Attitudes, existing support and required incentives to increase Continuous Cover Forestry in Sweden

Victoria Lejon

MSc Thesis (30 ECTS credits)
Science for Sustainable development
Upphovsrätt

Detta dokument hålls tillgängligt på Internet – eller dess framtida ersättare – under 25 år från publiceringsdatum under förutsättning att inga extraordinära omständigheter uppstår.

Tillgång till dokumentet innebär tillstånd för var och en att läsa, ladda ner, skriva ut enstaka kopior för enskilt bruk och att använda det oförändrat för ickekomersiell forskning och för undervisning. Överföring av upphovsrätten vid en senare tidpunkt kan inte upphäva detta tillstånd. All annan användning av dokumentet kräver upphovsmannens medgivande. För att garantera äktheten, säkerheten och tillgängligheten finns lösningar av teknisk och administrativ art.

Upphovsmannens ideella rätt innefattar rätt att bli nämnd som upphovsman i den omfattning som god sed kräver vid användning av dokumentet på ovan beskrivna sätt samt skydd mot att dokumentet ändras eller presenteras i sådan form eller i sådant sammanhang som är kränkande för upphovsmannens litterära eller konstnärliga anseende eller egenart.

För ytterligare information om Linköping University Electronic Press se förlagets hemsida https://ep.liu.se/.

Copyright

The publishers will keep this document online on the Internet – or its possible replacement – for a period of 25 years starting from the date of publication barring exceptional circumstances.

The online availability of the document implies permanent permission for anyone to read, to download, or to print out single copies for his/hers own use and to use it unchanged for non-commercial research and educational purpose. Subsequent transfers of copyright cannot revoke this permission. All other uses of the document are conditional upon the consent of the copyright owner. The publisher has taken technical and administrative measures to assure authenticity, security and accessibility.

According to intellectual property law the author has the right to be mentioned when his/her work is accessed as described above and to be protected against infringement.

For additional information about the Linköping University Electronic Press and its procedures for publication and for assurance of document integrity, please refer to its www home page: https://ep.liu.se/.

© 2023 Victoria Lejon
Välj licens/Choose licence.
Table of Contents

1 Abstract ........................................................................................................................................... 1

2 Introduction ...................................................................................................................................... 1
   2.1 Background .................................................................................................................................. 2
   2.2 Problem Discussion ......................................................................................................................... 4
   2.3 Purpose .......................................................................................................................................... 4
   2.4 Research Question ......................................................................................................................... 5
   2.5 Limitations ..................................................................................................................................... 5

3 Frame of References .......................................................................................................................... 6
   3.1 History of the Swedish Forest Industry ......................................................................................... 6
   3.2 Swedish Forest Today ..................................................................................................................... 7
   3.3 Conventional Forestry ................................................................................................................... 9
   3.4 Policy strategies in the Swedish forest ............................................................................................. 10
   3.5 Sustainable Forest Management .................................................................................................. 11
      3.5.1 Continuous Cover Forestry ................................................................................................. 12
      3.5.2 Attitudes regarding CCF .................................................................................................... 14
      3.5.3 Hinders regarding CCF ....................................................................................................... 14

4 Methodology and Materials ................................................................................................................ 16
   4.1 Research Paradigm and Approach ............................................................................................... 16
   4.2 Research design ............................................................................................................................ 16
      4.2.1 Method and Data Collection .............................................................................................. 16
      4.2.2 Data sample from interviews with stakeholders .................................................................... 17
      4.2.3 Data analysis ....................................................................................................................... 18
   4.3 Theoretical Framework ................................................................................................................ 19
      4.3.1 Multi-level perspective ......................................................................................................... 19
      4.3.2 Theoretical Approach .......................................................................................................... 19
   4.4 Data Quality .................................................................................................................................. 20
      4.4.1 Ethical Considerations ......................................................................................................... 20

5 Empirical Findings ............................................................................................................................. 22
   5.1 Attitude ......................................................................................................................................... 23
      5.1.1 Structures within the forest sector ......................................................................................... 23
      5.1.2 Social and ecological values in the forest ............................................................................. 23
      5.1.3 Scepticism due to lack of knowledge and practical examples ............................................. 25
1 Abstract

An increasing wave of critique against conventional forestry favouring even-aged monoculture plantations and intense ground preparation in Sweden is arising, where some researchers are warning about the negative consequences of the long history of intense forestry and increasing extraction due to the growing demand for bioenergy has caused devastating consequences on ecosystems in forests such as loss of biodiversity. Additionally, reports are revealing that Sweden will not meet its own national environmental goals. Meantime, a growing interest in Continuous Cover Forestry (CCF) has increased due to prioritising biodiversity and conserving ecological and social values in the forests. Therefore, this study aims to explore pathways towards more diverse and varied forest management by examining the attitudes, existing support and required incentives for stakeholders in the Swedish forest sector towards an increase of CCF. This study follows an interpretive approach, where qualitative semi-structured interviews are conducted with different actors within the Swedish forest sector along with a literature review. The empirical data is analysed through a coding procedure and analysed with the multi-level perspective approach. The main findings of this study suggest that the existing attitude and support contribute as well as prevent an increase of CCF to some extent, however, the required incentives are crucial for forest actors’ ability to increase CCF. To conclude, the incentives are discussed to affect the ability to increase CCF, and if implemented, the incentives will in turn influence the attitudes of willingness to increase CCF and the existing support to develop in relation to CCF.

Key words: Continuous Cover Forestry, Conventional forestry, forest management, Sweden

2 Introduction

Resources from the forest are supposed to be the answer to many different interests today (Hansen & Malmaeus, 2016). Increasing wood production is stated to be the solution to multiple problems, concerning for example climate change, green energy and transition from a fossil-based society to a bio-based society (Lindahl et al., 2017). To keep up with the transition, Sweden is one of the countries that has tried to set up a strategy and implemented a goal to be fossil free by 2045 with the plan to replace fossil fuel energy with bioenergy, where the Swedish forest will be the main resource (Börjesson et al., 2017; Regeringskansliet, 2018). This has led to an increasing demand for bio-based resources, more specifically wood material (Lidestav & Westin, 2023; Regeringskansliet, 2018).

Sweden’s land area is dominated by forest, with around 68 % of the land area in Sweden covered by forest, and around 84% of the forest area consists of productive forests (Fischer et al., 2020; Kumar et al., 2021; SCB, 2023). The Swedish forest has been an important resource for hundreds of years. The Swedish forest has been referred to as the “backbone of the Swedish economy and welfare state” (Fischer et al., 2020, p. 899; Lindahl et al., 2017). During the industrial revolution of the 1800s, the demand for tree-material increased, and cultivation intensified (Eide et al., 2020; Skogskunskap, 2017). The increased demand led to overuse of the forest, therefore, in 1903 Sweden implemented the first forestry act with the purpose to ensure regular tree plantation after cultivation, and to make sure that a more stable tree-material flow would occur. An agricultural view of the Swedish forest evolved, and monocultures increased in line with the new method including plantation/sowing, clearing/thinning, ground preparation and then it starts over with plantation again (Skogskunskap, 2017). This method will later be identified as conventional clearcutting forestry (Hertog et al., 2022; Lindkvist et al., 2012). With the development of technology and goals to produce more wood, clearcutting...
became the most common forestry method and norm in Sweden during the 1950s (Skogskunskap, 2017). At the same time, the Swedish Government officially banned continuous cover forestry methods (henceforth referred to as CCF) due to the exploitation of old forests in the north, and land areas had to be replaced with a more rational method which led to clearcutting and artificial regeneration (Hertog et al., 2022; H. Lundmark et al., 2013). However, lately, the realization that clearcutting and even-aged monocultures are not a good forestry method from a social, ecological, and economical point of view has occurred. Where the intense ground preparation and monoculture plantation are threatening biodiversity and recreational values, and the lack of quality in the wood taken out leading to economic loss for the forest owners (Eide et al., 2020; Ottosson, 2022; Pukkala et al., 2011). Hence, a gradual interest in going back to CCF is increasing, which was the leading method before it got prohibited during the 1950s (Hertog et al., 2022; H. Lundmark et al., 2013; Pukkala, 2016).

2.1 Background

Today Sweden has the largest forest cover in the European Union and is a major and frequent exporter of tree materials like wood, pulp, and paper (Hertog et al., 2022). In order to keep up with the material flow and ensure a high economic outcome, a high circulation and storage of the wood material is required and to accomplish that, clearcutting forestry is the chosen method among many forest actors and is argued to be the most efficient forestry method (Albrektson et al., 2012). Yet, researchers are warning that the long-term focus on high wood production and increasing extraction due to the growing demand for bio-energy has caused devastating consequences on the ecosystems in the forest such as loss of biodiversity (Eide et al., 2020) and would put even higher pressure on the Swedish forest (Angelstam et al., 2020; Lidestav & Westin, 2023). For example, the Swedish forest is increasingly being more vulnerable towards climate change, such as droughts and forest fires which will demand adaptation strategies to prevent these actions to happen. Further, biodiversity policies are not fulfilled with the current intensive clearcutting forestry with monoculture plantations. Additionally, the traditional Sami reindeer herding is negatively affected by the forest model since young, even-aged and monoculture forests are replacing old forests which have been revealed to detriment lichen which is an important resource for reindeers. It also adds to the social aspect of the indigenous people's rights since it affects the husbandry and land-use traditions (Hertog et al., 2022; Sandström et al., 2016).

In this paper, CCF will be used as a collective word and include different methods that go under the category of being alternative to conventional forestry. There exist several different methods and models for example selective logging and the Lübeck model, further, it also exists frameworks such as close to nature-framework. CCF highlights biodiversity and the importance of conserving ecosystem services and social aspects of the forest (Hertog et al., 2022). In line with the environmental and social benefits of CCF, Pukkala et al. (2011) are arguing that a transition towards CCF during a longer time period is more economically beneficial for the forest owners since the quality of the trees will increase and could be sold as timber which would generate a higher financial outcome for the forest owners. Pukkala, (2016) and Pukkala et al. (2011) suggest that CCF can be more economically profitable, along with that CCF includes a better carbon balance due to a lower amount of pulpwod in harvested timber compared to clearcutting forestry which influences the high manufacturing releases and low substation effect of pulpwod products.

The European Commission has set up strategies such as “EU forest strategy 2030” aiming to protect and restore forests including a biodiversity strategy as a part of the European Green Deal which strives for Europe to be the first climate-neutral continent (European Commission, 2023). Additionally, strategies such as “management solutions, decision-support and
monitoring tools” have been implemented to understand the complex interactions between production and ecosystems in the forest to meet climate change goals (European Commission, 2023). The Swedish government empathise with forests being an important aspect to reach climate change goals. Simultaneously, Sweden has set national environmental goals for sustainable forestry with goals concerning production and ecosystem services, additionally, Sweden is committed to biodiversity conservation through multiple targets (Angelstam et al., 2020; Danley et al., 2021; Skogsstyrelsen, 2023a). However, Sweden implemented a forestry act in 1993 that required conservation and development of nature values, along with additional forest strategies such as registration of biotopes to protect land areas and sustainable development goals to find a more sustainable way to manage forest activities. Nonetheless, these implementations have had limited effects on the management approaches in the Swedish forest (Hertog et al., 2022; Lindahl et al., 2017). Further, the Swedish Forest Agency report that Sweden is not on track to meet its own goals regarding sustainable forests “Living Forests”, which strives to protect biodiversity and maintain social values in the Swedish forests (Danley et al., 2021; Skogsstyrelsen, 2022a). Some of the goals that Sweden does not live up to are represented in the table below.

