is affected by road construction and wind turbines.

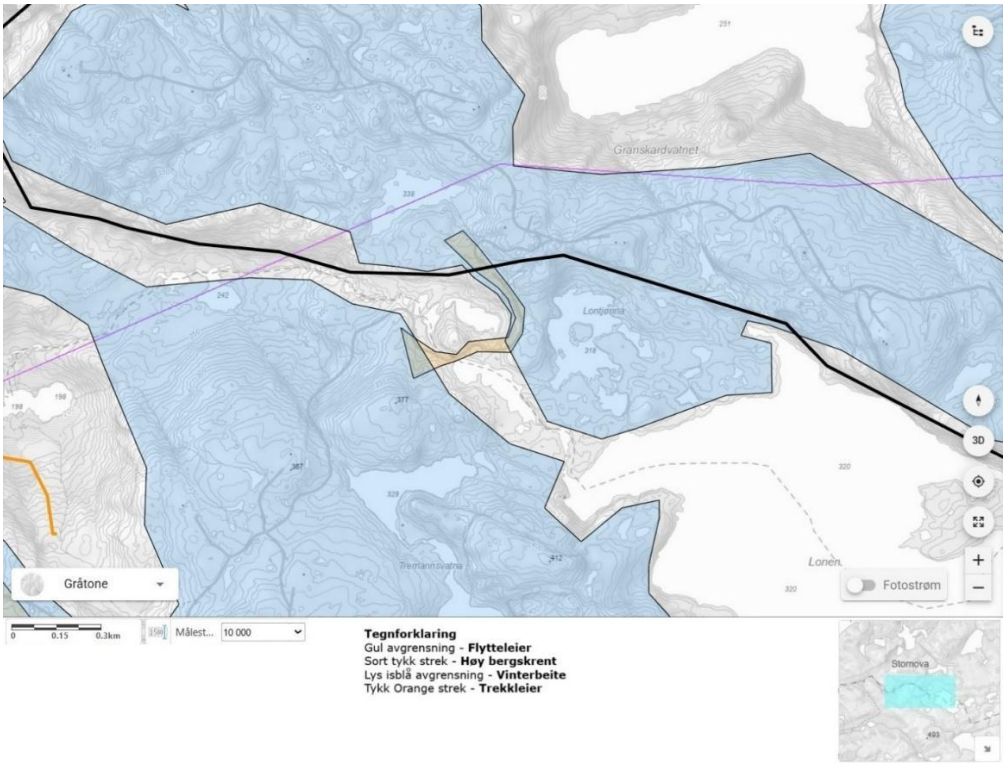


Figure 61. Map moving west of Storheia cliff (LAJ/NVE).

Figure 62. The Storheia plateau seen from the east (Inspection photo MØN/LAJ).

Eftestøl (2022) has described in detail how the winter pastures on the Storheia plateau itself have been destroyed by the wind farm development. Figures 60 and 62 show how the roads wind their way and that there are wind turbines on almost all grazing perches.

The migration route over FV715 (Torsengdalen) is currently intact. It provides access to the lower-lying areas southwest from Laugen. The westernmost areas are early winterland and although the eastern areas are physically accessible as late winter pastures, both these areas and the Lakshaugan winter grazing area (Aunfjellet) further south are too small to be used for a whole winter. As mentioned above, due to barrier effects and distances, it is difficult to move between winter grazing areas, once the animals are within an area. Sør-Fosen sijte is also a small sijte with limited available labour.

8.6 Lakshaugan winter pastures (Aunfjellet)[38]

This is an isolated area due to Sørfjorden and the road network. It is a demarcated winter grazing area that requires physical relocation there. It has a natural boundary in the south by the large valley from Sørfjorden with the steep scree up the valley all the way to Rødsjøen in the southeast. It has a natural delimitation of the Nordelva-Krinsvatnet watercourse. A possible migration route via Krinsvatnet (figure 62) is blocked by a toll station atthe road junction between RV710 and RV715 (Karensetra).

[38] New text after inspection and interview with Leif Arne Jåma

Figure 63. Sconnected moving path over Krinsvatnet (Inspection photo MØN/LAJ).

The last untouched access is the narrow strait between Krinsvatnet and Rødsjøvatnet, but the ice conditions have become increasingly difficult.

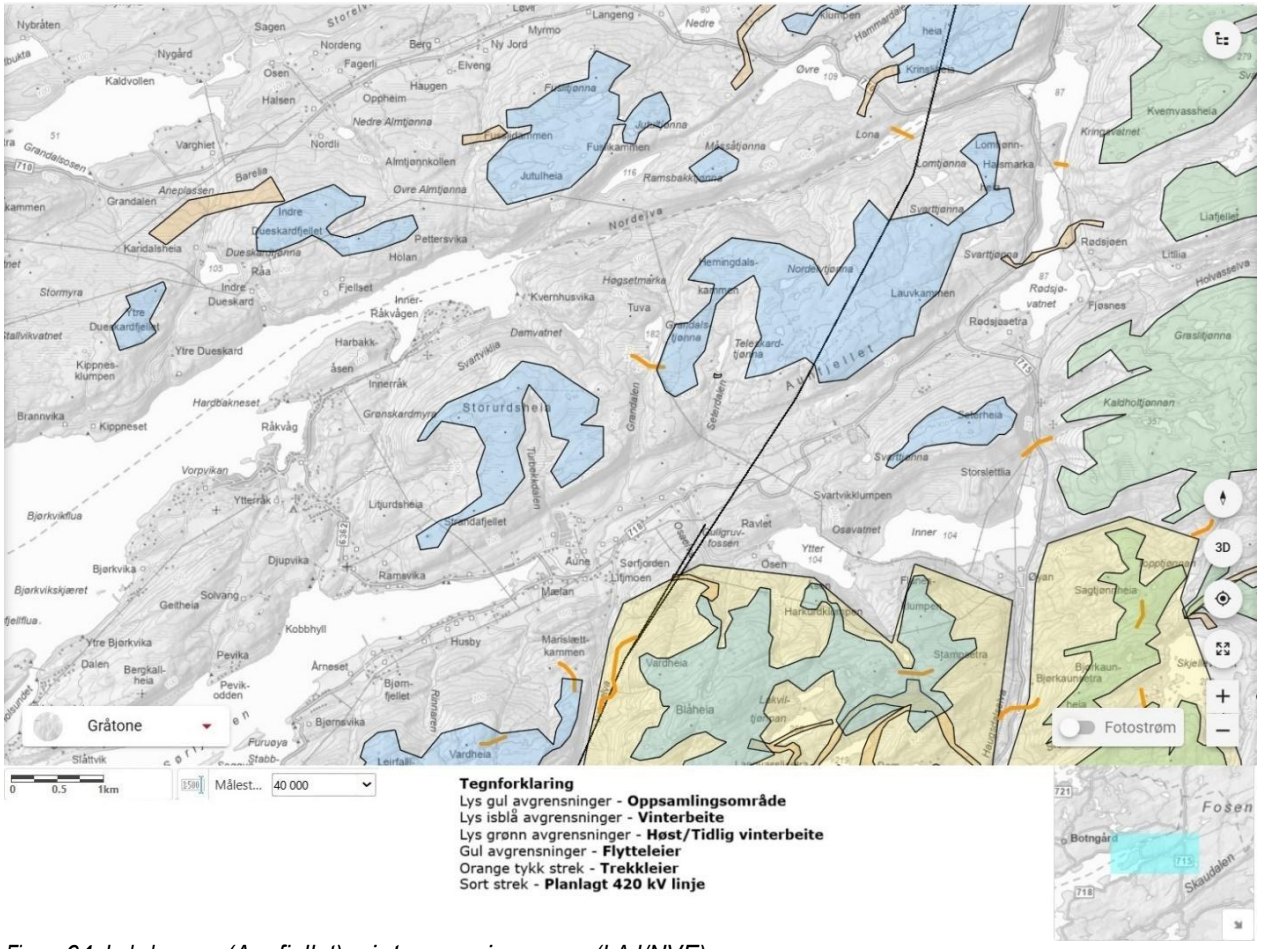


Figure 64. Lakshaugan (Aunfjellet) winter grazing area (LAJ/NVE).

9 Fosen reindeer grazing district Economic situation

County Governor in Trøndelag Sent 08.10.2022 a note until Fovsen Njaarke sijte and LMD with title *"Assessment of the sustainability of Reindeer herding in Fovsen Njaarke sijte".* Initially, it says:

"In recent years, the County Governor has observed that the development in Fovsen Njaarke sijte has been very negative. Sijten meets the political objectives for sustainable reindeer husbandry to a limited extent. First and foremost, this is visible in the sijte's loss and production figures for both sijte groups. From experience, sijten has been a well-ordered reindeer grazing district with good production seen
in light of the resource base. The County Governor has compared figures with other districts in the Nord Trøndelag reindeer grazing area, and we believe there is reason for great concern for future reindeer husbandry both in the short and long term at Fosen."

Text Box 10. The State Administrator About the slaughter weights (2022:3)

The slaughter weights of the sijten have traditionally been slightly below
lack on Upland
Grazing where insect
areas heat Reduced (lower
temperature and wind; aeration areas).
The summer pastures are located at around 5-600 meters, with the highest peak on the Fosen peninsula at just under 700 meters above sea level. In hot weather in the summer, the

The memorandum reviews the management objectives based on the

The Reindeer Husbandry Act and then compares the figures for the Sijten with the Nord-Trøndelag reindeer grazing area.

Text boxes 10, 11 and 12 summarise the County Governor's main points when it comes to slaughter weights, production and losses. Figures 66-69 are our compilations from the Resource Accounts for the last 29 years.

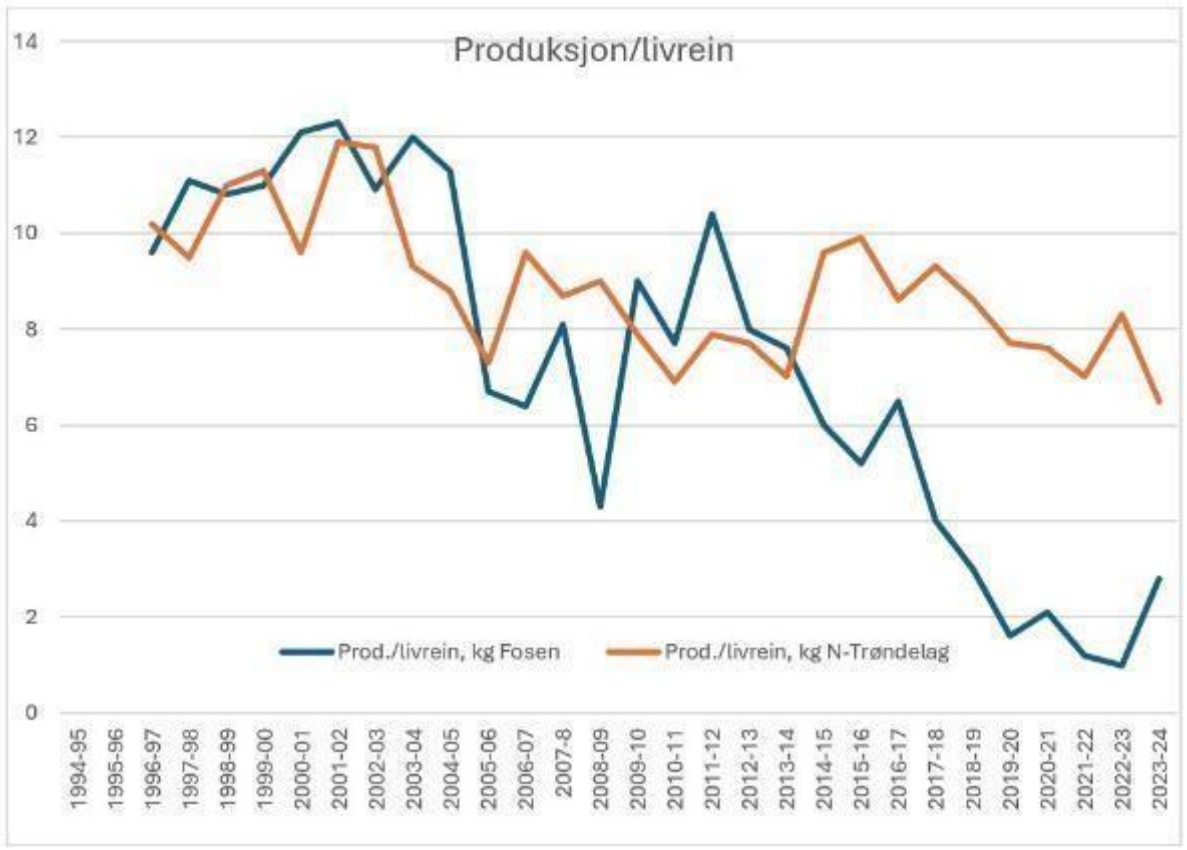


Figure 65. Production per year Uterus. Fosen and Nord-Trøndelag (Resource accounts 1994-2024)

You can see a common pattern in all four figures. Fosen has more favourable figures than Average reindeer herding area in the first decade, so vary Fosen around average it next Decade, but since 2016/17 Fosen has markedly worse figures than Nord-Trøndelag.

Figure 65 shows that production at Fosen is weaker than the area average already in 2014/15, and that it has fallen dramatically further since 2016/2017. How dramatic this is becomes even clearer if we compare the relationship between the number of lost animals and the number of animals slaughtered (see Figure 66).

Text Box 11. The County Governor on production (2022: 2 -5)

Fovsen Njaarke sijte does not seem to be able to maintain the upper permitted number of reindeer despite a low harvest of slaughter in recent years.

The slaughter weights of the sijten have traditionally been slightly below the average for Nord-Trøndelag due to poorer quality of the summer pastures.

The weights for both calves and adult females have been at or above the norm for the criteria for an ecologically sustainable reindeer number.

For calves, the average weights for the period 2016/17 to 2020/21 have been atthe same norm and the same figure for adult females is above the norm.

Since 2016/17, the harvest at Fosen has beensignificantly reduced and 2016/2017 is the last year of operation with almost "normal" harvest (our emphasis).

A reduction in slaughter yield and slaughter animals naturally results in low production. Low production per reindeer gives signals of low calf availability, high losses and/or low slaughter weights.

