



Exploring the conditions for a shift to Continuous Cover Forestry in Sweden

A practice-based approach to understanding what enables and challenges forest management practitioners to practise Continuous Cover Forestry

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Exploring the conditions for a shift to Continuous Cover Forestry in Sweden. A practice-based approach to understanding what enables and challenges forest management practitioners to practice Continuous Cover Forestry

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Abstract

This thesis investigates the adoption of Continuous Cover Forestry (CCF) in response to mounting environmental concerns stemming from conventional forestry in Sweden. Utilising a social practice-based approach with qualitative interviews and observations of forest managers who engage in CCF “on the ground”, the study uncovers a complex of practices connected to CCF, encompassing policy and regulation, research, advice, services, and forest ownership. By investigating the elements and interlinkages of these practices, the study finds key enabling factors and challenges within the intricate web of CCF practices. Emphasised challenges are; lack of competencies in CCF, predominant advice advocating conventional forestry, scarcity of CCF service providers, entangled timber contracts, insufficient research and concerns of forest expropriation due to high nature values attributed to CCF-managed forests. Enabling factors include knowledge-sharing interactions in networks and collaborations with diverse stakeholders, including independent CCF companies, forest owners, foresters, entrepreneurs, service workers, researchers and non-governmental organisations. Additionally, recreational activities, environmental stewardship, and improved workplace conditions motivate forest managers to embrace CCF practices. The research highlights the need to re-evaluate the division between conservation and production forests, urging the extension of CCF promotion into productive forests. Furthermore, the study underscores the importance of diverse perspectives in advisory practices and advocates for increased, nuanced, and collaborative research on CCF's viability within Sweden's evolving forestry landscape.

Keywords: Environmental Communication, Social Practice Theory, Practice Based Approach, Continuous Cover Forestry, Forest Management Practices, Swedish Forestry.

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Abbreviations

CCF	Continuous Cover Forestry
SFA	The Swedish Forest Agency
FOA	Forest Owner Associations

1. Introduction

In recent years, Sweden's forestry has come under increased scrutiny due to concerns surrounding the environmental impact of the prevalence of clear-cutting and monoculture practices. Recent extensive storm damage and infestations, such as the spruce bark beetle, underscore the growing risks of the current monoculture and clear-felled dominated forestry. These risks are expected to worsen in a warmer climate (Roberge et al., 2020). Addressing these issues and critiques regarding unmet ecological objectives has spurred a growing recognition in Sweden for a necessary recalibration of management methods.

As the call for more sustainable and ecologically sensitive approaches to forest management gains momentum in research and politics on European and international levels, the concept of Continuous Cover Forestry (CCF) has emerged as a potential solution (European Commission, 2021). CCF, characterised by its emphasis on maintaining a continuous tree cover and diverse species composition, offers a promising alternative to conventional methods, aligning more closely with the principles of ecosystem resilience and long-term timber production sustainability.

In the Swedish context, transitioning towards CCF represents a significant departure from established practices and norms of conventional forestry. Such a transition requires a comprehensive understanding of the challenges and enabling factors that can facilitate adoption across the forestry landscape. Studying various forest managers' endeavours to implement CCF may offer valuable insights into potential pathways for achieving successful adoption of CCF. This thesis thus seeks to delve into the experiences of forest managers as they navigate the complexities of transitioning to CCF, shedding light on the multifaceted dimensions that influence their decisions and actions.

1.1 Research Problem

The research problem addressed in this thesis concerns the challenges in transitioning to more sustainable alternative forest management practices in Sweden. As part of the new EU Forest Strategy 2030 to mitigate climate change and biodiversity issues related to forest management, the European Forest Institute

(EFI) released a report in 2022 that introduced and defined the concept of Closer-to-Nature Forest Management for European-wide implementation (Larsen et al., 2022). Given the pressure on Sweden to align with this strategy and the growing advocacy for CCF management, it becomes pertinent to comprehend the conditions for such a potential transition within the Swedish context.

The potential shift in forest management approaches in Sweden will not solely be dictated by laws and policies. As several social theories propose, societal structures, including rules and institutions (Bourdieu, 1977; Giddens, 1984), as well as our connections with nature and science (Latour, 2005), are believed to be shaped and continually reshaped through the interplay of actors, structures, and the natural environment. Following this logic, a transition in Sweden's forest management would be influenced by the interactions between actors, structures, and nature. Comprehending how these interactions influence forest managers' adoption of CCF is essential for ensuring future sustainable changes to Swedish forest management.

The findings from research on forest managers who have successfully transitioned their management practices to CCF underscore the value of their experiences. Insights from their interactions with actors, structures, and nature can highlight both enabling and challenging factors in transitioning to CCF management.

1.2 Aim and Research Questions

This thesis aims to understand the enabling and challenging experiences of forest management practitioners engaged in CCF management. Analysing the experiences of these forest managers can provide critical insights, shedding light on potential requirements for transitioning to CCF in Swedish Forestry.

To study these experiences, a social practice-based approach is applied in the conceptual framework. This approach draws on Elisabeth Shove, Mika Pantzar, and Matt Watson's (2012) conceptualisations of practice formation, stabilisation, and change. Particular attention is given to Shove et al.'s concepts of the elements that form practices (meanings, materials, and competencies) and how practices are interconnected and influenced through bundles and complexes of practices. In regard to these concepts, analytical attention is directed at the linkages between materials, meanings and competencies within practices associated with CCF management.

Main research question:

- What do forest management practitioners experience as enabling and challenging aspects of implementing CCF?

Guiding research questions to help answer the main research question:

- What are the meanings, competencies, and materials of the various practices connected to CCF?
- How do meanings, competencies, and materials within these practices enable and challenge forest management practitioners to implement CCF?

2. Background

2.1 Context

2.1.1 Definition of CCF in Sweden

In Sweden, CCF is called "clear-cut-free forestry" (hyggesfritt skogsbruk), but it was just recently that the SFA published a definition and guidelines for CCF (Appelqvist et al., 2021), which underscores its ongoing evolution. This innovative approach to forestry stands in contrast to conventional practices. While conventional methods involve clear-cutting and regenerating entire forest areas, leading to monocultures, CCF aims to maintain continuous forest cover by strategically removing individual trees or minor patches (SFA, 2023). This approach preserves the ecological integrity of the forest while allowing for sustainable timber extraction.

Furthermore, although limited in Sweden, studies emphasise CCF's ecological merits (Sténs et al., 2019) and associated ecosystem services (Pang et al., 2017, Zanchi and Brady, 2019) over clear-cut forestry in Sweden's forests. Research has also proven the potential contributions of CCF to climate change adaptation and risk management (Björkman et al., 2015, Jönsson et al., 2015) and its ability to store carbon (Lundmark et al., 2016). CCF has also been proven to provide heightened social advantages (Eggers et al., 2019).

2.1.2 The Forest Management Landscape in Sweden

Sweden's natural landscape is predominantly forested, covering approximately 69% of the country's total land area, with 84% classified as productive forest area (SCB, 2021). This extensive forest coverage underscores the profound influence and significance of forestry practices on the nation's environmental, economic, and social fabric.

Production forests are dominated by even-aged management of Scots pine and Norway spruce (SFA, 2022), and CCF silviculture is rare in Swedish forestry (Sténs et al., 2019). The evolution of Sweden's current monoculture clear-felling forests

has roots in various historical factors. These encompass the land privatisation two centuries ago, the mid-19th century industrialisation, and the 20th century's development of efficient mechanisation paired with an intensified focus on production objectives in the Forest Act. This convergence led to a dominance of clear-cutting methods and norms until the 1990s (Enander, 2007; Lisberg Jensen, 2011). In 1993, a crucial amendment to the Forestry Act gave equal importance to sustainable production and biodiversity preservation (Nylund, 2010). This change marked the beginning of Sweden's contemporary forest policy. Despite this dual policy objective, current management practices still favour economic sustainability over environmental (Eggers et al., 2019). The "freedom under responsibility" principle also characterises current Swedish forest policy, empowering forest owners to make decisions on provisions, certification, felling, and more. However, obligations such as obtaining felling permissions for areas exceeding 0.5 hectares and undertaking conservation measures for ecologically significant forests also exist (SFA, 2023).

The distribution of forest ownership in Sweden is diverse, reflecting a range of stakeholders contributing to forest management. Notably, 48% of forest owners are sole proprietors, 24% represent private corporations, and 21% comprise state-owned corporations. Additionally, 6% comprise other private owners, such as religious institutions and collective community owners, while 1% are other state owners, including municipalities and foundations (SFA, 2020). This multifaceted ownership landscape reflects the various motivations and dynamics that shape forestry practices nationwide.

The SFA, a pivotal administrative authority, enforces forest policy and regulations, supervises industry compliance, offers guidance (through courses, lectures and the online learning platform "Kunskapsbanken"), and conducts comprehensive forest assessments. Encouraging responsible stewardship, the SFA advocates for forest management plans, aiding negotiations and conservation efforts (SFA, 2022).

Another influential organisation in the Swedish forest sector is Skogforsk, the Forestry Research Institute of Sweden. Skogforsk plays a pivotal role in advancing knowledge and innovation within the forestry field. Notably, Skogforsk also educates forest workers from service companies, providing essential skills for sustainable management practices.

The forest management landscape also encompasses Forest Owner Associations (FOAs), which operate as economic collectives to advocate for members' interests, particularly sole proprietor forest owners. These associations play a vital role in providing forestry advice and offering services such as timber procurement, crafting management plans, thinning operations and land preparation. Noteworthy among these are Södra Skogsägarna, Mellanskog, and Norra Skog, collaborating through the central organisation LRF Skogsägarna (LRF, 2021).