Table 1. The 5 most important problems to solve in the Swedish forest according to the Swedish Forest Agency. Note. Translated and cited from Levande skogar. Fördjupad utvärdering 2023 (p. 10) by Skogsstyrelsen. (2022). Rapport 2022/12.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lack of important habitats in the forest landscape. Several types of habitats are declining and becoming increasingly fragmented.</td>
</tr>
<tr>
<td>2</td>
<td>Unfavourable status or negative development for many forest-dwelling species. Many threaten and sensitive species are declining, and populations are becoming increasingly fragmented.</td>
</tr>
<tr>
<td>3</td>
<td>Several of the forest’s ecosystem services have inadequate status.</td>
</tr>
<tr>
<td>4</td>
<td>Cultural environments are destroyed in the forest landscape in connection with forestry measures.</td>
</tr>
<tr>
<td>5</td>
<td>Negative impact on the water streams within the forest landscape.</td>
</tr>
</tbody>
</table>

Even though recourses from the forest can replace non-renewable products such as fossil-fuel energy, accomplishing a sustainable way to manage the forest with fulfilling social, ecological, and economic aspects remain a big challenge due to conflicts of interest such as production interests and restoration and protection of biodiversity (Hertog et al., 2022). Further, this study advances the literature by diving deeper into the potential ways to balance the different interests and conflicts of the Swedish forest (Lidestav & Westin, 2023), without compromising the future health of the forest by investigating attitudes, existing support and required incentives to increase CCF. The focus is on stakeholders working within the Swedish forest sector. In the following sections, the purpose of the study and research questions are stated, followed by a background section in the form of a frame of references and methodology part. Sequentially, the findings are presented, followed by an analysis. Finally, the conclusion provides key outcomes of the research, and the paper ends with limitations and suggestions for future research.
2.2 Problem Discussion

As mentioned, clearcutting is presently the main method in Sweden due to its efficiency in producing wood (Danley et al., 2021; Hertog & Brogaard, 2021), favouring even-aged monoculture plantation and intense ground preparation, where ground preparation is implemented to favour the new plant to better manage competition from other vegetation (Skogsstyrskap, 2023). However, researchers are warning about the negative consequences of the long history of intense forestry and increasing intensification of the forest (Angelstam et al., 2011; Hertog et al., 2022). According to the latest Swedish Red List, 394 out of 999 species are threatened due to clearcutting forestry (SLU Artdatabanken, 2020). Natural-grown forests in Sweden are clearcut and planted with monocultures such as spruce or pine stands. There are species such as the fungi “hydnellum mirabile” (SLU Artdatabanken, 2023) that only can live in forests with a diverse variety of old trees and dead wood, which makes it difficult for these species to survive due to the monocultures.

Further, a spruce tree can be as old as 500 years and a pine tree can be over 800 years, however, today these trees often get cut down between the age of 80-120 years old (Ottosson, 2022; SLU Artdatabanken, 2020). The older the forest is, the better carbon sink the forest is since it is stored in the ground where carbon is gathered (Luyssaert et al., 2008; Wardle et al., 2012). Meanwhile, research has shown that a large amount of carbon dioxide is released when cultivating the forest since the carbon stored gets released (Amiro et al., 2010; Buchholz et al., 2014; Dean et al., 2017; He et al., 2016; Vestin et al., 2020). Additionally, when ground preparation is implemented as a part of clearcutting forestry, carbon is released from the ground (SLU, 2000). And even though plantation is a part of clearcutting forestry, Lindroth et al. (2010) state that it can take up to 30 years until the CO2 emissions from the clearcut area are compensated by the newly planted trees. Lindroth et al. (2018) shows that ecosystems in a forest could be maintained and favoured over time if using management approaches that avoids clear-cutting, which in turn will enhance the total carbon uptake in the forest.

The Swedish Forest Agency informed 2022 that the goal of “Living Forests” will not be reached with the current measures (Skogsstyrelsen, 2022a). Along with this (Vestin et al., 2020) argue that “the management of forests can impact the environment in many different ways such as greenhouse gas exchanges” (p. 2). More, Axelsson et al. (2007) point out that a higher variation of management approach in Swedish forestry can contribute to achieving the national environmental goals for example “Living Forests” and the aim to be fossil-free by 2045. Further, how to balance the ecological, social and economic goals in the Swedish forest is highly debated and discussed (Hertog et al., 2022). However, some of the existing literature focuses on the need for a transition towards a management approach that prioritises the protection of biodiversity within the forest industry (Hertog et al., 2022; Pukkala, 2016). Furthermore, Hertog et al. (2022) present research that provides evidence that CCF compared to clearcut forests results in a wider range of ecosystem services and increased social values creating better conditions for reindeer husbandry. To minimize CO2 release, clearcutting should be avoided, where CCF is pointed out as a better method from a climate perspective (Peura et al., 2018; Pukkala, 2016). Still, only 1-5% of the productive forest land in Sweden is managed with CCF (Felton et al., 2016; Hertog et al., 2022). An apparent gap in the literature is recognised as a general lack of studies on how the transition could be implemented, more specifically, what required incentives for actors within the Swedish forest sector would be needed for an increase of CCF.

2.3 Purpose

Some existing research state that a transition from clearcutting to a more diverse range of forest management is necessary (Axelsson et al., 2007; Hertog et al., 2022; Pukkala, 2016). Danley et
al. (2021) conclude that some forest owners could be willing to shift their management approach towards a method that take social and environmental aspect into account as well as the economic aspect, but “relying on volunteerism alone is unlikely to yield widespread and systematic improvements in forest and biodiversity protection” (Danley et al., 2021, p. 10). Therefore, the purpose of this thesis is to explore pathways towards more diverse and varied forest management by examining the attitudes, existing support and required incentives for stakeholders in the Swedish forest sector towards an increase of CCF.

2.4 Research Question
To meet the purpose of this study, the framework multi-level perspective will be applied, and inspiration from the study “Barriers to expanding continuous cover forestry in Sweden for delivering multiple ecosystem services” (Hertog et al., 2022) along with qualitative interviews with stakeholders in the Swedish forest sector the following questions have been developed:

RSQ1: What is the current attitude regarding an increase of CCF in Sweden and how is it affecting the implementation of CCF?

RSQ2: What existing support is provided for CCF/ implementation of CCF practices in Sweden?

RSQ3: What are the required incentives for actors within the Swedish forest sector to increase CCF?

2.5 Limitations
An ethical consideration that the reader should keep in mind is the risk of subjectiveness by the author. Since the author is studying a university program with a main focus on sustainable development, the author's passion for the research topic may result in a critical viewpoint and an instinctive finding between sustainability and forestry. Hence, the risk of subjectiveness originates from the author's fundamental values concerning different perspectives of sustainability. However, subjectiveness is highly considered during the process. Additionally, the interviews were collected in Swedish, hence, that was the mother tongue of the interviewees. Further, the interviews were also transcribed in Swedish. However, the quotes and data used in the result part of this paper were translated into English by the author. Therefore, the reader should keep in mind that the translation of the interviews made by the author is an interpretation of the original language Swedish. Furthermore, the fact that the results are gathered from stakeholders in the Swedish forest sector, could be questioned whether the results are applicable to other countries than Sweden.
3 Frame of References

To shed light on a relatively complex topic, this section strives to present findings from existing literature in line with the chosen topic of this study. A large scope of peer-reviewed articles in the field of relevance connected to this paper was selected using the search parameters presented in table 2, and added to Zotero, a reference management tool. In order to find relevant and recent research articles, the author reviewed and browsed through the first scope of papers, and in turn, prioritised and sorted out the most applicable literature to analyse further. Additionally, the chosen theory “Multi-level perspective” will be introduced and explained at the end of this section.

*Table 2: Search parameters*

<table>
<thead>
<tr>
<th>Database and Search Engine</th>
<th>LiU Library, Science Direct (Elsevier), Google Scholar, Scopus, Web of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examples of Search Words</strong></td>
<td>The Swedish forest industry, Sustainable forestry, CCF, Conventional forestry, Forest management</td>
</tr>
<tr>
<td><strong>Literature types</strong></td>
<td>Peer-reviewed articles, Academic books, and websites</td>
</tr>
<tr>
<td><strong>Publication period</strong></td>
<td>2000-2023</td>
</tr>
<tr>
<td><strong>Language of publication</strong></td>
<td>English and Swedish</td>
</tr>
</tbody>
</table>

3.1 History of the Swedish Forest Industry

The Swedish forest has been important throughout history, both for industrial development as well as economic welfare. A common practice during the 1800s was selective logging, which refers to a management approach where a selection of specific trees are harvested and clearcutting of areas is not implemented (Albrektson et al., 2012). Followed by the industrial revolution and increased demand for wood materials in industrially developed countries around Europe are analysed to be the driver of the transition from selective forestry methods towards clearcutting forestry (Albrektson et al., 2012; H. Lundmark et al., 2013). The increasing demand pushed the exploitation of the old Swedish forest. In line, the pulp industry increased and stressed the cutting of the forest even further, which in turn encouraged intensive forest management (Albrektson et al., 2012; H. Lundmark et al., 2013). Angelstam et al. (2020) explain that traditionally the approach of the forest has aimed to maximize economic revenue from wood material.

The economic incentives started to increase with time and the Swedish government used them to motivate forest owners around the country to increase production and plantation to ensure
cheaper wood and a steady supply of wood material to the expanding forest industry. During the 1950s the government lead a transition from selective logging towards clearcutting forestry with the aim to ensure consistent wood flow. Plantation of monoculture leads to productive young forests, where fertilisation, ground preparation, genetically improved seedlings and afforestation resulted in increasing volumes of trees. Later on, the practices got mechanized (Angelstam et al., 2011; Axelsson et al., 2007; Lindahl et al., 2017). It also resulted in a loss of old trees and forests, along with large areas of clearcuts. Further, the increased use of specific herbicides removed the deciduous parts in the young productive forests (Angelstam et al., 2011). However, during the 1970s and 1980s, intense clearcutting forestry started to be criticized from an environmental angle, due to its prioritising of economic profitability and high wood production and lack of consideration of biodiversity and nature values (Lindahl et al., 2017).

It was not until the 1990s that the concept of sustainability started to approach the Swedish forest policy (Fischer et al., 2020). The Swedish Forestry Act from 1993 weighs environmental and production aspects equally, however, due to the economic recession during the 1990s the capacity to check and review actors within the forest industry decreased, which lead to own responsibility and a frame consisting of minimum requirements that needed to be followed, this situation will later come to be called “freedom with responsibility” (Fischer et al., 2020). Nonetheless, due to the long tradition of prioritising high wood production, the culture and attitude continued with this approach even though the policy aimed to create the environment and wood production equally important (Lindahl et al., 2017).

3.2 Swedish Forest Today
Sweden is one of the countries with the most forest land cover in Europe. The forest industry plays a huge role in the Swedish economy and is the world’s third-largest exporter of sawn and fourth-largest exporter of paper and pulp, where 80 % of the production from the forest goes to export and corresponds to a value of 164 billion Swedish kronor (Andersson & Keskitalo, 2018; SCB, 2018). More, 3% of the GDP is coming from the forest industry (Andersson & Keskitalo, 2018; Skogsindustrierna, 2022). Around 68 % of the land area in Sweden is covered with forest, and approximately 84 % of the forest land is productive forests (see figure 1) (SLU Riksskogstaxeringen, 2021).

![Figure 1. Illustration of the division of land area in Sweden. Note. Author’s own figure. The scale of the figure is not accurately represented. Mark i Sverige. By Statistiska Centralbyrån (SCB), 2023.](image-url)
Of the productive forest land, 80% of the trees are even-aged, where 0.8% of it gets clearcut every year which equals 187,000 hectares. Furthermore, as a part of the clearcutting forestry, 255,000 hectares are cleaned and 313,000 hectares are thinned out (Hertog et al., 2022; Riksskogstaxeringen, 2020). In an article from 2022, researchers mapped the last primary forests in Sweden, where around 2% of forest land is identified as old forest. An old forest in Sweden is referred to as a forest that is older than 120 years in southern Sweden, and in northern Sweden, the age limit is 140 years. These primary forests are located in small patches surrounded by managed forests with monocultures (Joelsson, 2022). Scots pine and Norway Spruce are the most common trees in Sweden due to their ability for intense wood production (see figure 2) (Angelstam et al., 2020).

![Growing stock by tree species in % in productive forests](image)

Figure 2. Showing the division of the most common tree species in productive forests in Sweden. Note. Author’s own figure. Skogsdata 2022. Aktuella uppgifter om de svenska skogarna. SLU Riksskogstaxeringen. (2023).