The production per reindeer in Fovsen Njaarke is now the lowest in Nord

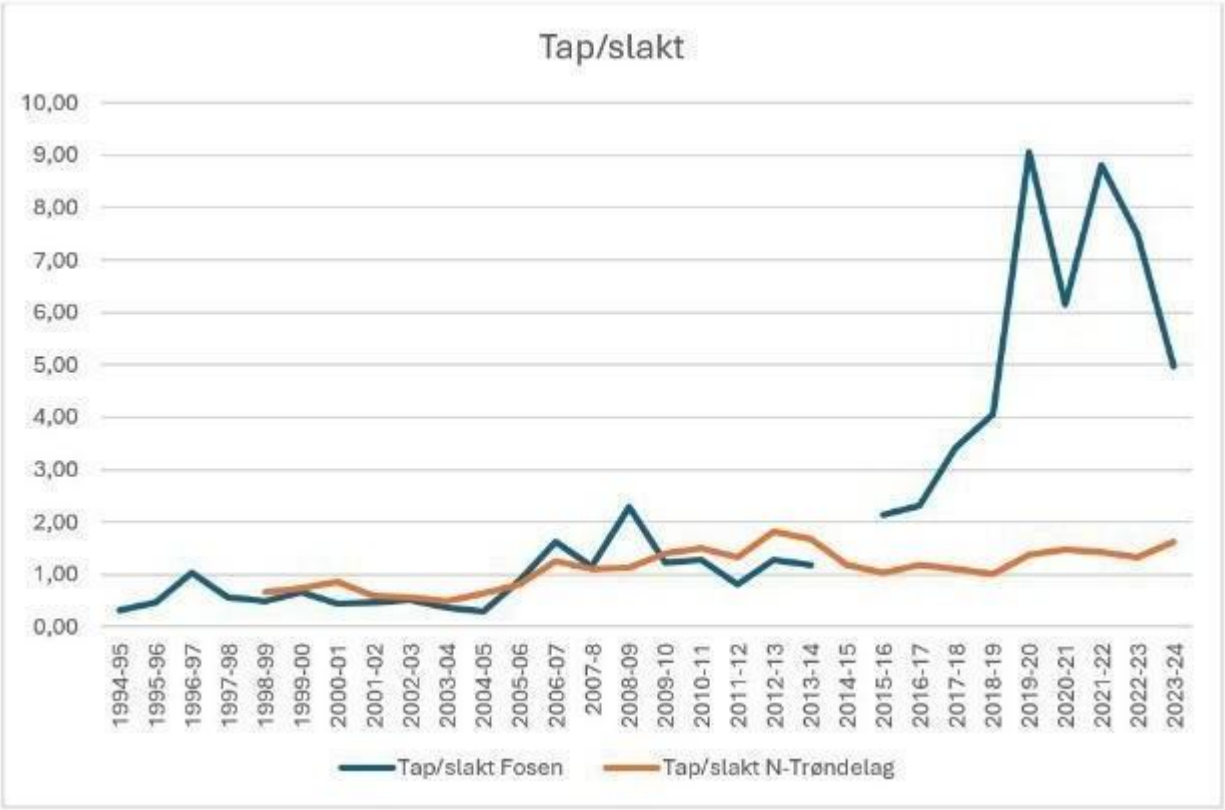


Figure 66. The ratio between the number of lost and the number of animals slaughtered. Fosen and Nord-Trøndelag (Resource accounts 1994-2024)

Figure 66 shows that before 2016/17, the pattern for Fosen is about the sameas for Nord-Trøndelag. Losses and slaughter are about the same, but in some individual years, the losses are in the worst case twice as large as the harvest. After 2016/17, the losses each year are suddenly many times as high as theslaughter yield. This loss level is about double the average for the two most loss-prone reindeer grazing areas, Troms and Nordland, which in the period 2013/14 –2023/24 lost an average of 3.1 and 3.5 reindeer respectively for each reindeer slaughtered (Resource accounts 2024).

We have gone into the Resource Accounts and investigated the loss development for both calves and adult animals

For more details, see Figures 67 and 68.

Text Box 12. The County Governor on losses (2022:6)

Damage from wolverines and lynx has been detected, but no breeding of wolverines, bears or family groups of lynx has been found within the area in 21/22. In addition, injuries from golden eagles have been detected. Injuries from bears and wolves have not been proven. Sijten does not have major losses torailways and roads as some other districts in Trøndelag have.

Sijten has the largest reported calf loss (in %) of all districts in Trøndelag in 20/21. The number of adult animals lost is also highest for the reindeer grazing area (our emphasis).

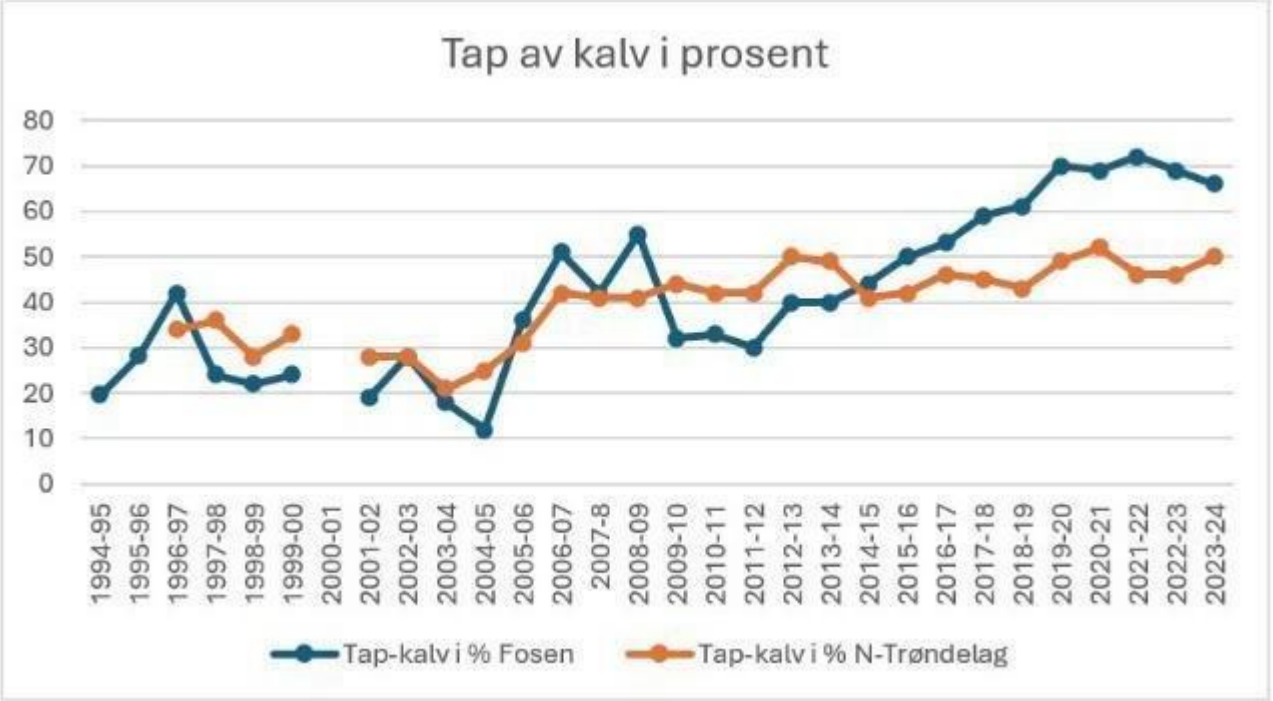


Figure 67. Loss of calves in percent. Fosen and Nord-Trøndelag (Resource accounts 1994-2024).

Figure 67 shows that calf losses at Fosen have increased steadily over the past 15 years, and since 2016/17 the level has been markedly higher than the area average. It is serious for production when two out of three calves do not live in the autumn. This provides little income basis, and the reindeer owner has little or no room to choose which animals to put on as livestock.

> With regard to calf loss, the County Governor of Nordland has conducted a study for the entire Nordland reindeer grazing area based onthe Resource Accounts 2019/2020 and INON 2018. A correlation analysis was carried out between a calculated calf slaughter factor and estimated proximity to technical interventions. The analysis shows a correlation between calf loss and proximity to major technical interventions of 0.8 (Domaas m.etc. 2021). In popular terms, this means that in eight ain ten cases, the calf losses are greater the closer the calving land is to major technical interventions.

Figure 68 shows that the loss of adult reindeer over the past 10 years has varied by about 15 per cent[39]. Most adult reindeer are females[40], so that the adult reindeer loss corresponds to a loss of about 13 per cent. High loss of adult females is not only serious. It is dramatic. In the best case, it takes two years before a female calf can have replaced an adult female and have given birth to its first calf. When there is initially too little calf, it may take longer. So the combination of high calf losses and high female losses is doubly critical.

[39] Calculated at 14.9%

[40] For every bull nest at Fosen, there are eight females (Resource accounts 2024)

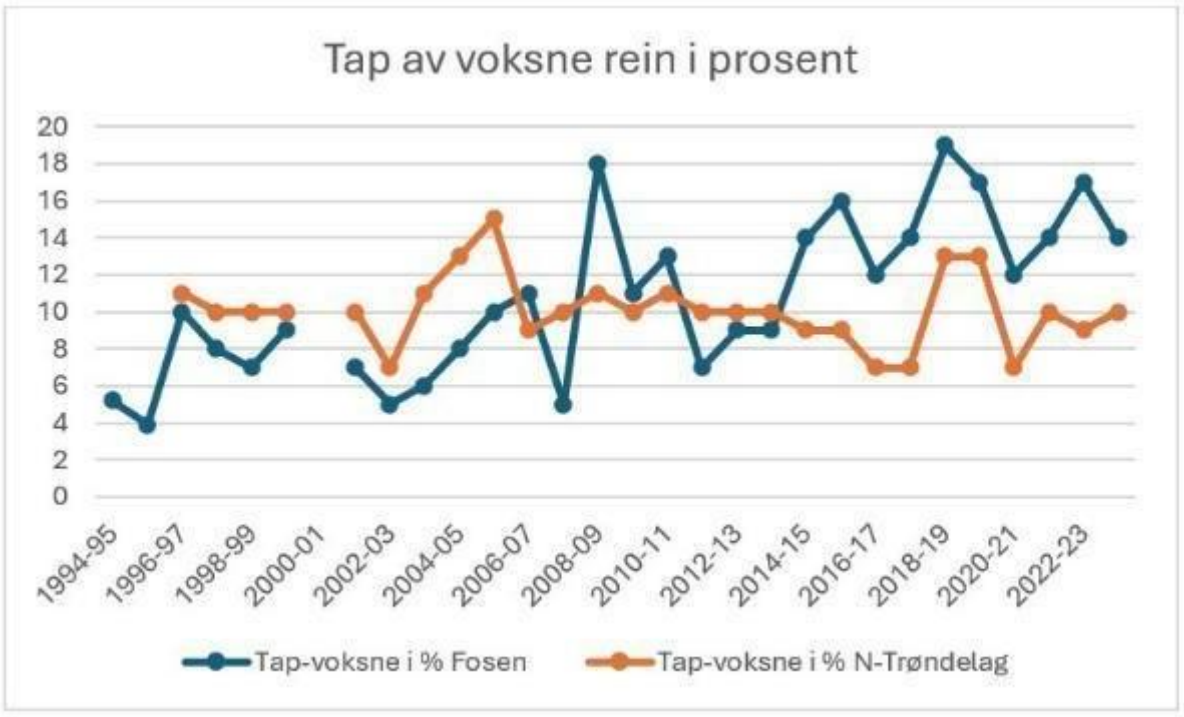


Figure 68. Loss of adults1 reindeer as a percentage. Fosen and Nord-Trøndelag (Resource accounts 1994-2024).
[1)]The loss of the female would have been the most interesting parameter, but the loss statistics are not specified by gender.

Researchers at the Swedish University of Agricultural Sciences (SLU) have calculated, based on selected assumptions, that a sustained loss of 7.5 per cent or more entails a risk of collapse, i.e. that despite limited slaughter yield, the reindeer herd will not be able to grow again. They have conducted a study in Njaarke Sami village [41] in Jämtland, where two sijts had common summer grazing, but were separated in the winter. One sith had an average loss of 7.1 per cent, while the other had as much as 18.4 per cent. The first managed to increase the number of reindeer, while the second was in a sustained collapse. The large losses were explained as effects of extensive predation from lynx and wolverine (Åhman m.etc. 2014).

The figures indicate that Fosen is in the midst of a persistent collapse similar to the one described for one of the sijt in Njaarke Sami village. The figures from the Resource Accounts apply to the entire district. The County Governor states that the southern group did not have anyanimals for slaughter in 2019-2022, see figure 69.

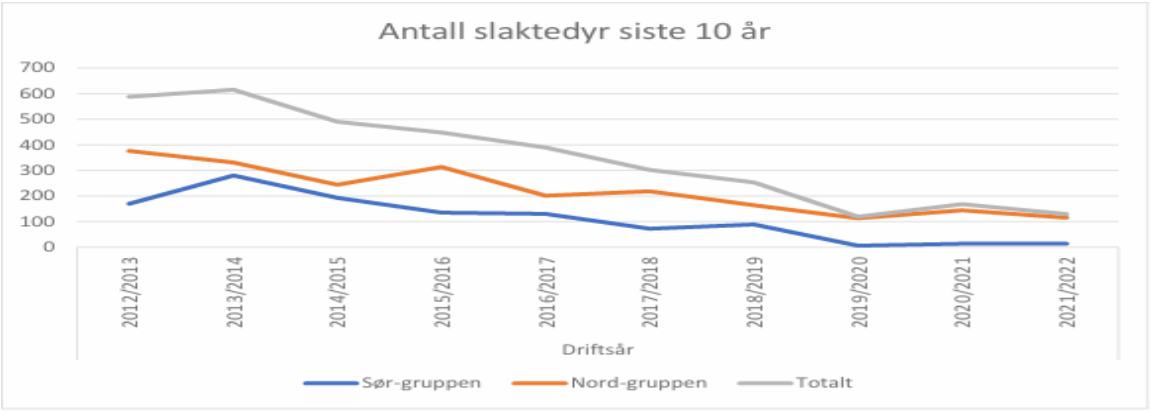


Figure 69. Number of animals for slaughter Fovsen Njaarke 2012-2022 (County Governor 2022:3)

[41] Låarte sijte/Luru reindeer grazing district's closest neighbor on the Swedish side.

This means that Sør-Fosen sijte is even worse off than the figures show. After referring to research results on avoidance and reduced grazing use as a result of the Roan wind power plant, and that shifts in grazing use pose new challenges, the County Governor writes in his assessment of the sustainability of reindeer husbandry at Fosen, among other things:

> *"All experience indicates that if there is disturbance in a grazing area, the majority of the animals will migrate to other areas where they are more undisturbed, if possible (avoidance behaviour). In addition, disturbances in important grazing areas will lead to greater dispersion of the reindeer herd and changed grazing patterns.*
>
> *At Fosen, the County Governor is aware that reindeer migrate to a greater extent in the forest and on cultivated farmland. We have experience with this from other reindeer grazing areas also if reindeer are disturbed in their natural seasonal movements. Changed grazing patterns contribute to new challenges for reindeer husbandry when herding the herds. They tend to divide and spread over larger areas. In the forest and arable land, there are often more difficult operating conditions such as poorer snowmobile conditions as well as clear and rough terrain. This in turn contributes to reduced opportunities for good operating conditions so that reindeer owners can collect, mark and separate their animals as they have done before»* (County Governor 2022:7)

In our interview with three representatives of the neighboring district of Åarjel Njaarke, see above, it was similarly revealed that one of the effects of the newly upgraded 420 kV line through their district was avoidance, which caused the reindeer to migrate down to cultivated land, so that this led to a new conflict with agriculture. The County Governor further states:

> "The proportion of loss of adult animals, compared to other districts, is large. This may be an indication of increased external and/or internal factors that contribute to reduced fitness and quality of life for the reindeer, thus also higher mortality.
>
> As previously mentioned, [cf. Box 8] the resource base is more limited on the Fosen peninsula than in other areas, which is reflected in the density of reindeer and partly on the slaughter weights. The district's flexibility to meet various challenges, such as interventions, is therefore limited.**There is therefore reason to consider whether increased activity in the reindeer grazing area, especially from 2016, has had an impact on the sustainability of the reindeer** herding area [our emphasis]. Sijten is considered by the County Governor to have been a well-ordered reindeer grazing district with good production. Losses to predators should also be lower compared to other areas. This is reflected in the fact that the proportion of animals applied for that are replaced by predators by the County Governor is lower here than in other districts in the Nord-Trøndelag reindeer grazing area.
>
> The area board for reindeer husbandry in Nord-Trøndelag considered the consequences of the Storheia and Roan wind power plants to be so negative that they appealed the decisions in 2008. In retrospect, it has also turned out that the consequences of wind power on the reindeer's land use were greater than first thought.....
>
> **Disturbances within central grazing areas have probably led to greater dispersion of the reindeer herds and changed grazing patterns that have unfortunate consequences for the operation**. In light of this, the County Governor believes that there is reason to be concerned about both ecological and economic sustainability. There is reduced resource utilisation of the grazing basis as the reindeer do not stay on traditional and fixed seasonal pastures, and the supply of slaughter animals of good quality appears to be reduced. Nor is there any longer a basis for a sufficiently good economic livelihood, as the income from reindeer herding is limited. Family-based reindeer herding, which aims to help secure the Sami language and social life, has been reduced as there is a limited basis for making a living from traditional reindeer herding in Fosen" (County Governor 2022:7).

The County Governor's summary states, among other things:

> **The County Governor is therefore very concerned about the overall sustainability of Fosen. This is due in particular to the encroachment situation, including wind power development, but also an increasing loss situation to predators and a general increase in traffic/tourism in the reindeer grazing area in recent years, which in total challenges the sustainability of both the short and long term of the**." (County Governor 2022:8).