The forest management landscape in Sweden extends beyond these actors to include an array of other service company providers. These companies offer essential services, ranging from timber harvesting to forest planning, to support forest owners in managing their lands sustainably.

Sweden is also home to prominent forest industry players spanning biofuel, pulp, paper, cardboard products, and timber. Leading industry companies like Stora Enso, Billerud Korsnäs, and Holmen own vast forest expanses, underscoring their significant role in the forestry sector's commercial landscape. The state-owned company Sveaskog further contributes to this ecosystem by selling timber, pulpwood, and biofuels to various industries while maintaining substantial forest holdings.

2.1.3 The Ongoing Transformation of Sweden's Forestry

The forest sector has been appointed a central role within the EU's directives to achieve a bioeconomy (EU, 2021). The forest sector is also a key component in Sweden's plans to become independent from fossil fuels. In Sweden, this sector has been appointed with responsibilities such as contributing biomass for renewable energy, lowering carbon emissions, providing employment in rural areas and adding economic growth to the state (The Swedish Government, 2021). "The Swedish model of forestry", which involves a Forestry Act that gives equal importance to sustainable production and biodiversity preservation, has been revered as one of Europe's most sustainable forest models (European Environment Agency, 2021).

However, this type of bioeconomy, where the forest is seen as a solution to multiple kinds of sustainable issues, further intensifies pressure on the forest and necessitates political trade-offs. The Swedish model has furthermore faced scrutiny on its ability to deliver outcomes aligned with the dual objectives in recent research (Beland Lindahl et al., 2017; Mårald et al., 2017). Implicit trade-offs have also been illuminated (Holmgren et al., 2022; Hertog et al., 2022). Additionally, a disconnect between Sweden's policy goals and on-ground forest management has been exposed, revealing a persistent dominance of traditional wood production objectives and economic sustainability (Beland Lindahl et al., 2017; Eggers et al., 2019). Furthermore, Holmgren et al. (2022) have analysed Sweden's bioeconomy as a discursive construct, revealing an influential network led by forest industries, owner associations, councils, and research entities.

Furthermore, the European Commission's new EU Forest Strategy for 2030 encourages member states to make sustainable developments to their forest strategies. These involve eradicating monoculture forests, increased protection of old-growth forests, increased subsidies for sustainable forest practices to forest owners, and providing educational opportunities for diverging actors on sustainable

forest practices (European Commission, 2021). The guidelines for Closer-to-Nature Forest Management from the EFI (Larsen et al., 2022) further establish a directory towards more CCF.

Taking all these factors into account indicates that a shift in Sweden's forest management policies and practices is on the horizon. And there is already some recognition of increasing CCF in Swedish forest policy. Since 2005, the SFA has been responsible for augmenting knowledge about CCF to comprehend appropriate methods for alternative forestry better since evaluations indicated limited adoption (SFA, 2022). However, its adoption in production forests remains scarce (Hertog et al., 2022).

2.2 Previous Research on Forest Management

2.2.1 Research on Forest Management and Forest Owners

Distinctive of research on forest management is that considerable focus is put on forest owners, and most studies are qualitative with case studies and interviews. Furthermore, research on forest management and ownership in Sweden often delves into transformative processes to illuminate how policies may be formed to foster desirable practices.

Some research has investigated forest owners' management in relation to climate change mitigation and adaptation, revealing that forest owners' actions may differ from the recommendations of governing organisations (see Ugglå & Lidskog, 2016; Andersson et al., 2018; Lidskog & Sjödin, 2014; Rist et al., 2016; Lodin, 2020). While some research accentuates forest owners' influence in forest management directions in Sweden (Nordlund & Westin, 2010), other studies reveal that they are often significantly influenced by external factors, including outsourcing of forest operations and advice from professional advisors (Eggers et al., 2014) or family relations (Törnqvist, 1995). One such study addresses the challenge of balancing climate goals with biodiversity conservation in southern Sweden's forestry (Lodin, 2020). The study explores diverse management scenarios in collaboration with stakeholders, revealing the importance of social context and advisory services. The results underscore the impact of industrial actors in advisory roles, as it hinders forest owners from gaining knowledge about alternative methods. Comparably, another study on forest planning and advisory services in Finland found that hired planners struggle to harmonise the policy objective of timber supply with the varied desires of forest owners (Hokajärvi et al., 2009).

Gender also plays a notable role in forest ownership research, especially as European forest ownership dynamics have shown a discernible shift. Over the years, the proportion of female forest owners has risen significantly, from 21% in

the 1970s to 38% in 2012 (Zivojinović et al., 2015). There are also gender differences in harvesting and silvicultural activities among female forest owners in Sweden (Lidestav & Berg Lejon, 2013). Recent research on gendered values within Swedish forestry has illuminated that gender considerations can contribute to deviating from prevailing norms, including resistance to clear-cutting practices (Bergstén et al., 2020). Cross-national investigations have also highlighted that female forest owners often hold softer values associated with forests, prioritising objectives beyond production-centric goals (Reed & Varghese, 2007).

Studies also indicate that forest owners in Sweden associate diverse benefits with their forest ownership and management, including wood production, nature conservation, hunting, and aesthetics (Hugosson and Ingemarson, 2004; Nordlund and Westin, 2011). This is particularly relevant as many sole proprietors derive their incomes from sources other than their forest properties (Lidestav et al., 2017; Westin et al., 2017), indicating that their forest management decisions might not be solely driven by financial considerations such as harvesting incomes (Andersson et al., 2010; Nordlund & Westin, 2011). Similar income dynamics have been discovered in international studies on forest owners in Portugal, the UK and Finland (Novais and Canadas, 2010, Sutherland and Huttunen, 2018). These studies examined motivations behind actors' actions to find possible links to preferred forest management methods for devising and promoting effective policy measures. Sutherland and Huttunen (2018) explored why forest owners practice alternative methods over timber-focused forest management policies. They applied practice theory in interviews with forest owners in the UK and Finland, uncovering seven distinct bundles of practices: creating attractive living spaces, engaging in forest-based leisure activities, biodiversity conservation, heritage preservation, renewable heat use, and household timber production. These findings resonate with the diverse benefits found in Swedish forest ownership (Hugosson and Ingemarson, 2004; Nordlund and Westin, 2011), they also highlight that the various motivations of small-scale forest owners align more with CCF principles (Sutherland and Huttunen, 2018). Notably, instead of utilising these insights to promote traditional timber production, these bundles can be instrumental in further investigating what enables CCF.

Moreover, one doctoral thesis on forest governance and management has also employed a social practice approach (Wallin, 2017). The thesis explores the impact of social practices on forest governance and management in Sweden through future studies, including interviews and cases with varying stakeholders. The findings identified social practices relevant to developing more participatory and sustainable forest governance, including personal relationships with advisors and purchasers, adherence to local values, discussions with neighbours, intergenerational ties to forests, and rural lifestyles. Furthermore, the findings indicate tension arising from

the tendency of social practices to streamline rather than diversify forest management.

2.2.2 Research on CCF Management

There has been limited research on the social contexts of Closer-to-Nature and CCF management in Sweden. One study found during this thesis process was Hertog et al.'s study (2022), which is highly relevant to this thesis scope. Their study involved interviews with forest professionals and owners from conventional and niche CCF practices. Contrary to the social practice approach of this thesis study, they used a transition theory framework analysis. Their findings revealed that the limited adoption of CCF is not solely due to a lack of knowledge and ecological limitations. Instead, the study indicated a mismatch between CCF and the prevailing clear-cut forest management in culture, forestry education, industrial networks, and timber markets, which hinders CCF. Interviewees identified insufficient CCF research and niche actors adapting practices from abroad (e.g., the German Lübeck method) via trial and error. Forest companies and owner associations wielded significant influence. Lack of CCF knowledge among operational workers and advisors, private funding bias, and economic concerns hindered adoption. Policy-wise, the Swedish approach of separating timber production and conservation raised fears of restricted harvesting due to heightened nature values. Collaboration and learning from CCF practitioners emerged as critical enablers, fostering study visits, research collaboration, conferences, and courses.

Two international studies provide valuable comparable insights on CCF management in other countries. One study examined the implementation of nature conservation in private forest management by professionals from public and private actor organisations in Finland (Primmer, 2010). The findings revealed that both types of professionals are more concerned about the opinions of their peers on nature conservation than about society at large. Another international study relevant to this thesis is Kiisel and Remm's (2022) study, which explores integrating CCF in clear-cutting-oriented Estonian forestry. By applying the framework of a socio-technical transition, they examine forest owners' choices, networks, materials, and regulations for fostering change. The study unveils that enabling factors include public support and emerging research, while impediments include weak advocacy and lack of CCF examples. The research underscores the need for forest system changes.

Creswell and Creswell (2018) point out that the main reason for a qualitative research study is to explore the unknown. The study should thus be developed out of a clear research gap in previous literature. Taking a new perspective that goes against some expected aspects of a research topic or studying an unusual group are two explorative ways to contribute to new understandings of a research topic

(Creswell & Creswell, 2018). Although one recent study investigated the challenging aspects of the interplay between conventional and CCF actors to implement CCF in Sweden, this is a novel focus on a relatively unusual group. There is thus room for further research that explores the challenges through a different theoretical lens. This thesis study's angle on successful transitions by CCF managers might shed further light on the enabling and challenging factors that influence decision-making, thereby adding depth to the existing understanding of sustainable forest management dynamics in Sweden. This master's thesis can also correlate its findings with the previous research, potentially confirming, contrasting, or expanding upon its insights. Understanding what has enabled and challenged successful transitions would be highly valuable in the bigger picture of ultimately achieving a societal transformation of Sweden's forest management model.

