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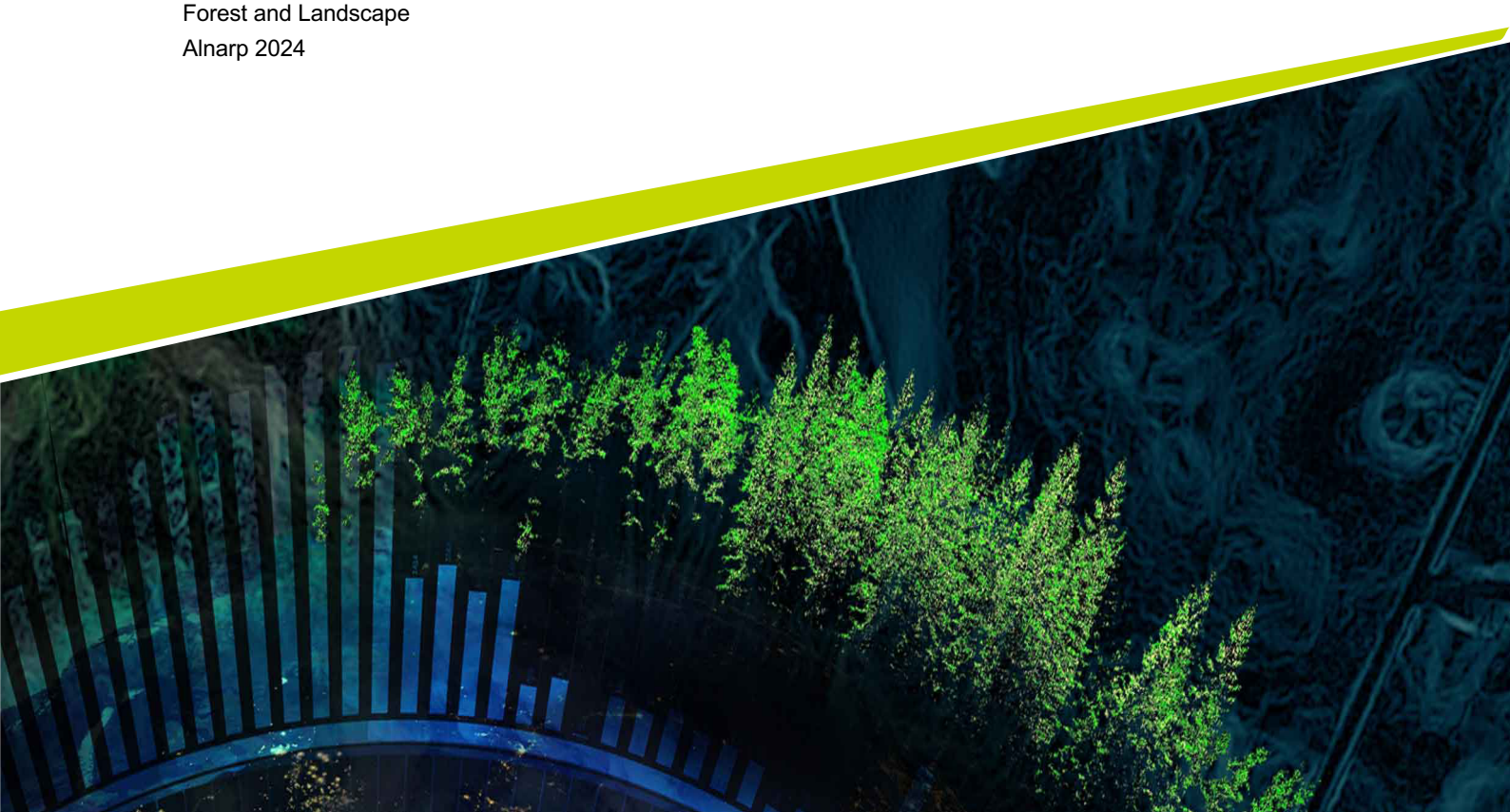

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Abstract

Introduced in 1974, the Beech Forestry Act has significantly shaped beech forest management in Sweden. This study aims to articulate the impacts of this legislation from the perspectives of forest stakeholders in southern Sweden. I explore both the constraints and potentials of beech forestry, through qualitative interviews with key stakeholders complemented by a literature review. A notable finding is the labour shortage in terms of effective beech management, reflecting a broader issue within Swedish forestry. Additionally, this report delves into the broader implications for beech in forest management and its market demand, both nationally and globally. Through stakeholder insights, I examine how legislative frameworks and market forces might either restrict or enable the sustainable management of beech forests in southern Sweden.

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Introduction

The European Beech (*Fagus sylvatica)* plays an important role in the landscapes and ecosystems of southern Sweden. Beech is a highly valuable tree in Sweden, from an ecological (biodiversity, habitat) and socio-economical perspective (timber harvest, recreation) (Martinez del Castillo et al., 2022). Despite the species having such a vital role in the structure of the southern Swedish landscape, beech forests face some challenges, rooted in the deeply engrained forestry practices in Sweden, characterized by an abundance of clear-cut managed forests dominated by spruce and pine. Due to this, Swedish forestry caters to these types of forest, and causes disparity within the forestry sector. There is a lack of knowledge, expertise, sawmills, and a national market specifically catering to beech forest. These challenges arise primarily because of the hesitance towards doing what is outside of the norm within forestry (Hertog et al., 2022). There are many reasons to increase the broadleaf cover in Sweden, including ecological, recreational, and climate-related factors.