The County Governor's data are here placed in a larger context of data from the Resource Accounts. We can state that the County Governor's description is a sober presentation of the situation as it appeared 2-3 years ago. We are witnessing a slowly ongoing collapse. The necessary conditions for re-establishing sustainable reindeer husbandry at Fosen will, in our opinion, be:

1) No new major interventions that further undermine sustainability.
2) Implementation of mitigation/damage reduction measures that reduce the burden on Fosen reindeer herding.
3) Realization of new winter pastures outside Fosen as soon as possible, i.e. from the winter of 2025-26.

10 Spring evaluation of Effects of that planned 420 kV power line

In this chapter, we will describe the planned power line and assess the effects on reindeer herding's grazing use and movement in the winter grazing areas through which the route passes.

10.1 Description

The planned power line is of the same type as the already built 420 kV line that comes from the north and goes into the Åfjord transformer (see figure 70).

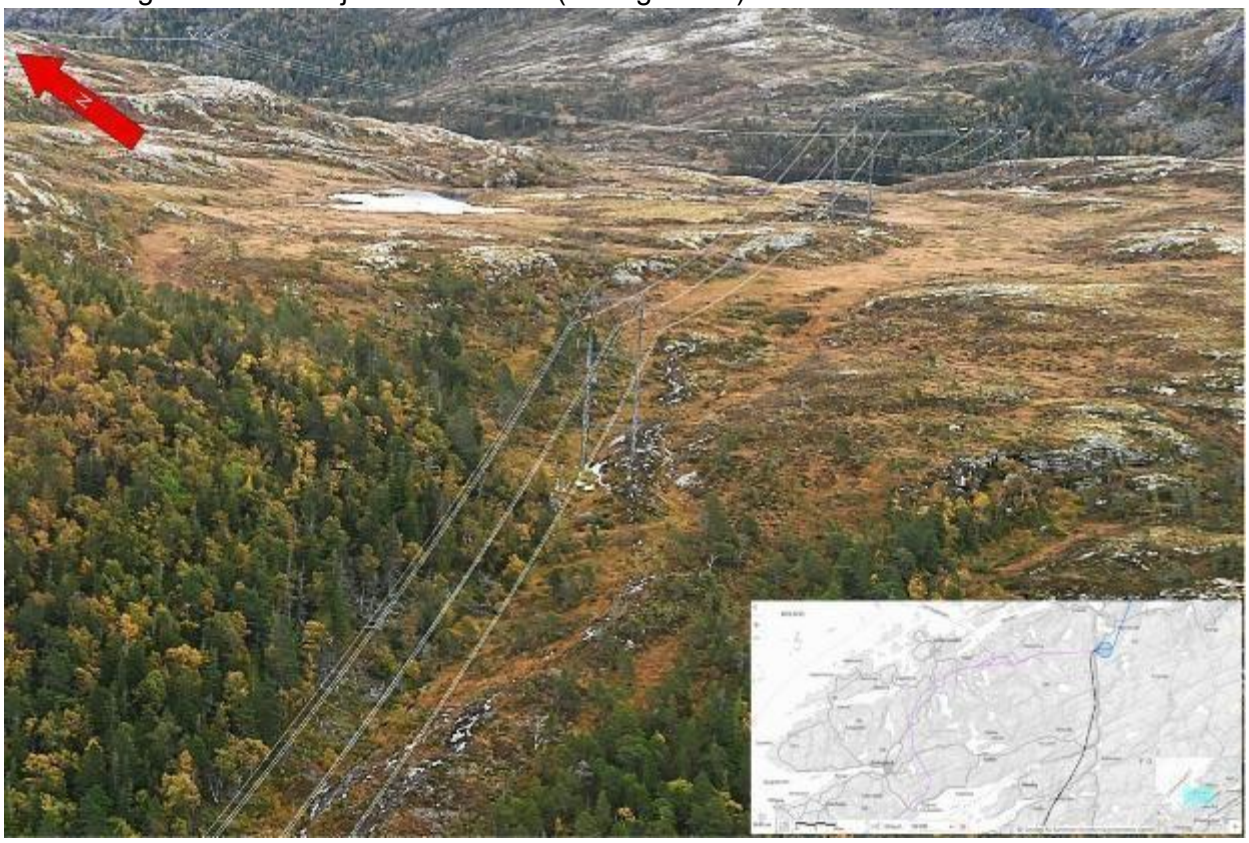


Figure 70. 420-kV line on bare mountains and in forests. Åfjord (Inspection photo MØN/LAJ).

Figure 70 shows that the power line is highly visible in open mountainous terrain, but will be somewhat less visible in dense forest. The technical specifications for the power line are reproduced in Table 4.1 in Naturrestorationerings KU (Eftestøl 2022:25). The masts themselves are designed as shown in Figure 71.

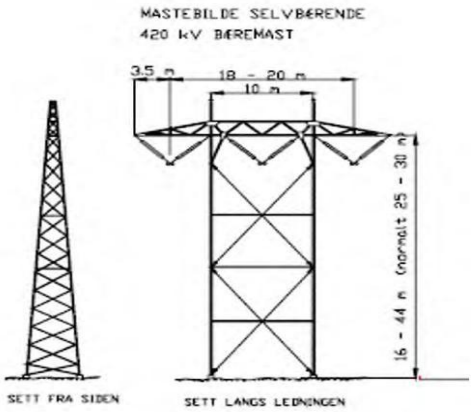


Figure 71. Statnett's standard mast for 420 kV power line (Eftestøl 2022:26)

The mast height will normally be 25-30 meters, but can vary from 15-45 meters. The width between the outermost wire on the two sides willbe 18-20 meters. A building ban belt of 10 meters will be established on each side of the line, which at thesame time will become a clearing belt in the forest, of a total of approx. 40 meters. The distance between themasts will vary from 150 to 800 meters, with normally approx. 3 master's pr. km. Thespanover valleys can be significantly longer (Eftestøl 2022).

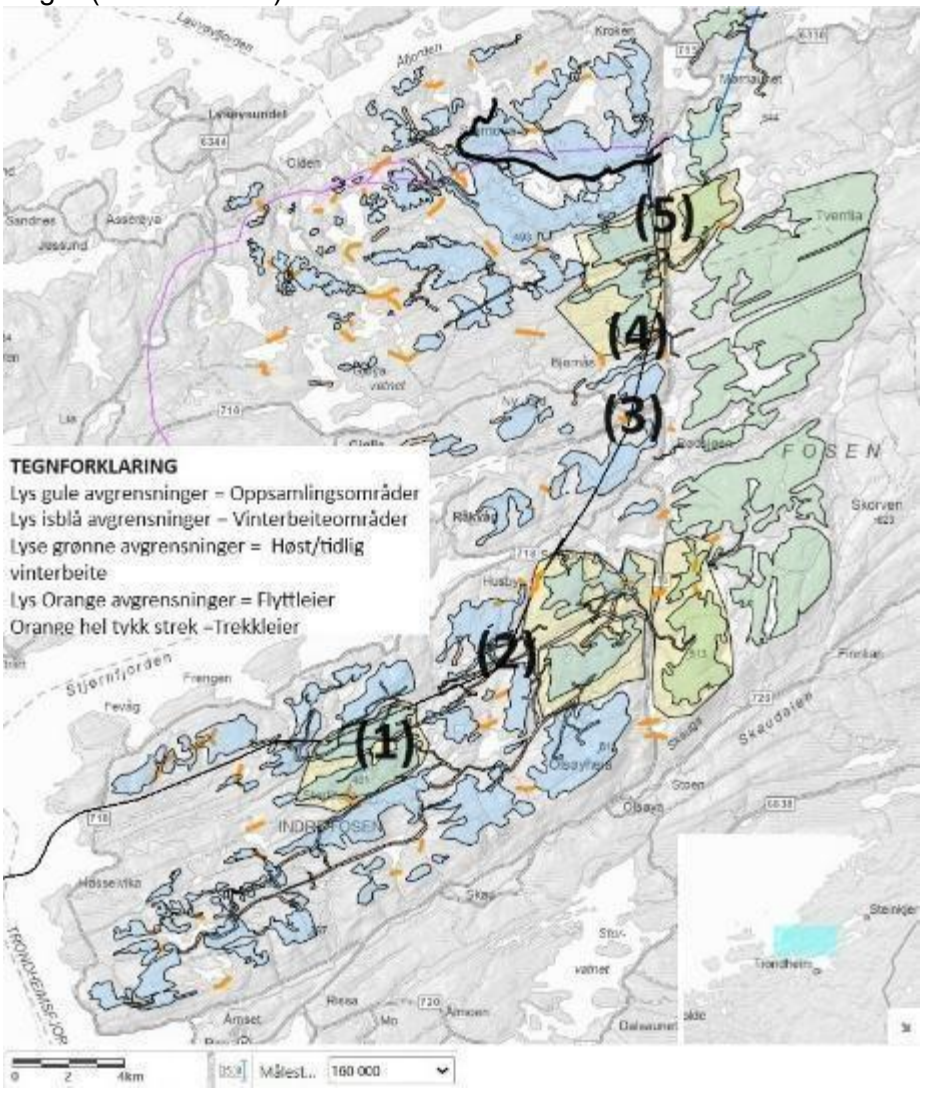


Figure 72. Overview map with the pipeline route, grazing areas, collection areas, migration and migration routes. Numbers

(1) to (5) indicate critical bottlenecks in relation tomigration sites/collection areas (LAJ/NVE).

The overview map shows that the pipeline route crosses or comes into contact with migration routes and/or collection areas (bottlenecks) in five areas; two in Rissalandet and three in connection with Storheia;
(1) centrally in Rissalandet, (2) in the north of Rissalandet, (3) at Nordsetervatnet (4) in Torsengdalen and (5) the eastern migration route to Storheia,

10.2 The land of Rissa

The pipeline route runs from Aunfjæra and further up through the forest northwest of Storlidalen. When it comes up to the mountains, it first goes over some smaller hills or a little up the mountain forest sides and then further down to the edge of the marshes northeast towards and past Fessdalen and towards Bismartjønna. It then turns further north into Nord-Møssmørdalen where it again goes up into the mountain forest, first west of Litjmovegen and Tverrelva before crossing over to the east side just north of Vikasetra. It then follows on the east side of the valley along the west side of Blåfjellet and then relatively high in the mountain forest over the hills and down to Sørfjordalen where it crosses RV718 and the large scree and out of the Rissa winter grazing area.

In the hilly landscape southwest of the Rissa winter grazing area, the line runs in the mountain forest with *a spruce ridge, which* has tree-growing lichens that are part of the winter grazing cycle, which is also both necessary and important grazing in periods when the grazing on the bare mountain is inaccessible or inaccessible. Clearing the route in 40m width will lead to large areas of this grazing being removed. When clearing the route, there will of course be a succession with the growth of both grass and bushes as on a normal logging area. The problem is that the arboreal lichens are attached to old trees and shrubs. In a power line route, arboreal lichens will never have time to establish themselves before they have to be cleared again.

In addition to direct grazing loss, there is also the question of how a new power line will affect grazing use, migration and active relocation of reindeer.

> If we remember figure 25 from Ildgruben, it showed that on one of three mountain ridges, almost no reindeer had migrated to the west side of the 420 kV power line in winter, while the picture was a little more varied for the other two. Especially if it hung low. In the forest, the reindeer migrated relatively easily under the power line in one direction, but not the other without being driven. Despite attractive grazing, the peace of mind in the forest had still been lost. The reindeer also found other towpaths to avoid the power line.

There are obviously several factors influencing the degree of avoidance and barrier impact, but open landscape, i.e. visibility, appears to be important.

The pipeline route runs from the southwest in an open valley floor and when it has reached the top of the mountain over open marshes or fairly low hills. The terrain is mostly open and about 25-30 meters high masts and the power line must be assumed to be clearly visible over most things. In cold and calm winter weather, free movement can possibly go relatively undisturbed, but in unsettled and humid weather, we must assume that the 420 kV line both creates strong and unpleasant sound and produces Corona discharges with UV light that the reindeer will perceive as frightening. In the summary for Nature Restoration's KU, it is said:

> "Within the Rissa area, the pipeline can also create a barrier effect in relation to draughts up to the mountain areas around Ørnheitjønna [centrally located in the mountain massif east of Fessdalen, our note] and Hafellkeipen west of Fessdalen, *but we do not believe this barrier effect will be significant in the operational phase* [our emphasis] (provided that the reindeer herders and Statnett consider details about the placement of mast points etc. in consultation). Animals may be somewhat delayed in their migration when crossing the wire, but they will cross the line if other natural conditions allow for it." (Eftestøl 2022:7)

This quote refers to both a locality far in the southwest and a locality relatively far in the northwest, i.e. in principle the entire westernmost spit of land in Rissalandet, i.e. all the mountain areas northwest of the pipeline route. Although reindeer herders have experience that reindeer pass more easily under a power line that hangs extra high, it may seem somewhat optimistic to assume that the location of the

Mast points will have such a great impact on the draught under the line that it will eliminate most of the barrier effect. Compared to Åarjel Njaarke, which has large differences in altitude, Rissalandet is a more homogeneous landscape where the power line route largely runs down valleys or over open plains, not across large valleys so that the power line will be at a high altitude above the ground.

If the reality should turn out to be, as we believe there is reason to fear, that the placement of mast points will not be sufficient as a measure, it could in the worst case mean that *access to the entire outermost northwestern spit of land of Rissalandet will be blocked or impeded*. We will follow the power line route's meeting with the migration route systems from the southwest and northeast.

10.2.1 Rissalandet central

The north-central part of Rissalandet is well distanced from population centers and excursion areas. The south-central part has several exit areas. The relatively flat areas in the middle of the mountain, around Storsalen and towards Fessdalen, are breeding grounds for the reindeer as they meet the criteria;*Good and accessible pasturesamtbeitero*. These areas are also central to free access to the surrounding bare mountain pastures.

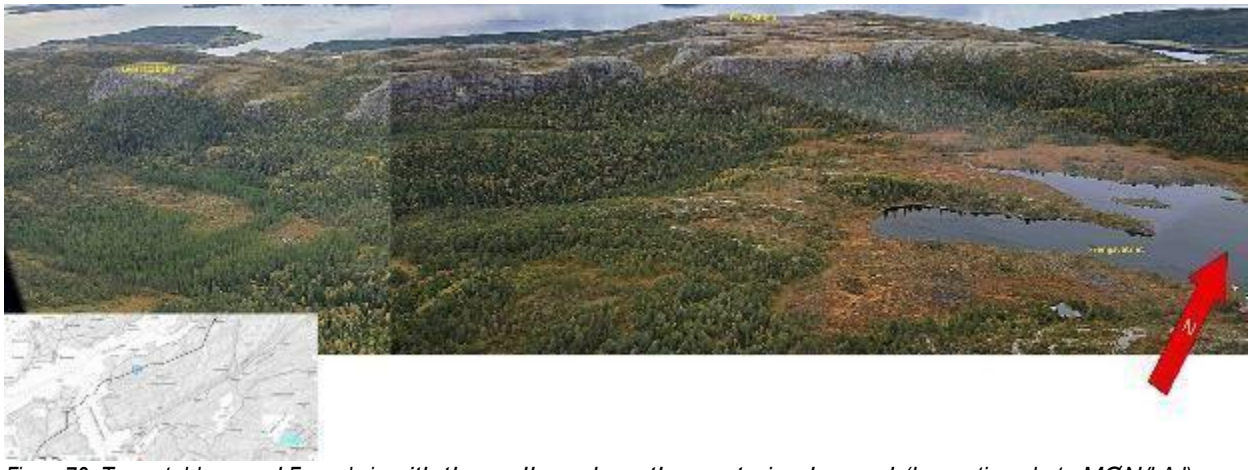


Figure 73. Tverrstabben and Frengsheia with the valley where the route is planned (Inspection photo MØN/LAJ).

Figure 73 shows the southwesternmost large "island" of the mountain winter pasture with Tverrstabben, Frengslia and Frengsheia that is actively being moved to. The pipeline route comes up into the valley through the forests and marshes in the valley in front and passes over the marshes just northwest of the tip of Frengsvatnet that is furthest back in the picture.

