



Norwegian University
of Life Sciences

Master's Thesis 2024 30 ECTS

Faculty of Biosciences, Department of Plant Sciences (IPV)

Factors affecting farmers' coastal heathland management – a case study in Nerlandsøya, Norway

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Acknowledgements

Thank you to the farmers who participated in the study. The thesis would not have been possible without gathering perspectives about your farming. Thank you, Egil Kvalsund for helping with scheduling the interviews.

I want to thank everyone at the office building at Tingvoll gård for providing me with an inclusive and inspiring work-environment during my stay. Thank you, Kristin Sørheim, for organizing the interviews with the farmers. Thank you, Sara Hansdotter, for being my interview-partner and for your work with the focus group interview, and for being a great mentor providing sound advice and constructive feedback.

Thank you, my two supervisors, Tor Arvid Breland, from NMBU, and Tatiana Rittl, from NORSØK. I have learned a lot from your feedback and suggestions, which kept me on course in the turbulent journey of writing this master's thesis.

Lastly, I want to thank my family for their continuous support.

Abstract

The semi natural nature type of coastal heath provides a range of ecosystem services benefitting society. Phenomena, such as land use change, soil nitrification and the abandonment of heathland management, threatens the coastal heathland functioning and continued ecosystem provisioning. The semi natural nature type is red-listed in countries in Europe where they are located, and conservation efforts have been made. In Norway, conservation was promoted through the development and implementation of national government-initiated action plans. Management groups, often comprised of farmers and landowners, have the responsibility to use the action plans in their effort to maintain or promote well-functioning heathlands, through the activity of burning vegetation, and through having livestock, such as sheep, graze the land. Considering the essential role the farmers play for coastal heathland functioning it is important that they continue their practice. The scope of this study is to investigate what factors affect farmers' coastal heathland management. A case study was used as research strategy, with Nerlandsøya in Norway being the study location. Four semi structured interviews with 6 farmers, and one focus-group interview with 7 farmers were done for data collection. Coding and categorization of content from interview-transcripts were done for data analysis. The 6 identified factors affecting farmers' coastal heathland management were: economy, society, the burning practice, the infield -and outfield combination, the sheep, and personal motivation. These factors shape farmers' management, which is essential for preserving the red-listed, semi-natural landscape of the coastal heathland and its ecosystem services.

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1. Introduction

1.1. Coastal heathlands

Coastal heathlands are semi-natural nature types, dominated by heather vegetation (Fajardo, 2016). The distinction of “semi-natural” points to a nature type being influenced by human management (Haugum, 2021). Grazing and burning are central constituents of coastal heathland management (Vandvik et al. 2005). In Europe, the management has been dated back to around 4000 BC (Prøsch-Danielsen & Simonsen, 2000), and it has been practiced along 3600 km of the west coast, with coastal heathland areas being found as far south as the Iberian Peninsula in Portugal and as far north as Lofoten in Norway (Kaland & Kvamme, 2013). Traditionally, coastal heathland management was a yearlong practice yielding meat, wool, manure, berries, and honey (Hjelle et al., 2010). Today, such output would fall under the umbrella term of ecosystem services.

1.2. Ecosystem services of coastal heathlands

The ecosystem services of coastal heathlands can be divided into the four groups: basic support services, products, regulating services and cultural or non-materialistic services (United Nations Environment Programme, 2010).

The basic support services provided by coastal heathlands are largely like those found in other ecosystems. These general services include plant photosynthesis, decomposition of organic material and nutrient recycling, and subsequently the generation of topsoil (Kaland & Kvamme, 2013). The rate of topsoil generation is higher in coastal heathlands than in forests in the same areas due to water balance differences (Kaland, 1986).

The main products of coastal heathlands are meat, wool and skin from grazing livestock, and honey from bees. Honey from heathlands is considered a high-end product. The meat and other products come from livestock that is particularly well-adapted to the heathland (Kaland & Kvamme, 2013). For example, in Norway it is common to have the traditional breed “gammel norsk sau” (old Norse sheep). Meat from the old Norse sheep also used to be a high-end product, and farmers received a premium for Old Norse sheep meat, but as supply began to exceed demand, this scheme was terminated (Diemont et al., 2013).

The regulating services comprise the contribution in creating clean water and good air quality, the facilitation of insect pollination, erosion regulation, wildfire prevention and soil carbon sequestration (Kaland & Kvamme, 2013).

The cultural or non-materialistic services comprise the traditional culture value of coastal heathlands (Kaland & Kvamme, 2013). For the local community, the distinct landscape can play an important role in fostering a sense of cultural identity which is difficult to give a quantifiable value. Fostering cultural identity can also be promoted through tourism (Vittersø & Amelien, 2011). The coastal heathland's tourism generating ability is associated with people's interest in experiencing the timeless landscape and its openness to the coast and sea.

A prerequisite for coastal heathlands to provide these ecosystem services is that they are in good condition. There are threats to well-functioning coastal heathlands, some of which will be described in the following.

1.3. Threats to coastal heathlands

In contemporary times, much of the heathland in Europe is in poor condition and it is classified as a red-listed nature type (Janssen et al., 2016; Hovstad et al., 2018). There are multiple factors that contribute to threatening coastal heathland extension. These include land-use change, increased nitrogen exposure, and abandonment of heathland management.

Land-use change

Coastal heathlands are often located in proximity with highly populated areas, and as more and more buildings and roads are built in such areas the heathlands become more encroached (Haugum, 2021). The phenomenon of farmland being converted is not confined only to coastal heathlands and afflict other nature types as well. For example, in Norway from 2017 to 2018, the total area of land used for infield pasture shrank by 1070 hectares (Bye et al., 2020). This is more land converted than what the Parliament had set as target for 2020, which was less than 400 hectares (Innst. 56 s (2015-2016)).

Increased nitrogen exposure

The increased nitrogen content in coastal heathland soil is a result of deposits from nitrous oxide emissions and nitrogen run-off from industry and intensive agricultural activity (Haugum, 2021). An increase in soil nitrogen contribute to the loss of coastal heathland in the sense that it makes the *Calluna vulgaris*-dominated coastal heathland vegetation less

competitive (Aarrestad 2009). *Calluna-vulgaris* is most competitive in nutrient poor - including nitrogen poor – soil (Bobbink et al., 2003).

Abandonment of management

Abandonment of coastal heathland management results in successional changes where forest vegetation replaces heather vegetation (Saure et al., 2013). For example, in Norway, shrub and tree species, including the invasive Sitka spruce will outcompete the heather vegetation (Fajardo, 2016). The Sitka's vertical trunk growth in combination with a horizontally extensive canopy shoot growth, prevents sunlight from reaching the heather. Another factor that helps Sitka outcompete heather is its effective seed dispersion (Kaland & Kvamme, 2013).

To protect coastal heathlands from threats, national governments have developed approaches aimed at conservation. The conservation approaches done in Norway are described next.

1.4. Conservation efforts of coastal heathlands in Norway

In 2015, coastal heathlands were classified as a “utvalgt naturtype” (selected nature type) by “Miljødirektoratet” (the department of environment) (Forskrift om naturtyper etter nml., 2011, § 3). A “selected nature type” is one with a distinct ecological makeup and unique composition of biodiversity. Selected nature types are supposed to be prioritized in municipality-level conservation policies. The state government develop action plans for the management and conservation of selected nature types and the municipalities have the responsibility to implement these.

Action plans are supposed to promote three national environmental goals for biodiversity, and one cultural environment goal (Miljødirektoratet, 2023). The four goals are: “the ecosystem ought to be in good condition and provide ecosystem services”; “no species or nature types ought to go extinct, and the state of species and nature types being endangered ought to be improved”; “a representative selection of Norwegian nature ought to be preserved for future generations; and “a diversity of environments of cultural value ought to be preserved as a foundation for knowledge, recreation and use”.

In praxis, management-groups, consisting of farmers and landowners, are the main implementors of the action plans in managing the coastal heathlands, and they receive subsidies for doing so. Subsidies are distributed both nationally and regionally. One national

subsidy scheme is the “Areal -og kulturlandskaptilskudd” (referred to as area and cultural landscape support (ACL) from hereon) (Forskrift om produksjonstilskudd og avløsertilskudd i jordbruket, 2014, § 4). ACL has been criticized for not being specific in guiding receivers towards environmental aims (Asheim et al., 2020). Regionally, subsidies are allocated through “Regionale miljøtilskudd” (RMP) (regional environment support) and “Tilskudd til spesielle miljøtiltak i jordbruket” (SMIL) (support to special environmental efforts in agriculture). SMIL support is allocated to one-time projects (Forskrift om spesielle miljøtiltak i jordbruket, 2004, § 3), while RMP support is allocated on a yearly basis (Landbruksdirektoratet, 2020). The scope of RMPs is county specific. For example, in Møre og Romsdal farmers do not receive support based on the amount of heathland they have burned (Forskrift om regionale miljøtilskudd I jordbruket, Møre og Romsdal, 2021, § 10), while in Vestland farmers receive this kind of support (Forskrift om regionale miljøtilskott I jordbruket, Vestland, 2023, § 11). The maximum amount of support farmers in Vestland get per hectare burnt area is NOK 4000.