More, around 41% of the productive forest in Sweden today is between 0-40 years old, and around 85% of the productive forest is younger than 120 years old (SLU Riksskogstaxeringen, 2021). Additionally, even though Sweden established the first national park in Europe in 1909, Sweden has today the second lowest amount of protected land in Europe (Danley et al., 2021). Today it exist 30 national parks in Sweden, intending to maintain nature as it is for current and coming generations (Naturvårdsverket, 2016). Along with national parks, Sweden consists of 5000 nature reserves from north to south, and 75% of the nature reserves are located in mountain areas. The meaning of nature reserves is to protect nature and preserve biodiversity, as well as secure the social values for humans in the form of nature experiences. Only 1.5% of the forest below the mountain areas are protected by nature reserves, therefore the Swedish government implemented an environmental goal called “Living Forests” which is aiming to increase the number of nature reserves and wetlands and lakes among others to reach the national environmental goals (Naturvårdsverket, 2010, 2021).

Roughly 50% of the forest land in Sweden is owned by 330,000 private forest owners, and according to Hertog et al. (2022), almost all of them cultivate their forests with the clearcutting method (see figure 3) (Andersson & Keskitalo, 2018).
Most private forest owners are dependent on a contract based on the Swedish forestry model, which is based on a shared understanding of the importance of planting trees to avoid exploitation and in turn deliver a stable wood supply to the industry, additionally the revenue is shared between the industry and private owners. With respect to this, the existing forest owner associations are important actors to ensure individual person’s rights (Lidestav & Westin, 2023).

### 3.3 Conventional Forestry

Sweden has for decades pursued an intensive forest management approach including rough ground preparation, monoculture plantations and clearcutting big areas to maximise wood material outtake (see figure 4 as an example of how it can look like) (Lindahl et al., 2017). The forest owners are supported by forest cooperatives or associations and the Swedish Forest Agency, where marketing, sales services and forest management services are provided including advisory services (Albrektson et al., 2012). The most common management approach by private owners is clearcutting (Andersson & Keskitalo, 2018). Clearcutting can be viewed as similar to cultivating agricultural land, as it includes harvesting of trees in a decided area, followed by preparation of the ground before planting new trees and addition of fertilizer. There are different methods for preparing the ground, one of the most common ones is “harvning” which means that a machine is taking up mineral soil by creating tracks in the form of long rows in the ground with the aim to disintegrate the soil (Skogskunskap, 2017).
Lindahl et al. (2017) discuss the reasons around clearcutting still being the leading method, which is stated to be because of the efficiency to produce a high amount of wood. It also corresponds to the increasing demand for wood to solve environmental problems in society today. Along with the economic benefits such as exporting wood (Andersson & Keskitalo, 2018). Even though economic, social, and ecological dimensions are stated and identified as strategic goals in the Swedish forestry model, the increasing wood demand as an answer to economic and environmental problems in our society continues to prioritise the economic and production aspect of the forest (Lindahl et al., 2017).

3.4 Policy strategies in the Swedish forest
The forest regulates the climate and consists of a high variety of biodiversity, different trees which store carbon, along with providing humans with timber and pulpwood, berries and mushrooms and fresh water. To protect nature and maintain the important sustainability aspects of the forest, the Swedish government has implemented “Living forests”. “Living forests” are environmental goals that include protecting biodiversity and maintaining culture and social values in the Swedish forests, the goals are evaluated regularly (Skogsstyrelsen, 2022e). However, the latest follow-ups have shown that Sweden is not on board to meet their own goals regarding the biodiversity in forests since ecosystems are not consummated (Hertog et al., 2022). More specifically, “measures taken to protect nature and the diversity of ecosystem services are not sufficient to stop the ongoing loss of habitats in the forest landscape” (Lidestav & Westin, 2023, p. 5).

Along with national goals, Sweden has committed to biodiversity conservation on an international level. Sweden has signed the Convention on Biological Diversity, more
specifically, goals including “at least 17% of terrestrial ecosystems should be conserved through an effective system of protected areas covering representative land covers with functional connectivity, additionally, prescribes sustainable management of the forest landscape surrounding protected areas” (Angelstam et al., 2020, p. 2). Along with the EU Biodiversity Strategy, and national forest and environmental policies with the goal to protect 20% of forest land to favour naturally occurring species. Further, Sweden is striving to maintain social values in the forest by creating recreational values such as nature tourism (Angelstam et al., 2020; Skogsstyrelsen, 2022d). Further, the transition from fossil-based to bio-based energy to meet the national goal to be fossil free by 2045 has increased the interest in wood (Lidestav & Westin, 2023). Along with bio-based energy, climate change and transformation in demography will create greater challenges for the wood to be enough, as well as for the actors to manage trade-offs between the interest of the forest (Sandström et al., 2011).

In the aforementioned “freedom with responsibility” where the forest owner has the freedom to develop their forest according to their goals and wishes, the forest owners still carry a responsibility to make sure that new trees grow after harvesting along with consideration of nature values. However, the policy “freedom with responsibility” has been investigated and reviewed and strongly criticized for not taking all three pillars of sustainability (social, ecological and economic aspects) into account. As well as failing the national and international environmental goals concerning the forest (Lindahl et al., 2017). Further, meeting the environmental goals requires altruistic initiatives from private forest owners, meaning, the Swedish government and policies are relying on voluntarism from the forest owners to meet the goals for a sustainable forest (Danley et al., 2021). In order to do so, Lidestav and Westin (2023) state that incentives would have to be implemented to achieve management that supports the ecological and social aspects of the forest.

Lastly, in the year 2020, the red list was presented, where species and their health are evaluated. 999 out of 2249 of the threatened species live in forests (Ottosson, 2022; SLU Artdatabanken, 2020). Conclusions were made that these species are to some extent negatively affected by the Swedish forestry model, however, 394 out of the 999 species are directly threatened due to clearcutting forestry and monocultures (Ottosson, 2022; SLU Artdatabanken, 2020). During the 1990s the Forest Agency started by identifying and registering key biotopes in the forests, which will protect the biotopes and the forest land area. There exist more than 50 different key biotopes, the reasons for identifying biotopes can be cultural, historical, or ecological reasons. However, other areas can be important for biodiversity and hence not identified as a key biotope, then it is called an object with nature value. Nonetheless, in 2021 the Swedish Government decided to stop the identifying and inventorying of key biotopes and objectives with nature values in all sectors. The reason is that the biotopes and nature values enable appeal against decisions regarding forest management. In line, old key biotopes can be unregistered if wanted, which will make areas unprotected by law and allowed to be managed (Skogsstyrelsen, 2022f, 2022c).

### 3.5 Sustainable Forest Management

Contrary to the policy strategies, sustainable forest management can be referred to if sustainability is considered to be reached in social, ecological, and economic aspects. Where ecological sustainability means that the ecosystems and biodiversity should not be disturbed or jeopardized, and economic sustainability implies current extraction of forests should not decrease future harvest levels and that economic generation should be maintained (Pukkala, 2021). Further, from a social human perspective, the forest supplies nature experiences, and recreational opportunities, such as playing and hunting (Hansen & Malmaeus, 2016). Research has shown that the forest can be used for rehabilitation from stress-related exhaustion, where
conclusions are drawn that humans have an instinctive relationship with nature “based on not only its life-supporting qualities but also its ability to meet our biological, evolutionary, aesthetic, intellectual, cognitive and spiritual needs” (Sonntag-Öström et al., 2011, p. 246). Naturvårdsverket (2010) highlights the importance of conserving nature for human health and tourism. Sonntag-Öström et al. (2011) conclude by stating four features that have a rehabilitative effect while being in forests: “being away, extent, fascination and compatibility” (2011, p. 246).

In the last decades, a growing interest in different forest management strategies that prioritise equal weight of social, economic, and ecological sustainability has increased. Wood production and economic aspects are still demanded in society, however, methods with social and ecological values are getting increasing attention. These methods are often referred to as CCF (Hertog et al., 2022). Lundmark et al. (2013) affirm that the meaning of sustainable forest management has changed from focusing on ensuring a steady timber supply to finding a sustainable approach to finding a balance between ecosystem services. Withal, the increasing awareness and knowledge about environmental aspects and the new Forestry Act in 1993 concluding that timber production and environmental conservation are seen as equal goals for Sweden from now on has changed the view towards sustainable forest management to some extent (Hertog et al., 2022; Skogsindustrierna, 2013).

Additionally, the Swedish Forest Protection Act demands that forest owners manage their forest to consider the ecological and social values of the forest (Skogsstyrelsen, 2022b). However, how to best achieve a sustainable approach in the forest is highly debated (Hertog et al., 2022). Some research stated that a mix of flexible management approaches in the forest is the best way to approach the balance between social, economic and ecological aspects in the forest (Pukkala, 2021). While some argue that management approaches promoting uneven-aged methods are the most beneficial considering sustainability, and considering economic sustainability, uneven-aged management is more economically beneficial for private owners compared to if the owner would use clearcutting as a method (Pukkala et al., 2011).

3.5.1 Continuous Cover Forestry
CCF is characteristic of not clearcutting forest land, it involves uneven-aged forest management where a selection of different tree species is harvested. Selective felling is implemented to maintain a steady forest cover (see an example in figure 6) (Felton et al., 2016; Hertog et al., 2022). CCF can also be mentioned as clearcut-free forestry, where the Swedish National Forest Agency describes it as “forestry methods that do not create clearcuts, including selective logging, patch cuts and shelterwood systems” (Hertog et al., 2022, p. 2). It exists different definitions, methods and frameworks which is illustrated in figure 5.
Figure 5. Different concepts of CCF. CCF cover the right side of the figure, whereas conventional forestry is on the left side of the figure. Note. Author’s own figure based on: Hyggesfritt skogsbruk. Erfarenheter från Sverige och Finland (p. 9) by Hannerz, M., Nordin, A. & Saksa, T. (2017). Future Forests, Rapportserie 2017:1. Sveriges lantbruksuniversitet, Umeå.

The Forest Stewardship Council consider CCF as a method of uneven-aged forest management with the main goal to keep or create multiple ages and species in the forest (see figure 6 as an example of how it can look like). While, clearcut-free forestry is broader and also includes even-aged methods that avoid clearcutting, for example, patch-cuts, selective forestry and screen-cutting (Hertog et al., 2022; Skogsstyrelsen, 2022b).

Figure 6. A forest managed with “close to nature forestry”. Note author’s own picture.
The research done so far is focusing on the ecological aspect of CCF. Where the evidence shows that CCF compared to clearcut forestry for example is more beneficial for fungus, and bilberry growth among other important biodiversity aspects (Hertog et al., 2022). Additionally, CCF has been shown to contribute with positive effects on climate change adaptation and carbon balance in the forest, as well as keeping the natural feeling of the forest (Hertog et al., 2022; T. Lundmark et al., 2016; Skogsstyrelsen, 2022b).

Active CCF is rare in Sweden, as mentioned around 1-5% of productive forest land is managed with CCF (Felton et al., 2016; Hertog et al., 2022). 14% of the forest land is state-owned, and less than 1% of the land is managed with CCF. Most of the 1% land area is located in more difficult geographical areas such as wetlands and mountain areas, where it is considered to be more beneficial with CCF due to practical reasons (Hertog et al., 2022). Yet, Hertog et al.’s (2022) findings reveal that actors using CCF on their land did it for “aesthetic and recreational values, biodiversity, a steadier income for the forest owner, increased forest resilience, the joy of experimenting with new methods, and ethical considerations for future generations” (p. 5).

3.5.2 Attitudes regarding CCF
The attitudes towards CCF differ among people in today’s society, where culture and traditions are forming different attitudes. The power of the industrial networks and the current forestry education imprint the norm of the forest industry today (Hertog et al., 2022). Where radical changes and suggestions are not very welcome (Lindkvist et al., 2012). Further, actors with a negative attitude towards CCF use arguments such as ecological risks, decreasing economic profitability and lack of technical knowledge (Hertog et al., 2022). Nonetheless, most actors within the forest industry acknowledge the forest as important for climate mitigation and energy transition. This in turn starts fundamental discussions about social transformation and how to manage the forest in future. The main differing notion is whether the demand for biomass for the transition from a fossil-based society should be fulfilled by the forest or not. Where one side expect the forest to act as the main resources for transition to bioenergy since it is unlimited and renewable (Börjesson et al., 2017). And the other side argues against this viewpoint and stress scarcity and protection of the forest and that the forest resources are not enough for all interest. This division is the base of many conflicts and debates in the forest sector today (Lindahl & Westholm, 2012).