To the left in the map in figure 74, the service pipeline route passes just northwest of Frengsvatnet in the direction of Hafellkeipen up a steep hill where it turns almost due east and close to the two Keiptjønnen.*Based on the map, the distance between the pipeline route and the migration route appears to vary from a direct crossing to a distance of a couple of hundred meters over a stretch of at least a couple of kilometers.*

In the KU it is said: *"Both the areas around Videslettheia/Storliheia and Frengsheia/Slettheia are used by a significant number of animals and a bottleneck is driven back from the westernmost parts of the area between Hafellkeipen and Jenssetervatnet"* (Eftestøl 2022:40). Apart from commenting on the location of mast points, the challenges associated with this bottleneck are not discussed.

As shown in figure 74, the area around Storsalen, Storliheia and Videslettheia is a large collection area with migration routes in several directions. Via Storlivatnet and Hafellsetervatnet there is a connection both west and north. The migration route westwards via Keiptjønna and Hafellkeipen goes to Frengsheia. From there it is a trek path with a connection further southwest to Høgkoren/Råkammen, Knubben, Skoleheia and Slettheia. The migration route north via

Selnessetervatnet goes to Selnesheia, which connects northeast to Dalaheia. Just over a kilometre further east, it takes off a migration route north

to Vardheia, Blåfjellet, Sauholsklumpen and Slettheia. Another couple of kilometers northeast, at Slåttbakken and Tånnårviksetra there is another moving path to Slettheia.

Over a stretch of 4-5 km, the pipeline route crosses four migration routes. The route goes completely open terrain about half a kilometre inside the north-eastern edge of the collection area in a length of 4 kilometres. This means that the power line will be visible throughout the northwestern half of the collection area. The migration routes must be used for both moving in and moving out from all the winter pastures northwest of the power line route, and the collection area must be used for gathering the reindeer from all the bare mountain islands northwest of the power line, from all the way from Slettheia (southwest) towards Fevågveien to Slettheia (northeast) towards Fessdalen. The main migration route northeastwards, in and out of the collection area, runs parallel to the pipeline route in this entire area at a distance of between half and a full kilometre.

We disagree with KU (Eftestøl 2022:7)'s assessment of the barrier effect, quoted above. In particular, the area around Hafjellkeipen and Keipttjønnin appears to be a bottleneck where we will expect the reindeer to resist passage, but both moving along the other mentioned migration routes and gathering reindeer within the outer half of the collection area must be expected to be difficult due to the easily visible power line close by.

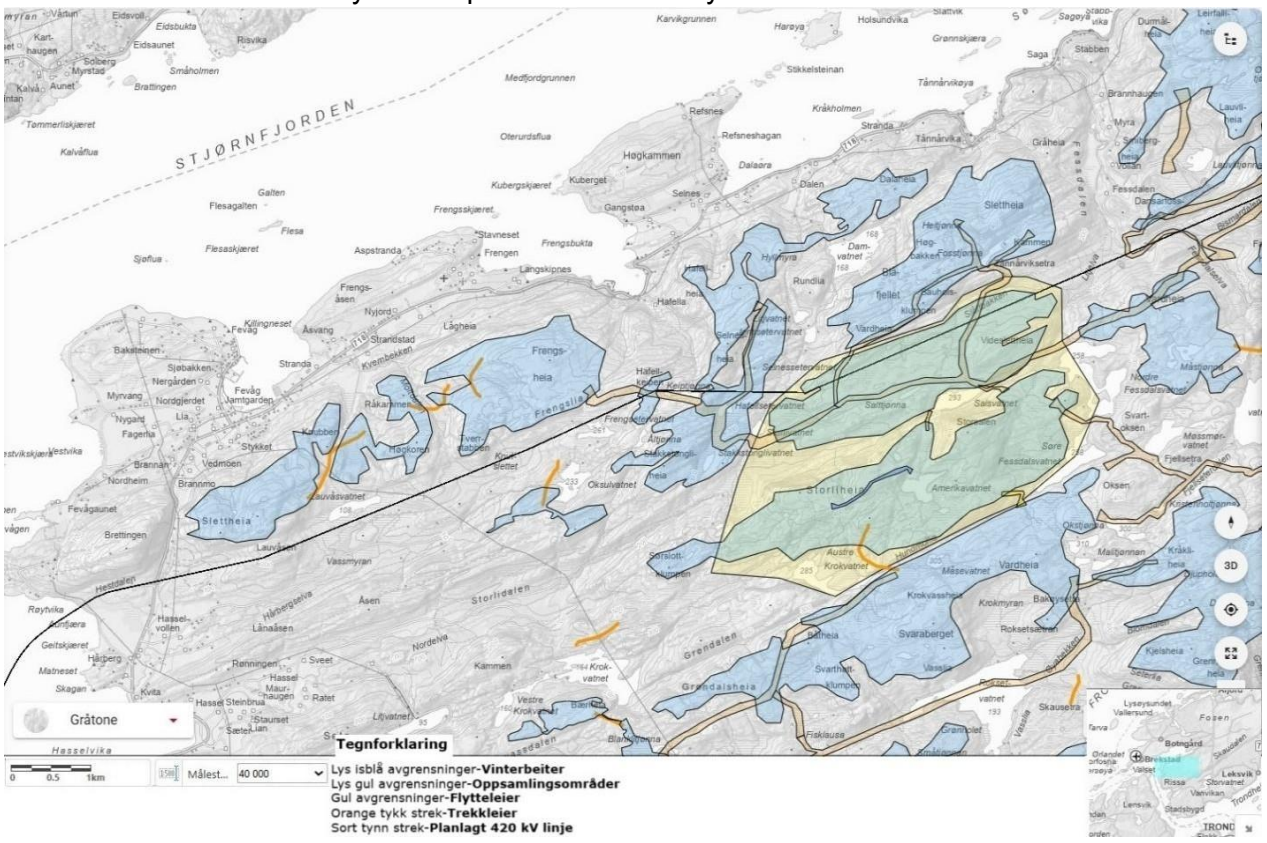


Figure 74. Overview picture: planned 420 kV power line through the Rissalandet winter grazing area (LAJ/NVE)

In the completely open landscape with marshes and fairly low hills where the line route crosses or is close by, the risk *of evasion when crossing or passing a new 420 kV line is considerable, especially in the event of rough and humid weather that promotes Corona discharge and loud noise from the line*. This can prevent or delay migration to and from most of the outer southwestern spit of land in Rissalandet. Gathering of reindeer in Rissalandet takes place from the outer edges, for example from Selnes, and inwards via the middle, then northeast and finally east and down to the fence facility in Haugsdalen.*Especially when assembling and moving with subsequent transport for winter grazing outside Fosen, it is critically important that the entire process can proceed without problems.*

The pipeline route continues further northeast in the valley between Sauholsklumpen and Videslettheia and after passing Fessdalen into Bismardalen.

Figure 75. Route over marsh in front of Saueholsklumpen and behind Vardheia. Salsvatnet in the foreground (Inspection photo MØN/LAJ).

10.2.2. Rissa Northeast

In the KU from Nature Restoration (Eftestøl 2022), the summary says:

> "Avoidance of central areas in the northern part of Rissa, however, will be most negative. These are areas where there is currently little disturbance and good pastures. When a power line is centrally located in these areas, animals may then be "pushed" away to less optimal pastures, both in relation to pastures,..... disturbances and conflict with other industries (agriculture)" (Eftestøl 2022:7).

When it comes to possible conflict with agriculture, Åarjel Njaarke has reported that evasion from the power line has precisely caused reindeer to migrate to inland land, and that this entails a conflict with the farmers that they have not had before. In the north of Rissalandet, this could potentially happen down towards Sørfjorden where grazing is already far down. At a gathering in March 2025, the reindeer owners again found reindeer both at Selnes and at Sørfjorden.

North of Fessdalen and further past Bismartjønna and the rest of the Rissa winter grazing area, the route is again mostly laid in the forest with framhte/spruce eggs, so that clearing the route here will have the same effect as in the southwest. The migration routes east of Fessdalen are crucial for the connection to Lauvliaheia, Leirfalliheia and Vardheia (west), Figure 76 provides an overview of the main migration routes and the collection area northeast of Rissalandet.

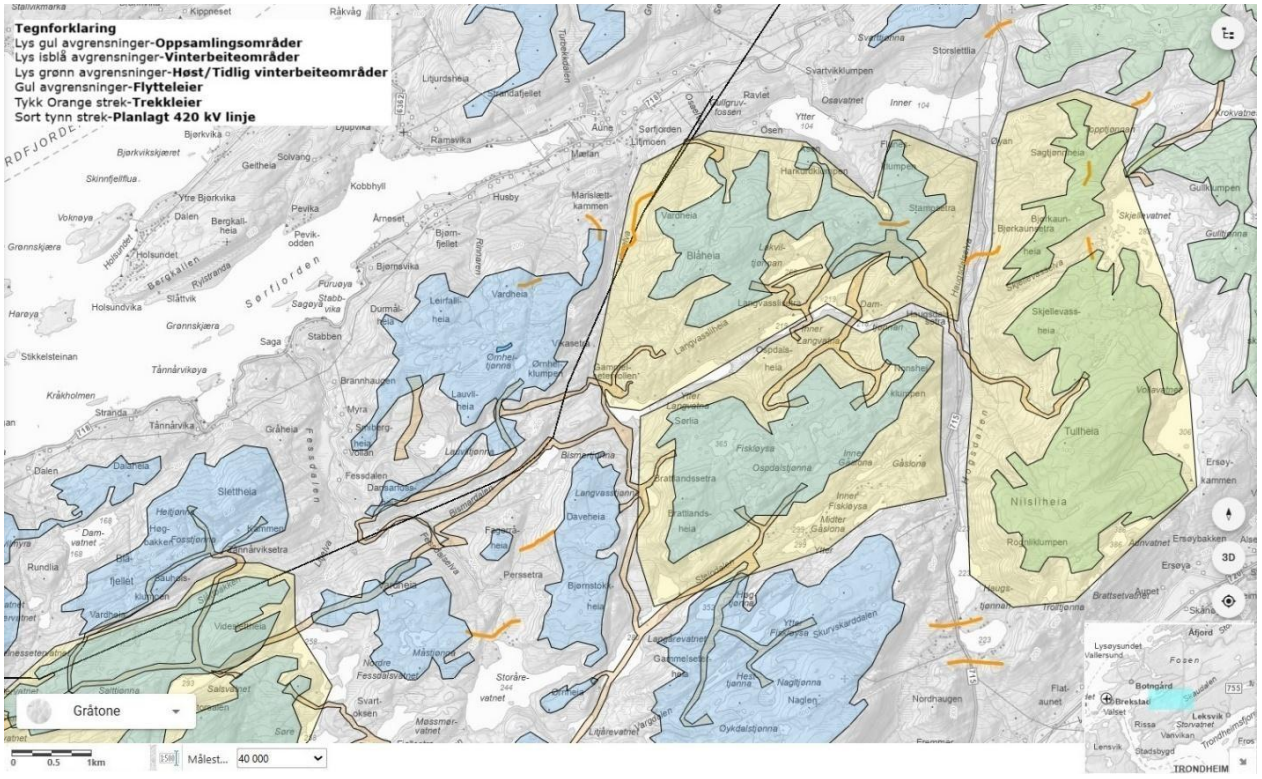


Figure 76. Overview map of power line routes and migration routes in the northeast of Rissalandet. (NVE MØN).

The relocation route between Lauvliaheia and Dansarfossheia is expected to be unaffected by the planned 420 kV line. The migration route between Dansarfossheia and Ørnheiklumpen runs on a steep slope down towards Bismardalen and runs along the edge of the quarry, see figure 77.

The power line route runs at the bottom of the valley in Bismardalen and comes northwest of Bismardalstjønna close to a trekking path between Moltdalen and Sør-Møssmørdalen. The migration here can stop, especially in bad weather.

The most critical migration route runs between Merraholsmyran in the west and through Nord-Møssmørdalen, along Ørnebekken and to Langvatnet , where there is a "crossroads". An arm to the south provides a connection to both Daveheia/Bjørnstokkheia and Brattlandsheia (eastwards). An arm to the north turns into a trekking path to Blåheia. Both from Blåheia and Brattlandsheia/Nonsheiklumpen, offshoots go together to the migration path down to the fence facility in Haugsdalen.

Blåfjellet and Brattlandsheia/Nonsheiaklumpen are collection areas for moving down to Haugsdalen. The whole of Blåfjellet is a land of well-being.

This northeastern part of Rissalandet is affected by infrastructure. There is a road through Fessdalen with a side road up to the quarry, and along the river towards the cabin field at Storårevatnet. In the KU, it is pointed out that "[t]here are many cabins and active snowmobile traffic between the cabins in central areas and year-round roads along the coast is great This happens throughout the winter, but especially in late winter when the days becomes longer and where pastures and flexibility are often most important" (Eftestøl 2022:36). The Litjomovegen road comes through the Tverrelvdalen valley to Gammelsetra. At Langvatnet, a couple of cabins have been found with very unfortunate locations, see figure 78.

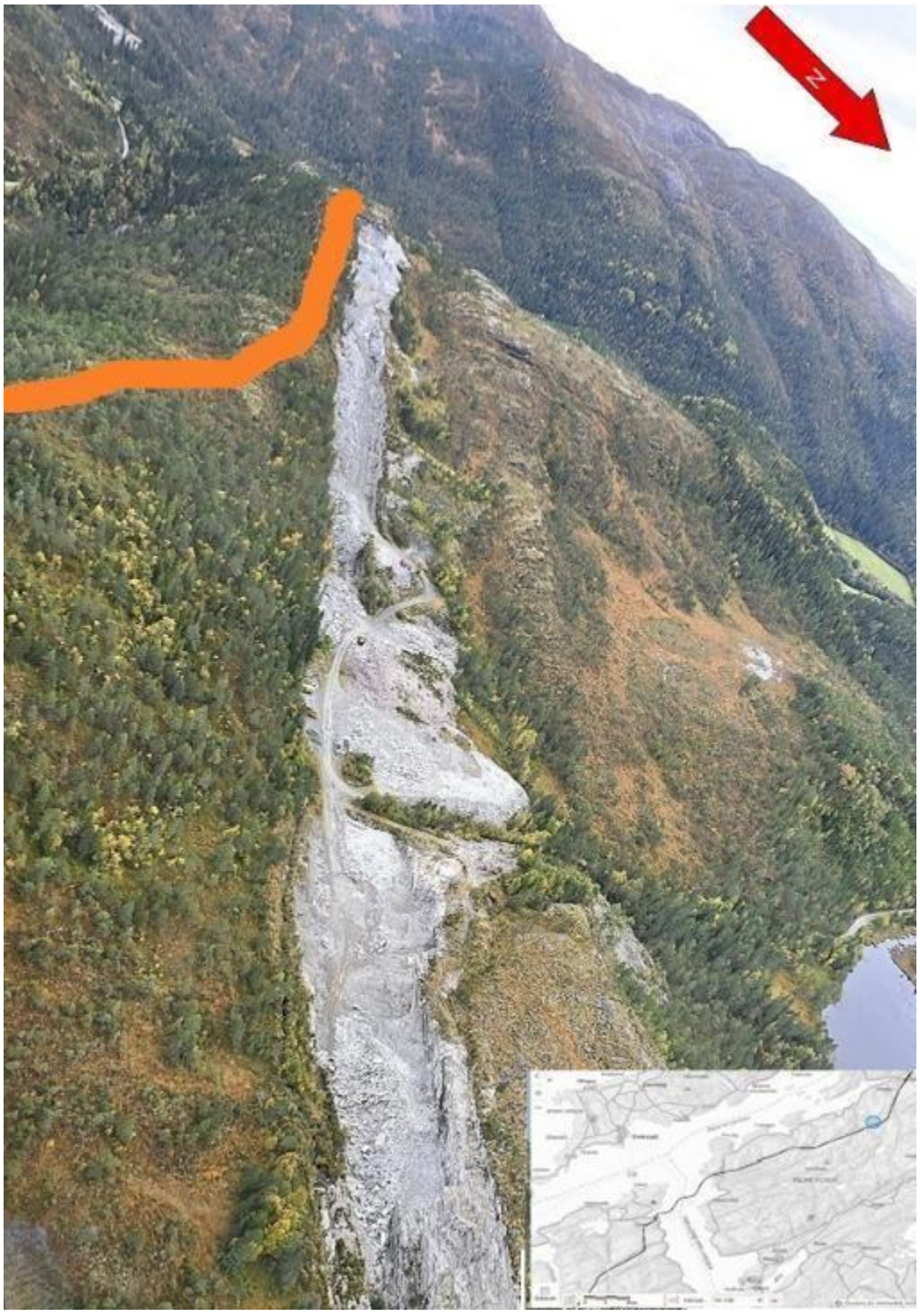


Figure 77. Thestone quarry at Fessdalen with a moving path on the outer edge (Inspection photo MØN/LAJ).