However, amidst these challenges, there are plenty of opportunities for change. In a time of climate change having large effects on forests, adaptation is necessary. Research indicates that there is potential for the expansion of beech in Sweden, both in terms of its distribution moving further north and an increasing demand for their timber material (Pramreiter & Grabner 2023; Löf et al., 2012). In this report, the complexities of the challenges and opportunities facing beech management in southern Sweden will be delved into, through the perspectives of important forest stakeholders.

In Europe, we are looking for ways to incorporate more forest management practices that are sustainable. A way to do this is to use continuous cover forestry (CCF). In some European countries, CCF systems are well established within the forestry practices, but in some countries, such as Sweden, the general attitude to CCF is often met with scepticism (Hertog et al., 2022). Overall, Swedish forests are dominated by intensive clear-cut managed forests that favour even-aged monocultures of mainly spruce and pine. Although clear-cut forestry plays an important role in Sweden's current forest management, other kinds of management have also been used. In order to use more CCF methods, there needs to be a shift in the current standard forestry practices. CCF methods are not ideal for monocultures of spruce or pine, but rather for various mixtures of species where the ages and structures in a stand vary.

Study Aim and Objectives

The aim of this study is to determine the limitations and opportunities for beech in Sweden. This will be done by synthesizing existing knowledge on the limitations of the usage and management of beech in Sweden, as well as by exploring the perspectives of forest stakeholders on the factors influencing the usage and management of beech trees in the county of Scania, southernmost Sweden. The objectives are as follow:

- to understand what hinders the usage and management of beech forest in Southern Sweden, despite the ecological, recreational, and climate-related motivations for increasing broadleaves in Sweden.

- What opportunities are there for beech in Sweden?

Background

Beech is one of Europe's most important trees, and the second-most common noble broadleaf tree in Sweden, after oak ("Bok (Fagus Sylvatica)," 2024). During the late Iron age, beech became the dominating tree species in Denmark-Scania, when it took over abandoned pastures and cultivated lands (Brunet, 2005). Studies show that during the early Middle Ages, the beech forests extended throughout large areas of Götaland, and were quintessential for survival, as they provided food for pigs and oxen, and fuel and timber for the local inhabitants (Brunet, 2005). Due to its high value, utilization surrounding beech has been restricted for a long time (Fogelberg, 2014). During Gustav Vasa's regime, year 1558, much like oak trees, the beech belonged to the crown, which meant that only the nobility was allowed to use them. Despite these strict legislations, the beech began to decline during the 17th and 18th centuries, mainly due to the production of pot ash and herring barrels. In 1734, a felling ban was imposed, where felling was only granted with conditions of regrowth mandates (*återväxtplikt* in Swedish), and this law was eventually heaved in 1793 (Fogelberg, 2014). Nevertheless, the beech forests were still being overexploited, there was a major population increase, and the beech forests' reduction started to take off at an alarming pace. Subsequently, World War One also began to create a high demand for beech timber for fuel needs.

During the middle of the 1800s, the cultivation of spruce began, which put a damper on the expansion of beech forests. The extensive spruce plantations on previous beech woodlands are the main causes of the beech's decline during the latter half of the 1900s (Fogelberg, 2014). In Scania during the 1960s, around 800 hectares of beech were felled each year, and only 15 percent was regenerated with beech or other broadleaves, whereas over 600 hectares were planted with spruce (Brunet, 2005; Fogelberg, 2014). Between 1945 and 1966, Sweden's beech forest cover decreased by 20 percent. According to the Swedish Forestry Agency, there were only 60 000 hectares of beech forest cover left by the end of this period (Fogelberg, 2014). The creation of nature reserves was the best possible way for the state to protect the beech forests at the time, although this was a tedious and complicated process (Fogelberg, 2014). In 1964, the government told the Swedish Forest Agency to find a solution on how to conserve the beech forest, and this ultimately led to the implementation of the Beech forestry act. In 1984, the beech forestry act was replaced with the noble broadleaves act in 1984, which provides the same restrictions as the earlier law did, but with the addition of the noble broadleaves, that is elm, ash, beech, hornbeam, wild cherry, maple, linden, and oak (Hansson, 2004).

An objective of the law is to maintain the structure of the landscape, and that the areas that consist of noble broadleaves retain the same species long term. Because it was not deemed to be as profitable to manage a beech plantation as it would be managing a spruce plantation, subsidies were introduced as incentive. First of all, these laws are applied to a stand wherein

at least 70% is composed of beech and is at least 0.5 hectares in size according to Skogvårdslagen (1993:553, 23§, Skogsstyrelsen, 2011). Some of the regulations introduced in 1974 entailed the following:

In a beech forest, beech trees shall not be felled without approval. This is however not necessary for thinning or pre-commercial thinning (PCT) aimed to favour the growth of the forest (Fogelberg, 2014, p. 45, *translated by author*). In a beech forest, or after the felling of a beech forest, the felled area will only be given approval to replant species other than beech after specific authorization (Fogelberg, 2014, p. 45, *translated by author*). Approval is given by the county board. Important that beech forest that is of value in terms of nature conservation values, shall be preserved as far as possible (Fogelberg, 2014, p. 45, *translated by author*).