Eriksson & Fries (2020) claim that knowledge about climate change and nature values is highly connected to what kind of forest management actors proceed with and attitudes towards using different management approaches as an alternative to conventional forestry. Furthermore, knowledge about climate adaptation showed to be connected with the implementation of adaptation measures like increasing variation between trees in the forest and leaving the forest untouched (Eriksson & Fries, 2020).

3.5.3 Hindrances regarding CCF
Increasing the frequency of CCF or changing it to the main method in Sweden is met by a few stated hindrances as identified in a study by Hertog et al. (2022). The culture and norms have to shift and in turn, the timber market, forestry legislation, education and research focus have to join the transformation (Hertog et al., 2022). Since clearcutting has been the main method for a long period of time, there is a knowledge gap in how to implement CCF in Sweden. This is a hinder to achieve CCF and anticipating costs is uncertain due to the knowledge gap previously mentioned, leading to uncertainties for the forest owner to proceed with a change from conventional forestry to CCF (Karlsen, 2021; Manner et al., 2023). Specifically, in a paper conducted by (Karlsen, 2021; Manner et al., 2023), the difficulties to anticipate the costs connected to the practicalities of CCF are considered major hindrances. Therefore, CCF needs to be saturated with more research about satisfying the economic, ecological and socio-cultural
aspects (Axelsson & Angelstam, 2011). The research that is done is mostly based on wood production in comparison between CCF and conventional forestry, hence, a lack of knowledge about social and economic aspects exists (Pukkala et al., 2011). Further hinderers mentioned by Hertog et al. (2022) are the existing power dimensions within the Swedish forestry sector that manifests through industrial networks with the power to shape the system in a way that is advantageous for conventional forestry management methods, for example by impacting what is educated and what is not. Therefore, information and advice outside conventional forestry is recognised as limited. As mentioned, the knowledge about CCF is low, which is reflected in limited research compared to conventional forestry (Hertog et al., 2022).
4 Methodology and Materials

4.1 Research Paradigm and Approach

Research paradigm can be described as the philosophical guideline for the implemented research, where the philosophy of research is referred to as the thoughts and beliefs of how the data about a phenomenon should be gathered, analysed and used throughout the study (Collis & Hussey, 2014). In this study, an interpretivism paradigm was implemented, which highlights that social reality is subjective and can be framed by people’s conceptions. Compared to positivism, which applies social reality as objective and not affected by the researcher (Collis & Hussey, 2014). Positivism will therefore not be applied in this study since it does not enable the researcher to observe the research questions from different angles and analyse them based on qualitative data, which in turn will be analysed from a subjective view. This can be done with an interpretivism paradigm (Collis & Hussey, 2014).

In order to proceed with a research paper, it is of need to find an appropriate approach to establish a connection between a theory and the research. This has resulted in two main approaches inductive and deductive (Awuzie & McDermott, 2017; Collis & Hussey, 2014). The deductive approach is referring to when a theory or theoretical structure is chosen and throughout the research analysed by observation and collected data (Collis & Hussey, 2014). Furthermore, the main difference between deductive and inductive is that the deductive approach starts with an existing and general theory which is later on narrowed down to the specific study and observations. Meanwhile, inductive starts with observations which later on aim to create a new theory (Woiceshyn & Daellenbach, 2018). Along with the two main approaches, a third approach exists and is called the abductive approach. Similar to the deductive approach it aims to move from generalization to empirical data collection, however, it enables the researcher to move more freely between data and theory and aim to create a new theory or develop an existing one (Awuzie & McDermott, 2017). To conclude, this study followed a deductive approach starting with the MLP framework, and later, applied the theory to the collected data for further analysation.

4.2 Research design

4.2.1 Method and Data Collection

The research design refers to the framework of research methods and techniques to achieve in-depth data. This deductive study adopted a qualitative approach to understand the necessary incentives for a transition within the Swedish forest sector. More, qualitative research methodology will be implemented in order to recognise actor’s actions and perspectives to interpret, understand and draw conclusions about the phenomenon of the study (Collis & Hussey, 2014).

The qualitative collection of primary data was done by using one-on-one interviews. One-on-one interviews were used since it is a “method in which a sample of interviewees are asked questions to find out what they think, do, or feel” (Collis & Hussey, 2014, p. 133). More, it can provide data and results of behaviours, thoughts and motivations (Henry et al., 2015). These were argued to be suitable for this study since they enabled the interviewees the chance to reflect and think about their attitudes and thoughts about the topic of this study. The thoughts of the interviewees added comprehensive understanding to the research since it gave for example ideas of incentives and hinders for transformation within the forestry sector.

The interviews consisted of both closed and open questions to gain as much in-depth information as possible (Kvale & Brinkmann, 2009). For this reason, the interview was semi-structured, where some questions were developed before the interviews, and some questions were developed during the interviews, which enabled the researcher the chance to form
questions depending on the answer received and the opportunity to elaborate on topics that came up during the conversation (Collis & Hussey, 2014). More, the prepared questions were aiming to target the interviewee’s thoughts and reflections on sustainable forestry and CCF. For example, questions like “What kind of possibilities do you see with CCF?” and “What kind of incentives would you be needed to increase CCF in your forest?” gave the respondents an understanding of the idea of the interview (further see appendix 1). One-on-one interviews are preferable in this study to gain the stakeholder's perspectives in detail.

In order not to make the interviews uncomfortable for the respondents due to language barriers and limit the answers and thoughts, all interviews were done in Swedish. Which was the mother language of all respondents contributing to this study as well as the researcher.

To add additional knowledge about the field of the chosen topic, secondary data was collected in the form of a literature review of peer-reviewed articles (see chapter 3). Further, relevant information was retrieved from chosen organisation’s websites. Secondary data can be referred to as data from existing sources (Collis & Hussey, 2014).

4.2.2 Data sample from interviews with stakeholders
To acknowledge relevant actors to interview within the Swedish forest sector, stakeholder analysis was used as a tool for identification. Stakeholders means someone that is or can be influenced by decisions and actions taken, as well as being able to influence the potential outcomes (Reed et al., 2009). Meanwhile, stakeholder analysis is a method where the stakeholders are identified and mapped. The first step is to “define aspects of a social and natural phenomenon affected by a decision or action” and the second, “identify individuals, groups and organisations who are affected by or can affect those parts of the phenomenon” and the third and last, “prioritises these individuals and groups for involvement in the decision-making process” (Reed et al., 2009, p. 1933). Nonetheless, due to geographical criteria and lack of time, it was not possible to include all stakeholders in the Swedish forest sector and as mentioned by Reed et al. (2009) “a line must be drawn at some point, based on well-founded criteria established by the research analyst” (p. 1937). Further, it can be hard to know which stakeholders should be implemented to match the focus of this study, therefore snowball sampling is recommended as a method to find the stakeholder to focus on (Reed et al., 2009). Snowball sampling (Collis & Hussey, 2014) was used by asking interviewees for suggestions of other people to interview that they would be considered relevant. Interviewees facilitated contact with actors relevant to this study which was highly appreciated to proceed with data collection. A total of 20 different actors were contacted, 13 accepted an interview and 7 did not respond. However, the reader should keep in mind that this sample of stakeholders does not completely represent and justify the Swedish forest sector.

Lastly, the data collected from interviews were finalized when saturation was fulfilled. More specifically, when no additional or new perspective and information was collected. Boddy (2016) states that data saturation determines whether the collected sample size is sufficient and representable enough.

<table>
<thead>
<tr>
<th>Interview nr</th>
<th>Interviewee’s Job Title</th>
<th>Date of the Interview</th>
<th>Interview Platform</th>
<th>Interview Length</th>
<th>Referred as in the paper:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sustainability Coordinator</td>
<td>21-Mar</td>
<td>Microsoft Teams</td>
<td>40 minutes</td>
<td>R1</td>
</tr>
<tr>
<td>2</td>
<td>Head of Forest Management</td>
<td>23-Mar</td>
<td>Microsoft Teams</td>
<td>40 minutes</td>
<td>R2</td>
</tr>
</tbody>
</table>
4.2.3 Data analysis

To begin the analysis, the interviews were read through thoroughly and transcribed right after conduction, key notes of initial thoughts and statements were taken during the first analysis of the data. The interviews were done in the mother language of the interviewer and respondents, therefore, the transcribing was translated as well. Analysing the collected data was used by implementing a thematic approach to identify patterns and understand aspects of the topic that the interviewees talk about in-depth (Gioia et al., 2013). The software tool NVivo v.12 was used to code and analyse the transcript from the interviews.

Coding the data collected by thematic analysis enabled the author to find common themes and patterns to simplify comparisons and different perspectives and angles of the respondent’s perspective (Boréus & Bergström, 2017). Further, when identifying and grouping the statements into coding themes, the theoretical framework was interpreted for analyse. The themes are identified as categories that are recognised from the interviews with different stakeholders. This opened up the opportunity to connect how statements and facts from interviewees to the topic of the study are related (Gioia et al., 2013).

The second step of the analysis was to code the collected data and organised the codes into categories based on similarities and concepts by identifying patterns. The reason for using codes and categories was to organise the attitudes and actions of the forest stakeholders and easier connect them to the topic of the study. Later, the codes were divided into categories (Collis & Hussey, 2014), example of a category is “Economic Incentives” which originates from the code “Economic support would be a required incentive for a change”. The described process of data analysis demonstrates how this study moved from raw data to analysis dimensions (Gioia et al., 2013).
4.3 Theoretical Framework

4.3.1 Multi-level perspective
The current society can be viewed as a socio-technical society which is driven by social and technical influences, such as energy and agri-food systems which are dependent on technology, policy, infrastructure, scientific knowledge as well as marketing and cultural aspects (Geels, 2011). Hence, changes can be referred to as socio-technical transitions. Further, the socio-technical different systems can be categorised into economic, cultural, technological, ecological and knowledge categories. When the categories interact they can create development, adaptation and collaboration with each other (Geels, 2011; Hertog et al., 2022). This study aims to understand incentives for a transition, and in order to understand transitions Hertog et al. (2022) argue that “structures, cultures and practices of societal systems” need to be understood and analysed together. Hence, the Multi-level perspective (MLP) framework will be implemented and analysed in this paper. MLP is an established framework that aims to map patterns and aspects of transitions.

The MLP consists of three different levels which aim to mirror the different levels in the socio-technical society. The “regime” is referring to the levels of established practices and structures in the society compared to the “niche” level which is referring to groups or streams of radical innovations and ideas. The socio-technical landscape is the wider context in society, which influences niche and regime dynamics. The MLP dive deep into structures and potential transitions, where the regime level is the main focus since that is where the change needs to happen and be implemented. At the same time, the niche level is key for the change to happen since they are the ones planting the seeds for a systematic transformation. The socio-technical landscape is equal to the broader aspect of society such as politics, social values, economic as well as technical aspects. The landscape level influences both the regime and the niche dynamics, however, the landscape level usually changes slowly (Geels, 2011; Geels & Schot, 2010). Thus, “this varied set of factors can be combined within a single ‘landscape’ category because they form an external context that actors at niche and regime levels cannot influence in the short run” (Geels, 2011, p. 28).