This critical relocation route will ensure *east-west connection with controlled relocation between Lauvliheia and Blåfjellet.*The reindeer do not like to be driven downwards, and if they encounter an obstacle, there is often a cross-stop or they are strongly reluctant. What happens in a bottleneck if reindeer do not dare to cross the power line? Leif Arne Jåma puts it this way:

> *"Especially the crossing from Langvatnet..... and up to Lauvliaheia, I imagine it will be problematic, both when moving to Lauvliheia, but especially back from Lauvliaheia, because then they have to be driven downhill before crossing the pipeline route.*

When this is the only migration route we have, topographically, and there is a bottleneck, what happens then? Maybe the reindeer herd stops and veers out of the migration path and straight up into the steep land where we are unable to follow and lose control of them.

When we have lost control of the reindeer, we have to go back up to Lauvliheia again, and start again from there. If it is not possible to move reindeer through a bottleneck, with three or four attempts, one must wait until the next day with new attempts. It is enough that a skier, cabin snowmobile or activity and sounds from a holiday home prevent the movement of reindeer."

There is thus a significant risk that the reindeer will spread in all directions and that there will be a gathering and a new attempt when the conditions are right.

There are no alternatives to this moving route. It can be considered to use helicopters to collect and drive reindeer. However, it has its limitations. The helicopter cannot fly low near power lines. What makes this extra critical is that Blåfjellet is a collection area for moving down to the fence facility in Haugsdalen.

Figure 78. Migration routes around the outer Langvatna. There are migration paths along roads and roads on both sides of the lake and further back to the right in the picture (Litjmoveien to the east). Moving towards Langvasskollen in the valley in front of the left in the picture. Moving to the left and in the middle of the picture towards Tverrelvdalen. Dotted line to the right in the picture marks the migration route into the Bismar Valley. Moving away from Ørnheiklumpen and Lauvliaheia at the very front of the picture. (Inspection photo MØN/LAJ).

In the KU, this relocation route is also commented on as an example of a bottleneck, but strikingly only as a challenge during the construction work. Specifically, two construction sites are mentioned in connection with the road/migration path at Langvatnet (figure 78) and the location of a mast point, and the need for adaptation to the terrain along the migration route. but the challenges of passing the power line itself are not commented on (Eftestøl 2022:39).

Here, too, we consider that the cow underestimates the barrier effect of a new power line. We consider that there is reason to expect that access to the areas northwest of the power line will be severely obstructed or blocked.

10.2.3 New challenges of climate change

The descriptions of the migration routes above and in front (see figure 66) are based on the fact that the migration takes place on snowy roads. Climate change has led to greater variation in the winter climate and the season with snow cover has become shorter (Hanssen-Bauer et al.etc. 2017). On the Norwegian Meteorological Institute's page "See Norway", snow depths are registered, as an average over routes of 1 km2. We have taken out some examples, see Table 3:

Table 3. Snø depth at various localities in Rissalandet pr. March 20th. 2010 –2025 (See Norway)

Snow depth March 20th	Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Bismar Valley	Cm	68,9	31,8	24,6	12	18,9	0	10,5	2,9	90,4	46,5	2,3	19,1	56,2	91,3	0	8,5
Videslettheia	Cm	71,8	64,3	85,2	24	17,9	0	30,1	7,9	108,4	60,7	2,6	26,9	81,9	118,2	0,4	47,1
Salsvatnet	Cm	89,9	92,8	100,4	55,3	19,8	18,9	97,8	81,9	143,3	108,7	93,4	70,8	134,4	66,5	153,3	134,4

We see that the snow depth seems to be greatest further inland, that the variation between years is large and that some years are snow-poor/snow-free as of March 20th. Fundamental changes can be seen in the long-term variations in the number of frost days when comparing different decades. Results from the EU project CHARTER show a sharp decline in the number of frost days for Trøndelag, especially in the "thawing half" of 42 and after the year 2000 (Bartsch 2022).

In 2025, Sør-Fosen sijte carried out a winter gathering at Rissalandet in mid-March. It was challenging because it was bare ground. The gathering had to be carried out with the help of helicopters and ATVs. The lakes were ice-free, so alternative migration routes had to be used. The bogs can also be too wet, so it is important to find drier and more passable and open landscapes.

Climate change has made it necessary to establish new migratory tenants for farms. Examples in Figure 79. A new large migration route goes southeast of Videsletthei, past Nordre Fessdalsvatnet and over Vardheia. It crosses Fessdalsvatnet and enters Bismardalen. At the winter gathering in mid-March 2025, reindeer were collected all the way west of Frengsheia, and led on this path. It is marked with a thick green line in Figure 79.

[42] February to July

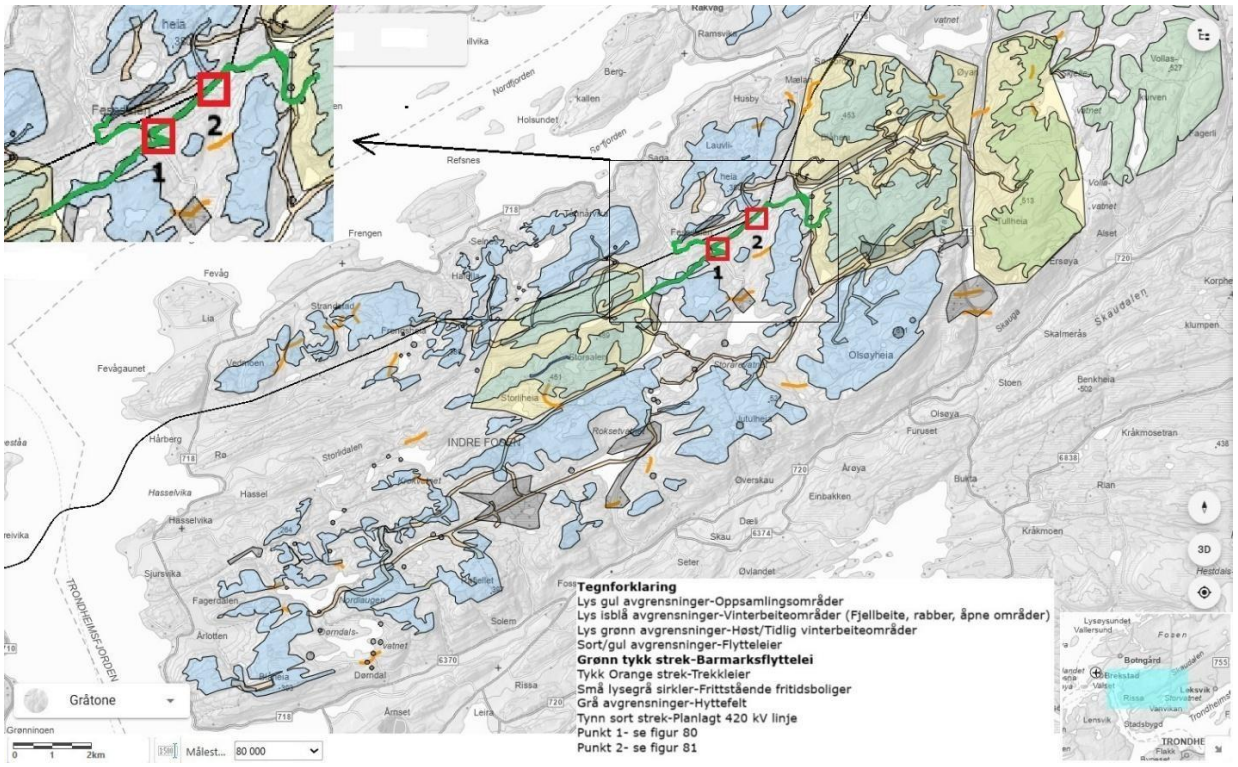


Figure 79. Overview of Rissalandet with inland bare ground migration land used in 2025.Points 1 and 2 mark the reindeer herd's position onthe slopesin figures 80 and g 81 (NVE/LAJ).

Points 1 and 2 in Figure 79 show the locations of the two images as follows. In figure 80 (point 1), the first reindeer are on their way across the Fessdal River. Figure 81 shows the herd in the Bismar Valley. The front is approaching Bismardalstjønna.

Figure 80. Relocation of reindeer at winter gathering March 2025.Crossing the Fessdal river (Photo: John Kr. Jåma).

Figure 81. Relocation of reindeer March 2025. Bismardalen towards Bismardalstjønna (Photo: John Kr. Jåma).

As can be seen from figure 79, the pipeline route comes straight into this migration path approximately where the herd is in the picture and continues on towards Bismardalstjønna. If the power line is built as planned, this relocation route cannot be used.*Moving on bare ground depends on driving by helicopter, and the helicopter cannot fly so close to a power line.*

Figure 79 also includes both individual holiday cabins and cabin areas. We should note that the bare ground moving path that was used in 2025 empties into the southern half of the collection area and is surrounded by cabins on 3 edges. This can also be challenging when moving towards spring with Easter and the cabin season in general.

Figure 79 also includes a new migration route from the quarry and down Dansarfossheia to the valley meeting between Fessdalen and Bismardalen and further along the Fessdal river until it runs together with the large migration route. In this case, too, the pipeline route comes directly into the relocation route. This relocation route is the bare ground alternative for moving down from Lauvliheia and can therefore not be used with a power line there.

The climate projections indicate a milder/warmer climate in all seasons, mostly in winter, more rain and less snow or snow-free in the outer parts of Trøndelag. for the next 80 years. There is already a great deal of variation between the years. This will continue (Bjerke et al. 2025). Increased winter temperatures mean that situations similar to late winter 2025 can be expected to become increasingly common in the years to come, but it is not possible to predict when such winters will come. In any case, this will mean that responsible planning of the future for Sør-Fosen sijte must mean taking into account that over the next few decades, the gathering of reindeer in Rissalandet may mean gathering on bare ground and with the help of helicopters. This will not allow for a new 420-kV power line right through Rissalandet.

10.2.4 Lakshaugan winter grazing area (Aunfjellet)

In the Lakshaugan winter grazing area, the route goes approximately due north over Lakshaugan. It first comes up the clock and then goes into the mountain forest with its element of emphasis. Then follows the longest part of the stretch over fairly bare and flat moors, before it again comes down into the mountain forest just east of Lomtjønnene and down the hillside to Hammardalstjønna where it is again led down into the mountain forest. Although this area is not widely used at the moment, the removal of vegetation here will mean significant grazing loss on a permanent basis.

10.2.5 Stornova/Nyvassdalsheian/Storheia winter grazing area

The pipeline route comes from the south over fairly smooth, bare rock with patches of small forest in between. At Blanktjønnbekken, there is a migratory river that comes over Nordsætervatnet (which is not used much due to varying ice conditions). Blanktjønndalen has steep valley sides and the migration route between Hammeldalshøgda in the south and Blanktjønnhøgda in the north therefore goes in an arc far down the hillside towards Nordsetervatnet where the valley empties. This means that the pipeline route crosses the migration path twice at very challenging points. There is therefore a significant risk that this relocation route will be seriously deteriorated or closed due to the pipeline route. If that happens, you have to go very far west to find the next opportunity. The next possible migration route is down in a deep stream valley. If you are going to come from south to north, it is possible, but if you are going from north to south, it will be closed if the reindeer do not want to go down the steep slope because there is a wire that is a disturbing element. Further north, the route goes over fairly smooth open mountain terrain, but roughly from Nordseterheia and northwards, the route again comes down into the mountain forest band where there is a lot of highlighting.

As described above, the migration routes go up to the Storheia plateau in several stages between different terrain levels. The route crosses both the main migration route in Torsengdalen and the parallel migration route to Torsengheia. It also comes quite close to the eastern migration route over Laugdalen. This may involve disruption. The route is also in contact with the eastern migration route up to the Storheia plateau itself (where Statkraft has built its administration building). In the KU from Nature Restoration, it is said in the summary:

> "For Group South, there will be the greatest potential negative consequence in connection with drift and migration up and down Torsengdalen and the areas directly south of Torsengdalen. The northern areas have had their value greatly reduced by the Storheia wind farm, and here the line is therefore now less important (Eftestøl 2022:5).

A new power line across Torsengdalen will undoubtedly have major negative consequences, but we must assume that Storheia will be available again as an excellent winter grazing area after the end of the licence period. This means that the assessment of the power line must be seen in a long-term perspective, so that these consequences must definitely be taken into account.

10.3 Direct grazing loss

The power line route is expected to be cleared of forest in a width of about 40 metres, somewhat wider in sloping terrain. Much of this forest is natural forest. Parts of the route are also prime terrain so that particularly important winter pastures will be lost. This may weaken the grazing dynamics around the forest line described in 7.2.4. We assume that the direct grazing loss is made up of the entire length of the clearing street itself from Aunfjæra to Åfjord transformer. The

width is 40 meters, but somewhat larger in sloping terrain. We add up to 10 percent and get the following calculation: 40 (+4) m * 35 km = 1.4-1.54 km2, i.e. **approx. 1.5 km²**.

10.4 Indirect grazing loss

The present impact assessment (Eftestøl 2022) claims, among other things, the following about indirect losses:

> "Based on what scientific studies show, power lines are unlikely *to be a strong enough obstacle to stop domestic reindeer from migrating, or being actively driven past, especially not in the long term* (our emphasis). However, crossing can be somewhat more difficult and the animals can move through faster
> the immediate areas of the measure compared to if the measure is not realised, especially under extreme weather conditions with a lot of noise, or in the event of pre-existing bottlenecks in connection with drift" (Eftestøl 2022:6).

This point of view is modified somewhat and further specified as follows:

> "However, based on opportunities for site- and time-specific effects and traditional knowledge, we have concluded that negative effects in areas up to 500 meters from the pipeline can be negatively affected in the operational phase. … Furthermore, we have estimated that the reduction in usage to be 25% within 250 meters and 10 % between 250 and 500 meters on average
>
> However, the actual winter grazing loss, especially during the bottleneck period, will be significantly less as much of the line that runs below the forest line is not particularly accessible during this period, especially where the 420 kV line crosses roads or runs along roads" (Eftestøl 2022:6).

We disagree with these assessments. As we have explained, scientific studies of power lines and their effects on reindeer and reindeer husbandry vary greatly in both methods and results. We have reviewed some of the studies conducted by the author and collaborators (Colman et al.etc.2015, Eftestøl m.etc. 2016, 2021). Above, we have referred to both other researchers' criticism of the methodological use in these studies (Danell 2016, Skarin et al.etc. 2015, 2019) and also collected reindeer owner experiences that indicate these studies' conclusions that power lines have little effect on reindeer and reindeer husbandry has weak empirical evidence.

KUen (Eftestøl 2022) also points to GPS studies:

> "When it comes to indirect losses in the form of evasion of the vicinity of the line, no recent GPS studies have been published that show evasion of power lines alone" (Eftestøl 2022:6).

Seen in isolation, this is probably correct, and we note that there is a large untapped potential in GPS studies. At the same time, we would like to point out that there are methodological challenges associated with such studies as well. We noted that even though the reindeer owners in Ildgruben in an interview with us described reindeer behavior in their encounters with the power line at Mofjellet in line with what in research is called "holding patterns", Skarin m.etc. (2015:1537) and Preisler m.etc. (2006), sand ended Eftestøl m.etc. et al. (2021) come up with what we see as a misinterpretation of observed effects and a conclusion that there are no significant negative effects.