The point of the law being established was to promote having an active forest management in a manner that preserves it for the future (Fogelberg, 2014). The subsidies were also introduced so that the landowners were compensated for encroachments that resulted in financial loss and extra costs, especially when the beech industry was less profitable than that of spruce (Fogelberg, 2014). The subsidies introduced cover 80% of regeneration felling costs, and 60% of the costs associated with the management of the young forests (i.e thinnings), as well as stand establishment and regeneration costs (28§, 1993: 553).

After the introduction of the Beech Forestry Act, the area of beech forest cover was stabilized and has been increasing since the 1900s (Fogelberg, 2014). Today the beech-covered area is estimated to be around 75 000 hectares, of which 7500 hectares are protected as nature reserves and national parks (Fogelberg, 2014).

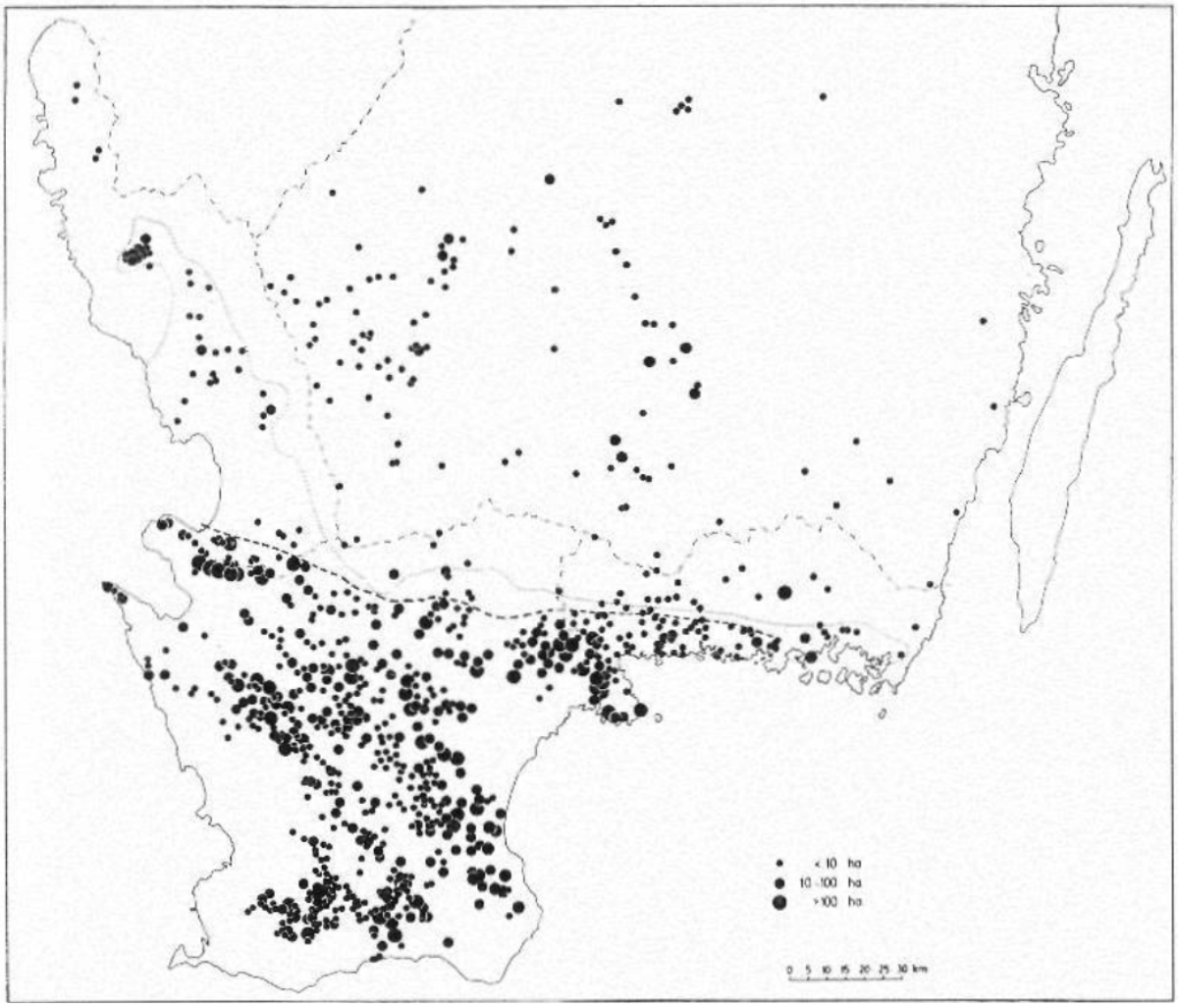

Figure 1. Beech forest stands in Sweden in the 1960s.Map shows the distribution of beech forest stands in Sweden, from an inventory carried out by the National Board of Forestry in 1967-1968. Retrieved from: Lindgren, L. (1970). Beech forest vegetation in Sweden – a survey. - Botaniska Notiser 123: 401-424. Reprinted with permission from the publisher.