The degree to which the burning practice’s positive impact on society is reflected in the value of subsidies allocated to this activity is a topic of discussion. A cost-benefit analysis done by Statistics Norway (SSB) compared the costs of heathland management with costs of firefighting, and it was estimated that the management approach was around NOK 200 million cheaper than the firefighting approach to putting out wildfires (Halvorsen & Grimsrud, 2021). One potential factor contributing to the phenomenon of farmers seemingly not receiving financial support reflective of the value of their fire-preventing contribution, is that it is unclear who should provide them with this support, and how much each potential provider should contribute with. Costs of wildfires and the benefits of preventing fires are shared between many actors, and there is a lack of concerted effort in getting an overview of the costs and benefits for different stakeholders (Halvorsen & Grimsrud, 2021). Having an overview of who the potential subsidy-providing candidates are could give direction for developing appropriate subsidy schemes supportive for farmers’ coastal heathland management.

Considering how the coastal heathland provides ecosystem services, which are acknowledged by the United Nations Environment Programme (2010), and the central role the farmers play in managing the heathlands, it is important that their management continues. Knowledge guides actions (Hawthorne & Stanley, 2008), and continued management can therefore be promoted by having knowledge about factors affecting farmers’ management.

To my knowledge, there is a lack of information about what factors affect farmers' coastal heathland management, but much is known about factors affecting farmers' management in other farming systems in Norway and neighboring countries, and some of these are described in the following.

1.5. Factors that affect farmers' management

Factors include farmers' income and costs, their sense of place attachment, and urbanization.

Income

Flaten & Rønning (2011)'s research on the economy of sheep farming in Norway showed that only a small number of farmers in the study obtained the minimum wage. The low wage is not just common in the sheep sphere of Norwegian farming but seem to be a sector-wide phenomenon. Research done by The Norwegian Institute for Agricultural Research in 2009 estimated the hourly rate of farmers to be 107 NOK, while the minimum wage in Norway was 120 NOK at that time (Heggelund, 2017). It is common for farmers in Norway to have non-farming sources of income, and Storstad & Rønning (2014) found that 95 % of farmers had non-farming income sources.

Possibilities for farmers to increase income include value chain integration (Heggelund 2017; Lawson et al., 2008), efficient utilization of available resources (Nitzko & Spiller, 2019), farm diversification and agricultural diversification (Barnes et al., 2015). A farm that has at least two agricultural enterprises, for example sheep and pork, is considered agriculturally diversified (Hansson et al., 2010), while farm diversification can be defined as the phenomenon of integrating non-farming income-generating activities into the farming business (Barbieri & Mahoney, 2009; Hansson et al., 2013).

Costs

It has been found that costs associated with investment in machinery play a particularly important role in farm operations' varying degree of profitability (Hansen & Stornes, 2010). Flaten & Rønning (2011) concluded that investing in expensive machinery often turns out to be unprofitable. Despite of this, farmers have expressed that investing in expensive machinery is necessary for the business to be operational (Heggelund, 2017).

Place attachment

Place attachment is associated with farmers' willingness to continue their practice (Daugstad et al., 2014; Quinn & Halfarce, 2014). The responsibility felt by farmers to preserve the landscape promotes further management, as they realize that if they don't do it, no one will and then the landscape will be lost (Frøyen, 2021).

Urbanization

Ortmann (2018) found that urbanization was viewed as a threat to the existence of the local farming community. This is supported in Selinger (2023)'s findings of (1) farmers having the perception that one reason why others quit is because they had lower living standards than non-farming neighbors, and (2) the phenomenon of other farmers shutting down their farming operation is taking its toll on the local farming community.

1.6. The scope of the master thesis

In this thesis I investigated factors that affect farmers' management of coastal heathlands, specifically. By doing so, a topic's identified knowledge gap was addressed. Knowledge about such factors is important because the farmers are the main stewards of the coastal heathland, and can be used in processes aimed at developing appropriate ways of managing this semi-natural nature type with its ecosystem service provisioning. Therefore, my research question was:

«What factors can affect farmers' coastal heathland management? »

My research strategy was a case study (Yin, 2003) on Nerlandsøya in Møre og Romsdal. I took a phenomenology-oriented approach, *i.e.*, studying phenomena as they are experienced and understood subjectively (Smith, 2013). Semi-structured interviews and a focus-group interview with farmers were used as data collection methods, while the data analysis was done through transcript coding and categorizing.

2. Materials and methods

2.1. Research project: Blå-grønt samarbeid 2.0 (BG2)

My thesis project was connected to the research project “Blå-grønt samarbeid 2.0” (BG2), funded by Møre og Romsdal county, where the collaborating actors are Runde forskning, Møreforskning, and Norsk Senter for Økologisk Landbruk (NORSØK). The main goal of the BG2 project is to contribute with value creation and sustainable development in the marine and land-based business sectors in Møre og Romsdal, by generating scientific knowledge in collaboration with the local businesses.

2.2. Case study location

Rationale choice of study location

The choice of Nerlandsøya as the study location was based on it meeting the four criteria that were used in the BG2 project for identifying a fitting study location. These were the four criteria that were used: (1) There is a populated settlement with agricultural activity, (2) Animals are grazing in the outfield, and the farming practice is representative for contemporary coastal-zone agriculture, (3) There are farmers positive to sharing their data and to collaborate in creating new data, and (4) Relevant studies that can be of use have been conducted here previously.

Nerlandsøya, Herøy municipality, Møre og Romsdal county

Nerlandsøya is an island of 14.6 square kilometers, in Herøy municipality. 871 people lived on the island in 2018. The landscape of the island is mosaic and comprise areas with coastal heathland, rocky mountainous terrain, and other nature types. The highest point is 430 meters above sea level. The coastal heathland area is mapped, and it is managed through burning and grazing sheep (Sørheim et al., 2020).

Møre og Romsdal, the county where Nerlandsøya is located, has an area of 13840 square kilometers and the number of inhabitants where 256 840 in 2021 (SSB, 2021). 74 % of the population lives in urban areas, and only 4 % of total area is agricultural land. Small-scale livestock farming is the main type of agricultural activity, with average farm sizes being in the range of 10-25 hectares (Zahl-Thanem et al., 2022). Sheep farming is the most common agricultural activity, and in 2022 there were 1065 sheep producers (Ruud, 2022).

2.3. The farmers

The interviewees were all farmers and members of the local “Beitelag” (referred to as “grazing group” hereafter). There are 8 farmers in the grazing group, and 7 of them participated in the focus group interview, while 6 of these participated in the semi-structured interviews. A short description of these 6 will be provided in the following.

Farmer A

Farmer A is from a neighboring island and moved to a farm in Nerlandsøya in 2014. His wife and him started with sheep production in 2016 with 5 “Spæl” sheep (a traditional sheep breed in Norway) and had the first lambing in 2018. They have 34 winterfed sheep, including 26 lambing sheep.

Farmer A has a teaching degree and works fulltime at a local family business, and his wife is working as a teacher. The farm is used for educational purposes in addition to production of meat, skin, and wool.

Approximately half the meat from the local slaughterhouse is returned to the farm and sold directly to consumers. Customers include family, friends, and people in the local community.

Farmer B & C

Farmer C and B are father and son. Farmer B has 52 “Norsk Kvit Sau” (NKS) (a common sheep breed in Norway) and Farmer C has 60 sheep of the breed “Gammelnorsk Sau” (referred to as old-Norse from hereon).

Farmer C started with old-Norse sheep in 2000. He found it challenging to combine the sheep farming with his fulltime job working as a fisherman in the beginning. It became easier to combine the two when farmer B started to get more involved in the sheep farming as he grew older. Farmer B’s continued involvement in Farmer C’s sheep farming eventually led to him starting his own in 2017. Farmer C has reduced his workload in the fisherman industry and can therefore spend more time on his sheep farming than what was possible earlier.

Farmer C chose to have old-Norse sheep because they are hardy breeds who fare well in the at times, steep mountainous terrain.

Farmer B decided to have NKS, as he had been inspired by the observation of a farmer in the local community's NKS lambs obtaining such high slaughter weight.

Farmer D

Farmer D has 69 old-Norse sheep, including 35 lambing sheep. He started with 5 old-Norse sheep in 2004, 8 years after he took over the farm in 1996.

Farmer D works in the fish industry full-time, and he thinks combining the two works well. He works a lot in the wintertime and spends more time at farming in the spring and summer, in order to be available during lambing season.