Beyond this, there are also, as far as we know, no studies that have attempted to find out under what conditions power lines cause avoidance and barrier effects. We agree with NVE (Berg et al. 2018) in that scientific studies should be supplemented with traditional knowledge. Our review of reindeer owners' experiences in 5.3 elaborates on this and crystallizes a number of factors that affect the extent of avoidance, as we have summarised in 5.3.5.

In our assessment of indirect effects, we will place particular emphasis on the fact that the pipeline route is mainly laid in *open landscape,* often over marshes or through valleys where it is visible from a long distance, and partly relatively far down in the forest slopes. The forest is in some

cases so low that masts and wires will be visible above the trees. As we have described in section 8.1.1, the utilisation of winter grazing is dependent on both free migration between the "bare mountain islands" and the surrounding mountain forests, as well as active driving of the reindeer along the various

the relocation sites.The date route is mainly located low in the terrain, we can expect that the free migration between each of the "islands" and the surrounding mountain forests is the least affected. However, the route is so close that one can expect that the power line, especially the one during damp unsettled weather, can also be expected to affect the free movement of the reindeer.

Reindeer owners' experience with other 420 kV cables means that the reindeer are more sensitive understatement than during free migration and grazing (Ole Johan Eira, pers. med.). Driving is also always most difficult downhill, and the reindeer are then more vulnerable to other disturbances. As KU (Eftestøl 2022) has also pointed out, there are bottlenecks in connection with both collection areas in Rissalandet. The risk that migration through bottlenecks both centrally (9.2.1) and northeast (9.2.2) in Rissalandet cannot be realised, or is seriously hindered, is considerable, especially when it comes to migration eastwards from Lauvliheia.

In 5.3.6, we proposed to distinguish between primary and secondary *avoidance*, where the primary constitutes the zone that is immediately avoided when objects can be perceived as threatening that are reminiscent of predators (including humans and dogs), e.g. corona discharges with sound and light.
The secondary avoidance zone isthe grazing area the reindeer will pass through after it has been frightened in the primary avoidance zone.

In figure 82, we have outlined these two zones on the basis of the power line's position in relation to the landscape when we try to see it in relation to the reindeer's gaze and reaction pattern (cf. box 8 in 5.3.6).

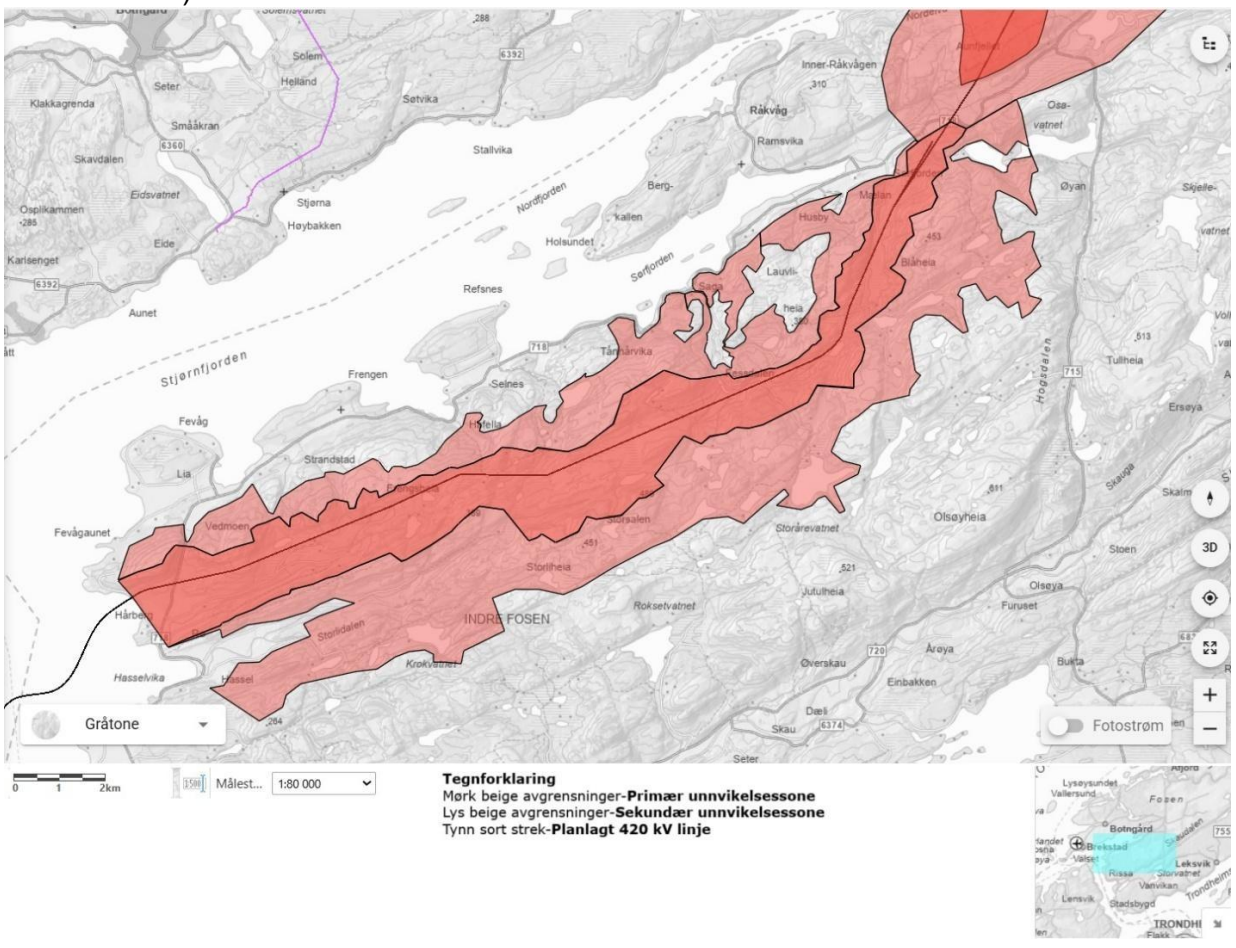


Figure 82. Primary and secondary avoidance. Note. white areas — no evasion (NVE/LAJ).

We see that the primary *avoidance zone is* narrowest, less than one kilometre in narrow valleys as in the Bismar Valley, but becomes wider, more than two kilometres, when the terrain south or southeast of the pipeline becomes

more open, such as in central Rissalandet towards Storliheia and Storsalen. The secondary avoidance zone is 2-3 times as wide, i.e. 4-6 kilometers. In practice, it is about half the width of Rissalandet. We can note that Lauvliheia is the only major bare mountain area that appears to be untouched. When a reindeer is frightened inside the primary avoidance zone, it passes through the secondary avoidance zone. It is only when it has entered the "white zone" that the reindeer feel safe enough to calm down and resume normal behavior.

10.5 Overall effect of previous and planned interventions

In figure 83, we have included previous interventions in the form of cabins and cabin fields, as well as the slate quarry at Fessdalen (cf. fig. 77). The previous procedures have been admitted without disturbance zones.

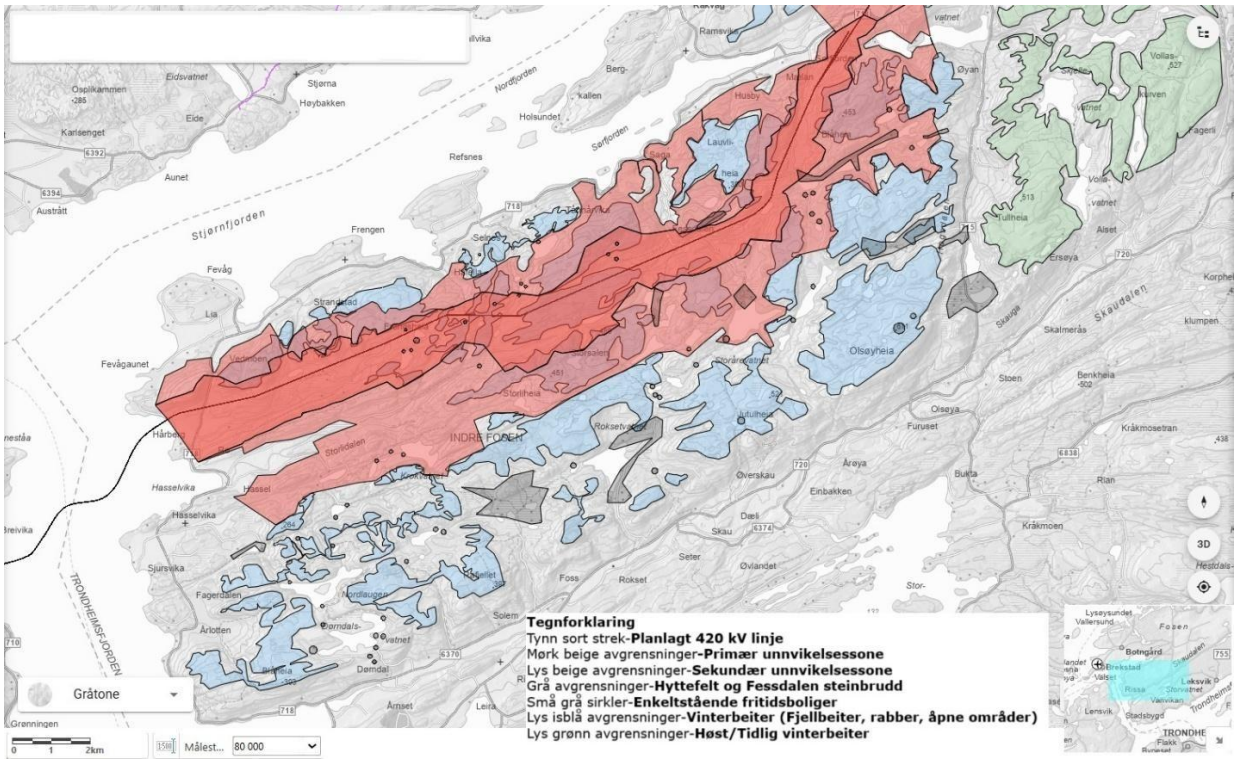


Figure 83. The land of Rissa. Avoidance zones and previous interventions (NVE/LAJ).

The figure shows that there are quite a few interventions both in the southern parts of Rissalandet and northwards around Fessdalen. It involves a fair amount of disturbance due to human activity.*The central parts of Rissalandet where the power line route is now planned, on the other hand, appear to be untouched areas with good grazing peace.*

Figure 84 also includes grazing areas, migratory and migratory beds, and collection areas.

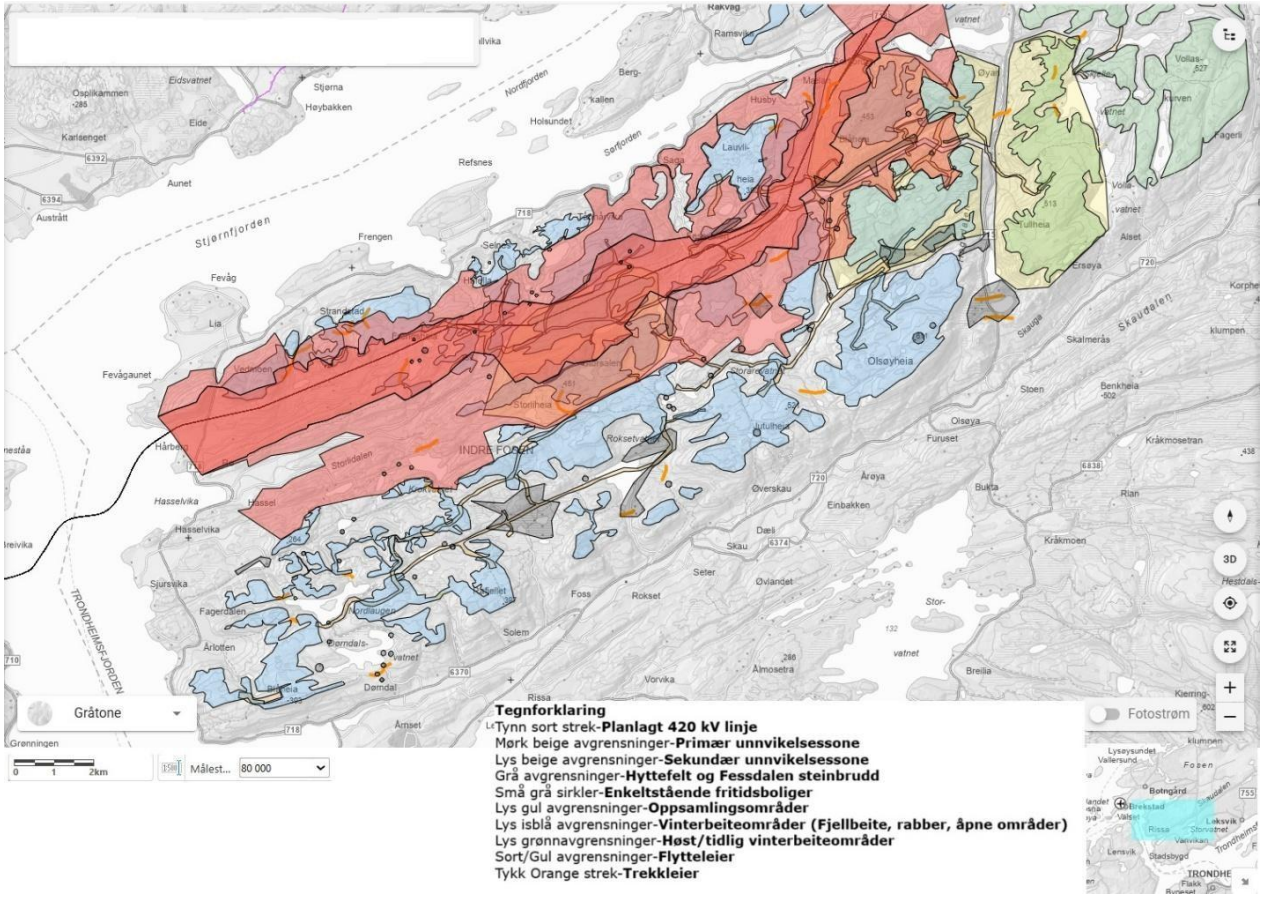


Figure 84. Avoidance zones and previous interventions (NVE/LAJ).

As previously shown in figures 74 and 76, Rissalandet has two collection areas with extensive migration routes.

Figure 84 shows that the collection area in central Rissalandet is currently relatively unaffected, but if the power line is built as planned, the entire collection area will fall within the secondary avoidance zone. The most central migration routes here are also located within the primary avoidance zone. This means that relocation and unification related to the central Rissalandet and the outer bare mountain areas southwest of Fessdalen will be in danger of failure if the power line is built as requested.

The collection area in the far northeast of Rissalandet is located just east of the primary avoidance zone through the Bismar Valley and northwards along the Tverrelva. The migration routes to and from the northeasternmost bare mountain areas, e.g. Lauvliheia is within the primary avoidance area and therefore very vulnerable. If it becomes necessary to move on bare ground, which in 2025 is, as mentioned above, the power line route laid in the actual relocation route. The collection area itself is also not untouched. The southern part is surrounded by cabins and cabin fields on three out of four sides. The northern part of Blåfjellet is so far untouched and is a well-being area with grazing peace. The main problem in northeastern Rissalandet, however, is that the migration to and from the outer parts of Rissalandet may be hindered by a new power line.

Figure 85 shows the pipeline route north of Rissalandet. For the wind farm at Storheia, we have added the planning area.