4.3.2 Theoretical Approach
In this study, the MLP framework will be used from the view that transitions are a non-linear process based on an exchange between regime, niche, and landscape levels (Geels, 2011).
Where the regime level will be represented by the current norm and main method in Swedish forestry which is conventional forest management. The regime level consists of different elements such as technology, politics, current market, culture, and attitudes. As recognised by the MLP, the regime is resistant towards change and niche influences due to established practices and cultural aspects. The regime level will be represented by CCF practices and attitudes, however, as mentioned by Hertog et al. (2022) the regime level may act as a barrier for niche level ideas and goals. The landscape level stands for the broader aspect such as social trends and actions. By investigating the linkage between the different levels in the MLP, attitudes, existing support and required incentives will be analysed to see how and in what way these factors can contribute to increasing CCF in Sweden. This study aims to get a better view of the current attitude regarding an increase in CCF, as well as the existing support provided for actors interested in or managing CCF. Lastly, required incentives for actors to increase the ratio of CCF. Following, in the analysis part of this paper, the three levels of the MLP will be discussed in the sense of an increase of CCF, where the landscape level will be focused on and further how the landscape level together with the niche can influence the regime. Studies before has divided for examples interview actors into the different levels of MLP. However, in this paper forestry methods will be divided into the regime and niche levels and the landscape level will be the main focus where arguments and actions will be discussed and analysed.

4.4 Data Quality
To ensure that the collected data was conducted and analysed in a way that the subject of the paper was correctly described and identified, credibility was implemented in this study (Collis & Hussey, 2014). To ensure credibility, data was collected in different ways. Both through existing sources via a literature review, so that people who are familiar with the topic or not should recognise/get an understanding of the background and relevant topics correlated with the study. Furthermore, this refers to validity which can be explained that multiple sources of evidence should be used to fulfil the validity of the paper (Collis & Hussey, 2014). In addition to the different methods used, the role of the interviewees was considered to cover as many actors as possible within the forest sector in Sweden to enrich the study with different viewpoints on the topic. Further, to strengthen the credibility of the interviews, similar questions were asked several times, such as “How do you support forest owners, interested in CCF?” and “How would you describe your role in influencing/ supporting forest owners towards CCF?”.

Furthermore, to facilitate transferability, the generalisation of the study is important for opening up the opportunity to conduct the same study again in a similar context (Collis & Hussey, 2014). To fulfil transferability, the methodology of this study has been described carefully. Specifically, data collection and the analysis of the collected data via thematic analysis. Further, the interview guideline is added in the appendix. The method part of this study aimed to include all steps taken and considered while conducting this study.

4.4.1 Ethical Considerations
Before conducting the interviews, the participants were informed about the ethics and confidentiality of the participants. Consent forms of data processing were handed out to and confirmed by all participants before interviews were conducted. The consent form includes information about this study, as well as information about data processing according to European Union General Data Protection Regulation 2016/679 (GDPR) and the option to participate or not. This study assumes anonymity regarding the participant's names and company/organisation's name, however, with the interviewee's consent, their role within the forest sector will be used to strengthen arguments and statements in the paper.
5 Empirical Findings

The results from the interviews are presented in this section and divided into categories and themes, which are presented in figure 8, as well as in sub-chapters. Each sub-chapters contains information and quotes from the collected data to provide examples and apply the empirical findings. The empirical data collected from the interviews with different actors within the Swedish forest sector concluded the main attitudes, exciting support and required incentives of CCF. Figure 8 below illustrates the categories extracted from the codes which are collected under the themes and is further explained under each sub-chapter.

![Diagram of empirical findings categories and themes]

Figure 8: Author’s own model based on empirical findings
5.1 Attitude

5.1.1 Structures within the forest sector
Empirical findings revealed that structures and norms such as the IT systems in use and organisational frameworks within the forest sector were affecting how forest actors perceived an increase of CCF in Sweden. R3 and R4 told a story about a meeting with their member organisation. The member organisation communicated that they are now forced to come up with a plan for CCF due to pressure from society. Further, conservative attitudes within organisations and in business models were mentioned, and old negative experiences since previous attempts of CCF were shown to be unsuccessful due to a lack of practical knowledge.

…attitudes connected to old negative experiences of CCF and the uncertainty of how it would come to affect the business models and the financial effects for the forest owners contribute to a sceptical attitude… (R9).

Further, R11 mentioned internal structures and attitudes as a hinder to innovation and change.

Imagine if you have a high position within an organisation, then it is safer to do as you have always done instead of challenge norms and structures (R11).

Concerning structures, one interviewee discussed the attitude expressed towards CCF in course literature used in different forest educations around Sweden.

In the part of the literature where they discuss different forestry methods, CCF is mentioned as an alternative forestry philosophy…which I agree with, however, all forestry has a philosophy behind so why don’t we talk about the philosophy behind conventional forestry? (R13).

Furthermore, two interviewees brought up the IT systems as being able to slow down and hinder the process of implementing CCF.

The IT systems used today are based on conventional forestry. Therefore, it will make changes and time to justify the systems towards a new way to manage the forest. And we may have run a little too fast forward, so the systems are not keeping up with the changes (R1).

R5 told that the IT systems that exist today are only suitable for conventional forestry.

When I’m about to register a CCF work done in a forest, the IT system shows an error… (R5).

On the contrary, different political arguments were brought up. R8 expressed a fear to miss the government’s law on regeneration and regrowth if a higher variation of forestry methods would increase. In the meantime, R5 and R13 mentioned that it is hard to go through a shift when the politics and laws are formed after conventional forestry.

The Forest Act is rather a production law than an ecosystem management law (R13).

On the other hand, the findings also revealed that forest owners feel uncertainty towards the governmental agency due to a lack of knowledge of CCF. One finding revealed that some actors experienced a fear of integrating with governmental actors.

It gets complicated as soon as you involve the governmental agency (R3 and R4).

5.1.2 Social and ecological values in the forest
Continuously, a factor that was raised multiple times was the positive contribution CCF can have on different values in the forest for example biodiversity and recreational values. The recreational value was specifically raised of importance concerning forest areas close to cities.
One interviewee expressed that land areas that do not include high nature and cultural values would be suitable to continue with conventional forestry to ensure a high wood supply.

All land may not be optimal for CCF, some land areas we should continue with conventional forestry, however, it would be beneficial to see an increase of CCF (R7).

Yet, the lack of knowledge concerning different values in the forest was also raised.

With reservation that we do not know all the effects, I believe that CCF have both positive and negative effects, for example, biodiversity and recreational values at least in some kind of forest environments (R6).

As an example, R1 mentioned that the demand for a change in the current forestry is increasing, however, R1 argued that a change does not have to mean that we shift away from conventional forestry. It is possible to continue with conventional forestry but with an increase in consideration of nature values.

Four of the interviewees mentioned that they do not see a problem with a small increase in CCF due to recreational value, although they showed a sceptical attitude towards a complete shift to CCF from conventional forestry.

More, a major advantage of CCF mentioned by all interviewees was that other values than production values get a chance to increase with a shift from conventional forestry whose main aim is to produce as much wood material as possible. A positive attitude towards an increase of CCF from two interviewees clearly expressed the benefits of broadening the spectrum of forestry methods and the chance to achieve more goals, both for individual forest owners as well as social goals concerning biodiversity, climate change or recreational values.

The production and ecological goal are supposed to weight equal according to the Swedish politics…The negative side is that we have too much focus on production and lose biodiversity and nature values on the way… (R6).

The topic of monocultures was raised many times and all the respondents mentioned the recreational benefits of CCF. This was also raised from a societal perspective that more people are requesting a nicer forest to visit with a higher variety of trees and species in the forest.

Almost half of the interviewees argued that we need to change the way we manage our forests to not lose biodiversity. One interviewee expressed specifically that a shift in forestry methods is crucial to reach climate goals.

…I do not see anything else that can help us as much as the forest can concerning climate change (R11).

R11 mentioned a solution based on practical experience together with conversations with researchers that by drastically decreasing the logging of the Swedish forest for a couple of years would contribute to stopping climate change, and after a period of time when the climate change is solved and under control it is possible to start managing the forest again with some kind of CCF. By then the forest will contain a high inventory of wood which will generate a good and stable economy.

R5, R10 and R13 expressed the benefit of the reduced risk of pests and diseases in the forest due to a decrease in monocultures. Trees in monocultures are similar in age and due to climate change and an increase in temperature, the trees get stressed which pests recognise and take advantage of.

…monocultures are a feast for the bark beetles (R11).
From an ecological point of view, R12 mentioned the composition of different tree species as a concern. It will favour the tree species that prefer shade like beech and fir. But pine will not benefit from that, and pine is considered a climate-adapted tree since it is more resistant towards heat and drought. Further, R12 answered that on a larger scale CCF will lead to less variation in the landscape.

Today we have a larger variety of stands throughout the country since you can plant whatever you want after clearcutting…with CCF will lead to less variation in the landscape (R12).

5.1.3 Scepticism due to lack of knowledge and practical examples
The empirical findings showed that all actors were to some extent considering the increasing trend of CCF. Some actors were more positive towards CCF and to implement more CCF in the future than others. However, one of the main findings was the shared scepticism towards CCF considering the lack of knowledge and experience of practicalities of the method.

The biggest hinder are lack of knowledge and lack of practical experience. We do not know how CCF works from a long-term perspective. CCF often is dependent on natural regeneration, and we do not know if that works and how well the regeneration is working long-term (R6).

Further, R8 and R9 mentioned the concern of advising forest owners about CCF and the economic outcome of CCF due to a lack of knowledge and experience. In line, R1 raised the same problem and argued that it is important to have an economic backup until the knowledge increase about the outcome of CCF. In case the economic outcome does not turn out as expected, the organisation needs to be able to step in and support it, and as of today, such a plan does not exist according to R1. Five interviewees highlighted that they are planning and working with innovation, however, it is impossible to join and steer the organisation towards every new idea that is acknowledged according to R9, who stated that “the process needs to take time and be worked through before started”.

A common theme from the empirical findings was a satisfaction with conventional forestry. Benefits such as efficiency, economic advantages, high wood flow, and substitute for fossil fuels as in bioenergy coming from wood were mentioned. At the same time a major finding was the shared fear and scepticism of increasing the usage of a forestry method that is lacking experience and knowledge of the outcome. A fear to lose growth and to lose the efficiency that the conventional forest industry has worked for over 100 years to accomplish if a transition from conventional forestry would occur. A potential decrease in wood material and financial outcomes were mentioned as negative aspects of CCF.

…we would produce less wood and a decrease in profitability for the forest sector would occur if CCF would be the main method… less wood would also be available to replace fossil fuel… (R1).

Concerning the interviewees that to some extents are working with counselling mentioned that they do not want to give forest owners any advice on a method that they do not have scientific knowledge about, which they argued that they lack CCF.

Additionally, the risk of converting the forest from a single-layered to a multi-layered forest was mentioned by R10. Therefore, it is important to not hurry too much and to implement a long-term plan for how we are going to increase the variety of the forests systematically.

5.1.4 Economic aspect
Another aspect that was frequently mentioned was the uncertainty about the economic aspect compared to conventional forestry which has shown a secure wood and economic return.
If the goal is to effectively produce and get as much economic return as possible as quickly as possible then it is difficult to beat conventional forestry (R7).

R2 and R12 mentioned that one positive side of natural regeneration is that it is much cheaper. However, a negative aspect of CCF is a lower growth and a decrease in wood supply which results in a more uncertain and negative financial calculation compared to conventional forestry.

Furthermore, the benefits of expanding CCF from the forest owner’s economic perspective were raised. R3 and R4 mentioned that they experienced that their conventional forest plan did not work out as planned by the advisor. The trees that were planted on their land turned out to be much worse in quality than expected, which decreased their financial outcomes when they sold the wood. R13 argued that the industry does not care about the quality since they can use it to produce pulp anyway, so it is highly beneficial for them.

Looking from the perspective of forest owners… the processing forest industry today almost pursues colonialism towards the forest owners. The concept of the forest industry today is optimized for the processing industry which they conduct on forest owner's land which provides the industry with resources. A shift would be beneficial for forest owners (R13).

At the same time, R3 and R4 mentioned how hard it is to make a living from your forest as forest owners, thus they discussed that maybe a shift towards CCF the quality of the trees could increase, which in turn could lead to a better financial outcome for the forest owners. R7 agrees that CCF could enable an increase in the financial outcome for the forest owners due to an increase in the quality of the trees.

Even if the quantity of wood increases or decreases, a decrease should be beneficial for the forest owners since the price of wood would increase. However, for the pulp industry, it would be negative since the resource would be more expensive…So I understand that the pulp industry has a negative attitude towards a shift, however, but the real question is: is it fair that the forest industry is formed after their conditions? (R13).