One of his aims is to grow as good sheep as possible. He does this through selective breeding. Different qualities are considered when Farmer D does the culling process. These include the sheep's ability to gain weight, the ease to which its wool is to shear, the straightness of its legs, and the smoothness of the wool on its forehead. The yearly exhibition of rams at Nerlandsøya hosted by the "Norsk Villsaulag" (Norwegian wild sheep association) is one measure that promotes the growth of sheep with desired traits. In this exhibition old-Norse sheep are graded, based on traits valued by farmers. This event promotes knowledge sharing amongst old-Norse sheep farmers, which can be supportive to the future old-Norse sheep population in Norway.

Farmer E & F

Farmer F and Farmer E are father and son. They have one farming operation each. Farmer F has both NKS, and old-Norse sheep and Farmer E has old-Norse sheep only. They have around 200 winterfed sheep combined.

Farmer F has combined the sheep farming with greenhouse production, of flowers primarily, but also some vegetables. The greenhouse business is not operating to the capacity it usually has. This is partly a consequence of high costs of electricity.

Farmer E works in the “energy sector” in addition to sheep farming and says that he is interested in doing farming full time. Farmer E is contemplating on what he can do to make farming viable as a fulltime job.

2.4. Data collection

All semi-structured interviews and the focus-group interview were done by two people, one person from the BG2 project and me. They all took place during a two-day period in late February, 2024.

Semi-structured interview

The focus of the four semi-structured interviews, in which two included both father and son, was on farmers’ perspectives on their farming operation. Semi structured interviews were done as they allow for flexibility in interviewee responses, while at the same time providing a framework promoting sufficient progress (Bernard, 2017). The interview guide that was used is shown in Appendix 1.

Focus-group interview

In the focus group interview the main topic was the role of the grazing group in managing the heathland. The interview guide is shown in Appendix 2. The areas of responsibility during the focus group were split between the two hosts. One moderated the conversation and made sure that the interview guide was followed, while the other person noted down the first few words that were said, and by whom, during the interview. Knowing who says what is helpful in the transcribing process (Bernard, 2017).

2.5. Data analysis

After the interviews were conducted and before the transcript analysis had started, I drew a rich picture (Armson, 2011), which is shown in Appendix 3. The process of drawing the rich picture was meant to help me get an overview over the topics brought up in the interviews.

The transcript analysis process was influenced by the pile-sorting method (Lincoln & Guba, 1985), and comprised five steps. In the first step I identified and marked content in the transcripts that I perceived to be supportive and hindering to the farmers’ coastal heathland management. The second step consisted of making key-sentences that in few words represented the hindering and supportive forces. In the third step these key-sentences were

assigned to belong to either of six factors that I perceived represented the key-sentences. All the factor-assigned key-sentences were placed in factor-dependent groups in the fourth step. The fifth and final step consisted of fleshing out coherent factor-based content, including farmers' quotes. The result of the fifth step are shown in the following section.

3. Results – factors affecting farmers’ coastal heathland management

3.1. Economy

Economy was a central topic in the interviews. Economy-related aspects the farmers talked about included income, costs, and subsidies.

Income

The income from the coastal heathland management was low according to the farmers. In the interviews, income-increasing possibilities were talked about to. Identified income-increasing possibilities included value-chain integration, efficient resource utilization, increasing the production of sheep, and agricultural and farm diversification.

Value-chain integration

Some farmers perceived that they could get a larger share of the retail price, through this activity. Value-chain integration examples that were mentioned included butchering of the animals themselves and selling products to consumers themselves.

Some of the farmers were practicing value-chain integration. One of the farmers was taking some of the meat back from the butcher and sold it to consumers himself. Another farmer sold potatoes and honey, locally. Other farmers mentioned that they were interested in practicing value-chain integration. One way in which this was expressed was through seeing the benefit of establishing a local abattoir.

“If you are going to be able to make a living from this, it’s necessary to have your own approved abattoir” – Farmer B

Although some farmers perceived value-chain integration to be an economy promoting possibility there were also doubts associated with the profitability considering the extra labor that comes with it.

“It has a bit to do with working-hours and time, but we don’t take back meat from the slaughter. Some here on the island try to process and sell the meat themselves, but they can’t state that it has improved the situation to any significant extent considering the extra work” – Farmer F

Efficient resource utilization

Skin and wool were the products that brought in additional income per sheep amongst the farmers interviewed. One of the farmers had sold some sheep-skin on the consumer-producer direct-sales channel REKO-ringen. Two other farmers had also sold skins directly to consumers. Previously, these had a day-open local shop where greenhouse produce and sheep skin were sold, but this shop was longer day-open due to declining greenhouse production activity. High electricity costs contributed to reduced greenhouse production.

Increase production of sheep

One of the farmers was in the process of increasing his sheep-herd size. Part of the rationale for doing this was to utilize more of the available grazing resources. For herd expansion to be possible, a larger barn was needed to accommodate for the increased number of NKS. Pointing to the farming’s ability to finance for upgrading barn Farmer B had this to say:

“There isn’t even money for that, building something” – Farmer B

Income generated through non-farming activities enabled him to invest in upgrading the barn. In addition to high expenses associated with infrastructure upgrading, increasing the sheep herd were perceived to bring challenges during lambing seasons. Farmers perceived supervision to be essential, and a bigger herd meant more work.

Agricultural diversification

Some of the farmers had diversified their production. For example, one farmer had started producing vegetables in addition to NKS-sheep farming. The same farmer had also produced pork. The income generated through pork production had been good.

“Pork chops have been sold for NOK 170 per kg while pork chops in the regular supermarket have a price of around NOK 50 per kg – it’s about the quality of the product” – Farmer B

Another farmer had considered adding cattle for beef production into his farming operation. He suspected that the market demand for beef could be high.

“Light cattle breeds were discussed in relation to local food, getting hold of meat from lamb and sheep is easy in our areas, but getting hold of locally produced meat from cattle is not so easy” – Farmer E

He also mentioned that having a diversity of livestock species was beneficial for efficient utilization of grazing resources and for the mitigation of host-specific parasite proliferation.

Farm diversification

Farm diversification was practiced on one of the farms through incorporated on-farm education. The educational program was called “inn-på-tunet”, which was a welfare service provided on farms with the aim of promoting wellbeing and a sense of accomplishment in the participants. The service was offered 1-2 times a week and allowed the couple on this farm to spend more time on farming related activities than what they would have been able to without this initiative. It was also a source of income independent of extra investments in farm resources.

“There are no restrictions on the size of the barn, or how much forage-production area you have, you can get some income on other terms. That’s exciting” - Farmer A

Costs

The costs of farming were central constituents in the conversation about farm profitability. Farmer E had invested in expensive machinery including a tractor and equipment used for forage harvesting, primarily because he perceived this to be necessary for operating the business, but also because of an inherent interest in machinery.

“It is partially an interest in machinery. The technology and equipment we have today helps us manage our land in a better and more efficient way, and the use of GPS makes it easier to take care of the environment, when we fertilize, we do it as appropriate as we can, and that is something that matters to us, not least when it comes to pesticides, as small amounts as possible of course” - Farmer E

Although these costs were high, and only made possible through generated off-farm income, they would have been a lot higher if their farming operation was more conventional according to Farmer F.

“There is no reason to whine, based on extensive operation with old Norse sheep... those who operate conventionally, there the cost picture is completely different, and there is much less left for them, that’s the truth” – Farmer F

Subsidies

The farmers said that received public subsidies for different aspects of the farming. Subsidies were allocated to outfield grazing, meat production, burning and forest clearing.

Subsidies received for having grazing animals, were appreciated by the farmers.

“In order to graze the open fields, we have received good subsidies, we have to say, that is what enables us to keep going” – Farmer B

There were however also some frustrations associated with a lack of incentivization of proper management in subsidy schemes for grazing. Some said they got subsidies for using specific areas, but that the activity level of the specific area was arbitrary in relation to allocation of subsidies.

“If we release 200 sheep on an area that can’t sustain this population size, and the coastal heather gets destroyed as a consequence, we get just as much subsidies as if we manage it properly” – Farmer B

It was also expressed that there was a lack of subsidies allocated to burning, compared to in neighboring counties. 400 NOK per 1000 m² burnt area were given to farmers in these counties according to the farmers. There was agreement amongst the farmers that such a scheme, where the farmers are compensated per managed area, would be desirable.

According to Farmer E, a potential contributing factor to the lack of subsidies allocated to burning of heathland in Møre og Romsdal county could be that the traditional forms of agriculture weren't being prioritized. He hinted to the financially strong marine sector being prioritized over land-based activities, policy wise.

However, they had received some subsidies for burning. Applications for the regional subsidy scheme "Tilskudd til spesielle miljøtiltak I jordbruket" (SMIL), had been successful and funds related to burning, as well as forest clearing, had been granted.