Currently, the standing volume of beech is 22.6 million cubic metres, which is 2.4 percent of the total standing volume in Götaland (Skogsdata, 2022). For reference, the standing volume of Norway spruce (*Picea abies*) in Götaland is 434 million cubic metres, which comprises 45.9 percent of the total growing stock (Skogsdata, 2022). However, it is important to note that this is in all of Götaland, and not only Scania, whereas in Scania there is much more beech than there is further north (see Fig. 1). The map in Figure 1 showcases the distribution of beech in Southern Sweden, after an inventory had been done in 1967-68, and due to the Beech Forestry Act being introduced soon after (1974), and many areas with beech becoming protected as a result, the distribution of beech has not significantly changed since then.

Due to the intensive clear-cut management forestry methods that favour even aged monocultural plantations of spruce and pine, Swedish forests are susceptible to impacts from climate change, such as droughts, forest fires and pests and diseases (Hertog et al., 2022). In addition to this, these plantations do not meet biodiversity objectives. Many forested areas are

monocultures consisting of spruce that do not possess the complexity of an ecosystem that is able to support high levels of biodiversity. According to Hertog et al. (2022), the ecological risks, including windfall, pests, and bark beetle are lower in uneven-aged forests as opposed to even-aged forests. According to the Swedish Forest Agency, the best way for beech to regenerate is under a canopy of larger trees ("Skogsstyrelsens föreskrifter och allmänna råd till Skogsvårdslagen," 2011). This means that, when a felling is done, several larger trees are left standing, which also protects the seedlings, as they are sensitive to frost damage during the early spring months ("Föryngring av bok," 2016).

In Scania, beech forests are crucial for the conservation of endangered species, including plants, animals, and fungi (Hansson, 2004). With increasing demands on forests to provide sustainable materials for products as well as energy, the importance of lesser-used species, such as beech, also has increased. Beech is highly valuable in climate-adapted forest management and is universal in its utilization (Pramreiter & Grabner, 2023).

According to a study conducted in 2022, there is evidence that beech has severely declined over the past 60 years and will continue to do so for the next 80 years (Martinez del Castillo et al, 2022*).* However, this decline is seen in the southernmost distribution limits, and Sweden is not so impacted by this. According to Martinez del Castillo et al. (2022), there is a widespread decline of beech in Europe, except for in the more northern countries, including Denmark, Norway, and Sweden. Although there is a 20 percent recorded decline of beech in southern Europe, an increase of 10-20 percent has been recorded in northern Europe (Martinez del Castillo et al., 2022).

Rather than this creating a decline in Sweden, this might expand the border of beech further north. A warmer climate in Sweden, might be more fitting for beech, even north of southern Sweden.

Theoretical Framework

Implementing more beech forests in Sweden can be compared with a current trend of trying to implement more Continuous Cover Forestry (CCF). Beech is not managed in the same way that monocultures of spruce or pine are, which are what the Swedish forestry industry is accustomed to. Hertog et al. conducted a research study in 2022, interviewing forest owners and forest managers that use and promote CCF methods.

Here, I take inspiration from Hertog et al. on the different factors that limit an effective expansion of beech forest, as they are analog to those of CCF. The main factors that I decided to focus on are culture, markets, and legislation.

1. **Culture**

The culture factor is a significant barrier to alternative forestry methods because the forestry practices are engrained into Sweden's culture and history, making the sector very resistant to change. Conservationism contributes to this, and in order to change these norms, a paradigm

shift would be necessary (Hertog et al., 2022). Within the forestry sector, there is a strong sense of group identity, and there is a lot of social pressure. It is generally taboo to question the even-ages monocultural forestry systems that are the most common in Sweden today, because it has been that way for so long (Hertog et al., 2022).

2. **Markets**

There is a lack of price differentiation, as there is no added economic value despite higher timber quality. It can also be difficult finding a market that is profitable for smaller volumes and generally thicker trunks (Hertog et al., 2022). Generally, multi-layered, uneven-aged forests produce less timber than that of even-aged forests, although the quality usually is higher (Hertog et al., 2022). Additionally, selective logging is more expensive than clear-cut forestry because it takes more time and fuel per harvested timber volume (Hertog et al., 2022). Because there is no added value despite the quality being higher and the management potentially being more expensive, there is a lack of a market that benefits forest management that deviates from the norm (Hertog et al., 2022).

3. **Legislation**

The §5 and §10 curves are possible barriers in the Forestry Act, as they represent the minimum standing volume that is to be left after thinning (§10), and the standing volume below which forest owners must ensure regeneration (§5) (Hertog et al., 2022). According to a report written by the Swedish Society for Nature Conservation, CCF harvests often result in the standing volume levels being below the §10 curve, which means that the Swedish Forest Agency (SFA) has to give exemption to the law in these cases (Hertog et al., 2022). The curve was created to be applied to single-layered forest, so they end up being incorrect when applied in multi-layered forests (Hertog et al., 2022). This factor can limit the possibility to use other forestry methods, such as CCF, because the process becomes more complicated and tedious for forest owners and managers (Hertog et al., 2022).