3. Theoretical Framework

3.1 Social Practice Theory

The theoretical framework this thesis builds on is that of a social practice-based approach. Rather than isolating specific individuals, systems, objects, or structures, the unit of analysis in social practice approaches encompass the entirety of a practice, which allows for a holistic understanding of a research problem (Arts et al.: 2014; Schatzki et al., 2001; Reckwitz, 2002). Using a social practice-based approach thus offers a holistic view that delves deeper than individual forest managers, encompassing the societal context of CCF practices, such as how societal values, policies, market forces, industry practices, educational systems, and professional regulations shape and influence CCF practice.

Social practice theory has evolved over time and encompasses multiple strands. Still, the core of social practice theory examines practices through how individuals and groups engage in routine activities within specific social and cultural contexts, highlighting the interdependence of individual agency, social structures and material arrangements (Shove et al., 2012).

With its wide usage across various fields, social practice theory has diverse interpretations and applications shaped by specific research fields and disciplinary traditions. Consequently, a multitude of theoretical and empirical frameworks exist, adapted to different contextual research settings, leading to the frequent use of the term "practice-based approach" when referencing social practice theory (Gram-Hanssen, 2011). Despite this diversity, certain fundamental notions are commonly shared among practice-based approaches, such as focusing on social practices as the unit of analysis and recognising the influence of social context on shaping practices (Shove et al., 2012). The divergence of concepts within social practice theory can offer valuable insights into the contextual nature of practices and help to understand the complexities and variations in practices across different settings.

The multitude of theoretical frameworks and concepts within social practice theory enables and forces a research study to adjust its theoretical approach to the specific context of the studied situation (Gram-Hanssen, 2011). Following this appeal, Shove et al.'s (2012) practice-based approach, which "is particularly useful for assessing stability and change in practices" (Sutherland & Huttunen, 2018: 38),

has been selected in this thesis. A practice-based approach that can assess stability and change in practices is suitable for achieving the thesis aim, as the aim is to contribute insight into the conditions for increased CCF management practice in Sweden by understanding forest management practitioners' experiences of what enables and challenges them in practising CCF.

3.1.1 The Concepts of Elements, Bundles, and Complexes

The main concepts that guide this thesis come from Shove et al.'s (2012) practice-based approach. They conceptualise a theoretical lens based on explaining practices as made up of three elements: 1. materials, 2. competencies, and 3. meanings. Materials include aspects such as objects, things, infrastructures, tools, bodies, and natural resources. Competences are multiple forms of understanding and practical knowledgeabilities such as skills, know-how and techniques. Furthermore, meanings represent the social and symbolic significance of participation in the form of symbolic meanings, norms, ideas, aspirations, and emotions. In the case of CCF management, the elements could be categorised as this:

- Materials: This includes physical entities and resources involved in CCF management, such as people, policies, contracts, trees, tools (e.g., chainsaws, horses), industry systems (e.g., contracts, certifications), and natural resources (e.g., timber).
- Competences: These encompass the knowledge, skills, and abilities required for successful CCF management. Competences may include ecological understanding, tree identification, tree felling techniques, silvicultural practices, biodiversity conservation strategies, and adaptive forest management.
- Meanings: This refers to the social and symbolic significance associated with the practice of CCF management. Meanings may include cultural values attached to forests, the perception of sustainable and diverse ecosystems, the sense of stewardship and responsibility towards nature, and individuals' emotional connection with forests.

The basis of Shove et al.'s social practice approach also entails that practices are formed and changed through *the making and breaking of links* between these elements and other connected practices. This notion is effectively illustrated through the example of linkages in the practice of driving:

“[...] links are made and broken not only between the elements that constitute a single practice (driving) but also between the multiple practices of

which similar elements are a part (driving and repairing).” (Shove et al., 2012: 36)

The linkages of elements are argued to be relevant for how practices relate to each other and how relations between practices change over time and space (Shove et al., 2012). In the case of forest management, there are presumably many webs of connected practices, considering that it is a big industry with multiple actors. As such, it is relevant to study the elements and linkages involved in CCF management to discover how forest management in Sweden can change and develop to include more CCF.

Furthermore, elements are not isolated entities in one practice but are suggested to interconnect through the making and breaking of links to other practices. These linkages form *zones of overlap*. The overlapping zones of elements enable the transfer of knowledge, skills, and resources, allowing practices to mutually support and influence each other (Shove et al., 2012). When similar elements are present in multiple practices simultaneously, they link to form a common understanding of meanings across practices. This shared understanding of meanings enhances coordination, communication, and collaboration among practitioners, fostering a sense of coherence and shared purpose. On the other hand, there can also be contrary elements within connected practices that break linkages, which may lead to variations or conflicts in interpretations and understandings across the connected practices (ibid.).

Another part of linkages within practices is Shove et al.'s (2012) notion that elements change and endure through different *intersecting circuits*. One circuit is that practices endure when links between elements persist consistently and recurrently over time. A second circuit is that the linkages are limited and shaped by “the intended and unintended consequences of previous and coexisting configurations” (114). The third circuit is that practices persist and change through feedback between moments of enactment and patterns of mutual influence between co-existing practices.

Moreover, practices are suggested to relate to one another through links that form *bundles* and *complexes* (Shove et al., 2012). Bundles of practices are loose connections mainly based on co-location and co-existence. In comparison, complexes of practices are more integrated and dependent on each other. Their connections can be linked through “sequence, synchronisation, proximity or necessary co-existence,” which makes one practice dependent on another. These connections can be connected through one or more elements (meaning, competencies and/or materials) (ibid.). In the context of CCF management, it is highly relevant to study change by looking at its bundles, and particularly complexes, as forest management practice is part of a large industry and often requires the work of multiple people. For example, practices connected to CCF

management may be forest services and leisure activities. Leisure activities may be categorised as part of bundles as they occur in the forest but may not be a crucial part of CCF management. Whereas forest services may be categorised as part of complexes, as some forest owners may need outside assistance.

Using Shove et al.'s practice approach, change can be studied in CCF management by examining links between elements of the primary and its connected practices. Following this logic, CCF management comprises both bundles and complexes of practices. By assessing the integration and interdependence among these elements, one can categorise them as either bundles or complexes. Loosely tied practices are identified as bundles, while those with intricate, dependent linkages, spanning meanings, materials, and competencies are identified as complexes. This thesis gives an analytical focus to the complexes due to their interdependence and influence on CCF implementation.

Furthermore, in correlation with the notion that practitioners are carriers of practices and, as such, can be used to study practices (Reckwitz, 2002; Schatzki et al., 2001; Shove et al., 2012), this thesis will study CCF management through its practitioners.

3.1.2 Epistemological Orientation

Social constructivism emphasises the situated and context-specific nature of knowledge (Creswell & Creswell, 2018). Adopting a social constructivist epistemological orientation aligns perfectly with the notion that the development of practices, such as those related to CCF, is not fixed or predetermined but constructed through practitioners' social interactions and shared experiences. This perspective recognises the dynamic and context-dependent nature of how forest management practices, including CCF, evolve and are understood by those involved.

3.1.3 Theoretical Limitations

The divergence in conceptualisations and interpretations within social practice theory can challenge establishing consistent and comparable frameworks for analysis within one field and across others. This notion has been brought up by many scholars practising social practice theory, such as Gram-Hanssen (2011), Arts et al. (2014), and Shove et al. (2011), to name a few, and much of their work is about discussing and clarifying applications and concepts between disciplines and fields. The multitude can hinder cohesive understanding of social practices and limit interdisciplinary dialogue and collaboration opportunities. To thwart misunderstandings and foster constructive academic discussions across research disciplines and fields in the context of this thesis study, this study strives to provide

a thorough literature review, clearly define terminology and concepts, uphold methodological transparency and discuss reflexivity in analysis and interpretation.

4. Methodology

4.1 Methods

This thesis study proceeds from a flexible research design. Since a flexible research design involves an inductive and iterative logic that enables consideration of complexity (Robson & McCartan, 2016), it allows a nuanced exploration of the contexts connected to the CCF and the perspectives and experiences of the research participants. Unlike a fixed research design that relies on quantitative measures, which requires strict structures and early planning in the research process, a flexible research design offers a more adaptable approach. It recognises the evolving nature of the research inquiry and provides the necessary flexibility to explore new insights, adjust research questions, and refine data collection techniques based on emerging findings (ibid.). By choosing a flexible research design, this study can effectively navigate the complexities inherent in CCF management practice and comprehensively explore the experiences of CCF managers.

A flexible research design also fosters a participant-centred approach, enabling researchers to be responsive to the contributions and experiences of research participants, which can enhance the quality of the study (Robson & McCartan, 2016). This capability is especially relevant in this thesis study, where the perspectives and experiences of CCF management practitioners are critical to the research study.

4.1.1 Material and Delimitations

Material

The primary data for this study has been derived from interviews and observations of different types of forest management practitioners who actively engage in CCF. This choice of data type has been made in line with the thesis's social practice approach. Drawing upon most social practice theories, practitioners are often regarded as embodiments or carriers of a particular practice. Therefore, studying practitioners in observations or interviews allows for an analysis of the practice

itself, not only an analysis of the practitioners as participants of a practice (Reckwitz, 2002; Shove et al., 2012). Consequently, forest management practitioners were examined as embodiments or carriers of CCF management. This enabled a comprehensive analysis of the complex linkages of elements within practices associated with CCF management.

The research participants were a diverse set of eleven forest management practitioners operating in different parts of Sweden, including foresters, forest advisors, forest entrepreneurs, and forest service workers, many of whom fit into more than one of those categorisations. This study involved two foresters, one worked with specific CCF projects, and the other one worked with education at the SFA and held classes on CCF. Three service practitioners participated: a CEO from a company specialising in forest services and timber procurement, a CEO/worker from a smaller forest service company, and an entrepreneur providing forest services. The ten forest owners who participated in this study were small-scale forest owners with forest areas ranging from 10 h to 215 h. Some of these forest owners co-owned their forests with family members, and most of them had inherited forests. The research participants were six men and five women ranging from 41 to 76 years old.