"We applied for NOK 100,000 now, it was mostly for upgrading health, environment and safety (HSE), equipment and such. Half for equipment maintenance and half for HSE. A leaf blower can cost around NOK 8,500. And NOK 3,000 per person in protective equipment. And as I said, we have largely covered these things through these grant schemes" - Farmer E

3.2. Society

The society factor represents the local farming community, the non-farming community, including, friends and family, the scientific community, and the public sector, which were all brought up during the interviews.

The Local farming community

The local farming community comprised the grazing group, which consisted of the sheep farmers that participated in the focus group interview and at least one more farmer that couldn't participate. It was mentioned that this group cooperated in burning and outfield grazing management. The local farming community was also important in a more informal way, according to the farmers. It provided a social, knowledge-sharing, supportive community. This farming community was viewed as an essential part of the farming life and

for the continuation of the heathland management. This is reflected in the following extract of the interview with Farmer B and C:

Farmer B: *“we wouldn't have continued farming if there hadn't been anyone else here doing it”*

Farmer C: *“No, probably not. I doubt it.”*

The non-farming community

The non-farming community's impact on the farming had both been positive and negative according to the farmers. They were appreciative of; friends and family helping with the farming at times; establishing relationships with the local customers; hikers enjoying the landscape, and appreciating the farmers' effort in managing it, while keeping predatory birds away from sheep with their presence. One way in which hikers had impacted the farming negatively was through bringing off-leash dogs to the outfield. Off-leash dogs where sheep were grazing had been problematic. The farmers had applied for year-round leash mandates for dogs in the outfield to reduce this problem.

It was stated that it was mandatory for dog owners to have their dogs on leash in the period of 1. April to 20. August, but in Nerlandsøya sheep were outside all year round and thus exposed to attacks from dogs outside of this period. Signs that inform dog owners that they were entering an area used for grazing had been put up on outfield gates, but this had not been sufficient as a preventative measure for eliminating the problem with off-leash dogs according to the farmers.

Another challenge was that hikers sometimes were disconnected from the local farming and behaved in ways that reflect a foundation of poor knowledge about farming, which affected both sheep and farmers. For example, farmers mentioned that hiking tourists lacking knowledge and understanding of sheep had behaved in ways that induced stress in the animals. Sheep that were stressed could get lower slaughter weights, and the farmers perceived it as likely that this would become more common now that the local government had made new hiking paths in the outfield.

“Hiking paths were changed, and suddenly, the animals became homeless. You saw them pull away. There was unrest, and it was reflected in our herd’s slaughter weight. So one should not downplay that a large number of hikers is a problem.” – Farmer F

The farmers found it unfortunate that they were not included in the decision-making process regarding hiking-path development. They explained that the municipality were responsible for including the landowners when planning interventions pertaining to the outfields.

However, the farmers also recognized that the public sector had played a role in promoting the farming. The commencement of the heathland management on the island was a result of the public sector mapping the area, and reaching out to the farmers and asking if they could manage the outfield heather with support in form of funding.

“There were concerns that this grazing area would become overgrown, from the county governor and administration, the area was mapped and given an A value, I was contacted by administration to hear if I could do something to preserve this space, then funds were granted” – Farmer F

The heathland management plans given to the farmers was mentioned as another way in which the public sector had positively impacted the farming.

“Clearly, management plans make things visible in a completely different way than if it is just talked about. It is something to hold on to, and relate to, and which can be shown to others” – Farmer A

Researchers had also provided the farmers with support. Through the phenomenon of researchers showing interest in the coastal heathland, and the farmers managing it, the farmers’ perception of the importance of their work as stewards of the land had been consolidated.

“It probably makes us see the larger context. We understand that what we are doing is not only something that concerns us.” – Farmer B

3.3. The burning practice

Burning was done to improve the grazing quality. Farmers perceived the burning practice as essential for ensuring the better-quality grazing resources and for the continuation of the farming. The farmers started burning in 2016, after the practice had been abandoned for 50-60 years. One farmer said it was difficult to measure the extent to which the contemporary burning had improved the quality of the grazing resource, because the area that now had been burned was relatively small. However, some of the farmers mentioned that they had observed that the sheep preferred grazing in areas that had been relatively recently burnt.

One reason why the farmers hadn't burned more is that the window for opportunity for burning was vanishingly small. It was essentially Saturdays in March and April that most likely could provide burning-friendly conditions. Burning during weekends was considered most appropriate because this was the time the farmers most likely were free from their fulltime jobs. The fire-department preferred that the farmers avoided burning on red days, and farmers thus viewed Saturday-burning the most viable option. The reason stated by the farmers for why burning normally was done in March and April was because this period of the year was the most likely to offer weather conditions suited of burning. It was mentioned that some years burning wasn't done due to weather conditions not being suitable.

Widening the window of opportunity for burning could promote increased heathland burning, according to the farmers. This was believed could be promoted through receiving burning-specific subsidies, such as those received in other counties, which could be used to pay farmers to take time of their full-time job. The farmers also expressed an interest in the idea of the potential of using such subsidies to pay firefighters to partake or be available during burning sessions. A good work-relationship with the local fire department was perceived as promotive for safety in the burning practice.

“If there is an area with a lot of fire fuel, having firefighters nearby and access to water and such, you would feel safer.” – Farmer D

The heathland burning could come out of control according to some farmers, and as a child, Farmer C witnessed burning going wrong.

“I remember watching them burn when I was little, it caught fire, and they lost control, it was real... it did not go well” – Farmer C

Better equipment had improved the burning practice and made it safer, and the farmers hadn't had any major complications, but there was one minor incident mentioned by one of the farmers that negatively affected some in the local community.

“All the smoke from the burning on one side of the mountain ended up on the other side of the mountain. It cooled and sank down. So, it was half a day where it was foggy out there. There were probably some who didn't think it was so nice. Of course, it was unfortunate for those who experienced it” – Farmer A

Overall, people hadn't complained much about the burning practice, but farmers had the perception that people's attitude towards burning were mixed. According to some farmers, people's perception on burning was dependent on their knowledge of burning.

“Many people know a little about the tradition that was. It used to be common to burn out here” – Farmer A

One of the farmers questioned whether it was fair that the farmers bore all the responsibility when burning, pointing to how burning was something that benefitted more than just the farmers.

“You're doing it for the society as well, it's not just for us... is it right that we should be the only ones responsible? Of course we must act responsibly, there should be some kind of... [shared responsibility]” – Farmer B

It was mentioned that one way in which other people than the farmers themselves benefitted from the burning of coastal heathland was through this action's wildfire mitigation effect.

3.4. The infield and outfield combination

The farmers considered the outfield and infield combination as essential for the feeding the sheep adequately.

“It is very important, this infield and outfield combination, it makes it possible to achieve a decent result” – Farmer F

Outfield

Three outfield-related aspects the farmers described were: outfield overgrowth; over-grazing; and the mountainous and sometimes steep terrain.

Outfield – overgrowth

The farmers expressed that large areas on Nerlandsøya was overgrown with vegetation, as a result of not having been burnt for the last 50-60 years. It was mentioned that an overgrown outfield had poor-quality grazing resource compared to one that wasn't. According to the farmers, slaughter-weights would improve if the grazing resources of the outfield were improved, and they worked to accomplish this.

“The hope is now that when more active management is carried out, the quality of pasture will also improve. hopefully, then we will have higher slaughter weights” - Farmer A

Afforestation was another phenomenon associated with poorly managed heathland according to the farmers. One farmer mentioned that it made the area less suitable for recreation, through making it more difficult to maneuver in, and by making it less esthetically pleasing. One mentioned positive aspect about forest was that it could provide shelter for sheep if the vegetation density wasn't too high.

A forest clearing project funded through the municipality's SMIL initiative had been done, and this contributed to ameliorate afforestation, but there was still a lot of the forest left, which the farmers would like to clear.

Outfield – high grazing-pressure

A high grazing-pressure had negative impact on the outfield according to the farmers. Insufficient burning practices had been identified by the farmers as contributing to high grazing-pressure. Farmers had noticed that the sheep preferred the areas that recently had

been burned over those that hadn't, and when the burned area was small the grazing pressure could become sufficiently high to alter the vegetation-composition of the heathland. It was mentioned that the feeding-station areas in the outfield were susceptible to the same phenomenon of vegetation alteration. Increased manure dumping, and the manure being based on "invasive" infield forage, was mentioned as contributing to making the heather less competitive. One farmer explained that the heather vegetation was frugal and got outcompeted by species that thrive in well-fertilized soils. Farmer F recalled a conversation he had with an expert on coastal heathlands about the benefits of feeding-stations outweighing the negatives of the associated high grazing-pressure.