Additionally, the lower maintenance cost for CCF was brought up by three interviewees, where for example plantation is not needed since natural regeneration deals with that.

CCF does not include as many financial investments as conventional forestry does. You do not have ground preparation, plantation or unprofitable first thinning…and if you think of the worst scenario that the forest dies, from an economic point of view you have not invested a lot of money…you lose the value of the forest, but you do not lose the invested capital which you would have in conventional forestry (R5).

5.2 Existing Support
5.2.1 Education
One of the main supports that the findings revealed was the possibility of education. R2 mentioned that they provide both a newspaper and a website in collaboration with other actors in the forest sector.

I am quite sure that our newspaper has written the most about CCF and how to manage the forest in different ways. The reader can learn and get examples from reports from different forest owners. This is a way to contribute to the discussion about CCF (R2).
Internal education was also a common finding from the result. Responders mentioned that they started to educate people within the organisation with a plan to spread the knowledge to entrepreneurs and then further within the organisation and eventually to external actors.

We started with a smaller group within the organisation that gain knowledge within the subject of CCF. Now we have come to the stage where we will start to educate the entrepreneurs and counsellors who meet the forest owners (R12).

Another support mentioned was theme days, inspirational days, field trips and courses. Where different people that are interested in CCF or already manage their forests with CCF can come and get inspiration and see practical examples.

We arrange excursions where we invite people to come and look at practical examples and demonstration areas of CCF. The aim is to learn/educate and get inspired and have a discussion out in the forest (R10).

Finally, all stakeholders mentioned the ongoing and increasing research projects at universities that contribute to knowledge for all actors.

5.2.2 Advice
Another finding was counselling and advice that exists for CCF. The forest counselling that exists was pointed out as important to support forest owners in their management decisions.

We also offer free, professional individual CCF advice at the forest owners’ property… (R10).

Three interviewees also pointed out that counsellors must give advice that is balanced and neutral, meaning that the advice is not based on a specific method.

We do not want to force any forest owners to not try a new method, however, we should still be able to warn forest owners when we don’t believe that the ecological or financial outcome will be good. So, it is important to direct the forest owners on the right path (R12).

R3 and R4 highlighted the importance of deciding and identifying what you want as a forest owner, otherwise, there is a risk that the counsellors do what they think is best.

5.2.3 Practical Support
Practical support turned out to be a lacking factor today. R11 mentioned that they are lucky since where they live, they can get help from well-educated entrepreneurs, however, this is not the case all over Sweden.

R5 mentioned that the demand for their services is increasing due to the growing interest in CCF-educated entrepreneurs. Their company provide practical services such as planning, logging, and machines for example, but naturally, these services are regionally bound.

Furthermore, there exists a limited supply of practical support for CCF in Sweden. However, some regions in Sweden possess educated entrepreneurs more than other regions according to three interviewees.

5.2.4 Collaboration
R7 and R10 mentioned that they collaborate with universities, researchers, and governmental agencies to arrange forest days in demonstration areas where they show, discuss, and educate people about CCF. R13 mentioned that the collaboration between forest actors is increasing, and the reason is that more organisations are realising that they cannot skip the development and trend of CCF.
Further, the European Commission’s involvement in Swedish politics was brought up during a few interviews with different attitudes towards strategies conducted by the EU concerning Swedish forestry. Where a few interviewees argued that the EU should not be involved in the politics concerning Swedish forestry.

...I do not think it is wise with governing Swedish forestry from a central position and even less from EU-level, I think it is better to let the forest owners themselves decide and evaluate what is a suitable management approach in their forest... (R2).

On the other hand, some interviewees were positive about the EU being involved in how Sweden should manage the forest.

...we have signed up as members of the EU and therefore I think it is reasonable that the EU is examining and critically analysing how we are managing our forests. This is good otherwise we will continue to clearcut until all the trees are gone...along with the EU, other countries are wondering what we are doing, so it is not only the top level that is critical to us and how we manage our forests it is fellow countries as well... (R5).

5.3 Required Incentives
5.3.1 Political Incentives
One of the required incentives suggested by three interviewees was political measures. Where directions and goals implemented by the government could lead the direction towards an increase of CCF. One factor that was brought up multiple times was the conflict of interest in the forest and the balance between different values in the forest such as production, biodiversity, and recreational value. Where the importance of directions from the government was mentioned.

It is important with signals from the government, what is preferred?... In which direction should we head? (R10).

Another concrete example was governmental protection laws. Where a combination of protection of nature values, biotopes and species is combined with suitable forestry methods. This example is based on the problem with forest owners who are facing the conflict of wanting to develop nature values on their land. However, according to R2, developing nature values on your land is the biggest economic risk you can take as a forest owner since that means you will not be able to manage that land area because of the nature values developed and registered. So, with the suggestion of implementing governmental protection laws concerning nature values combined with suitable forestry methods for example CCF would benefit both ecological values as well as the economic aspect for the forest owner.

...when we ask our members, 80% state that they want to implement more nature values in the forest, yet 80% abstain because they are concerned about losing their land to nature reserves or losing economic values because they are not able to sell the forest/wood (R2).

Furthermore, another factor that could increase the implementation of the CCF would be for the government to ensure by public procurement that the wood comes from CCF production according to R2 and R6. In turn, political agencies could regulate the purchase of new wood to public buildings for example, which would increase the demand for forests managed with CCF.

5.3.2 Increasing Knowledge
The main incentive found was a need to increase knowledge about practicalities and consequences of CCF. All interviewees clearly stated that an increase of knowledge about CCF among forest actors as well as the society is needed for an increase of CCF. Theoretical
education is important as well as practical education on how to manage forests with the methodology.

It is important to educate the people working with the practicalities in the forest for examples in the machines and teach them how to log according to CCF (R2).

More, findings revealed a need to increase the amount of different research projects investigating methodology and practicalities for CCF. This was suggested to be done via collaboration between the EU, the government, the Swedish Forest Agency, universities, and forest actors. Furthermore, R13 discussed the idea of breaking the barrier between ecology research and forest research, which would decrease the knowledge gap and would benefit one another. Where transdisciplinary research between ecology and forest studies could gain more knowledge on how to manage the forest with a sustainable approach.

It exists a lot of research about forest ecology that one could implement to the current forest research, however, due to traditions and norms, ecology and forest research have been separated. Ecosystem and forestry methods have not been linked, but if we are ready to break that barrier, we have a lot of knowledge to gain (R13).

Ten out of thirteen interviewees stated a clear need for practical examples that can show different successful outcomes from CCF. Along with research, schools and universities were pointed out the include more education about CCF in their school plan. Two interviewees expressed that the fact that the education of conventional forestry is dominating today is a hinder to increasing the usage of CCF. Education has to be more equally balanced.

Another aspect mentioned was the need for a more neutral and balanced media flow.

I was so happy when I read an article yesterday about entomologists that have investigated bark beetles and the dry summer of 2018…their results show that it does not only have to do with climate change, but it also has to do with how we manage the forests as well… (R11).

Along with a neutral media flow, a critical mindset was mentioned by specifically one responder. Where the responder encouraged readers to critically analyse how the articles came up with a specific result and to read the method and material part of the study before concluding.

The general discussion in society was also mentioned as an important incentive.

…that we talk about risking and losing biodiversity and see a reduction of our nature values and so on, I think many people become interested in CCF by talking about these things… (R7).

Lastly, findings showed a request for the development of a united concept/description of CCF. Interviewees were discussing the confusion behind different names and descriptions of different methods, models, and frameworks. So, a more general and united definition of CCF was on the table. It was identified to increase the general understanding and decrease the confusion of what is what when it comes to CCF. A suggestion was that the Forest Agency should more concretely describe the definition of CCF, and other methods and frameworks connected to CCF.

5.3.3 Philosophical Questioning
An incentive that was brought up was deep philosophical questioning, meaning that some responders claimed that a change in beliefs and expectations as to what the forest is and should supply is necessary. Specifically, two interviewees were raising this aspect of incentive. R11 highlighted the importance of changing how society views the forest.
The forest is a complex system, and we have to look at the forest from that perspective. We need to change from seeing the forest as a plantation of trees and view it as a system (R11).

Further, the need to question the whole forest sector was discussed. The question of “who is deciding how we should think about the forest?” was brought up by R13.

The forest industry has a huge impact on the research and education agenda, as well as the counsellors that advise the forest owners. We think they are counsellors, however, in reality, they are wood buyers whose job is to buy wood as cheap as possible (R13).

I don’t even know how many times I have experienced the situation when the forest companies and counsellor are coming out to the forest to cut down and they say that when we are here, we should take this area over here as well, even though we did not plan for it we should cut it down when the machines are here. It will not grow there anyway (R11).

Both R11 and R13 pointed out that the whole idea behind conventional forestry is that we have to plant trees and then manage the forest, otherwise there will not be anything of value there. R11 and R13 argue the opposite though, that the forest does not have to be managed to survive and flourish.

I agree that a plantation field needs to be managed because that is a biological manipulation, however, a forest does not need to be managed because the forest can manage itself. And that is my agenda, to be able to contribute to change people’s view of the forest from a tree plantation to a complex system that doesn’t need to be managed by humans (R11).

R13 raised the philosophical aspect behind the different management approaches, and that we need to think about the philosophical thought behind conventional forestry.

I often hear that what I’m working with is rather a forestry philosophy than a management approach, and when I ask advocates of conventional forestry why they think I’m working with a philosophy and they are working with forest management, they answer that what I’m doing is not plannable enough from a logistical point of view (R13).

Further, they discussed the idea that they rather work with a forecast that is a logistical plan when it comes to the forest. Meaning when you apply conventional forestry you lose the perspective that a forest is a complex system.

Because when you have decided to have a strategic development plan for the forest, that means that you have let go of the thought that the forest is an ecosystem with its own integrity (R13).

Finally, R13 brought up the discussion about the definition of CCF. Where CCF refers to that forest areas continuously should be covered by trees, however, according to R13 that does not always have to be the solution.

…it is not sure that we solve the decrease of biodiversity in the forest just because we stop with conventional forestry, it will take more than that… (R13).

If there is a need or a will to restore a highly manipulated forest, it is sometimes required to clearcut the area to enable the natural tree species to grow back again. Also, natural disturbances can come to clear a forest land completely as well, meaning that it does not have to be a specific method that is always suitable. R13 highlighted the importance of mimicking the natural state
of the forest to the best of one’s ability, which R13 means should be identified before choosing the most appropriate method.

…to learn to see the forest as a complex system and follow the natural process. The forest is not constant, it changes, and it is important to value the process and not the state (R13).

5.3.4 Personal Evaluation
The emotional incentive, i.e., questioning the idea behind any chosen method and its subsequent results by evaluating if it is aligned with personal values, beliefs, and priorities was shown to be of importance for implementing CCF. R8 and R9 discussed the emotional incentive, which according to them was often stronger than economic incentives. Further, social capital, meaning a person’s ability to have an impact on other people’s choices and beliefs, was brought up to highlight that influencing others to show examples, spread information and boost people’s engagement and willingness. Along with social peer pressure which is recognised as having an impact on forest owners.

…it is not uncommon that forest owners take after another forest owner in the village, which can later be seen as a local influencer and influence others to do the same (R8).

In several of the interviews, the responders argued that personal evaluation of priorities and interest are highly relevant when choosing how to manage the forest. Firstly, the aspect of questioning yourself and your management approach was considered.

We always have to challenge ourselves in how we manage our forests, and how we can make it gentler…we need to question our methods… (R12).

More, R1 pointed out that questions such as: “What do you want with your forest, what is important for you as a forest owner” is important for all actors to keep in mind. Because when the forest owner has figured out the meaning and reason behind why they own and manage a forest it will be easier for them to decide which interests and values they want to prioritise as well as for the advisor to give suggestions in line with the forest owner’s values. R7 give an example in line with the same subject.

…we have always walked in this forest, and we like to pick berries and mushrooms here. The recreational values are important for us in this forest and that is why I want to raise these values. Therefore, I do not want to cut down the forest here for the economic perspective, other values are more important here… (R7).