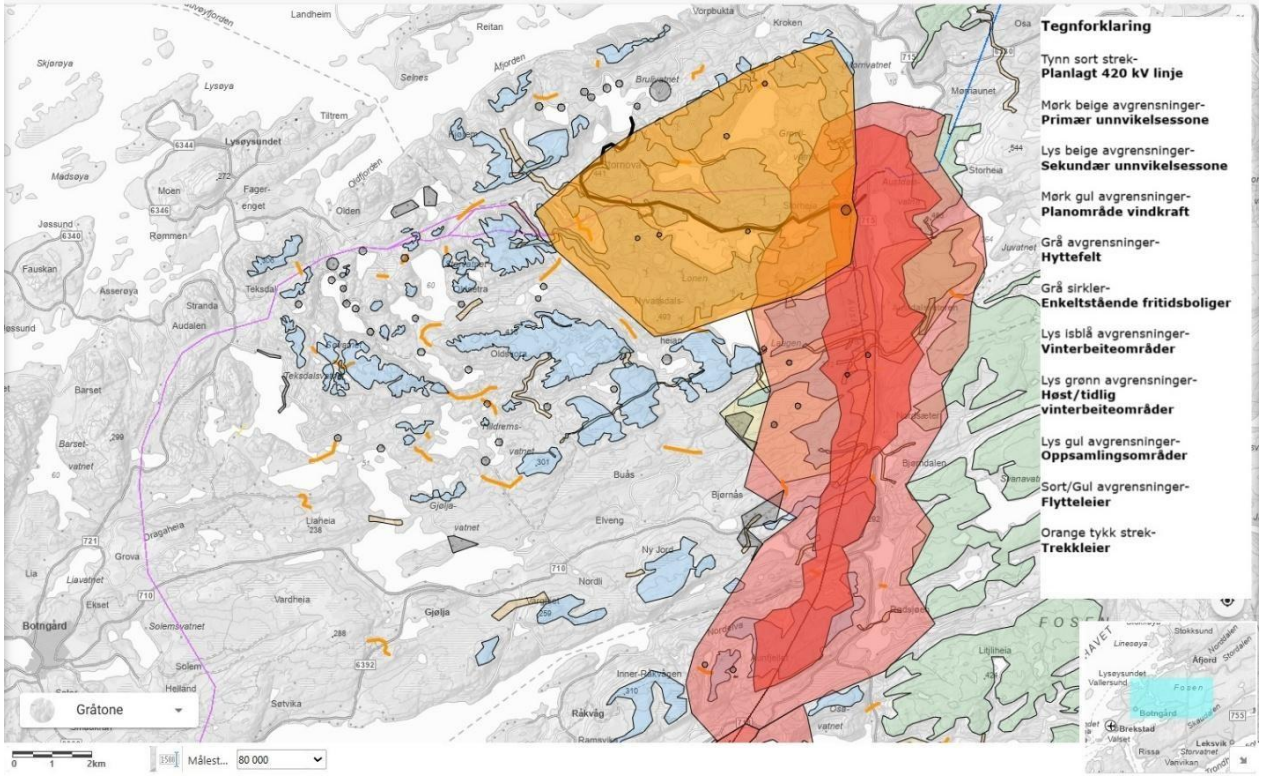


Figure 85. Avoidance zones and previous interventions (NVE/LAJ).

A new 420 kV power line will block access to both Storheia and Lakshaugan (Aunfjellet) winter grazing areas so that these areas cannot be used if the power line is built along the planned route without mitigating measures to secure the relocation beds. We assume that the Storheia plateau will be able to be returned as winter grazing land when the license period has expired. The areas south of Storheia are available today, but depending on the relocation locations.

10.6 Operational disruption, additional work and risk

The most serious risk associated with this pipeline route is the risk of disturbance during relocation. As we have described, the connection to and from the various "islands" depends on the migration routes. Some of these "islands" are internally connected by migratory beds, but then dependent on the migration route of the first in line. The most important is the migration path down to the fence facility in Haugsdalen, but the most critical is the move between Lauvliheia and Langvatnet. In the worst case, this can be destroyed and you are left with no alternatives. Unsuccessful migrations also tend to "settle" in the animals so that they can react with fear to new attempts.

This is reinforced by the fact that the winter gathering with emigration in 2025 had to take place on bare ground. Such moving is more demanding than moving on snowy roads and was dependent on helicopters. Helicopters cannot fly close to power lines. There is then a considerable risk that such relocation and unification will not be possible.

Sør-Fosen sijte is critically dependent on Rissalandet as a collection area for moving to winter pasture outside Fosen. Difficulties with gathering and moving out of Rissalandet can ruin the possibility of carrying this out.

10.6.1 Risk of conflict

If the power line is built in accordance with the planned route, there is also a risk of establishing

new conflicts. In KU (Eftestøl et al. 2022), Rissa winter pastures Stornova/Nyvassdalsheian/Storheia are compared:

"The reindeer herding is clear that Rissa is not as user-friendly as Storheia. This is primarily because there is a lot of human traffic in the area, even in winter. The area is also more fragmented than Stornova/Nyvassdalsheian/Storheia winter pastures. *In addition, Rissa winter pastures are relatively narrow, This, in combination with a lot of inland land along the outer edge of the area, increases the chances of conflict with agriculture in intensive use* (our italics" (Eftestøl et al.:2022:36)

Oxen nests are already found in inland areas in some places along the Stjørnfjord and Sørfjord.

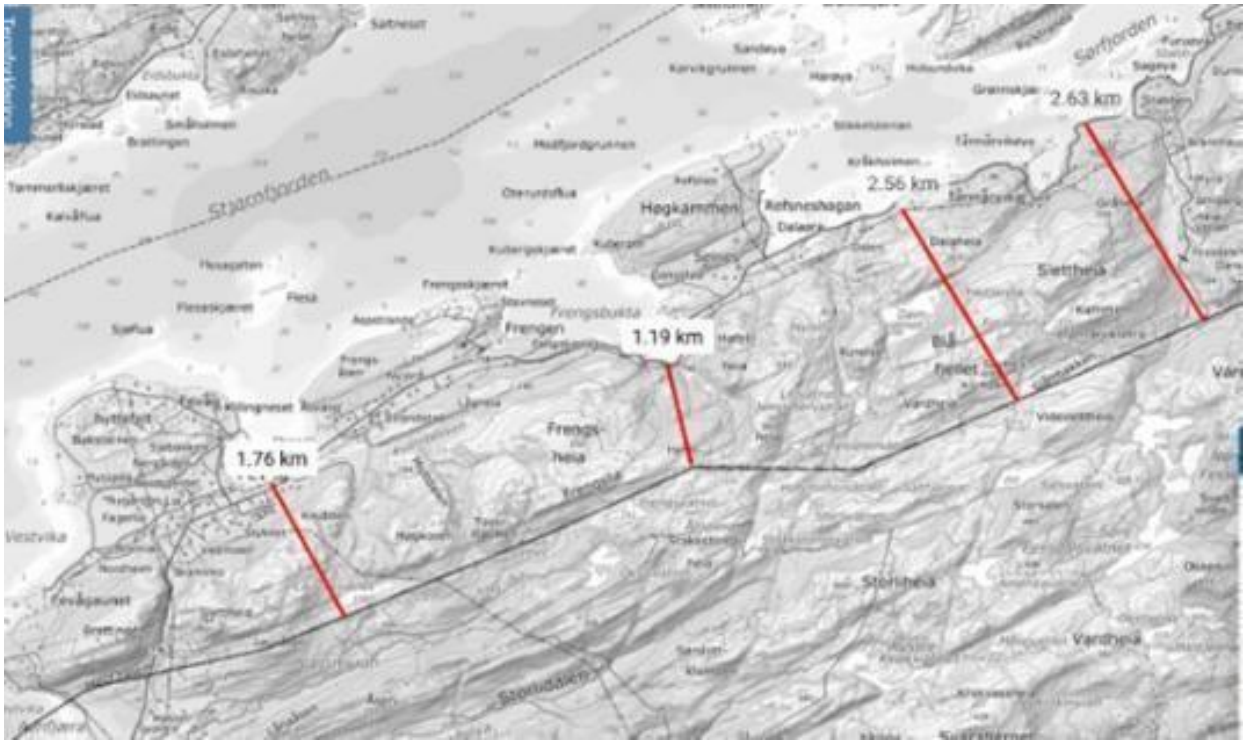


Figure 86. Distance from pipeline route to built-up areas in the northwest (Norway map.no/YES).

Figure 86 shows that the distance as the crow flies from the pipeline route down to the agricultural areas along the Stjørnfjord is in the order of magnitude *of just over one to just under three kilometres*. With the experience of Åaerjel Njaarke in mind, we must expect that evasion from a new power line can lead to bull reindeer migrating all the way down to unfenced agricultural areas to a not insignificant extent, so that new conflicts arise with reindeer on inland.

10.7 Summary

1. The direct grazing loss is permanent interventions that cover the entire pipeline route. The area is about 1.5 km2. This also includes important winter grazing with Framhte (spruce crow).

2. The central parts of Rissalandet are currently untouched by infrastructure and disturbance as a result of human activity. The establishment of a new 420 kV power line through this area must be expected to destroy the established grazing area in this area. The central migration routes and the northwestern half of the collection area fall within the primary avoidance area, so that collection and relocation to and from the bare mountain areas northwest of the power line may be disturbed or, in the worst case, obstructed. In the event of secondary avoidance, which can occur in the event of Corona discharge, large parts of the outer mountain grazing areas are affected so that access to these can be expected to be difficult.

3. In connection with northeastern Rissalandet, the migration route to and from Lauvliheia will be very vulnerable to avoidance effects, especially by migration from the west and east. Relocation through the Bismar Valley will also be very exposed as the power line is planned to run along the migration route over a longer distance. Moving on bare ground, which is dependent on helicopters, is considered impossible as it is irresponsible and illegal to fly close to power lines. Blåfjellet, which is a well-being area, an important part of the collection area for moving down to the fence facility in Haugsdalen, can also be affected by secondary avoidance.

4. There is a considerable risk that a new 420 kV power line across Rissalandet will lead to reindeer on inland areas along Sørfjorden, Stjørnfjorden and Skaugdalen, and give rise to new conflicts with agriculture.

5. A new 420 kV power line along the planned route could jeopardize assembly and relocation from Rissalandet down to the fencing facilities in Haugsdalen and thus also the opportunities for transporting reindeer to new winter pasture outside Fosen. The risk of this is amplified by ongoing climate change, which means that relocation may have to be carried out on bare ground that is dependent on helicopter use.

6. Lakshaugan (Aunfjellet) winter grazing area cannot be used without mitigating measures to secure the migration beds.

7. After the expiry of the licence period for the wind power plants, arrangements must be made for Storheia to be re-established as a winter grazing area. Future use will require mitigating measures that secure the relocation tenants.

11. Discussion

11.1 Status

Reindeer herding at Fosen has been well-ordered and stable, but the Resource Accounts document abnormally large losses from 2016 onwards, both of calves and especially of adult animals,so that the Fosen reindeer herding is in a ongoing collapse. The County Governor formulated a note of concern in 2022 and stated that the ongoing development is not sustainable. The white paper refers in particular to the intervention situation, including the wind power development, but also the loss situation and increased traffic (County Governor 2022).

It is critically crucial for Sør-Fosen sijte that winter grazing outside Fosen gets started as soon as practically possible. This means that new interventions that endanger emigration from Rissalandet must be avoided. In addition, damage reduction measures should be implemented to ease the pressure on the Fosen reindeer herders.

11.2 The grazing situation

The summer pastures at Fosen are species-rich and diverse. July, August and the first part of September are the months of the year when the reindeer have the fastest growth. If the grazing area is disturbed during this period, the growth is significantly reduced. Since the Fosen mountains are relatively low, there will be little difference in the air temperatures in the different altitude layers. On hot sunny summer days, there is a great insect nuisance. On such days in high summer, reindeer do not graze in the period at 09.00 to 18.00; The herds stand tightly packed on snow glaciers for as long as they last, or stand still on the highest mountain

peaks. Leif Arne Jåma clarifies the consequences of particularly hot summers:

> "If the summer period has been sunny and extra warm, experience has shown that the calves will be about 6 kg on average lighter in live weight than if the summer has been cool and the insect plague ... small. The condition of adult reindeer is also reduced for both weight and antler development."

Fosen har mye myr og sopprik skog som gir gode høstbeiter. Samtidig er det mye beiteuro på grunn av menneskelig forstyrrelse, bl.a. jakt, på høsten. Hvis reinen går redusert inn i vinterbeiteperioden på grunn av varm og tørr sommer, er de helt avhengig av å ha gode beitemuligheter gjennom vinterhalvåret, for å opprettholde kondisjon og produksjonsevne.

Som kjent har kystvinterbeiterbetydelig lavere beitekapasitet enn innlandsbeiter, men vinterbeitene på Fosen er likevel overraskende stabile og med god kapasitet. Det skyldes at reinen i tillegg til marklaverpå de avblåste rabbene på snaufjellet ogsåhar tilgang til skorpelavog henglavsom vokser på trær i de øverste sonene av fjellskogen. Disse lavene vokser på flere typer av gamle trær, særlig gran (jfr. 7.2.3).

Reinen veksler mellom fjellbeiter og skogsbeiter i en dynamikk (jfr. 7.2.4), som til dels styres av vær og snøforhold, men sannsynligvis også av fysiologiske behov. Selv om bruk av henglav som krisebeite, særlig på vårvinteren, er kjent både på kysten og i kontinentale områder, er en omfattende veksling mellom fjell- og skogsbeiter ikke beskrevet som system tidligere. På Fosen er dessuten innslaget av skogsbeite større enn man ville forvente ut fra kjente beskrivelser av vinterbeiter på kysten.

Fjellbeitene innenfor Rissa vinterbeiteområde finnes på rabbene på koller av snaufjell som stikker opp som øyer over skogs- og myrlandskapet. Beitedynamikken medskogsbeitene omkring rabbene går vanligvis i sykluser på få dager der mindre reinflokker trekker fritt mellom koller og mellomliggende skogs- og myr landskaper. For organisert flytting mellom de ulike fjellområdene er man avhengig av flyttleier som en del steder har flaskehalser som kan være kritiske å passere. En ny kraftledning tvers igjennom Rissalandet, vil sette bruken av inntil halvparten av Rissalandet i fare.

Tap av beiter

Vindturbinanleggene på Storheia har ødelagt de beste vinterbeitene på Sør-Fosen, og Sør-Fosen sijte er derforkritisk avhengig av at avtalen med vinterbeiterutenfor Fosen blirrealisert forå erstatte dette tapet. De beste gjenværende vinterbeitene er Rissa vinterbeiteområde. Dette området er samtidig det eneste mulige oppsamlingsområdet for flytting til vinterbeite utenfor Fosen.

11.3 Kraftledningseffekter

Statnetts klage tar utgangspunkt i*«anførsler om et pålastingsanlegg som skal vanskeliggjøres som følge av kraftledningen»*(2024:1). Dersom man leser konsultasjonsprotokollen, burde det være enkelt å se at anførslene dreier seg om langt mer enn et*pålastingsanlegg*. Utover at inngrepet berører særlig store deler av Rissalandet som beiteområde, er Sør-Fosen sijte også avhengig av å bruke Rissalandet som oppsamlingsområde og flyttened til eksisterende gjerdeanleggi Haugsdalen. Saken kan derfor ikke begrenses til kun å handle om kraftledninger og gjerdeanlegg.

Vi vil dessuten anføre at forholdet mellom kraftledninger og reindrift er langt fra så uproblematisk som Statnett framstiller det. Vi har konstatert at en del av forskningen på effekter av kraftledninger har svakt empirisk grunnlag (se 4.2. og 4.3). og synes å være mer opptatt med å bortforklare mulige unnvikelses- og barriereeffekter enn å utforske dem (jfr. 4.3.3). De konkrete forskningseksemplene fra Ildgruben og Saanti sijte har så tydelige metodiske svakheter at de ikke kan tillegges vekt.

Vi har bygd på forskning som begrunner og forklarer barriere- og unnvikelseseffekter samt ventemønstre (Vistnes og Nellemann 2008, Skarin m.fl.2015,2019, Danell 2016), men vi savner likevel forskning som har et større fokus på*under hvilke betingelser*kraftledninger kan forventes å bidra til unnvikelseseffekter.