"When you have a feeding station, and they eat and fertilize there, the vegetation becomes a bit grass dominated, but this is fine if we manage to maintain thousands of acres of coastal heather" – Farmer F

Outfield - Hard-to-maneuver mountainous terrain

The mountainous terrain could be challenging for the sheep to maneuver in, according to some of the farmers. The common NKS breed was particularly disadvantaged in this kind of terrain. Farmer B had an experience with helping a struggling NKS sheep in the outfield:

"One sheep fell. She didn't hurt herself, she looked perfectly fine, but got a mental block and refused to go back up. She went back and forth down there, and had to be carried up" – Farmer B

Farmer B said that the likelihood of accidents occurring, could be reduced by making sure that the sheep were allowed to move in the terrain in their own tempo.

Infield

The infield production was essential for the coastal heathland management continuation according to the farmers. One of the farmers pointed to the phenomenon of infield areas having been converted for other purposes, being a threat. One farmer said that it couldn't be easy for the municipalities to withstand the pressure applied by powerful actors desiring to convert arable land in ways that promoted their self-interest. Farmer D was opposed to the

agricultural land being converted and attempted to protect his infield land from being converted.

“They manage to convert areas with good topsoil into construction sites, it’s a shame. I received a phone call asking if I wanted to take my land away from agriculture to have it regulated as a building site instead, I was not interested in that” – Farmer D

Some of infield area used by the farmers was not owned by them, and the farmers consequently had a harder time with protecting this land. The risk of these infield areas being converted made the farmers reluctant to invest time and resources in improving the quality of these. For example, the farmers prioritized making draining ditches on land they owned themselves, over the land they didn’t own. As explained by one farmer, draining ditches were developed to mitigate leaching, which was a challenge in this area due to the wet climate.

3.5. The Sheep

The role of the sheep was multifaceted according to the farmers. It contributed with preserving the coastal heathland landscape; It provided the farmers with a source of income through meat, skin and wool production, and through public subsidies for outfield grazing; It’s presence both in the infield and outfield was positive for the overall perception people had of the island; and during the interviews it became evident that the sheep was a source of interest that brought joy for the farmers, and that they aimed to facilitate for the sheep to have conditions that let them thrive.

A coastal heathland preserver

The role of the old-Norse sheep as a landscape preserver was well illustrated:

“The sheep is a good mowing tool, beaten only by the goat, she is a bit tougher, but will eat your shoe too... but there is not much left of a small spruce after the herd of 35 [old Norse sheep] has been there. They also take deciduous forests, they eat bark in the winter and clear trees that way” – Farmer D

An income provider

As mentioned in the Economy section the income generated through the coastal heathland management was relatively modest according to the farmers, and this pertained to the share that came directly from sheep-output as well. One of the farmers mentioned that the income from meat alone constituted only around 1/3 of the income. It was mentioned that the subsidies constituted the lion's share of income from sheep-output according to the farmers.

“If we were to sell the meat with the same price as it has now, but without receiving subsidies, I don't think many people would have been interested in buying the meat, it is expensive” – Farmer F

An ambassador for the island

Farmers perception was that most people hiking on the island were positive to seeing grazing sheep.

“There are people who see sheep grazing, and think it is wonderful, and appreciate it a lot” - Farmer C

A being cared for by the farmers

The farmers said they were fond of their sheep and that they aimed to facilitate for them to thrive. Post-lambing intervention, and provision of supplemental feed in the outfield during winter, were example of measures that were mentioned as important in care-taking of sheep.

Post-lambing intervention

It was mentioned that old-Norse sheep generally did intervention-free lambing without complications, but that complications could occur post-lambing. Farmer D pointed to a tendency of the ewes stealing lambs from one another, and that this was exacerbated when multiple ewes were lambing close together.

“Especially with young ewes, several of them lamb in proximity to one another, they start licking the same lamb and then there is chaos. Two ewes can fight over one lamb, and there are three other lambs that are ignored” – Farmer D

In this stealing-situation, the farmer said that he would bottle feed and facilitate for reuniting ewes with lambs. This could be done by isolating ewes and their lambs from others, by placing them in smaller pens. Farmer D stated that one of the reasons why his lambs per ewe was 1.8, which was high for old Norse sheep, was that he intervened post-lambing.

“Stealing of lambs also happens in the outfield, and those who do not intervene post-lambing receive an average of 0.9 lambs per ewe, because lambs are lost” – Farmer D

The labor intensiveness associated with monitoring and intervening in the lambing process was pointed to by Farmer C as one reason for why he considered expansion of his old-Norse sheep herd as unlikely.

Despite of the labor intensiveness and the challenge of ewes stealing lambs, some farmers expressed that it was necessary to have the sheep gathered in smaller pens in the infield during lambing season. Lambing in the outfield was associated with the risk of crows, ravens and golden eagles taking newborn lambs.

Supplementary feeding

Farmers with sheep in the outfield during winter provided them with supplementary feed. Farmer D had feeding stations in the outfield that were accessible with tractors when the road wasn't snowed down.

“When the weather forecast shows that the weather is going to be bad, I will set up round bales before it becomes impossible to get there on the tractor. Then I head up on skis to open the round bales when needed. The round bales are covered with plastic so that the deer won't eat it” – Farmer D

He also mentioned that the amount of supplementary feed needed each winter depended on the amount of snow, which fluctuated from year to year.

3.6. Personal motivation

The farmers motivation for doing the farming was multifaceted and included an interest in sheep, producing food, taking care of the landscape, and inspiring the next generation.

Interest in Sheep

The interest in sheep came from the experiences with sheep management throughout life. The farmers grew up with, or around, sheep farming. They valued the sheep highly and appreciated its contribution in maintaining the landscape and producing meat. Farmer D said that being interested in sheep was a prerequisite for doing the local coastal heathland farming.

Interest in Food

The farmers expressed that they were interested in food and that local food production was important. One farmer had the perception that food from Norway often was produced with less use of input factors such as pesticides and antibiotics than imported food were, and that this was a good thing.

Preparedness was another factor that was pointed to when talking about local food being important, and that it seemed like more and more people began to reflect about this because of the COVID-19 situation and geopolitical uncertainty.

“It will probably be higher valued over time, having a patch of land, I hope it will be more appreciated. We saw it during the pandemic, many people became more aware, preparedness, if there is a conflict, the country is trying to provide for itself before food is exported. When it’s peaceful, you’ve had free access to everything. There’s a lot of cheap food imports, but when things turn around it’s different, to put it like this, I don’t think there will be beef from Brazil here” – Farmer D

Interest in the Landscape

The farmers cared for the local landscape, and this was connected to a sense of attachment they had to the place they grew up in. A deeper appreciation of the unique landscape was something one of the farmers mentioned had developed over time, as his knowledge of the landscape had increased.

“That which we did not know at the time, or that we did not think of at the time, was that we walked in a cultural landscape, it was something we began to understand in recent years... So, there is such a motivation there” – Farmer A

Perceptions about the Future

The farmers were interested in continuing farming, and were optimistic about the future, but at the same time being conscious of potential up-coming challenges.

Farmer B mentioned that there was a trend of urban migration, and that this could pose a challenge in the future when it came to having enough people around willing to get into farming.

Another threatening factor that was mentioned was the perceived social pressure of keeping up with the local community, financially. It was implied by one farmer that many people in the area had a lot of money, and that people could feel a sense of obligation to pursue material wealth. Doing local coastal heathland farming was not perceived by the farmers as promotive for acquiring material wealth.

Despite the potential problematic aspects, farmers generally had a positive outlook on the future of farming at Nerlansøya. The thriving local farming community was perceived to have raised a foundation for heathland management, which could be built on and improved going forward. Furthermore, it seemed like it was possible to inspire the next generation to carry on the torch as well.

“The two oldest kids say they will have a lot of different animals when they grow up. I think they will have to find a bigger farm” – Farmer A

4. Discussion

4.1. The factors affecting farmers coastal heathland management

The factors had both hindering and supportive aspects about them and can be viewed as areas of significance deserving of focus, rather than areas that are strictly either positive or negative, and unchangeable. The six identified factors are discussed in the following.

Economy

The economy of the coastal heathland management was characterized as poor according to all the farmers. If the financial result was too bad the farmers could not keep doing it.

Both high costs and low income, although the subsidy fraction of the income was relatively large, contributed to the poor economy of the coastal heathland management. Income being low coincides with Flaten and Rønning (2011)'s findings that only a small number of the sheep farmers of that study obtained the minimum wage, and with national trends of income in agriculture generally being low (Heggelund, 2017). One farmer mentioned that the low income consisted of 1/3 income from meat and 2/3 subsidies. When it came to costs, some farmers mentioned that those associated with the farming equipment and machinery were particularly large. The machinery was considered as necessary for the management on the island, which has been expressed by other farmers in Norway as well (Heggelund, 2017), and the farmers of this study paid for machinery through off-farm income. Another farmer used off-farm income to cover costs of barn-building. Farmers having off-farm income pertains to 95 % of farmers in Norway, according to Storstad & Rønning (2014).