The practice settings observed were the participation of practitioners in four lectures held over video meetings on CCF and Closer-to-Nature Forest management practices, two by the SFA and two by an independent CCF forest company. Different forest management practitioners participated in the lecture as guest lecturers, facilitators, or attendees.

Delimitations

Due to the confined scope of a master thesis and external factors like the data collection taking place during the winter season and COVID-19 restrictions, specific delimitations in terms of which kind of management practitioners and practice settings to study have been made. Particular attention has been directed towards certain forest managers “on the ground,” such as forest owners, forest advisors, forest service workers, and entrepreneurs, not politicians and scientists within the forest field. The digital lectures and the specific types of practitioners were chosen based on initial research on the topic and the continuous insights made during the data collection period.

4.1.2 Data Collection

To understand the broad context of this research problem, a big part of this study involved gathering knowledge on CCF and Closer-to-Nature Forest management in Sweden. Researching news articles, documentaries, and previous research

concerning the Swedish forest context provided a general understanding of the topic to proceed with the study.

The elements of CCF management and interconnected practices were gathered through qualitative interviews and observations with forest management practitioners. Unlike quantitative methods, where the ability to generalise and standardise findings is highly valued, qualitative methods value contexts (Robson & McCartan, 2016). The attention to contextuality makes qualitative methods appropriate for studying practices that are contextual by nature (Westberg & Waldenström, 2016; Arts et al., 2014).

Furthermore, recommendations on data condensation through continuous reflections and summaries were followed to save time and ensure the quality of the data and analysis (Miles et al., 2014 in Robson & McCartan, 2016). This was done through three common strategies:

1. Memoing during data collection.
2. Post-session notes to gauge relevance and inform future sessions.
3. Midway summaries to determine analytical trends and identify remaining data needs.

Qualitative Interviews

Due to its flexible design, semi-structured interviews were used in this thesis. These offer greater adaptability than structured ones, allowing for open-ended questions and adjustments based on context and participant feedback (Robson & McCartan, 2016).

Based on accustomed processes in semi-structured interviews, an interview guide with topics and questions based on the research aim was developed. Interview guides allow unplanned follow-up questions and modification during the gathering process (Robson & McCartan, 2016; Creswell & Creswell, 2018). The main themes in the interview guideline were based on a combination of the initial research question and the main concepts within the theoretical framework (meaning-making, use of materials, aspects of competencies and relation to other practices).

As is common in qualitative research with flexible designs, the interviewees of this thesis study were chosen based on snowball sampling (Robson & McCartan, 2016). This meant that just a few individuals were identified and contacted initially, then those informants suggested other people to contact, and this snowballing process of interviewing continued until reaching saturation. Saturation was reached after eleven interviews.

Interviews under 30 minutes are considered insufficient to gain qualitative insight (Robson & McCartan, 2016). The interviews were therefore held between 35 minutes to 1 hour and 15 minutes, depending on the engagement of the interviewees. The interviews took place over video calls due to the pandemic,

making it accessible for CCF practitioners based in different areas of Sweden to participate in the study. Interviews were recorded and transcribed to ensure a lasting record for later analysis and to maintain focus during sessions (Robson & McCartan, 2016). However, general notes were taken as a condensed data reference and backup against technical failures.

The interview guideline involved several key themes, which collectively provided a comprehensive exploration of the intricacies of CCF management, encompassing the motivations, practicalities, social dynamics, and external influences shaping the practices of forest managers. The themes were:

1. Practice motivations: exploring why the research participants chose CCF as their forest management approach.
2. Implementation: insights into the practical methodologies of CCF.
3. Benefits and drawbacks: real-world pros and cons of the CCF approach.
4. Collaborative engagements: examining the research participants' relationships and interactions in the field.
5. Influence dynamics: understanding reciprocal influences among CCF practitioners.
6. Regulatory impact: how official regulations and industry processes affect forest management choices.
7. Forestry norms: the influence of different norms on CCF decisions.
8. Promoting adoption: reflections on promoting CCF and its perceived challenges and advantages.

Qualitative Observations

Qualitative data is often collected in natural settings to grasp real-world contexts instead of laboratory settings (Robson & McCartan, 2016). In line with this notion, the forest managers were observed in a practice setting to witness linkages being made, sustained and broken between elements of practices in real time. These were qualitative unstructured observations made in this study's exploratory phase. The purpose of these observations was to gain a better initial understanding of the research question, specifically the linkages of elements forming the practice, and of what directions to take in the study, as is usual in flexible research designs where more qualitative data collection follows (Robson & McCartan, 2016). The unstructured observations also functioned as a supportive method to complement the data gathered in the interviews, as suggested by Robson McCartan (2016).

This thesis's qualitative approach, rooted in a social constructivist view, adopted a participant-observer role during the observations. Participation with the involved is seen as a tool to interpret the social construction of subjective meaning and experiences that form the social world (Robson & McCartan, 2016). In this study, the participation level was marginal mainly due to the digital lectures' tight schedule and inability to join psychical courses held after the time frame of this thesis study.

However, full engagement was not crucial since observations functioned as an exploratory and supportive method for the more in-depth interviews.

The observations were informal and thus included general notetaking and information-gathering from informants. As Robson & McCartan (2016) instruct, particular focus was put on the dimensions related to the thesis research question by observing problematic, interesting, or surprising things. Specifically, this meant determining what may characterise the practitioner's CCF management practices during the lectures and discussion and then integrating the findings into the interview questions.

4.1.3 Data Analysis

Thematic coding analysis has been used to analyse the interview and observation data. As a thematic coding analysis can be used to analyse all types of qualitative data (Robson & McCartan, 2016), it is an appropriate method for this study, which handles two types of qualitative data.

A thematic coding analysis consists primarily of coding, identifying themes from the codes, and interpreting the themes and their connections to theoretical concepts (Robson & McCartan, 2016). Using a standard thematic coding approach for flexible research (*ibid.*), initial loose coding was based on early data insights. This was followed by structured coding, considering the entire data set and the inductively shaped theoretical framework. The final process consisted of coding the identified practices related to CCF into themes of elements, i.e., the respective meanings, competencies and materials found in each practice. Identifying these practices and their elements made it possible to interpret the links between elements and practices and the level of dependence between different practices (if they were part of bundles or complexes of practices), which ultimately may form, stabilise and change CCF management practice. These themes and codes were integrated into a table to allow a clear analysis of the interlinkages between the elements of the practices. The effects of the linkages between the elements of the practices connected to CCF were then assessed to either enable or hinder CCF. In this way, the thematic coding table could be used to explore the research questions.

4.2 Methodology Discussion

4.2.1 Ethical Consideration

Specific measures were taken to obtain ethical research standards throughout the research study. An essential ethical principle to uphold is to protect the research participants from coercion, deception, and manipulation. This can be done by having informed consent from participants (Robson & McCartan, 2016). Informed

participation consent was obtained during the initial contact with participants via email. This involved providing participants with a consent form, which they were asked to review and complete.

Furthermore, ethical considerations should be made concerning how to respect potential power imbalances, avoid the collection of harmful information and offer reciprocity to prevent exploitation (Creswell & Creswell, 2018). In this thesis, power imbalances were reduced through assurances that no harmful information they may provide would be included. They were also asked to deduct anything they may have regretted saying. To avoid exploitation, the participants were informed of the research aim and underlying assumptions on the research topic at first contact. They were also asked if they expected anything from participating in the study and were informed early on that there would be no monetary compensation. All interviewees and observed individuals were anonymised to ensure the confidentiality of the participant's data (Patton, 2015).

4.2.2 Limitations in Validity and Reliability

The epistemological stance on social constructivism poses certain limitations to the reliability of research findings. Since social constructivism emphasises the situated and context-specific nature of knowledge, it may be challenging to apply the research insights to broader contexts or develop universal guidelines for CCF adoption based on the findings of this study. Furthermore, given the subjective nature of qualitative research, both participants and researchers bring their personal experiences and biases, which may affect the validity (Robson & McCartan, 2016). Engaging in reflexivity, a common practice in qualitative research, is thus crucial to address potential biases. While my background in environmental communications makes me naturally emphasise social and environmental aspects, I have actively worked to acknowledge the significance of industry and economic interests in exploring holistic sustainability within Swedish forestry. As for the subjectivity of research participants, the sayings of interviewees may not be the same as their actual doings or true inner feelings due to social desirability response biases. However, triangulation through multiple validity procedures can enhance validity (Creswell & Creswell, 2018; Robson & McCartan, 2016). For this study, triangulation was achieved by combining data collection methods, allowing for cross-referencing between emergent findings in observations and interviews.

Moreover, the absence of first-hand insights from conventional forestry management practitioners could limit a comprehensive understanding of how various forest management practices interact and potentially impact CCF adoption.

5. Findings

5.1 Complexes of Practices Within CCF

Reviewing the findings through a practice-based approach showed that CCF management depends upon multiple practices or so-called complexes of practices. The complexes of practices have been categorised as forest advisory practices, forest service practices, forest ownership practices, forest policies and regulations, and forest research practices. The linkages that bind the various practices to CCF will now be analysed and evaluated to determine if they hinder or enable forest managers to implement CCF.