Methods

Semi-structured interviews

The purpose of this study is to determine the opportunities and limitations for beech management in Scania, from the perspective of important forest stakeholders. In order to obtain in-depth information from these stakeholders, semi-structured interviews were chosen as the main data collection method. Research about qualitative methods was done prior to writing the interview guide. I have used Harvard University's Strategies for qualitative interviews, where they provide guidelines for developing interview questions, as well as a step-by-step guide to writing interview questions. The most important advice that I gathered from this includes the following:

1. Questions should be simple. Do not ask more than one question at a time.
2. The best questions are those that elicit the longest answer from the respondent. Do not ask questions that can be answered with one word. The more detail the better!
3. Ask "how" questions rather than "why" questions.

4. Keep in mind the logical flow of the interview. This may take some adjustment after several interviews.
5. Don't ask questions that require your respondents to do your analysis for you.

(Some strategies for developing interview guides, Harvard University, n.d.).

After this, I started writing my interview guide. When contacting the interviewees, I ensured to inform them that I would follow SLU's GDPR policies so that they were aware of their rights in terms of the interview questions and information being processed. No sensitive personal information was used in this study.

The first part of the interview guide consisted of questions that would help me understand the individual's background and where their perspective is coming from, this was basically an introduction to them as a forest stakeholder and how they manage their properties. The second part of the interview focused on the Beech Forestry Act, and their experiences of it. The third part of the interview was centred around questions about the market for beech on international and national levels, the industry, as well as other financial questions. The interviews were all held in Swedish, the questions were not all followed in the exact same order as to maintain a natural flow during the interviews. Some questions were not asked to some of the interviewees as they were not relevant to ask. For example, those that are employed by the public sector do not manage a specific area, they are rather assigned to an entire region, or even the country, so questions about the number of hectares managed would not apply.

The interview questions were all based on different aspects of beech, including each person's interpretation of the usage of beech in Swedish forestry, their thoughts on the beech forestry law, financial questions about the market and industry, and general questions about how they manage their forested land. The interview guide questions were followed in no particular order, but the general guide was applied. Seven interviews were conducted, and six of these were in person, whereas one was via telephone. The interviews mainly took place in the vicinity of the area that each respective person worked in, some of them being outside in the forest, and some in their offices. Some quotes from these interviews is included in this study, and the information retrieved from the forest managers was used in this analysis. The interview guide used can be found in appendix 1.

Participants

The first step in the process of conducting this research paper was to find important forest actors to interview. I carried out purposive sampling, this was done with support from teachers at SLU, and through own research about forest managers and owners in Scania. I then reached out to these forest stakeholders by email and phone. Those that were available were scheduled for an interview. Four forest managers, two forestry advisors and one forest consultant from the public sector were interviewed. Most of the interviewees were forest

managers of properties at forest companies, and some were employed by the Swedish Forest Agency. It was important to find people in different positions and different companies to interview, to have variation in the responses. Out of the seven individuals, one was a woman, the rest were men. For the sake of anonymity, the interviewees are categorized according to their profession. M stands for manager, A for advisor and C for consultant. See table 1 for information about the interviews.

Table 1: Table showing information about the interviews and interviewees

Reference in text	**Position at workplace**	**Interview location**	**Length of Interview**	**Sector**	**How many hectares managed?**	**How many ha beech?**
M1	Forest manager	Via telephone	0:39:58	private	N/A	~15% beech
M2	CEO	In person	0:25:26	private	N/A	413 ha
M3	Forest manager	In person	0:15:30	private	~9000 ha	~500-1000 ha
M4	Forest manager	In person	00:59:03	private	7500 ha	~2000 ha
A1	Broadleaf advisor	In person	01:16:28	private	N/A	N/A
A2	Ecologist	In person	00:38:50	public	N/A, works nationally	N/A
C1	Forest consultant	In person	00:40:17	public	N/A	N/A

Analysis

After the interviews had been conducted, I transcribed them. The interviews were partially transcribed using Microsoft word, and partially by just listening to them and writing down the important themes. The transcribed texts were then reviewed, and the recurring themes were highlighted. I then looked for patterns in the interviews to help me understand and process my data. Recurring themes were highlighted and analyzed, and the most important quotes were extracted. Throughout the interview process, I also found some new topics that were not included in the guide. Some interesting topics came up during the interviews that were not originally in the guide but very relevant for this study. These topics are all included in the results of this study. Once all the data was transcribed and the important themes and quotes were highlighted, I translated them from Swedish to English. In order to better understand the data, and find relevant theoretical information, a literature review was done. This was also very important to help me understand and contextualize the perspectives of the forest stakeholders.

Results

Opportunities

According to the participants in this study, there are plenty of opportunities for beech forest management in Scania. The main arguments for increased beech management that came up during the interviews were: potential on the global market, potential for the future of beech in a changing climate, and simply the fact that many forest actors are generally positively inclined towards beech. The majority of those that were interviewed strongly believed that beech will increase throughout southern Sweden and were especially very positively inclined towards the prevalence of beech forests, as well as increasing the management of beech, along with other noble broadleaves.