The farmers were doing different activities to improve the economy of their farming enterprises. Some farmers had practiced value chain integration, through skipping value adding middlemen and selling products privately. Others were increasing their number of sheep. Selling skin and wool in addition to meat was done by farmers to promote efficient resource utilization. Furthermore, Agricultural diversification was done by one through incorporating other agricultural activities such as pork production and vegetable production, while another was considering adding a light cattle breed suited for the landscape. Lastly, one farmer and his wife are practicing farm diversification, through on-farm-education provision.

Some of these attempts in income-increasing can be counterproductive when it comes to promoting coastal heathland management specifically. For example, value chain integration has been shown to lead to additional work (Lawson et al., 2008), and if this work is unrelated to coastal heathland management, the value chain integration has a negative impact, by stealing valuable time that could have been used on the coastal heathland management. Agricultural diversification, promoted by EU in their rural development policy (Barnes et al., 2015), can also promote reallocation of time, previously promoting management, to other, comparably demoting, activities.

On the other hand, the same attempts in income-increasing can be promotive of coastal heathland management. Value-chain integration is promotive if it results in an increased market demand for coastal heathland-specific products, which would incentivize an increased supply as well. Findings of Hersleth et al. (2012) indicates that there is market demand for meat from outfield grazing livestock. When it comes to agricultural diversification (Hansson et al., 2010), a heathland-focused approach such as the integration of cattle suitable to the landscape, is positive for the management.

Integration of suitable agricultural activities and achieving high market demands are important for agricultural diversification and value chain integration to promote coastal heathland management. These strategies for increasing income, in addition to farm diversification and efficient resource utilization, are relevant as the economy of the coastal heathland management is poor. Farmers have expressed that a certain financial result must be achieved for coastal heathland management to be possible. Economy is therefore a factor affecting farmers coastal heathland management.

Society

It became clear from the interviews that the society, in which the farmers are situated, affects their coastal heathland management. The part of society that farmers talked about the most in relation to its impact on the management, was the local farming community.

The local farming community was described as essential for the coastal heathland management. Farmers expressed that it was unlikely that it would be any farming in the area without the local community. Similar findings of the importance of the farming community in

mountain farming in Norway (Sellinger, 2023), shows that this phenomenon pertains to different farming-system contexts in Norway. However, the fact that coastal heathland farming requires burning, which the farmers do as a group, suggests that in the case of Nerlandsøya, it is technically true as well as emotionally true that the farming community is required for continued management.

The ways in which different other parts of society impacted the farmer's management positively, depended on the specific part. It was mentioned that friends and family played an important role in assisting farmers' management. The public sector played an essential role in promoting the commencement of the contemporary management, through mapping the area, and providing management plans and financial support. Hikers enjoying the local landscape was also something the farmers perceived as positive for the management. Vittersø & Amilien (2011)'s findings of tourism fostering cultural identity for locals, supports this perception. Furthermore, farmers mentioned that researchers showing interest in their local landscape and farming, had promoted a sense of work pride and consolidated their perception of the importance of coastal heathland management. This finding indicates that the work-relationship between the two parts was in accordance with Watkins (1990)'s five principles of a desired work-relationship between farmers and researchers.

In addition to having had a positive impact on farmers' management, hikers, and the public sector, were parts of society that have had negative impacts as well. A high traffic of hikers, especially those that were ignorant about the local farming, and acted accordingly, had made the sheep stressed. The public sector played a role in making the problem with high traffic of hikers worse, through developing hiking paths, which have had a displacing-effect on sheep.

There are ways in which the negative impacts of the society-parts of hikers and the public sector can be erased. Providing hikers with information about local farming can be promotive of increasing hikers' understanding of the local farming. Knowledge informs action, according to Hawthorne & Stanley (2008), and increasing hikers' awareness of the local farming can therefore increase the likelihood of hikers acting appropriately in the local farming environment. When it comes to the public sector, the farmers perceived it as important that they were included when the public sector plan to do interventions in the outfield that affect their management. This is in agreement with van der Heide et al. (2013)'s

statement of how a participatory approach, where perspectives from various stakeholders are represented, is a precondition for designing landscapes that are socially desirable.

Farmers' participation in public-sector decision-making, and education provision to hikers of the local landscape, can alleviate these parts of society's respective negative impacts on coastal heathland management, and simultaneously strengthen their positive impacts. Society's, and particularly the local farming community's positive impacts are essential for the farmers' coastal heathland management.

The burning practice

Burning was perceived by the farmers as necessary for the maintenance of the coastal heathland. This is in agreement with the findings of Vandvik et al. (2005) on burning being a central constituent of the coastal heathland management. The farmers mentioned that it facilitated for good quality grazing-resources. Furthermore, without burning the semi natural landscape of the coastal heathland, it would eventually be lost (Saure et al., 2013). Because of a lack of burning the last 50-60 years, the state of the coastal heathland on Nerlandsøya was in relatively poor condition according to the farmers. The farmers had in recent years started to burn, with the aim of improving the grazing resources and to prevent loss of the heathland.

The farmers had not been able to burn much heathland yet, due to burning only being possible a few days a year. This was partly due to weather conditions, but mostly because the farmers' lacked free time. The farmers have other paid jobs, while the burning is volunteer work, and thus difficult to prioritize doing.

The farmers perceived that by receiving subsidies for burning they would be able to allocate more time to this activity. Considering Statistics Norway (SSB)'s cost-benefit analysis estimating that a management approach is a far more financially viable option than a wild-fire extinction approach (Halvorsen & Grimsrud, 2021), the farmers should receive financial support for their burning. For this to happen, the phenomenon described in Halvorsen & Grimsrud (2021), of the lack of information regarding who benefits from the prevention of wildfires, must be overcome. As a first step in promoting farmers' getting support reflective of the importance of their effort, they should receive the burning-specific subsidies that are

allocated in other counties, such as In Vestland (Forskrift om regionale miljøtilskot I jordbruket, Vestland, 2023, § 11).

Some farmers perceived that subsidies could make the burning practice safer as well. Being able to have the local fire-fighters, with their expertise, more involved in the burning practice would make the burning safer, and this would be easier to facilitate for if the work was paid, and not purely based on volunteering, according to the farmers. As one farmer has experienced, safety should be promoted as burning can go wrong. Furthermore, if something went wrong, and the farmers were liable, subsidies could alleviate a potential financial burden.

Today, the farmers are essentially putting their health and financial resources at risk for free when practicing burning. The allocation of subsidies to burning would make it safer for the farmers, it would be a token of acknowledgment for the important work they do, and it would facilitate for the farmers to do more of burning. A lack of burning reduced grazing quality and eventually lead to loss of heathland, and the burning activity is therefore an essential part of the farmers' coastal heathland management.

The infield -and outfield combination

According to the farmers, the combination of the infield -and outfield providing the sheep with heather-dominated feeding resources the whole year round, and the infield supplementing this heather-based diet with more nutritious season-dependent grass feed, was essential for the farmers' coastal heathland management. The farmers have had challenges associated with both the infield and the outfield, and since the combination between the two is key, the challenges of one are challenges to the whole.

Both the infield and outfield have had challenges with their quality as grazing resources, according to the farmers. In the outfield these were associated with poor nutritional quality vegetation due to much of it being old and woody heather, and due to certain areas being dominated by trees. Afforestation is characteristic of poorly managed heathland according to Fajardo (2016). In other locations in the outfield, challenges with poor nutritional-quality vegetation were associated with an overexposure of high grazing-pressure, according to some of the farmers. Furthermore, some of the vegetation was in areas where sheep, especially the

NKS sheep, struggled maneuvering in. When it comes to the infield, heavy rainfall, which is estimated to be exacerbated in the future because of climate change (Seneviratne, 2021), in combination with poor drainage of soil, was a challenge associated with its quality as a feed resource.

The farmers were implementing measures to deal with challenges facing the outfield -and infield combination. A project for clearing forest had been done to improve the outfield as a grazing resource. In the infield the farmers have made ditches to ameliorate the challenge with poor drainage.

There were constraints affecting farmers' ability to manage some of the challenges appropriately. A lack of time made sufficient outfield management difficult. In the infield, digging ditches on land that was not owned by the farmers was not prioritized due to their lack of authority in protecting this land from conversion. Infield being converted is a legitimate concern, as Bye et al. (2020) have identified this phenomenon as a national trend in recent years. The lack of authority farmers had over land they manage but doesn't own, influencing their willingness to make draining ditches, seem to be a national phenomenon as well. Landbruksdirektoratet (2015) found that agricultural land in Norway that is not owned by those who manage it, tend to have more drainage problems than land owned by those who manage it.