5.3.5 Increasing Support and Counselling
A general lack of support and counselling concerning CCF was acknowledged. Balanced guidance on the market would be preferred, where advisors had equal knowledge about conventional and CCF. Further, a broader supply of services would benefit forest owners to initiate CCF.

…it exists a clear expectation to complement our forest service program with an alternative to meet expectations from forest owners who are interested in management approaches other than conventional forestry… (R8).

…it we should give the forest owners a balanced counselling which should not be based on whether we like CCF or not, or that we are trying to convince the forest owners to manage their forest in a specific way. The advice should be based on how the forest looks like and the knowledge we possess… a consultation that is trustworthy and builds on science and proven experience (R12).
Another aspect that was brought up was the needed support for forest owners to have the courage to go against the norm. Support and consultation can be a good back for forest owners to lean towards.

…it takes time for a forest owner to take a step away from the norm. As a forest owner, you need to process the thought of change and have the chance to hear it from different people and perspectives. You do not want to be the one who deviates from the norm and gets exposed and left out… (R10).

One interviewee specifically highlighted the importance of a clear marketing strategy for CCF to make the different support and consultation services that are available visible. Connected to this a suggestion of a collaborative network for CCF actors and services was mentioned as a tool for making the supplies visible to forest stakeholders.

5.3.6 Economic Incentives
Economic incentives were up on the table in almost all interviews to some extent and the economic aspect is crucial to make change happen. R3 and R4 brought up the example that they get paid for restoring wetlands on their property, and similar incentives could trigger people to shift their management approach. Similar economic incentives as mentioned were revealed as positive and examples such as storing carbon and preserving biodiversity in exchange for economic incentives would prevent clearcutting on forest lands. The business idea of companies being able to buy forest services for climate compensation was mentioned. That carbon storage via not cutting down the forest could benefit both forest owners as well as companies wanting to climate compensate.

Further, the development of business models was mentioned.

…a development of business models for wood from non-conventional forests…stimulation share and starting share could be a good incentive for forest owners to get started… (R10).

Furthermore, a demand from customers is important, and an interest from the market to pay more for certified wood from non-conventional managed forests. Along with developing business ideas that shift the focus from productivity as the only financial outcome and increase the opportunities for other values in the forest to contribute to the economic outcome. For example, tourism activities can come to cover production costs and redefine business ideas in the forest.

Finally, economic incentives for alternative management in areas which include high nature values could contribute to the usage of CCF.

5.3.7 Supply and Demand
If CCF should increase, the market needs to be able to supply services intended for CCF according to the results. For example, an increase of entrepreneurs working with CCF and having knowledge about it is key, this is suggested to be done via education and change of business models within organisations. Implying that well-educated entrepreneurs that can supply adequate knowledge could increase the demand for CCF within the industry.

However, R5 argues that one problem with the lack of educated entrepreneurs within the CCF field is that they are bound to contracts with wood-buying organisations that decide how and where they are going to work. A freer market for entrepreneurs would enable more to work with CCF if the interest and demand exist. R13 agrees with this statement that increased independence from the wood-buying industry is important. It will increase a more open market with a higher variety of supplies and services. Additionally, increasing collaboration between forest actors was brought up to promote increased knowledge and a wider network.
...it would facilitate if I as an advisor could refer to and guide forest owners to entrepreneurs working with CCF... (R7).

Along with educated entrepreneurs, R10 mentioned the problem with shifting a forest from a single to a multi-layered forest, and that it can cause devastating consequences such as pests and the forest blowing down. However, R5 brings up the same subject but from another perspective. R5 mention that a problem exists with a lack of knowledge around entrepreneurs and that can lead to a bad job in a forest where the results end up failing.

...the problem with entrepreneurs lacking practical knowledge is that it can lead to a bad job, which ends up with bad consequences like the forest blowing down. The results of the specific case will spread around the village and an attitude that CCF is not a good method will develop. That is why it is important with educated entrepreneurs... (R5).

Lastly, a more neutral informational flow in media for example in newspapers are important.

...the information that reaches the forest owners today with so-called magazines and advertising that looks like a newspaper, are all coming from or has a strong connection to the forest/timber industry with the aim to highlight and promote conventional forestry... (R13).
6 Analysis

6.1 Multi-level perspective

The following part of the study presents a model where the MLP is presented in a figure created by the author. The figure indicates the exchange between the different levels with references from (Geels, 2011). Followed by the model, an analysis of the identified exchange between the levels from empirical findings follows.

![Figure 9. Model-based on MLP. Note. Author’s own figure.](image)

6.1.1 Exchange between regime and landscape level

Geels (2011) acknowledges that the regime refers to routines, norms, and the main focus of society. Findings showed that it exists a lack of knowledge and research about CCF (Hertog et al., 2022; Pukkala et al., 2011), and one reason mentioned in the empirical data was that it was due to the focus on conventional forestry research, which can be argued to fulfil the statement that the regime (conventional forestry) is the main focus in the society.

Further, the regime level and landscape level (which refers to the wider context of the society, including for example political and economic aspects) influences each other (Geels, 2011), which the empirical findings of this paper confirm. One clear example of this is brought up in sub-chapter 5.1.1, where one interviewee stated that the operational IT systems are developed in a way that support conventional forestry. In the same chapter, both laws and educations are formed and shaped after each other, ultimately, influencing what knowledge is taught and spread as well as nudging actors towards conventional forestry methods. Effectively this means that the current and past exchange between the regime and landscape has produced a Maslov’s hammer of conventional forestry, meaning that it has created a hammer that sees every patch of forest as a nail, acting as an inhibitor towards an increase of CCF. An analogy to this metaphorical hammer is brought up in the interviews where the Forest Act is discussed as a production law rather than an ecosystem management law, since you, as a forest owner is obliged to meet the criteria stated in it, which includes sustainability measures while still maintaining a specific production rate (Skogsstyrelsen, 2023b), effectively empowering conventional forestry. This idea is further supported by the fact that CCF was banned as mentioned in the background of this paper.
The increasing wood demand in society to mitigate climate change and contribute to the shift from fossil fuel to biofuel (Lindahl et al., 2017), is reflected in the strong relationship between landscape and regime level. The relationship is based on that the landscape wants an increase of wood material to the bio-energy transition and the regime level wants to increase the wood flow to enable a high economic flow (Albrektson et al., 2012). Further, empirical findings show that conventional forestry has the advantage of producing and delivering pulpwood in more time and quantity efficiently, which is adding to the dominance of conventional forestry.

A hinder found from the interviews was the uncertainty among counsellors regarding advice about CCF, resulting from the fact that there is limited research of CCF, and the majority of existing education focuses on conventional forestry. This can be argued to confirm that the landscape and regime highly influence each other compared to the landscape and niche level. The arrows in the figure illustrate the exchange between the levels, where the regime has a more direct exchange to the landscape level compared to the niche level which has a longer arrow to the landscape level figuratively indicating that this exchange is slower and less robust.

Hertog et al. (2022) highlight that the regime is resistant to change due to established practices and cultural and normative aspects, which confirms the findings. For example, the established IT systems, machines, and other technological factors that are built after conventional forestry practices. More, the results showed that the current situation of Swedish forestry is suitable for a certain kind of industry, for example, the pulp industry. The pulp industry is interested in pulpwood, which is appropriate since conventional forestry produce all kind of quality wood. And the less quality the wood is the cheaper it is for the pulp industry to buy it. Due to this situation, the pulp industry is not pushing for a shift of management approach used, which is aligned with the regime being resistant towards an expansion of CCF that favour high-quality timber which is more expensive. Additionally, the reality reflects that the connection between the regime and landscape level is strong since the regime is influencing the landscape to be an advantage for conventional forestry and vice versa.

6.1.2 Exchange between niche and regime level

A lack of interaction between the niche and regime levels was recognised. The regime is resistant towards influence and changes from the niche level (Geels, 2011; Geels & Schot, 2010), which can be discussed as the reason why different attitudes towards the expansion of CCF exist. If the influence from niche to regime level is lacking, practical and knowledge arguments from niche (CCF) are not going to reach and impact the regime (conventional forestry). Yet, one of the main findings was the shared scepticism towards CCF considering the lack of knowledge and practical experience, which can be argued that the niche level has not expanded enough and is able to influence the regime and landscape level enough. However, empirical findings contribute to arguments that attitude, existing support and incentives can contribute to the expansion of niche level, this will be further argued in section 7.2.

Along with (Hertog et al., 2022) results regarding barriers to the increase of CCF, like limited knowledge and established power dimension are in line with the findings of this paper. The hinders to CCF expansion can further be discussed to originate from the strong relationship between regime and landscape, hence decreasing the interaction between regime and niche due to lack of exchange. As discussed the regime is considered to be highly influenced by norms and cultures (Geels & Schot, 2010), which can be seen as confirmed by findings of sceptical attitudes towards the EU:s involvement to examine the Swedish forestry approach. EU can come to put high pressure on Swedish forestry to achieve sustainable forestry strategies (European Commission, 2023), and therefore be of disadvantage to conventional forestry. Therefore, the regime level is argued to be highly framed after conventional forestry. Adding to that, no influence from regime to niche was discovered in this paper. Developing the
exchange between niche and regime could be further investigated, however, the results brought up the combination between ecology and forestry. Combining ecology knowledge from the niche level with forestry knowledge from the regime level could develop the established practice and establish a way for the niche level to influence the regime level, yet this combination connected to the MLP should be further investigated.

6.1.3 Exchange between landscape and niche level

The fact that none of the interviewees was completely negative to CCF shows that the niche level to some extent is influencing the landscape level, however, it also confirms that the landscape level is changing slowly (Geels & Schot, 2010). A conclusion can however be drawn that the interviewees that considered and thought social and environmental values in the forest are important had a more positive and open attitude towards CCF.

When the economic aspects of CCF were brought up some interviewees were positive, and some negative. The findings show that, in general, forest owners have a more positive view of the economic aspect as CCF could yield higher quality biomass that can be sold at a higher price. Simultaneously CCF is less investment intensive for the forest owner in relation to conventional forestry where one must spend money on ground preparation etc., meaning that potentially CCF may ensure a larger economic revenue and lower economic risk for the forest owner. On the contrary the other actors within the forestry sector, according to the findings in this paper, tend to be less positive towards CCF. Likely, this is due to the facts that these actors do not require higher quality biomass to produce the majority of the products within the industry, meaning they would pay more for higher quality that for them is unnecessary. This can be argued to be due to structures within the forest sector and historical experiences. The findings also underlined that the process to change the norms and cultures will take time and needs to be worked through well before implementing CCF practically. Findings also revealed that many entrepreneurs in the forest sector are connected to a contract with different forest industry organisations, which further can be argued to work as a hinder to the development of CCF expansion. If the entrepreneur is linked to a contract of an organisation whose main focus is conventional forestry, it will be difficult for the entrepreneur to learn more and work with CCF since then the landscape level once again shows to be stronger connected to the regime and the norm compared to the niche level.

Findings showed criticism of the politics and laws concerning the forest to some extent, hence a need for clearer directions from the government was requested. The interviewees asked for guidance towards a distinct direction since that would help them to prioritise measures to address and know where to point their focus. This confirms Danley et al.’s (2021) results that policy reforms could help forest owners to fill the gap between different goals in the forests. Yet, the results once again point towards that a stronger relationship is needed between the niche level and landscape level so that support could increase to CCF measures.

Lastly, the questions raised about biomass being a solution for climate change is seen as one of the biggest division in the forest sector today (Lindahl & Westholm, 2012). The national environmental goal to be fossil free by 2045 via a shift from fossil fuel to biofuel is demanding an increase in wood material (Lidestav & Westin, 2023; Regeringskansliet, 2018), which adds to the advantage of conventional forestry which is identified to produce a large amount of wood fast (Albrektson et al., 2012; Lindahl et al., 2017) which also reflected some of the arguments from the empirical findings where statements revealed that is hard to beat conventional forestry when it comes to efficiency in producing pulpwood fast. However, contrary arguments were brought up as well where using CCF and saving the forest would be the solution to climate change. Pukkala et al. (2011) confirm in a comparison study between even-aged plantation forestry and uneven-aged management which can reflect conventional forestry versus CCF, that
uneven-aged management performed better in timber, carbon, and bilberry benefits, except for carbon benefit in a pine stand. Continuing on this debate, one can see that both niche and regime level influence and put pressure on landscape level, however, the request for clearer and distinct statements and support from institutions and government (landscape level) could help lead the way forward.