5.2 Forest Policy and Regulation Practices

5.2.1 Material Elements – Navigating Policy Legacies and Regulatory Realities

Upon observations and interviews with forest management practitioners actively involved in CCF, it became evident that current and historical policies and regulations wield a substantial influence over the feasibility of implementing CCF practices in present-day Sweden. The "Freedom under responsibility" principle, central to Swedish forestry, grants agency to forest owners. The research participants said forest managers often stress this agency, urging owners to set goals and seek aligned services. However, other regulations, like those for felling and conservation, also guide owners. Through the lens of "making and breaking links," this principle forms a foundational link, giving owners decision-making agency within regulations. Yet, these links are nuanced by felling and conservation rules, shaping the choices for forest practitioners.

The legacy of prior policies also seems to linger and influence contemporary practices and forest managers' ability to implement CCF. The research participants referred to the power of regulations that existed until 1993, which still affect current forestry. The former Forestry Act, enforcing a production-oriented approach,

obligated forest owners to manage their lands with this focus and altered the entire forest industry's systems and mechanisms. It led to the development of big political, financial, educational and industry systems, as well as forestry techniques, methods and tools that served to foster high production. These systems are still in place, and the research participants said they affect forest practitioners' possibilities to practice alternative forestry management.

A poignant example of the remnants of the Forestry Act that some research participants pointed out is the enduring impact of monoculture planting, a practice imposed by past regulations. One forest owner talked about how his family members were obliged to plant monocultures before the new Forestry Act, which restricted the mixed tree species they planted afterwards from growing up in his forest today, seeing as wild animals eat the sprouts of low-leaf trees. The research participants also highlighted the forest industry system's influence on various forest operations and institutions, including the FOAs, the SFA, timber companies, and forest service companies, favouring conventional production-intensive forestry management. This preference, in turn, has implications for implementing CCF management in ways that will be further discussed in the subsequent sections.

Another regulation the research participants raised was Sweden's strategy for balancing production and biodiversity goals, specifically, aspects that involve categorising forests into those designated for timber production and conservation. To safeguard biodiversity, regulations are in place that limit harvesting in forests with high ecological value. This regulation raised concerns among the research participants that their CCF efforts might lead to the development of significant ecological values, potentially resulting in harvesting restriction or even land confiscation, thus ending their CCF harvesting.

The concept of zones of overlap is observable in the interplay between historical policies and current practices here. The legacy of prior policies casts a shadow over contemporary alternative forest management endeavours, establishing zones of overlap between historical regulations and present-day practices. The enduring impact of the production-oriented Forestry Act's regulations has fostered a continuity of monoculture planting and clear-felling practices. This historical practice manifests as an overlap between past and present, influencing not only forest practitioners but also the mechanisms of the forest industry and associated institutions.

5.2.2 Elements of Competencies – Understanding and Applying Policies and Advocating Interests with Diplomacy

Competence lies in the forest managers' ability to remain informed and align their practices within the confines of the regulatory forest framework. The research

participants mentioned that they achieved this by obtaining information from their FOA contacts or seeking guidance from the SFA. For instance, forest owners are required to seek approval for their felling activities. Conversely, the SFA is responsible for enforcing the policies, ensuring their organisation and forest management practitioners adhere to them. This involves reviewing felling applications and conducting forest inspections to safeguard specific nature values.

Engaging with various stakeholders is another essential competency, reflecting the concept of intersecting circuits. Forest management professionals often negotiate with regulatory agencies such as FOAs and the SFA. This creates complex intersections of interests. Navigating these circuits diplomatically is crucial for those practising CCF. Some participants expressed the need for policy changes to support CCF in production forests. They showcased their advocacy through a co-authored article emphasising CCF's profitability and sustainability in Swedish forestry, backed by significant endorsements.

5.2.3 Elements of Meanings – Historical Influences and Evolving Attitudes

Embedded meanings within policy practices were said to resonate from the former production-oriented Forestry Act. This historical perspective seems to even reverberate within the SFA. A production-centric paradigm once coloured their stance towards CCF, resulting in a perceived reluctance to endorse it today, according to some of the research participants. Several of them mentioned that some forest management practitioners still believe the SFA are critical of CCF, and this perception sometimes results in forest owners turning away from the SFA for guidance and information about CCF. This perception, however, is evolving. While some practitioners were said to still harbour scepticism towards the SFA's support for CCF, the SFA worker who participated in this study acknowledges a shift in the agency and the general industry's approach, with growing encouragement for CCF practices. Here, the notion of intersecting circuits comes into play as the historical influence intersects with evolving attitudes and policies, shaping the agency's growing support for CCF practices.

In dissecting these complex interactions between elements of meanings, materials, and competencies within forest policy and regulation practices, it is apparent that a tapestry of both historical legacies and contemporary pressures plays a pivotal role in shaping the landscape for CCF implementation in Sweden.

5.3 Forest research practices

5.3.1 Material Elements – Limited CCF Research and Cross-practice Influences

Some research participants stressed the significance of research practices in CCF. Forest managers pursuing CCF methods were said to often seek research-backed information, but they noted a scarcity of studies on CCF-managed forests.

Additionally, the SFA relies on forest research from universities, while the state-funded institute, Skogforsk, acts as a guiding entity for forest service companies. According to the research participants, expanding Skogforsk's research into CCF could boost its adoption among these companies.

Furthermore, some participants with forest research backgrounds highlighted that much forest research is industry-funded, potentially affecting research validity by favouring conventional forestry. They discussed how industry-funded projects, like those by Skogforsk, can influence research directions.

The materials within research practices resonate with the concept of making and breaking links as the symbiotic relationship between research and forest management is palpable. The forest industry's close ties to research can be seen as establishing links that impact the direction and scope of research efforts. Moreover, the SFA and forest service companies translate research outcomes into actionable strategies, thereby embedding research into their operational and educational frameworks, creating a material link through zones of overlap between research and forest management. Moreover, if the research scopes and findings emphasise conventional forestry methods due to financial links to industry actors, the research may, in turn, forge persisting linkages to conventional forestry practices, ultimately challenging CCF endeavours.

5.3.2 Elements of Meanings – Influencing Research Pursuits and Public Discourse

Through discussions with research participants, it became clear that forest research can influence meanings and shape perspectives within other practices. Thus, research may serve as a guiding compass for forest managers' decision-making. For instance, research participants emphasised that an increase in research on CCF could not only contribute to the public discourse about transitioning toward CCF in Sweden but also hold the potential to validate or challenge the viability of CCF practices. Research findings were thus identified as a pivotal factor capable of steering the trajectory of CCF adoption, given the influence of forest research on many forest managers, as mentioned earlier.

Additionally, a research participant who was a forest researcher highlighted a dichotomy within forest research departments—manifesting as aligning with

environmental sustainability or economic viability. The latter faction was said to have close industry ties, such as being affiliated with forest company boards. These two factions have overlapping zones with other practices; the economic faction had shared elements with the forest industry and their timber objectives. While the other faction shared elements with ecological and climate mitigation practices in the form of competencies and meanings.

5.3.3 Elements of Competencies – Deficient CCF Research and Implications of Funding Origins

Within forest research practices, the competencies possessed by different actors may influence the implementation of CCF management substantially. Competencies within forest research practices encompass the ability to critically evaluate research methodologies, findings and contextual relevance. The research participant from one of the CCF service companies shed light on such limitations in CCF research projects.

According to this research participant, there is inadequacy in CCF research arising from the disparity between research settings and actual CCF practices. Most studies are done in traditionally managed forests without enough adaptation time for CCF methods. The forest service workers in these projects are also often unfamiliar with CCF, leading to results that may not accurately reflect CCF's potential. These research deficiencies reveal a 'breaking of links' that may hinder accurately representing CCF's potential in research findings. As proposed by the service practitioner, the solution lies in conducting research in forests managed with CCF for a considerable period already, ideally around 50 years. This underscores the importance of competencies in considering contextual relevance.

Moreover, the validity issues connected to forest research being funded by forest industries highlight the need for competencies in critical evaluation of research biases.

5.4 Forest Service Practices

5.4.1 Material Elements – Constraining Contracts, Transformative Processes and Blurred Lines Between Workers and Clients

Service practitioners consist of company owners and their different operational service workers who usually specialise in one or several silvicultural services, such as developing forest management plans, operating machines, preparing the land, planting seedlings, thinning, felling and purchasing timber. In addition to company owners and workers in service practices, large forest owners (like municipalities)

and small-scale forest owners are also part of the material elements in service practices as they are the ones who order service, making forest owners and service providers dependent on each other. The research participants also indicated that some forest owners seeking CCF management rely on these services as they do not handle operations independently. This poses a challenge for CCF implementation, as few service companies are offering CCF services, often resulting in forest owners turning to service companies without CCF experiences.

As for CCF services, the research participants explained that CCF requires less frequent operational management in the forests since most CCF methods build on the idea that nature should manage itself. No land preparation is done, thinning is kept at a minimum, planting may be done naturally, and the machines used to pick fell or screen fell are often smaller, not used at all or replaced by horses, resulting in more fuel-efficient equipment.

Moreover, timber production from CCF silviculture turned out to play a significant role in enabling and hindering service companies to practice CCF. According to the research participants, the felling process tends to be more time-consuming than traditional methods due to heightened efforts to protect the tree's surrounding environment, and pick-felling yields less quantities of timber. Moreover, transitioning a conventionally managed forest to a fully stocked continuous cover takes time. However, as the forest develops richer natural values, it becomes less vulnerable to pests and diseases, leading to a more sustainable stock. Many of the research participants also claimed that this leads to higher-quality wood.