Limited authority over managed land that is not owned by them, and time constraints on outfield management, are aspects hindering the farmers at Nerlandsøya to deal with challenges with the grazing quality of the infield and outfield. The challenges with grazing quality, associated with drainage problems in the infield, and vegetation overgrowth and high grazing pressure in the outfield, can threaten the infield -and outfield combination's ability to provide the sheep with a balanced diet, which is essential for the farmers' coastal heathland management.

The sheep

The farmers' perceived the sheep to be a crucial constituent of the management of the heathland. This perception is supported by Vandvik et al. (2005)'s finding of grazing livestock playing a central role in coastal heathland management. According to the farmers, the sheep

were preserving the nature type by contributing to limiting the vegetation growth. Ecosystem services of the coastal heathland associated with sheep is the provision of products, such as meat, wool and skin, and the provision of cultural services, such as maintaining and being a central part of the cultural landscape of the coastal heathland (Kaland & Kvamme, 2013). Furthermore, the sheep meant a lot to the farmers, and they were interested in facilitating for them to be free of stress. This was partly because low-stressed animals have higher slaughter weight (Grandin, 2017), but primarily because the farmers found management more enjoyable when the sheep were calm and content. The farmers talked about different challenges that jeopardized the well-being of the sheep.

Predatory animals and hikers were the main challenges of the sheep according to the farmers. Birds, such as crows, ravens, and golden eagles in particular, were threats to new-born lambs, and two of the farmers had experienced losing lambs to the golden eagle. Golden eagles are not a threat to lambs that is unique to Nerlandsøya, but rather one that breaches regional borders. Hammer (2016) attributed 49 % of known causes of lamb-loss to golden eagle predation in the neighboring county of Trøndelag. Some of the farmers also had experienced losing lambs to off-leash dogs. In addition, dogs have been known to cause the sheep to be stressed, and this pertained to high traffic of hikers as well.

The challenges facing the sheep were important for the farmers to alleviate, and if possible, they facilitated for the sheep to be sheltered from these. For example, the farmers had applied for year-round leash mandating for dogs in the outfield. In order to deal with the problem with birds, the sheep were taken to locations where it was easier to keep them safe during lambing season. The labor intensiveness of the measure alleviating the loss of lambs to birds was pointed to as preventing potential sheep-herd expansion.

The challenge with high hiker-traffic causing sheep to be stressed was one the farmers had difficulties with doing much about, and they perceived this challenge to be exacerbated as a result of the development of new hiking paths in the outfield.

The farmers expressed an interest in having visitors if they did not bother the sheep. Similar findings have been made by Selinger (2023), where farmers in Norway expressed an interest for slow tourism, where visitors learn about animals, without disturbing them. Furthermore,

Barry (2023)'s findings of hikers being positive to livestock-encounters, indicate that slow tourism with animals, is something hikers in Nerlandsøya could also be interested in.

Slow tourism can be a way of alleviating the farmers' unsolved challenge with sheep being bothered by hikers in the outfield. It is important to deal with this challenge, and those with off-leash dog and birds, as this promotes the sheep's ability to play its role in contributing with ecosystem services, and in the farmers' coastal heathland management.

Personal motivation

People who are motivated to do a job are more likely to do a good job (Vo et al., 2022), and all the farmers were motivated to do coastal heathland management.

The farmers' motivation was associated with a variety of interests. The farmers were interested in sheep, producing local food, and managing the local landscape. Furthermore, earning money was not the farmers' central interest, which is in line with Flaten & Rønningen (2011)'s findings on the values of sheep farmers elsewhere in Norway. However, earning money was viewed as necessary for continued practices by the farmers of this study.

The explanation for why farmers had their specific interests can be elucidated by looking at the personal motivation section in the result section, where experiences were central in shaping interests. One farmer's interest in food was associated with his perception of preparedness being important from a food-security standpoint. The interest in the local landscape was connected to feeling attached to the place, which is in line with findings of Daugstad et al. (2014) and Quinn & Halfarce (2014). The interest in managing the landscape had for one farmer, in part to do with preserving cultural heritage. This coincides with the findings of Frøyen (2021) of traditional mountain farmers in Norway being interested in preserving cultural landscapes. Moreover, the importance of personal experiences in developing interests for landscapes and nature is highlighted by Heslinaga et al. (2020): "for people to support nature protection, they need to know what is being protected and why, and ideally, they need to personally experience the area".

Conversely, a lack of experiences in nature can promote indifference to its management, and can have contributed to promote the trend of rural migration of young people, which Rye &

Blekesaune (2008) has shown is a national phenomenon, and which was mentioned by one of the farmers as a potential threat to coastal heathland management, by acting as a void that could have been filled with a sense responsibility to stay and preserve the local environment.

Urban migration of young can be ameliorated by incentivizing them to stay, which can be done though providing young people with experiences of the local nature and consequently foster an interest in management of local nature, as personal experience is a key constituent in getting people interested in nature management, which is illustrated by farmers' experiences with the coastal heathland having contributed to them getting interested in aspects about the coastal heathland and its management, such as the sheep, local food production, and landscape preservation. Furthermore, these interests have motivated the farmers to do coastal heathland management, and farmers' personal motivation promotes good work, and is thus a factor affecting farmers' coastal heathland management.

4.2. Limitations – generalizability

Site specificity makes all farming systems unique (Altieri, 2002), and consequently also put a cap on the transferability of knowledge between different farming systems. The results obtained in this study are thus to some extent primarily applicable to the coastal heathland management on Nerlandsøya in Norway. However, as the discussion of the factors illustrated, some of the findings of this study is commensurable with findings of research done in other context, both geographically and production system-wise (e.g., farmers' income being low (Flaten & Rønning, 2011; Heggelund, 2017), farmers' strategies for increasing income (Nitzko & Spiller, 2019; Lawson et al., 2018), and place attachment being important for farmers (Daugstad et al., 2014; Frøyen, 2021; Quinn & Halfarce, 2014). This implies that some of the findings of this study are relevant on a spatial and temporal scale, broader than the coastal heathland management system on the island of Nerlandsøya in Norway. Still, in order to provide conclusive, for example, country-level knowledge about factors that affect farmers' coastal heathland management, studies with a higher number of farmer participants, representing a larger geographical area, are recommended.

4.3. Implications of findings and suggestions for further research

Factors that affect farmers' coastal heathland management, is important to have knowledge about, as farmers are the main actors managing the red-listed, ecosystem- providing, semi natural nature type of coastal heathlands. Furthermore, such knowledge can be used in processes aimed at improving the coastal heathland, and its management.

Further research can focus on aspects related to the factors identified in this study. For example, research can investigate the possibility of developing subsidy schemes that adequately compensate for the risk farmers take, and the value they bring, through their burning practice. Another focus area can be on how to do income-increasing strategies, such as farm diversification and value chain, suitable to coastal heathland management.

Furthermore, there is a need for research on how farmers' participation in public decision making and educating of tourists can be done to promote these parts of society's positive impact on coastal heathland management. Investigation on how issues of farmers' limited time and lack of authority over land can be ameliorated to facilitate for the infield -and outfield combination to provide good grazing resources, is another suggestion. Moreover, possibilities for doing slow tourism for sheep welfare purposes, and protection of lambs against birds of prey, that are commensurable with herd expansion, are topics worthy of attention. Lastly, research can be done on the topic of urban migration-reducing possibilities, and how facilitating for experiences, interests, and motivation associated with management of local nature resources potentially can play a role on this front.

5. Conclusion

The six factors that affect farmers coastal heathland management identified in this study were: economy, society, the burning practice, the infield -and outfield combination, the sheep, and farmers' personal motivation. The **Economy** of the management was poor, and strategies the farmers considered or attempted, to ameliorate this, was the income increasing possibilities of efficient resource utilization, farm diversification, agricultural diversification, and value chain integration. Integration of agricultural enterprises that are coastal heathland-related, and creating a high market demand is crucial for the agricultural diversification and value-chain integration, respectively, to be promotive of coastal heathland management. **Society**, and especially the local farming community, positively impacted the farmers' management. However, hikers and the public sector also had negative impacts, and these can be reduced by educating hikers about the local farming, and through farmers' participation in public sector decision-making influencing farmers' management. **The Burning practice** wasn't done as much as needed for improving the heathland sufficiently, due to farmers lacking the incentives to do it. The allocation of subsidies to the burning practice can; facilitate for the farmers to do more burning; signal that the management was appreciated; and make the practice safer for the farmers, and lower the financial risk. **The infield -and outfield combination's** provision of a balanced diet to the sheep, was threatened by the challenges of high grazing-pressure and vegetation overgrowth in the outfield, and poor drainage in the infield. The farmers were hindered in dealing with these challenges because they had limited authority over managed infield not owned by them, and due to a lack of time doing outfield management. **The sheep's** key role in the coastal heathland management was hampered by challenges associated with birds of prey, off-leash dogs, and high traffic of hikers in the outfield. Labor-intensive, close-quarters, lambing-season regiments, and application for year-round leash mandating for dogs, were done to deal with the former two, respectively, while slow tourism can be an alternative way of dealing with the latter. **Farmers' personal motivation** was associated with interests in sheep, local food production and landscape management. The interests came from experiences, and as experiences can promote nature management, providing the local youth with experiences of the coastal heathland can foster their interest in management of this local nature type and incentivize them to stay, which subsequently can contribute to counteracting the trend of urban migration of young people.