For å utfylle kunnskapsgrunnlaget, har vi gjennomgått reineiererfaringer fra fire ulike reinbeitedistrikter og oppsummert deres erfaringer. Vi er derfor enig med NVE (Berg m.fl. 2018, NVE 2024) som anser at det er behov å legge større vekt på reineieres erfaringer med kraftledninger. Vi mener vår utforsking av reineiererfaringer bør videreføres. Det er også behov for ny forskning, spesielt på Coronaeffekter og hvordan lyd og lys påvirker rein, inkludert ulike dyrekategorier, under ulike betingelser og ulike driftsaktiviteter, i forskjellige landskap og til ulike årstider.

For øvrig er det slik at når myndighetene ikke er sikre på kunnskapsgrunnlaget, gjelder føre -var-prinsippet.

> Om myndighetene oppfatter kunnskapen om hvordan kraftledninger virker på reindrifta som utilstrekkelig, må man praktisere føre-var-prinsippet etter nml § 9. Føre-var-prinsippet krever at det skal tas sikte på å «unngå mulig vesentlig skade» på naturmangfoldet. Dette prinsippet får anvendelse når to forutsetninger er oppfylt: (1) man mangler tilstrekkelig kunnskap om naturmangfoldet/virkningene, og (2) det skal tas sikte på å unngå vesentlig skade på naturmangfoldet (KMD 2016). Dette innebærer at myndighetene må gjøre en skjønnsmessig vurdering ut fra foreliggende kunnskap selv om den kan være usikker.

Den planlagte kraftledningstraséen kommer i konflikt med hovedflyttleier og oppsamlingsområder både sentralt og nordøst på Rissalandet. Det kan innebære både at tilgangen til de ytre delene av Rissalandet blir vanskeliggjort, i verste fall umuliggjort, og at samling av rein fra Rissalandet blir tilsvarende vanskeliggjort/umuliggjort.

Storheia (etter avvikling av vindkraftverkene) og Lakshaugan (Aunfjellet) vinterbeiteområder kan ikke brukes uten avbøtende tiltak som sikrer flyttleiene.

I mars 2025 ble samling og utflytting fra Rissalandet gjennomført på barmark. Denne operasjonen forutsatte bruk av helikopter. På grunn av pågående klimaendringer må vi forvente at slike barmarkssituasjoner vinterstid blir stadig vanligere i årene framover. Helikopter kan ikke fly nært kraftledninger. Ut fra foreliggende klimaframskrivninger betyr dette at risikoen for å komme i en situasjon der man ikke får med seg reinflokken ut av Rissalandet på en kontrollert måte vil måtte forventes å øke for hvert år som går.

12 Oppsummering og konklusjon

1. Dessverre har norsk forvaltning av samiske reindriftsarealer gjennom sine avgjørelser i inngrepssaker i betydelig grad oversett KU-forskriftens krav om at samlede effekter skal vurderes. Dette har lagt grunnlag for at man i praksis gjennomfører en «bit-for-bit»-politikk i strid med regelverkets intensjoner.

2. NVE sa nei til ekspropriasjon fordi man mente det var betydelig usikkerhet knyttet til de samlede negative virkningene for reindrifta av en ny kraftledning slik at man sto i fare for å påføre reindrifta på Fosen et nytt folkerettsbrudd.

3. Vi fant at et hovedproblem i dagens konsekvensutredningssystem og praksis, er at reindriftsamenes tradisjonelle kunnskaper vanligvis ikke tillates å spille den rollen som regelverket tar sikte på. NVEs avslag på Statnetts forhåndstiltredelsessøknad åpner imidlertid for at en evt. utbygging kan skje i samsvarmed en avtale bygd på folkerettensprinsipp om fritt forhåndsinformert samtykke (FPIC). Hvorvidt det blir utfallet, vil avhenge av Energidepartementets beslutninger i forhold til klagebehandlingen.

4. Vi har gått igjennom forskning på arealinngrep og effekter av kraftledninger for reindrifta og dessuten samlet og oppsummert reineiererfaringer med kraftledninger. Vi har også registrert at det er dårlig samsvar mellom den dominerende vitenskapelige forskningen om forstyrrelser og infrastrukturinngrep og mye av KU-praksisen i Norge. Konsekvensutredningene er ofte altfor snevre

både i romlig og tidsmessig forståelse samt inkludering av reindriftssamenes kunnskap. Vi har lagt til grunn at samskaping av kunnskap kan forventes å bli den nye normen for KU for inngrep i reindrifta.

5. Vi har også lagt vekt på at ny fysiologisk forskning på reinsdyrs syn og hørsel åpner for en dypere forståelse av inngrepseffekter som tidligere er registrert, men ikke fullt ut forstått og forklart. En mer målrettet GPS-forskning som foregår i nært samarbeid med berørte reindriftssamer, vil kunne gi grunnlag for avklaring av tema som stadig er omstridt i rettsapparatet. I mangel av veldokumentert forskning har vi innhentet reineiererfaringer med kraftledninger og benyttet disse som indikasjoner på effekter som synes å være godt begrunnet.

6. Vi har levert en omfattende framstilling av reindrifta på Fosen og særlig av vinterreindrifta på Rissalandet. Viharpresentert en hittil ubeskrevetvinterbeitedynamikk med rotasjonsbeitingmellom snaufjell og fjellskog som kan gi mye av forklaringen på hvorfor reindrifta på Fosen og i andre distrikter langs kysten har vært mer stabil enn det mange ville forvente.

7. Fra og med 2016 har reindrifta på Fosen hatt en alvorlig negativ utvikling. Dette er veldokumentert i Ressursregnskapet og påpekt i en melding fra Statsforvalteren i Trøndelag i 2022. Statsforvalteren uttrykte sterk bekymring for den helthetlige bærekraften på Fosen. Ressursregnskapet viser at tapstallene, særlig forvoksne simler, eruforholdsmessighøye, fleregangerhøyere enn slaktetallene. Dette innebærer at Fosenreindrifta er inne i en langsom kollaps. Sør-Fosen sijte er enda dårligere stilt enn det totaltallene for hele distriktet viser. Uten fundamentale endringer kan ikke denne reindrifta overleve. Statsforvalteren anser at bærekraften i reindrifta på Fosen i særdeleshet er truet av inngrepssituasjonen, inkludert vindkraftutbyggingen, men også rovvilttap og økende ferdsel/turisme.

8. Dersom den nye 420kV-ledningen bygges i samsvar med den omsøkte traséen, er det stor risiko for at det pågående kollapset for Fosenreindrifta ikke blir stoppet. Det vil innebære at Norge gjør seg skyldig i et nytt menneskerettsbrudd på Fosen. Nye vinterbeiter utenfor Fosen representerer en mulighet til å stoppe kollapset slik at de to sijtene på Fosen kan få reetablert seg og igjen bygge opp en robust reindrift. Ei ny kraftledning tvers igjennom Rissalandet vil høyst sannsynlig ødelegge muligheten for å få dette til for Sør-Fosen sijte.

9. NVEs reservasjoner i forhold til Statnetts søknad var knyttet til risiko for menneskerettsbrudd. Vår konklusjon er entydig: Den eneste forsvarlige konklusjonen er at den planlagte 420 kV-ledningen bygges etter en alternativ trasé.

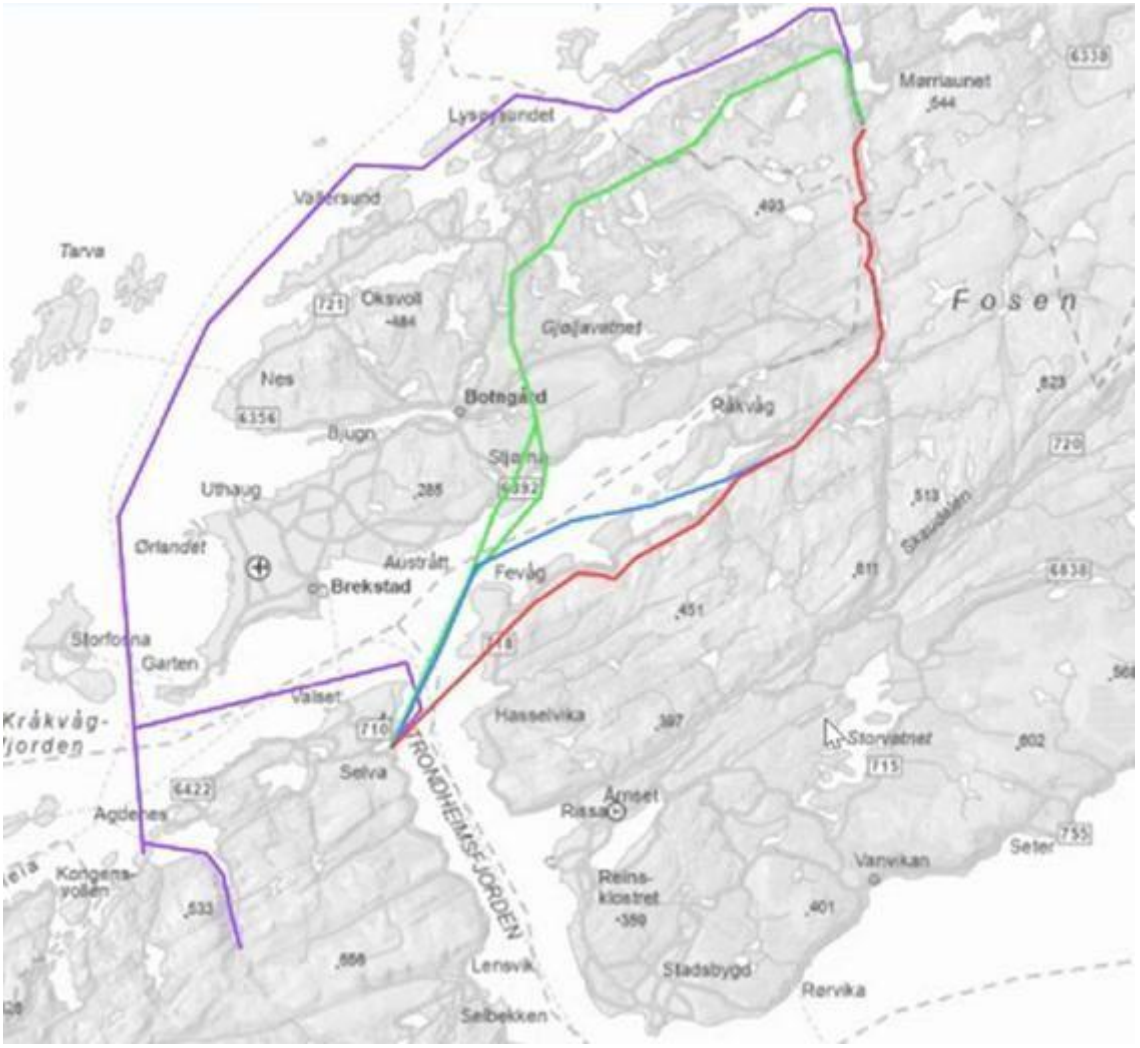
13 Alternativekraftledningstraséer

Sør-Fosen sijte er ikke motstander av et det bygges en ny 420 kV-ledning mellom Åfjord og områdene sør for Trondheimsfjorden, men er sterkt imot den omsøkte traséen tvers igjennom sijtens vinterbeitebeiteområder. Vi skisserer alternativene i dette delkapittelet. Beskrivelsene er nokså summariske. Formålet her er å vise at det er reelle alternativer, ikke å drøfte dem i detalj. Sør-Fosen sijte vil kunne utdype dette.

13.1 Sjøkabel (fiolett ledning)

Det optimale for Sør-Fosen sijte ville vært at 420kV-ledningen legges videre i sjøkabel fra Snilldal eller Agdenes og rundt Ørlandet, Bjugn og Lysøysundet og inn til Åfjord og over land nord for Storheia og sørover til Åfjord trafo (*fiolett ledning*i figur 87). Det ville imidlertid være en meget

kostnadskrevende løsning slik at vi vil også lansere to kombinerte alternativer og et landbasert alternativ som også vil kunne være akseptabelt.



Figur 87. Alternative kraftledningstraséer (NVELAJ).

13.2 Kombinert alternativ 1 (Grønn ledning)

Tensio søkte om en 132 kV-ledning fra Åfjord trafo til Eide i Ørlandet. De har planlagt at denne ledningstraséen skal gå over Storheia og igjennom vindturbinparken. I et oppfølgingsmøte med Statkraft, LMD og ED ble idéen om å la 420-kV-ledningen følge Tensios trasé lansert. Da kan man sløyfe 132 kV-ledningen, erstatte den med 420 kV med sjøkabel videre over Trondheimsfjorden. Sør-Fosen sijte kan støtte denne løsningen forutsatt at traséen legges nord for og rundt Storheia. Denne nordlige traséen ble utredet i januar 2025 av Norconsult, etter konsultasjon mellom Sør-Fosen sijte og NVE i mai 2024. Dette med tanke på at Storheia skal kunne tilbakeføres til vinterbeite når konsesjonstida for vindkraftverkene er ute. Dette er etter at Sør-Fosen sijte sitt synspunkt den minst skadelige traséen over land i Storheia vinterbeiteområde.

13.3 Landbasert alternativ 1 (Rød ledning)

Denne traséen går fra Aunfjæra langs Stjørnfjorden og FV718 i skogslia mellom bebyggelsen og fjellet og videre opp Sørfjorddalen til Rødsjøen. Videre nordover fra Rødsjøen til Åfjord trafo foreslår vi at

man tar i bruk jordkabel. Denne avstanden er om lag 12 km i luftlinje. I Hemnes kommune er det etter krav fra Ildgruben reinbeitedistrikt brukt jordkabel over en strekning på 3,3 kilometer mellom Stormålvatnet og Leirskardalen. En tilsvarende løsning bør kunne være mulig også på Fosen, i det minste på strekningene omkring flyttleiene. Sør-Fosen sijte mener dette er den minst skadelige traséen som i sin helhet går over land i Rissa vinterbeiteområde.

13.4 Kombinert alternativ 2 (Blå ledning)

Dette alternativet forutsetter sjøkabel fra Snilldal over Trondheimsfjorden og inn Stjørnfjorden og Sørfjorden og følger rød ledning videre nordover på land til Åfjord trafo.

13.5 Oppsummering

For Sør-Fosen sijte vil de skisserte alternativene begrense risikoen for både driftsmessige problemene og beitetap som vi har beskrevet for Rissalandet, ikke minst at risikoen for at samling og flytting av rein for transport til vinterbeite utenfor Fosen kan bli spolert. Dersom løsningen blir rød eller blå ledning bør dette omfatte bruk av jordkabel for den nordligste delen av traséen slik at beitetapet for de to nordligste vinterbeiteområdene minimeres og samtidig sikre at flyttleiene ved Nordsetervatnetog Torsengdalen ertilgjengelige etterkonsesjonen forvindkraftverkenepå Storheia er utløpt.

14 Avbøtende tiltak

Trafikken på FV715 har økt mye de siste årene. Det har flere årsaker. At Ørlandet flystasjon ble hovedflybase for Forsvarets jagerfly, har økt antall ansatte der betydelig. Det er stor pendling fra Fosen inn til Trondheim. Det er særlig stor helgetrafikk. I tillegg har man etter koronapandemien fått en markant økning i rekreasjonstrafikken, som allerede var stor på forhånd.

For å få en sikker kryssing av denne sterkt trafikkerte veien, er det alt nå mye som taler for at det ville være optimalt å bygge en viltbro/reinovergang eller «renodukt» som man sier i Sverige. (jfr. E6 Sefrivatn, E8 Lavangsdalen, E4 Gran sameby). Med erfaringene fra utbyggingen av skytefeltene i indre Troms in mente (Riseth 2015) er det all grunn til å forvente at trafikken vil øke på grunn av økt øvingsaktivitet.

Det kritiske for en slik konstruksjon er at den blir plassert slik at dyrene oppfatter den som en del av trekk/flyttleia og kan se over til den andre sida og oppfatte at det er trygge forhold der. Beplantning ved gjerder/rekkverk med stedegen vegetasjon og en bredde på noen titallsmetervil bidra til å sikre dette (Per Sandström, pers. med.) En reinovergang vil sikre farefri kryssing av FV715 og vil gjøre overgangen mellom høst- og vinterbeiter mer smidig og utnytte økende naturlig trekk til reindriftas fordel.

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