Proceeding from a market logic helps demonstrate the influences of timber production on CCF implementation, as one of the research participants pointed out. Forest owners profit from selling their timber at a high price, while businesses that buy timber profit from high qualitative timber at low prices. If CCF allow forest owners to cultivate high-quality wood affordably and sell at premium prices, it makes CCF more profitable for owners but less so for timber buyers. Furthermore, the companies that offer forest services often work together under contracts. The contracts consist of monthly agreed quotas of felled and delivered timber and are often several yearlong commitments. These contracts, as noted by numerous research participants, can act as a barrier to CCF adoption. Since CCF yields less timber, service companies may lean towards conventional clear felling to meet their contractual quotas with entities like FOAs and timber businesses. This makes it challenging for them to experiment with CCF methods due to the potential loss of joint agreements. Despite these challenges, there is a growing demand for CCF, and service companies that offer CCF services, like the ones in this study, face an overflow of clients they can't accommodate. Notably, one of these companies also bought and sold timber. This freed them from conventional methods needed to

reach typical timber quotas, which might indicate a solution to the confinement to conventional services that the timber contracts.

CCF services are commonly utilised in forests earmarked for nature conservation due to high biodiversity. Forest owners can use subsidies from the SFA for biodiversity projects to offset service costs, as CCF reduces operational needs, cutting costs for clients but reducing service company income. The subsidy allows service companies to earn similar amounts from both CCF and conventional jobs. According to the research participants, the subsidy offset of income loss makes CCF attractive for some service providers. This situation highlights the concept of intersecting circuits of consequences, here intertwined and shaped by the intentions and outcomes of several forest management practices, namely regulatory nature conservation efforts, finance, service providers and forest owners. These evolving linkages, influenced by ecological goals and financial realities, make CCF economically feasible.

CCF also requires a more intimate connection to the forest and a stronger relationship between the ones who order services, the service companies and their employees (the executors) in a way that is unnecessary in conventional forestry. The service practitioners must discuss plans and tactics that correlate with the ideas and aspirations of those who order the service (usually forest owners), as there are different forestry styles within CCF. These discussions become particularly important in negotiations between clients and service workers with limited experience in CCF. In a way, the usual lines between the ones who orders services and those who provides services become blurred in CCF, as it requires competence to make judgements and decisions on site and a more profound interaction among these people and artefacts.

In the interactions between forest owners, service workers, forests and tools, the theoretical concept of zones of overlap gains prominence. The material elements of CCF services intersect with conventional tools, machinery, contracts, and techniques within conventional forest services, sparking discussions and adaptations that navigate this transition, like zones of overlap.

The notion of making and breaking links can also illuminate the transformative process between conventional practices and CCF, particularly in the instances where service companies get requests for CCF services, prompting them to explore CCF methods. As practitioners engage with the new material elements associated with CCF, the links to conventional tools and techniques are reconsidered and modified. This process of breaking away from established normative methods to forge new ones characterises the possible evolution of CCF practices within the forest service sector.

5.4.2 Elements of Competencies – Navigating New Competencies and Client Interactions

There are multiple types of competencies involved in service practices. The forest service workers range from foresters with university educations to forest machine operators with specific education in forest machine operating. Furthermore, forest companies offering services get support and guidance from the Swedish forestry research institute Skogforsk. Skogforsk provides the companies with suggestions on critical figures for analysis and development of the business and methods for drift work (Skogforsk, 2022). However, to carry out CCF services, service practitioners need particular skills and knowledge that may not be possible to acquire through standard education or Skogforsk, according to the research participants. CCF is a process that requires specific theoretical and practical forestry knowledge connected to obtaining high timber quality whilst achieving high nature values. It is a process that involves regular ventures into the forest to examine trees from different angles and identify other nature values to consider, such as biodiversity conservation through the care of endangered species and valued habitats and the allocation of forest provisions. CCF service workers use typical nature conservation techniques: creating dead trees, removing bark, planting certain trees to manage monocultures, and more.

Consequently, service companies must develop new knowledge and skills in CCF from alternative sources to offer and deliver successful CCF work. The two service companies who participated in this study had thus acquired their competencies in other ways. One had acquired competencies from intergenerational transfer of historic forestry methods in horse-drawn work and networking in horse-drawn associations. The CEO of the other CCF company initially learned about CCF from a forest owner with a forester background, and then they developed operational strategies together. After that, the company employees took lectures and courses, did individual research, and continued to learn from forest owners by practising CCF.

The concept of making and breaking links is evident in the search for competencies necessary for CCF. The emergence of specialised CCF service companies highlights the process of breaking away from normative methods to forge new competencies. These companies, driven by the need to offer successful CCF work, take innovative routes to acquire competence. The breaking of links with traditional education channels prompts them to explore intergenerational practices, networking within specific associations, and collaboration with experienced forest owners. This process of making new links to alternative sources of knowledge fosters the development of competencies tailored to CCF requirements. However, the research participants also told stories of service companies who had tried CCF, failed and discontinued CCF, which they thought was because they hadn't sought new competencies in CCF. The research

participants also claimed that the forest industry is generally understaffed, which may create time-related issues in acquiring new competencies in CCF for service workers.

The concept of intersecting circuits offers insight into the evolving competencies within forest service practices. Established forest service workers' skill sets and educational backgrounds form the initial circuit of competencies. The emergence of CCF introduces a new circuit that intersects with the conventional one, necessitating the adaptation of competencies. This intersection is characterised by both intended and unintended consequences. Service companies that fail to acquire the new competencies required for CCF may be constrained by their existing links to traditional methods. On the other hand, specialised CCF service companies exemplify the successful navigation of these intersecting circuits.

5.4.3 Elements Of Meaning – Navigating Risk and Reward

The research participants emphasised that service practitioners are primarily driven by the desire for a positive, social, and fulfilling work environment, as well as the ability to generate sufficient revenue from their services, which CCF work offers. Those who transitioned from conventional to CCF work noted increased client appraisals for their skills and knowledge in conducting CCF methods.

These appreciations could be related to intersecting circuits through feedback loops. Initially motivated to succeed in delivering CCF services from new requests, service practitioners acquire new knowledge and skills in CCF, often together with other forest practitioners such as forest owners. With each job, their proficiency in CCF grows. This newfound competence gains appreciation from clients, establishing a reciprocal connection. This interaction evolves into an intersecting circuit of feedback loops where enhanced competencies and appreciations coalesce to sustain core motivations of fulfilling work.

Furthermore, timber production has economic benefits for various stakeholders, from forest owners to pulp producers, and is integral to Sweden's bioeconomy and welfare. Many of the research participants also said they value forests as sustainable resources within this bioeconomy. They saw CCF timber production as a way of achieving biodiversity and sustainable economic objectives for themselves and the state.

For the service company using horse-drawn forwarding, engaging in CCF was a way to preserve heritage and connect with traditional forestry methods of their ancestors. The research participant saw it as blending old practices with modern techniques, safeguarding both ecological values and cultural legacy. This perspective of meaning represents an intersecting circuit where heritage, historical methods and contemporary ecological demands converge, ensuring heritage is preserved while meeting today's sustainability needs.

Some participants viewed CCF services as a risk because of its controversial nature in the largely conventional forestry industry. This approach could strain collaborations and be seen as criticism by peers or colleagues. One research participant noted that while many in the service industry privately practice CCF in their own forests, they keep it secret due to its taboo nature in business circles. It appears that the conventional practitioners reproduce certain assumptions that do not seem to reflect the experiences of those doing something different. However, service companies that offer CCF believe there is a significant opportunity to challenge the status quo. Given the rising demand and unmet need for CCF services among forest owners, these companies stand to benefit greatly from filling this market gap.

The forest service domain seems to be a crucible of innovation and tradition, where ‘zones of overlap’ emerge at the juncture of established practices and emergent methods of CCF. These zones encapsulate dynamic interactions where the perspectives of service providers and forest owners converge. The risk-taking aspect of practising CCF exemplifies these zones, where practitioners navigate the overlap between conventional forestry norms and the transformative potential of CCF. The taboo surrounding CCF within the industry signifies the boundaries of these zones, highlighting the challenges of challenging the status quo.

These findings showcase the interdependence of CCF management and forest services. Within CCF, service practitioners collaborate closely with forest owners who rely on their services and service providers rely on their orders. For success, the meanings, materials, and competencies of service providers must thus align with the needs of those purchasing services. This alignment is challenging to reach given that most service providers only offer conventional services and have opposing ideas about the economic viability of CCF.

5.5 Forest Ownership Practices

5.5.1 Material Elements – Service-Reliant and Self-Operating Owners

While no official statistics pinpoint which types of forest owners practice CCF in Sweden, this study's research participants indicated that it is mostly small-scale owners, with a few larger private and public owners allocating areas for nature conservation. Most of the research participants who were forest owners saw their forests as supplemental income. Moreover, the research participants said that many forest owners interested in CCF were women.

The research participants said CCF-practicing forest owners are often more involved in tasks like planning and regularly monitoring their forests. In other

words, they seem to engage more with material elements of forestry than conventional forest owners may do. The research participants also observed that many owners operate independently, likely because few service companies offer CCF services which non-independent owners would require to be able to practice CCF. Most of the forest owners of this study were also self-operating, undertaking tasks akin to those of service companies.

Moreover, the research participants said that CCF forest owners not only manage their forests but also use their forests for recreational activities (such as picking berries and mushrooms, horse riding, mountain biking, running and hiking), timber supply, self-sufficient householding and some explicitly to mitigate climate change and conserve biodiversity within the forest. For people to enjoy forest-based recreation, the forest owners were said to need to manage their forests in specific ways to provide an environment suitable for forest-based recreation. This would entail creating game-suitable habitats and environments where berries, mushrooms and other wildlife thrive and accessible trails to forest areas.

These different activities can be seen as bundles of practices that link to their overall CCF management. The concepts of intersecting circuits and zones of overlap are especially evident in forest ownership practices, as many bundles of practices intersect with their forest management, such as recreational activities and environmentalism.