6.2 Expanding the multi-level perspective
6.2.1 Willingness and Ability
Pukkala (2016) state that the chosen management system in the forest highly depends on the preferences of forest landowner. Further, the Swedish forest strategy “freedom with responsibility” combined with the national goal of “living forests” with production goals and environmental considerations put the responsibility on forest owners to meet these goals (Danley et al., 2021). Lidestav and Westin (2023) state that the Swedish government and policies are relying on voluntarism from the forest owners to meet the goals for a sustainable forest, hence incentives would be needed to achieve management approaches that can meet these goals. Several of the interviewees claimed that their choices related to management methodology was at least partly based upon their own personal evaluation. Deciding what kind of forest one wants to achieve and then seeing results towards that goal may serve as a self-supporting incentive to maintain and manage the forest a certain way. Such self-supporting incentives might influence other actors via media or word of mouth through social capital as mentioned in 5.3.4.

Reflecting on the empirical findings of this study combined with the MLP one can argue that the required incentives revealed contribute to the ability to increase CCF and expansion of the niche level which further has a better chance to influence the landscape and regime level. For example, two interviewees stated that a lack of trust between forest owners and governmental institutions exists, and with the incentives of increasing knowledge via collaboration between actors, this barrier could break. Via an increasing collaboration and exchange of knowledge between forest actors, the ability to support each other could in turn increase the CCF in Sweden.

Political incentives could also affect the ability to increase CCF by directing a way between different interests. Lindkvist et al. (2012) and Sandström et al. (2011) stated that policy regulation benefiting multiple-use forestry could regulate and help meet different interests in the Swedish forest. In the findings, this is brought up in chapter 5.3.1 when the economic risk is greater than the ecological value for the forest owner as one is not allowed to manage areas with registered nature values, highlighting that political incentives are necessary to ensure that the forest owner may avoid personal economic risks to maintain high natural value on ones land. Further, policy incentives could increase the ability to increase CCF. The current support that exists contributes to the ability of forest actors to proceed with CCF. For example, practical support increases the concrete ability to manage the forests with CCF. However, findings showed that the practical support is regionally based, so not everyone has the same opportunity in Sweden to access the same support. Therefore, political incentives might be necessary to harmonize a national support system in order to ensure equal assistance regardless of geographic position. This relation is illustrated in the model below where existing support together with required incentives contribute to the ability for expanding the niche level. The expansion of the niche level will in turn increase the influence from niche to regime and landscape level.

Moreover, the different attitudes and arguments, either pro or con an increase of CCF affect the willingness. For example, the polarised debate was mentioned as contributing to a lack of positive attitude along with experience from the past with intensive selective logging with non-
wanting results. The sceptical attitude can lead to the willingness not wanting to increase the CCF, however, with existing support and incentive affecting the ability and expansion of the niche level, the landscape level will in time be influenced by the niche level. When the landscape has changed, the attitude can come to look different due to social norms and trends.

To conclude, attitude, support and incentives are important for the ability and willingness to expand the niche level, which in this case refers to CCF in Sweden, and in turn this will impact the landscape level. At the landscape level, the social norms and trends can then develop and expand to the advantage of the niche level which in turn will have the capability to influence the structures of the regime level, and it is at the regime level where the change will happen (Geels, 2011). Where, CCF will have the opportunity to increase in Sweden.

Figure 10. Model of expansion of MLP. Note the author’s own figure.
7 Conclusion

To conclude, this study purposed to investigate attitudes, existing support and required incentives among stakeholders in the Swedish forest sector to increase CCF. This paper argues that the existing attitude reflects the willingness and existing support, and incentives indicate the ability to increase CCF. Meaning that the findings indicate that the existing support and required incentives are all important in the context of increasing CCF in Sweden. Additionally, the results also indicate that the existing attitude and support are preventing CCF expansion both on a local and national level. Further, the research questions are answered below.

RSQ1: What is the current attitude regarding an increase of CCF in Sweden and how is it affecting the implementation of CCF?

The findings reveal that the current attitude regarding an increase of CCF in Sweden varies, however, it is overall positive to some extent. In addition, the attitudes affect the willingness among Swedish forest actors to increase CCF, where the sceptical and negative attitudes are argued to prevent the implementation of CCF practices. The attitudes are influenced by culture, norms due to structures, lack of knowledge and practical examples and economic aspects as well as prioritisation of different values in the forest. Further, this paper argues that support and incentives will contribute to positively influencing the attitude towards CCF.

RSQ2: What existing support is provided for CCF/ implementation of CCF practices in Sweden?

The support that was found to exist was education, advice, practical support, and collaboration between actors in the Swedish forest sector. The findings reveal that the existing support is contributing to the ability for implementation of CCF. However, the existing support is overall low and at the same time argued to prevent the increase of CCF by not being established to the same extent throughout the country and inadequate knowledge among advisors. Therefore, this study investigates the required incentives to expand the support of CCF, and in turn the implementation of CCF.

RSQ3: What are the required incentives for actors within the Swedish forest sector to increase CCF?

The findings suggest that political incentives, increasing knowledge, philosophical questioning, personal evaluation, increasing support and counselling, economic incentives are required incentives to increase CCF in Sweden. Expanding the knowledge about financial outcomes and practical experience was found to be of high importance, where a newly developed business model for CCF was revealed to be important for the ability to increase CCF in Sweden and further, advance the economic outcome for forest owners. In addition, practical experience will lead to confidence and a more convincing attitude on how to transit to and manage CCF.

Further, increasing support systems nationally was underlined as a decisive factor for the ability to implement CCF. Since today's findings showed that the existing support and attitudes are to some extent preventing CCF to increase on a local and national level due to regional-based capacity and unequal distribution of support systems.

Since existing attitudes and support were found to contribute as well as prevent an increase of CCF to some extent, the required incentives are crucial for forest actors’ ability to increase CCF. To conclude, the incentives are discussed to affect the ability to increase CCF, and if implemented, the incentives will in turn influence the attitudes of willingness to increase CCF and the existing support to develop in relation to CCF.
8 Acknowledgements

I would like to express my gratitude to everyone who has supported and contributed to my thesis. First, I would like to thank my supervisor Madelene Ostwald for insightful feedback and valuable input. Also, I would like to thank Sepehr Shakeri Yekta for the genuine and great support during the process. Secondly, I wish to show my appreciation to all interviewees taking part in this study and providing insight into the field of study. A special thanks to the two persons who devoted their time and effort to providing me and my supervisor with valuable information and insights through a field visit. Last, but not least, I would like to thank my family and friends for their love and support throughout the process. And my dog who reminded me to take important breaks throughout the process.
References


Appendix 1 – Outline of interview questions

Outline 1

1. Introduction
   - Introduce myself and my subject and thank the person for participating in the study.
   - Ask for approval to record the interview.
   - Remind about GDPR and the consent form.

2. About the Participant
   1. How long have you worked in the forest industry?
      - Follow-up question: What has your career in the forest industry looked like?
   2. How would you describe your role?
      - Follow-up question: what are your main duties?
   3. Is sustainability a part of your everyday work?
      - Follow-up question: If yes, how?
   4. Has sustainability always been part of your work?
      - Follow-up question: If yes, has it changed over time? If so, in what way?
      - Follow-up question: If not, has it changed over time? If so, in what way?

3. Sustainability and forestry
   1. From your perspective, how would you describe sustainable forestry?
   2. How do you/your organization work for sustainable forestry?
      - Follow-up question: How would you describe your role/you as an organization in promoting sustainability in today's forestry?
   3. What advantages do you see with today's forestry from a sustainability perspective?
   4. What disadvantages do you see with today’s forestry from a sustainability perspective?
   5. Does your organization advocate any specific method?
      - Follow-up question: If yes, why?

4. Support and incentives for CCF
   1. Do you work with CCF today in any way?
      - Follow-up question: If yes, what does your work with CCF look like?
      - Follow-up question: If no, are you open to developing your business and working with CCF to any extent?
      - Follow-up question: Who within your organization works with CCF? Is it a specific group or is it widespread within the organization?
   2. Do you have any future plans regarding the work with continuity CCF? For example projects?
- Follow-up question: What is driving it forward?
- Follow-up question: Do you collaborate with other actors? Which types of actors, if any?
3. What possibilities do you think there are with CCF?
4. What do you think are the obstacles to CCF?
- Follow-up question: What do you think are the most effective means of overcoming these obstacles?
5. Have you seen any difference in the interest of CCF among forest owners?
6. Do you offer any support/incentives for people who are interested in CCF/ for people who already manage CCF?
- Follow-up question: If yes, what does it look like?
  If not, is it something you have considered?
7. What obstacles do you see for the use of continuity forestry to become more common/more appreciated?
- Follow-up question: What incentives would need to be implemented to increase the use of continuity forestry in your opinion?
- Follow-up question: How/in what way would these incentives contribute to increased use of continuity forestry?

5. End of interview
- Thank the person for participating in the interview and for their time.
- Do you have any questions for me?
- Ask if the person has any recommendations for people to interview.

Outline 2

1. Introduction
- Introduce myself and my subject and thank the person for participating in the study.
- Ask for approval to record the interview.
- Remind about GDPR and the consent form.

2. Alternative 1: About the participant
1. How long have you worked in the forest industry?
2. How would you describe your work at X?
- Follow-up question: What forestry methods do you use today? Why do you use this method(s)?
3. Can you tell us a little about what the forest(s) look like in which you work? For example: area, type of tree, where in the country?
4. Have you made any major changes in the way you manage your forest recently?
- Follow-up question: If yes, in what way?
5. Is sustainability part of your everyday work?

- **Follow-up question:** If yes, how? If not, do you think it will change in the future?

3. Alternative 2: About the participant

1. Can you tell me about the forest you own? *For example:* area, type of tree, where in the country?

- **Follow-up question:** How long have you owned the forest?

2. Is the forest your main source of income? Are you dependent on income from your forest?

3. What do you use the forest for today?

4. If you manage the forest, how do you manage the forest today?

- **Follow-up question:** Do you manage the work in the forest yourself or do you take help from companies? If so, how did you choose the company?

5. Have you made any major changes in the way you manage your forest recently?

- **Follow-up question:** If yes, in what way?

4. Sustainability and forestry

1. Are you personally interested in sustainability and sustainability issues?

2. From your perspective, how would you describe sustainable forestry?

3. How would you describe your role in promoting sustainability in today’s forestry?

4. Are you actively looking for new knowledge about how you can make your work more sustainable?

- **Follow-up question:** Why? Why not?

5. Would you say that you see any difference in awareness of sustainability within the generation before and after you?

6. What advantages do you see with today’s forestry from a sustainability perspective?

7. What disadvantages do you see with today’s forestry from a sustainability perspective?

5. Support and incentives for continuity forestry

1. Do you have any experience in conducting CCF?

- **Follow-up question:** If yes, describe in what way.

2. Based on yourself, what are your thoughts on what CCF means in concrete terms?

3. Are you interested in CCF?

- **Follow-up question:** If yes, what kind of support is there for those interested in CCF to get?

- **Follow-up question:** If no, what would you need to become more interested and willing to use CCF?
- Follow-up question: Is there something (incentive) you lack on the market today that would contribute to you implementing CCF in your work? Alternatively, increase usage.

4. What changes would you like to see to improve the conditions for CCF?

5. Do you feel that you get the support you want from various actors in society?

6. Do you feel that you possess sufficient knowledge regarding CCF?

7. What possibilities do you think there are with CCF?

8. What obstacles do you think there are with CCF?

6. End of interview

- Thank the person for participating in the interview and for their time.

- Do you have any questions for me?

- Ask if the person has any recommendations for people to interview.