The Beech Forest Act

The Beech Forest Act does not seem to be a major issue according to most of the forest actors that were interviewed, and according to M2: "the beech forest act is not a hinder to forestry. Without the act, we would have significantly fewer noble broadleaves". Similar to this, A1 expressed that: "without the beech forestry act, many beech stands with high biological value would be replaced with spruce. Half of the beech we have today would not exist". Here, this person means that the beech that currently exists, or that has been around for a while, would have been replanted with spruce a long time ago, because spruce is generally more profitable. Additionally, M4 expressed that "the beech forest act is positive, not problematic. Beech is a good tree species with regards to both production and recreation". M3 also said: "the law does not have a major impact; I would have continued managing beech anyway to spread the risks and to have nicer properties". This stakeholder expressed that they really like beech in terms of its aesthetic values, and even without the subsidies, would have continued to manage beech forest anyway. However, this person also explained that there would probably be much less beech today had it not been for the subsidies resulting from the act and said: "I think that when the law was introduced, my predecessors would have made sure to harvest the beech and plant spruce instead". This is because spruce was more profitable. According to C1, without the act, much less beech forest would be regenerated, because it is expensive, and spruce is much cheaper. Whether or not the advisor or manager has a positive attitude towards the act, they all recognize that the Beech Forest act has helped in terms of increasing (or not decreasing, rather) the broadleaf cover in Sweden.

The future of beech

Something that was quite interesting that came to light during the interviews is that beech is in fact being produced and actively managed quite a lot in southern Sweden, rather than its utilization being hindered and that it is not being actively managed to its full potential, if anything it seems to be expanding. According to M4, there certainly is growing potential for beech in Sweden: "With regard to climate changes, pressure from game and its great quality, it has a bright future ahead". According to A2, there are also "many financial opportunities for beech on the global market." Furthermore, most of the forest managers that were

interviewed were very positively inclined to having more beech coverage in their forests, with M3 stating that "wherever there is beech now, it needs to continue that way" and explaining that the plan is to allow the beech stands to expand and grow in area, rather than plant new stands, because "the quality will be better". In line with this, A2 is of the opinion that there are many possibilities for beech to grow further north, especially along the west coast. A1 also says that "beech is possible all the way to Uppsala" and that "more and more forest owners are becoming curious about beech management." This is positive for the future of beech, because there seems to be a lot of potential, and this potential is recognized by forest managers. Although some of the managers did say that they did not necessarily have the expansion of specifically beech as a goal, they all wanted to increase the noble broadleaf cover in some way, with most of them especially planning to plant more oak. According to M1, this is because oak provides a stable long-term market, and because it is difficult to plant beech stands. M1 and M3, as well as M4 state that it is difficult to plant new beech, and the quality of planted beech is worse than that of naturally regenerated beech. When asked about the future of beech, M4 states that the noble broadleaves, including beech, are increasing because the subsidies are so beneficial, and the current economy is looking fantastic for all assortments of noble broadleaves. Overall, the forest actors might not all have been planning to plant more beech, but they were not opposed to an increase of beech on their property, meaning that if it were to regenerate on its own, they would probably allow it to.

Challenges

Despite the many opportunities and future possibilities for beech in Sweden, there are also potential hindrances, and as expressed by the forest actors, the lack of working force and lack of knowledge seem to be the major barriers to extending the beech management in Sweden. An efficient summary of the challenges was given by M1, who states that there are three things that would need to happen to increase beech management in Sweden, these being: more profitability from beech - especially in the domestic market, more qualified forest workers and more Swedish sawmills that process beech timber. I found that these three aspects also resonated across the study participants.

<u>Labour shortage</u>

As was expressed by several of the interviewees, one of the major problems when it comes to beech forestry is the lack of working force available to take care of the special needs for beech forests. This issue came up with every single interviewed stakeholder. The individuals interviewed all have different roles within the forestry sector, yet they all expressed that they experience this problem. According to M1, it is difficult to find people that can and want to work outside with beech management. Throughout the interview, M1 mentions numerous times that the lack of work force is a recurrent issue. He says that it is a significant problem because it is difficult to find people who want to work with beech management. Similarly, according to both M4 and A2, there is a major shortage of Swedish forest workers. M4 says that "there is a shortage of workers among Swedes, nobody wants to work, and there is no interest in working manually." This opinion was also expressed by A1 numerous times during

the interview. Both M3 and M1 expressed that the knowledge is there (at their respective companies), but the working force is lacking. By this, they mean that the knowledge to pursue extended beech management exists, but because of the labour shortage, the knowledge is not used to its full potential. M2, however, currently does not experience an issue at his working place in terms of working force, although he does mention that the lack of Swedish working force is a problem, much like M4 and A2 expressed. The main issue with not having Swedish workers is due to the communication barrier due to language differences. C1, as a person that has had a lot of manual working experience in the forest, also mentions that there is a lack of manual forest workers, and that this is an issue.