5.5.2 Elements of Meanings – Multifaceted Motivations and Dynamics Behind CCF Adoption

All the research participants said that forest recreation and love for forests are the main reasons forest owners engage in CCF. The forest is seen as an essential recreational environment for physical and mental health, and the aesthetics of the forest is a crucial aspect of the level of enjoyment attained from the forest. Here, intersecting circuits of personal pleasure and ecological preservation converge, reflecting a profound intertwining of recreational joy and commitment to safeguarding natural havens.

Furthermore, many forest owners aimed to have a self-sufficient household of certain food stocks such as berries, mushrooms and meat. This synergy underscores a zone of overlap where ecological balance and self-sufficient sustenance coexist harmoniously, enabling CCF implementation.

Another drive among the forest owners (and other actors engaged in CCF) was environmentalism. All the research participants spoke of the need to mitigate climate change and strengthen biodiversity in forests and saw CCF as the only and easiest way of achieving sustainable forestry. Practising CCF was also said to decrease anxieties over climate change and nature destruction. Some said creating a better environment for the next generation was comforting. Here, the making of

links between CCF adoption and ecological well-being emerges as a strategic approach to mitigate anxieties about climate change.

CCF forest owners were also said to value economic prosperity to various degrees. The main goal for almost all the forest owners who practised CCF was to achieve profitable and environmentally sustainable forest management. This can be understood as a diverging circuit of value interpretation. Economic aspirations intersect with environmental sustainability, forging a dual ambition for forest management that is both profitable and ecologically sound. These intersecting circuits of economic and ecological value highlight the dynamic purposes within forest ownership, involving several ideas of successful forest management.

Similarly to service providers, community and exchange of information between other forest managers seemed to be an essential part of what excited forest owners to choose CCF, further strengthening this mutual feedback loop.

CCF forest owners also valued heritage preservation, specifically the preservation of specific sites in the forest with sentimental value. These sites often had high nature values and were best preserved through CCF methods, such as replantation of the same types of tree species after felling or avoiding felling at the sites. This sentiment links ancestral memories and ecological values, resulting in the preservation of forest sites with sentimental and ecological importance. These linkages highlight the significance of CCF methods, linking heritage with ecological health.

Moreover, research participants discussed that women, often newcomers to forest management, might be more open to experimenting with new forest methods as they may not have set ideas of how to do things yet—a perspective shared by both men and women in the study. As the number of women forest owners continues to grow, research participants believe that this trend could lead to an increased demand for CCF services.

Co-owning forest owners interested or engaged in CCF were not always unanimous on managing their forests with CCF. The research participants shared several stories and experiences of quarrels and family disputes. Some had convinced their family members to try CCF, while others had been overruled to practice conventional forestry. One of the co-owning forest owners told a story about a friend who also had tried to convince their co-owning family members to start with CCF when they inherited their family estate. This suggestion started a significant conflict and resulted in the friend being alienated from the family.

The co-owning forest owners interested in CCF represent a unique circuit of practices where their aspirations and preferences for adopting CCF intersect with the broader context of family dynamics and ownership. The conflicts and disputes within this circuit reveal the intricate interplay between individual intentions and collective decisions.

5.5.3 Elements of Competence – Fostering CCF Through Knowledge and Collaboration

Becoming competent in CCF was regarded as the key to achieving profitable and environmentally sustainable CCF management for forest owners. Knowledge in both theoretical and practical CCF not only made those forest owners who wanted to be self-operating to perform most forest management tasks themselves, but it also helped forest owners to communicate with hired companies and co-owners. A thorough understanding of CCF made it easier for forest owners to explain and discuss management plans and tactics with forest service companies inexperienced with CCF. It also enabled the forest owners to discuss and convince their co-owners (often family members) to practice CCF.

Finding that few companies offer CCF pose some obstacles to forest owners' CCF practices. Many research participants shared stories of forest owners failing to get desired CCF services due to miscommunication and lack of competencies in CCF. Owners seeking CCF from less-competent companies were said to need high ordering competencies to convey their goals and preferences clearly. Inadequate knowledge can result in miscommunication and disappointment. The concept of breaking links arises when owners struggle to get proper CCF services due to a lack of competence, hindering effective communication and adoption.

Achieving success in CCF was said to demand time, planning, physical work, and knowledge. Forest owners also had to invest in learning through alternative activities such as visiting other CCF forests, attending alternative courses, and reading relevant materials. These efforts establish vital links to external knowledge sources, empowering them to improve their CCF practices and make more informed decisions.

Other aspects of forest ownership competencies involve keeping within the law (like applying for felling permissions), figuring out the aims of their forest, planning and coming to agreements with co-owners (family/relatives) on forest management decisions and styles. Many forest owners discussed experimenting with various CCF methods to determine the most suitable and economically viable approach for their specific forests and goals. For instance, to enable forest-based recreation activities, forest owners need to know how to create a prosperous environment for game, berries, mushrooms and wildlife, which would entail knowledge of nature, ecological processes, and biodiversity. Forest owners also need to be able to prune trails and select tree species that create an attractive polyculture. They may also have contact with hunting teams to hear requests on forest management methods appropriate for hunting.

The forest owners' competencies seem to be a pivotal factor that can either facilitate or impede the adoption of CCF. Considering the notion of zones of overlap, the convergence of knowledge between forest owners and service companies emerges as a significant determinant for successful service provision

and favourable forest management results. On the other hand, the limited availability of companies offering CCF services creates a zone of overlap that hinders CCF adoption. Forest owners' lack of understanding and competence in CCF methods and service companies' insufficient knowledge lead to misaligned expectations and disappointing outcomes. This lack of overlap in competencies results in barriers to effective communication and collaboration.

5.6 Forest Advisory Practices

5.6.1 Material Elements – Conventional Advice Dominates, While CCF Advice is Found Through Alternative Sources and Networking

Advisory practices cover activities like education, lectures, and personal guidance and almost all research participants were involved in some forest advisory activity, making it integral to CCF practices.

Based on the stories of the research participants, two main advisory practices emerged: conventional forestry and CCF. Conventional advice comes from larger entities like big forest companies, most service firms, and forestry schools. CCF advice primarily originates from small-scale forest owners, specialised CCF companies, and some academic institutions. Notably, universities and the SFA dabble in both. The Swedish Agricultural University leans towards conventional methods but does provide CCF education. The SFA mainly endorses conventional methods but offers some Closer-to-Nature education.

As previously mentioned, information on CCF is scarce. The research participants thus gave and sought advice in multiple alternative settings, such as CCF-specialised companies, books, online forums, and alternative education. Forest site visits were said to be another common activity for conventional and CCF advisory practices. However, forest site visits seemed more important for CCF practices as they functioned as “living labs”, demonstrating CCF's potential to the broader industry. Some living labs were even specific research projects involving various stakeholders, including forest managers, NGOs and researchers.

5.6.2 Elements of Meanings – Divergent Meanings and Disconnections

The meanings of forest advisory practices advocating CCF circled mostly around achieving economic sustainability compatible with high biodiversity in forests. The objectives mentioned by the research participants included boosting and raising CCF awareness, understanding the relationship between forestry methods and their

impact on biodiversity and climate, and offering tools to facilitate communication among forest managers.

The meanings of conventional forest advisors, on the other hand, influenced by the forest industry's norms on high timber production favoured economic gains, typically seeing CCF as non-viable in economic terms, according to the research participants. The prevailing conventional advice can be seen as links being made and reinforced to the industry's dominant norms on CCF as economically non-viable, which might deter practitioners from considering CCF, thus creating barriers to CCF adoption. On the other hand, the emergence of forest advisory practices advocating for CCF by showcasing proof of economic viability, for example through research projects, can break links with the perception that CCF is non-viable.

5.6.3 Elements of Competencies – Limited CCF Information, Conventional Forestry Influence, and Prerequisite Devotion

Both advisory practices required specific competencies to give appropriate advice on forest management. However, CCF advice involved more competencies in achieving forests with ecological and economic values. These competencies were beyond traditional forestry education and involved CCF courses by the SFA or CCF specialised companies, personal experiences and social learning and networking, even across countries. Some had, for instance, gone on organised forest visits to Germany to learn more about a specific type of CCF called “The Lübeck method”.

Due to the effort it took to become competent in CCF, some research participants believed one must be genuinely devoted to CCF, often driven by values like environmentalism and a love for biodiverse forests. Without this dedication, many forest managers default to adhere to conventional forestry advice from major advisors like FOAs, according to the research participants.

The consistent focus on conventional forestry within advisory spaces can reinforce entrenched norms, impeding the integration of CCF-related discussions relating to the concept of circuits of endurance through consistency. This sustained emphasis may challenge novel concepts, like CCF, to gain prominence. However, the emergence of advisory practices specialising in CCF can create new links to material elements that provide practitioners with information, tools, and resources specific to CCF. These links may break from the conventional forestry approach and foster the development of competencies related to CCF.

Moreover, diverse forest managers meet in these advisory settings, sharing varied CCF perspectives. Whether it is forest owners seeking advice or industry professionals attending specialised lectures, these interactions exemplify zones of overlap where differing practices overlap. Such overlaps stimulate discussions on

the advantages and challenges of different CCF methods, which were observed during the SFA and CCF company's lectures. This interaction also fosters intersecting circuits of feedback loops, refining CCF methods.