Knowledge about the factors that affect farmers' coastal heathland management is important because the farmers are the stewards preserving the red-listed, semi-natural nature type, of coastal heathland with its associated ecosystem services which society benefits from. More knowledge is needed about how aspects related to the identified factors can be addressed to promote coastal heathland management, and further inquiry is encouraged.

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Appendix 1: Interview-guide for semi-structured interviews

Hvorfor driver du med gårdsdrift? (sosialt, økonomisk, naturkonservering)

Hva er dine hovedutfordringer knyttet til situasjonen din som bonde?

Brenning av kystlynghei på Nerlandsøya – Hva har den av betydelse for deg og din gårdsdrift?

Hvordan ser du på din rolle som bonde, i forvaltningen av kystlynghei på Nerlandsøya?

Har du en jobb ved siden av?

- Hvor my tid bruker du på den andre jobben i forhold til gårdsarbeidet?
- Hvorfor har du en til jobb?
- Ønsker du å ha en ekstra jobb?

Er det mulig å drive med gårdsdrift på heltid, hvorfor/hvorfor ikke?

- Grunner til hvorfor det kunne vært mulig kunne blant annet vært at større skala produksjon kunne gitt et tilfredsstillende resultat.
- Er det ikke mulig å gjøre det økonomisk tilfredsstillende å kun drive med gårdsdrift blir det vanskelig å gjøre det på heltid.

Er du fornøyd med situasjonen som deltids/heltids bonde, hvorfor/hvorfor ikke?

Hvordan kan økonomien i gårdsdriften bli bedre?

- Større produksjon, mer tilskudd, ta større del i verdiskapninga (slakt, skjæring, pakking, markesdføring, salg), senke kostnader (innvesteringer, teknologi (no-fence, strømgjerde)), senke tap av besetning (vakhund, gjeting)), turisme.

Hvordan føler du at lokalsamfunnet oppfatter deg som bonde?

Hvordan ser du for deg at fremtiden for denne typen gårdsdrift er?

- Ville du ha anbefalt unge mennesker om å begynne med denne type gårdsdrift, hvorfor/hvorfor ikke?

Er det noe jeg ikke har spurt om som du tenker jeg burde ha spurt om?

Appendix 2: Interview-guide for focus-group interview

Introduksjon

Kort presentasjon av:

- Oss
- Formål med gruppediskusjonen:

Vi ønsker å utforske faktorer som påvirker opprettholdelsen og utviklingen av landbruk og forvaltning av kystlynghei på Nerlandsøy. I dette gruppeintervju vil vi fokusere på bøndernes sitt ståsted og synspunkter.

- Formål med masteroppgaven

Tidsbruk: 10 min

Diskusjonsspørsmål:

1. Om Beitelaget

- Kan dere fortelle litt om beitelaget som samarbeider med brenning av kystlynghei? Hvilke er med der?
- Når startet det og hvorfor?
- Hvordan er beitelaget organisert? (Organisasjonsform og ledelse)

Tidsbruk: 10 min

2. Landbruket og skjøtsel av kystlynghei

- Er det viktig å bevare landbruket på Nerlandsøya? Hvis ja, forklare hvorfor?
- Hvorfor driver dere med brenning av kystlynghei?
- Hvordan ser dere på deres kollektive rolle i å bevare og utvikle landbruket og forvaltningen av kystlynghei på Nerlandsøya?

Tidsbruk: 20 min

3. Økonomi og finansiering

- Kan dere dele erfaringer med kostnadene ved brenning av kystlynghei?
- Hvordan blir den kostnaden finansiert? Finnes det noen støtteordninger fra kommune, fylke og nasjonale myndigheter i knyttet til beitelagets skjøtsel av kystlynghei? Beskriv disse.
- Hvordan opplever dere støtteordningene? Er de tilstrekkelige?
- Hvis de ikke er tilstrekkelige, hvilken forbedring hadde vært ønskelig?

Tidsbruk: 20 min

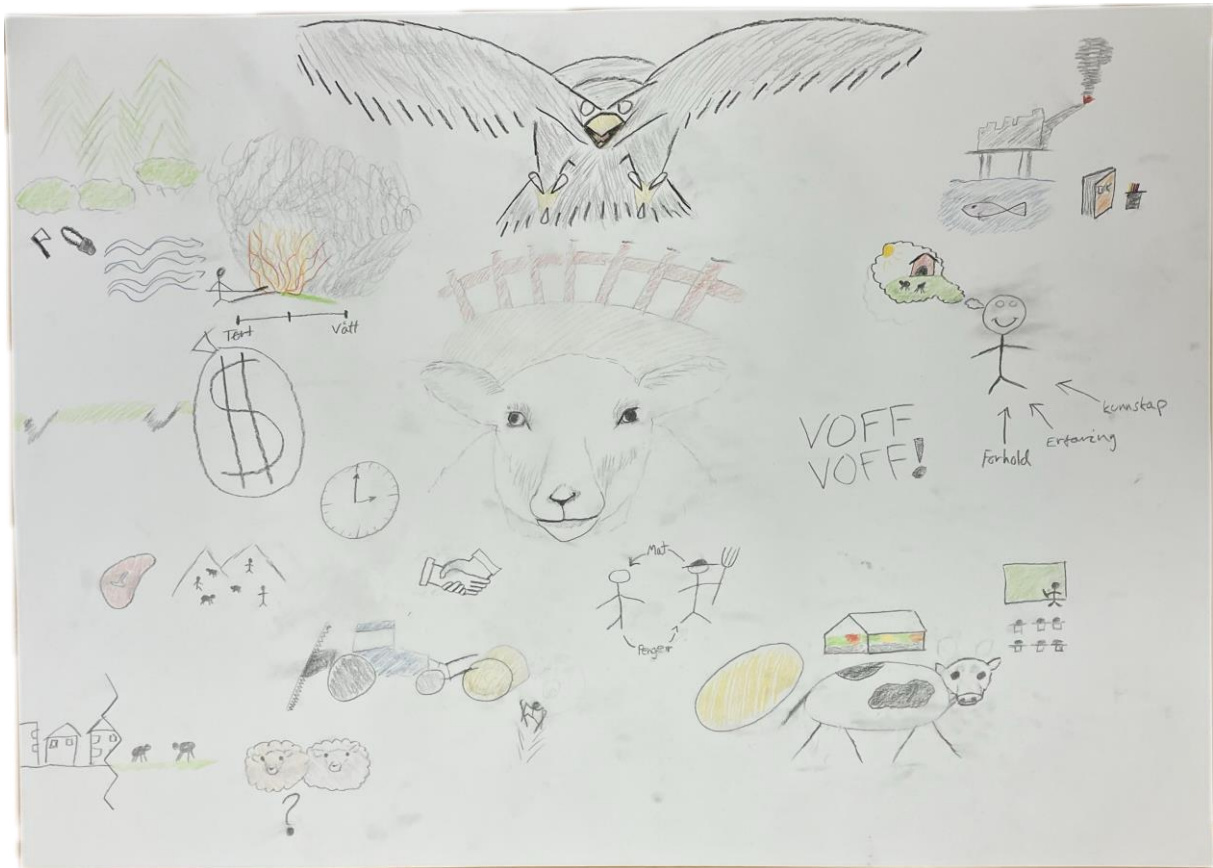
4. Fremtid

- Hvilke muligheter og trusler ser dere for fremtiden av landbruket på Nerlandsøya og forvaltningen av kystlynghei på Nerlandsøy? (Spesifiser gjerne hvis mulig om disse muligheter og trusler er knyttet til Økonomi? Miljø? Klima? Sosiale forhold? Teknisk utvikling? Politikk?)
- Forestill dere landbruk og forvaltning av kystlynghei på Nerlandsøy om 10 år, slik som dere ønsker å ha det da. Beskriv den visjonen for fremtiden. Hvilke strategier vurderer dere for å nå disse visjonene?

Tidsbruk: 25 min

Totalt: 1 h 25 min. Så hvis vi setter av 1 h 30 min for hele sesjonen så er vi innenfor og kan legge in en 5 min pause halvveis hvis det er behov for det.

Appendix 3: My rich picture





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