Lack of market potential

As M1 mentions, more Swedish beech sawmills are needed in order to increase its management in Sweden. M1 also describes the lack of sawmills as an issue in terms of increasing beech management: “a lot of potential for beech has arisen over the past five years, and there is an international market. Within Sweden, it is a niche market with very small sawmills, of which this individual’s company sells to, but these sawmills can only process timber in very small volumes, and that they have very specific requirements, this is not enough to depend on.” Despite the lack of sawmills, this individual sees potential on the international market. A2 also expressed that it would be beneficial with a domestic market: “Although there are a lot of financial opportunities on the international market, a Swedish industry would be nice, it is better to export finished products as opposed to the raw material.” A1 expresses “The main factors that limit beech are that it is troublesome and time-consuming, but most of all that the price is too low.” M2: “it is unfortunate to have to export all beech, and it would be nice to have an industry within Sweden, and there is a lot of market potential internationally, although this could also be a problem due to potential conflicts.” Despite seeing the financial potential, M2 identifies the drawbacks associated with not having a Swedish industry. M4 explains that the international market is much bigger than it ever could be within Sweden, and that Sweden is too small to have its own market. However, despite the overall lack of a Swedish market and industry, it is important to mention that, although small, there is an industry in Sweden. A1 recognizes the pulp mill in Nymölla as a major buyer of beech timber, along with the pulp mill in Mörrum, where beech is an important component in their textile pulp, and both pay well.

Overall, despite a profitable international market with a lot of future prospective, the stakeholders interviewed generally would like to have an increased market and industry within Sweden.

The Beech Forestry Act

As mentioned earlier, not all forest actors see the Beech Forestry act as a hinder to their active management, however, some actors do, and some consider it to be overall problematic.

M1 does express that the act makes procedures a bit more complicated than they would be if it did not exist. “The beech forestry act affects the management quite a lot, you have to apply to do a regeneration felling, which is somewhat more complicated than reporting a regular regeneration felling. And there is more administration with the subsidies, but I see it in the sense that the reason for the subsidies is that the act puts a restriction on the ownership rights of the forest owners.” This person is not against the forestry act, but rather thinks that it is reasonable and justified thanks to the subsidies. If the subsidies did not exist, M1 may be of a different opinion. Another perspective can be considered from that of someone working in the public sector, A2, who says: “Many landowners, especially those with large estates, did not want to commit to keeping the beech in large areas, so they then cut down the beech in these large areas. And unfortunately, they mainly cut down the best beech trees”. Despite this, A2, also expressed that without the act, even more beech would have been felled, and we would have much less beech than we do today. Along these lines, C1 said that “a lot of beech forest was felled when forest owners found out that the beech forest act would soon take place”.

The factor of the high rate of beech trees that got cut down prior to the act is arguably attributed to the awareness of the fact that the act would soon become reality. However, as was stated by many of the forest actors, the beech forest act is not what poses the biggest hinder for beech forestry.

Discussion

The theories and ideas that were discussed with forest stakeholders are very useful, because they are a good representation of how other stakeholders of similar experience might feel. Although there seem to be some challenges to expanding the beech coverage in Sweden, according to the forest stakeholders that were interviewed, it seems as though it certainly is expanding rather than decreasing. Most of the forest stakeholders were of the consensus that there is a bright future for beech forestry in Sweden, and that it only will improve in the future. It was interesting to look at the beforementioned theories, including culture, the markets, and legislation. As can be seen in the results, these three factors are integrated with the results from this study.

In the article written by Hertog et al., culture was seen as one of the major barriers to CCF. Although this factor was not expressed as the most significant barriers to CCF in this study, we can draw parallels between it and using alternative forestry methods in Sweden, a country dominated by even-aged monocultural plantations. This perspective can be applied for beech forestry as well because beech management deviates from the norm and does not use clear-cut management. Sweden’s forestry practices are engrained into our culture, making it very resistant to change (Hertog et al., 2022).

The market is central to forestry, and there are many different types of markets, including the labour market and the industrial market. In this case, the labour market is a significant problem, because the jobs are there, but there are not enough people taking them. Another market is the industrial market, which is necessary for the timber to be processed. However,

at the core of both markets is the fact that there is no added economic value to the products, although they are higher-quality products (Hertog et al, 2022). Multi-layered, uneven-aged forests generally produce less timber than even-aged forests do, but the quality is usually higher (Hertog et al, 2022). Maybe if alternative forest management was rewarded with some form of price differentiation, there would be more of an incentive to do it. Furthermore, if this were the case, maybe more people would choose to manage their forests differently, creating more demand for industries that process this type of timber, and both the labour and industrial markets could expand.

The Beech Forestry Act can be looked at from different perspectives where overall, according to the interviewees in this study, it has not been a hindrance to beech forest management. However, legislation that applies to CCF can also be applied to beech management because it is a form of management that does not align with the norm in this country. Forestry models are designed for the common Swedish forestry practices, as in clear-cut forestry.

The positive perspectives of the interviewees can be supported from other sources of information, for example from modelling studies. Both beech and spruce have similar demands in terms of soil properties, and they are both shade tolerant species, their stands tend to be quite dark, and it can be difficult for other species to establish themselves. However, due to the increasing threat of damages from climate change, the risk for extreme weather events and damages also increases. A major threat to Norway spruce is damage from bark beetles. After the 1969 storms in Sweden, enormous bark beetle damage was associated with substantial volumes of windthrown trees (Schlyter et al., 2016). In a climate that is increasing in temperature, the risk for bark beetle damage to spruce trees also increases. Monocultural spruce stands are greatly at risk from damage, and both the frequency and intensity of these storms are predicted to increase in southern Scandinavia (Schlyter et al., 2016). Forests of similar age and composed of the same species are the most prone to these damages, therefore, the fact that there are so many monocultural spruce stands of the same age in southern Sweden, gives cause for concern (Schlyter et al., 2016).

With a warming climate, temperate broadleaves, such as beech, will likely be able to establish further north, and eventually become more competitive than Norway spruce and Scots pine (Löf et al., 2012). The retainment of broadleaved forests can be achieved through an active silviculture, where both environmental values and timber production are equally important (Löf et al., 2012). Climate change predictions for southern Sweden show that in the future, there will be higher production in the temperate broadleaved forests, and that the trees species present will be more competitive than coniferous tree species will be (Löf et al., 2012). Additionally, uneven-aged mixed forest stands would probably recover faster after disturbances than even-aged monocultures. According to Pramreiter & Grabner (2023), there is an increasing global demand on forests to provide sustainable materials for energy production and other wood products, the lesser-used tree species, like beech, grow in importance. Additionally, the authors claim that beech, along with birch, is the most versatile alternative to Norway spruce, compared to other deciduous species.

Limitations

Some limitations were faced while conducting the research, that should be taken into consideration when reading this report. One of the major potential limitations, or something that could cause issues when testing the accuracy of the data, is selection bias as those that were interviewed manage beech forests. This means that they likely are positively inclined towards them, whereas somebody that does not have this same experience may not have the same attitude towards them. Because of this, it may not be a fully accurate representation of other forest managers/owners experiences in southern Sweden. In order to gain a more representative understanding of the attitudes towards beech forestry in Sweden, it would be beneficial to interview forest managers that do not manage any beech at all. However, it would be important to keep in mind that they may not have the necessary knowledge and experience when it comes to beech, whereas those interviewed in this report certainly have experience with beech, and likely with many other tree species as well. This study was conducted in Scania, where there happens to be a lot of beech forest, but many other types of forests as well.

Furthermore, it would be beneficial to look into the perspectives of those that do not manage any beech despite there being potential for it, in terms of having the right soil and site conditions. This would provide more nuance and depth to the study because it could more accurately represent Swedish forest stakeholders. This study could look very different had I interviewed people further north, that manage beech forest on less beech-appropriate soils. Additionally, it would be beneficial to interview other types of forest stakeholders, such as those working within the industry. Their perspective on this topic would be very valuable in terms of the relevance and potential of beech, both within Sweden and on a global market. Also, it would be beneficial to gather perspectives from a more diverse range of forest stakeholders. This should include smaller forest owners and forest owners/managers from various demographics and backgrounds, as well as those living in different areas in Sweden.

Another limit is time, had there been more time, more interviews would have been possible, and they could have been more in-depth. Additionally, if there had been more time, it would have been possible to do a pilot test ahead of the interviews.

Conclusion

To sum up, conducting an interview study about the perspectives of forest stakeholders concerning beech forest management in southern Sweden has revealed that there are challenges to expanding the management thereof, but also that there are many opportunities for it. Despite there being several obstacles potentially hindering the extended beech management, including lack of knowledge, expertise, and overall scepticism, forest stakeholders are optimistic in terms of the future of beech forest management.

Implementing more beech management into Swedish forestry presents the opportunity to enhance ecological, recreational, and biodiversity factors of forests, while also improving the sustainability, resilience, and economic value of forests.

Moving forward, it is crucial that the conservation and sustainable management of beech is prioritized, so that they continue to thrive for many generations to come and can have the opportunity to reach their full potential. The active management of beech is crucial for the development of the forestry industry, and not only that the beech is left on its own, but that it is actively being managed (Löf et al., 2012). The next steps to take in terms of beech management would be to do more research. It would be valuable to know the opinions of a geographically more widespread group of forest stakeholders, as well as different types of stakeholders. It would be valuable to learn the perspective of the smaller-scale forest owners, for example. It would also be valuable to look into some other factors affecting beech management. Some of these factors may include looking into the recreational factors of beech forests, the climate-driven factors, or delving deeper into the history of beech management. Nevertheless, coming to a deeper understanding of the topic would be of benefit to the future of beech in Sweden.

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Agnes Andrée

Appendix 1:

Interview guide

Aim	**Interview questions**
Introduction	- What is your name? - What is your position at your workplace? - How long have you worked here? - Can you provide some information about the properties you manage? - How much beech forest do you manage? - How is this forest used, and how much of it is used for production purposes? - Is managing more beech a goal for you? If not, what hinders you from it? - What affects your decision to manage beech?
The Beech Forestry Act	- Are you familiar with the Beech Forestry Act? If so, how has it affected your management? - What do you think would be necessary in order to manage more beech in Sweden? - Did you receive any subsidies when the law was imposed? - From a legislative perspective, would you like to increase your beech management? - If the beech forestry act did not exist, how do you think your use of beech forest would be affected? - Have you wanted to change the beech stands to a different species but not been allowed to? - Have you ever had to contact the Swedish Forestry Agency with regards to questions about beech forest management? - How does it look when you want to fell a beech stand/go through with other forms of beech management?
Finances/Income	- Which trees/stands does your main income come from? - To whom do you sell the beech? - Do you think that a national market/industry could be possible? If not, what are the major barriers?

	- If you did not receive any subsidies when the act was imposed, would you feel differently about it? - Do you think the subsidies are high enough?
Other	- Do you have the knowledge to manage more beech forest? - Does the Swedish Forestry Agency provide advice for how the beech forests should be managed?

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