6. Discussion

6.1 Policy and Industry Power – How Industry Systems and Policies Shape CCF

The findings illuminate how forest policy and regulation practices intricately link to forest management practices and shape the boundaries and possibilities of implementing CCF. The Freedom under responsibility policy was a pivotal material element within the complex of CCF practices. This policy was an aspect that enabled the research participants to encourage each other to define their goals and demand services that aligned with their visions of CCF management. This discovery exemplifies that this policy indeed grants certain agency to forest owners in decision-making. This policy's significance exemplifies how a material element functions as a link-maker, facilitating connections between forest owners and decision-making in CCF practices by granting them a certain degree of agency to shape the direction of their forestry endeavours. This effectively breaks away from traditional approaches and forges new links towards alternative forestry and CCF. However, this agency was also impeded by the influences of other practices, which challenged the research participants' implementation of CCF and prevented other forest owners from gaining awareness of CCF. This was exemplified in the research participants' stories of forest owners getting persistent advice from FOAs and service companies to manage forests with conventional forestry methods, even to those who requested CCF services. The significant influence of forest companies and FOAs also resonates with previous research on Swedish forest management (Hertog et al., 2022, Wallin, 2017, Lodin, 2020).

Another essential element in policy practices was the historical production-oriented Forestry Act. This policy was said to have altered the entire forest industry's systems and mechanisms. It persistently influenced contemporary practices, resulting in monoculture forests, entrenched industry systems, biased research paradigms, methods, norms and guidance favouring conventional forestry and production-centred objectives. The lingering effects of these historic regulations challenged the research participants in their CCF endeavours in several ways, illustrating the concept of zones of overlap between past and present

practices. One of the biggest concerns related to the effects of the historic production objective policies was the entrenched industry systems, where ties to timber production objectives and timber contracts obstructed many professionals from offering CCF services, seeking new competencies and advocating CCF. The market logic governing timber production is essential in understanding the potential motivations and resistance to adopting CCF. These implicating ties to timber practices have also been registered in previous research on Swedish forest management (Lodin, 2020, Hertog et al., 2022, Wallin, 2017). Another lingering effect of the previous policies is the monoculture forest plantations, which made it difficult for the research participants to grow multispecies in previously monoculture-managed forests successfully.

Two current regulations were also found to be of importance for the research participants' endeavours in CFF, one enabled CCF, the other challenged it. Research participants were concerned that their CCF efforts might result in harvesting restrictions and halt their CCF management due to regulations protecting ecologically valuable forests. These concerns have also been documented in Hertog et al.'s study (2022). On the other hand, the conservation subsidy offers economic incentives for conservation services, which was said to motivate service companies to provide specific CCF services, thus enabling forest owners to purchase them. This subsidy forms a linkage between nature conservation, financial gains, and CCF services, ultimately facilitating CCF.

Amidst these policy dynamics, the competencies of forest practitioners play a pivotal role. Understanding policies, aligning practices with regulations, and effectively engaging with stakeholders demand a nuanced grasp of the regulatory terrain. Diplomacy becomes crucial for advocates of CCF, given potential hindrances posed by historical influences and institutional preferences.

6.2 Researchers' Role in Validating or Challenging the Validity of CCF

The examination of forest research practices unveils how research acts as a guiding compass for forest management decisions on CCF. The quantity, quality and focus of CCF research were thought to significantly influence public opinion on CCF and shape meaning and decision-making regarding CCF in Swedish forestry. Research was thus seen to hold the power to validate or challenge the viability of CCF, impacting its adoption trajectory. The perceived scarcity and inadequacy of CCF research methods were seen to potentially hinder the accurate representation of CCF's benefits and sustainability. The shortage of research on CCF has also been documented to influence CCF adoption in previous research (Sténs et al., 2019; Hertog et al., 2022).

Additionally, two research factions, one focused on environmental sustainability and the other on economic viability, were said to influence CCF research significantly. An illustrative case of forest research's influence is evident in how regular service companies draw their competencies from Skogforsk's research, which predominantly supports conventional forestry.

Despite the challenges posed by the scarcity and limited research methodologies in the CCF field, it motivated the research participants to actively participate in research projects to enhance research methods and promote CCF adoption, such as living labs of forest projects, and this study.

6.3 The Importance of Diverse Perspectives in Forest Advise

Underscored in the findings was the significance of forest advisory practices, as they were highly integrated and interconnected with forest management, specifically regarding CCF management. The limited availability of comprehensive CCF information, the persistent emphasis on conventional forestry norms and the lack of competencies in CCF among mainstream advisors and in education, coupled with economic- and time constraints among forest management practitioners seeking to acquire CCF competencies, emerged as significant hurdles for CCF implementation. Additionally, industry actors serving as advisors who frequently question the economic viability of CCF were also identified as challenging CCF implementation. These results echo the findings from Hertog et al. (2022), Lodin (2020) and international studies like Kiisel and Remm (2022) and seem to reinforce established paradigms, impeding the integration of CCF advice.

Moreover, CCF advisors demonstrated a need for more extensive competencies than their conventional counterparts. However, the need to go beyond mainstream sources for advice on CCF has resulted in new links to alternative learning and advisory practices that foster CCF management, specifically through experimental management approaches, new collaborative networks of social learning and the emergence of companies offering education in CCF in the form of courses, lectures and books. The making of these links enables practitioners to break from traditional practices and explore CCF methods. Advise was given and sought in a network of mixed forest managers engaged in CCF. These collaborative learning processes correlate with Hertog et al.'s findings on it being a key enabler for CCF implementation (2022).

Moreover, overlapping zones emerge when conventional forestry practitioners engage with those devoted to CCF, fostering cross-practice learning and information exchange. Examples include service companies seeking advice from CCF specialists and forest owners requesting CCF services from traditional

providers. This interaction introduces conventional practitioners to new CCF concepts, sparking discussions on its viability and potentially resolving disagreements.

6.4 Services and Ownership Symbiosis

Another emphasis in the findings was the pivotal role of forest service and forest ownership practices in integrating CCF. CCF services operate with distinct operational management approaches, which are divergent from conventional methods, thus playing a key role in collaborative forest management by providing essential services to forest owners who do not do operative work. The successful deployment of CCF services crucially hinges on aligning providers' specialised expertise with clients' specific needs. However, as previously mentioned, challenges arise due to heavy production objectives in industry systems, research, and advice, imposing constraints on their abilities to explore CCF methods and deliver successful CCF services. Similar to findings in Hokajärvi et al.'s (2009) Finnish study, the research participants noted that conventional service workers had difficulty reconciling high timber felling objectives with the diverse goals of CCF forest owners.

Competence emerges here as a foundation for realising successful CCF implementation for both forest owners and service providers. However, the scarcity of research, advice, and competent service providers, which was also evident in Hertog et al.'s (2022) findings, presents communicative challenges that sometimes lead to miscommunication and unmet expectations that hinder collaboration. Amidst these challenges, social learning emerges as a pathway to CCF progress. For example, successful CCF service workers cultivate their expertise by developing strategies and tactics together with forest owners. This bridge between forest owners and external expertise nurtures a fertile ground for collaboration, creating intersecting circuits of feedback loops of shared insights, understandings and evolving strategies and methods unique to CCF, where the lines between service providers and clients blur.

The meanings within forest owners and service providers engaged in CCF become particularly relevant for CCF adoption. The research participants said that service practitioners strongly emphasise fostering positive work environments while generating revenue, which CCF could offer. They also considered CCF profitable and strongly emphasised that it could be so for others, a result that goes against the findings in Hertog et al.'s study (2022). Notably, the findings also highlight risk-taking inherent in service practices, stemming from the possibility of unsettling established norms and collaborations. This resonates with Primmer's (2010) study on Finnish forest professionals, which revealed more concern about peers' opinions regarding nature conservation than those of the broader society.

However, in this study, the potential rewards intrinsic to CCF service work were found to render the associated challenges worthwhile, according to the research participants.

On the other hand, forest owners balance profitability aims with the meanings of interconnected bundles of practices that span beyond forest management. These bundles encompass practices of a wide array, from recreational endeavours to timber and food supply and environmental stewardship, which all resonate with CCF. These bundles of practices and the aims within them also confirm those found in previous research on Swedish and Finnish/UK forest ownership (Hugosson & Ingemarson, 2004; Nordlund and Westin, 2011, Sutherland and Huttunen, 2018). The elements within these bundles of practices harmonise with CCF, creating intersecting circuits and overlapping zones that enable the research participants to embrace CCF.

Furthermore, competencies in CCF played a crucial role in forest owners' ability to explain and persuade their co-owners to adopt CCF. Co-owning families represent a unique circuit of practices where individual intentions intersect with the broader context of collective decisions, family dynamics and ownership. As Törnqvist's (1995) research points out, decision-making in ownership structures is indeed influenced by family dynamics.

The research participants also discussed gender. Echoing previous research findings that gender could contribute to deviating from established norms in forestry (Bergstén et al., 2020), the research participants said new female forest owners, lacking established forest management practices, might be more open to exploring alternatives like CCF. As the number of women entering forest ownership grows, it could potentially drive an increased demand for CCF services.

6.5 Implications and Solutions

To tackle the challenges found in policy practices, it might be time to re-evaluate the distinct division between conservation and production forests that signifies Sweden's policies and regulations on achieving a strong bioeconomy, as the research participants claim CCF is both economically and ecologically viable. The promotion of CCF by governing bodies should thus encompass not only conservation forests but also productive ones. Furthermore, there should perhaps be an explicit guarantee that CCF-managed forests will not be seized for conservation purposes, even if they attain exceptionally high ecological value. This assurance could prevent forest managers from being deterred in their CCF endeavours.

Regarding challenges to CCF inherent in the forest industry, timber contracts stood out as particularly hindering. Since CCF production cannot meet the standard timber quotas, the timber quota contracts restrict professionals from pursuing CCF

practices. Re-evaluating the timber quota system to accommodate CCF can address these challenges. Another suggestion from the research participants is to establish a new wood certification specific to CCF, which could ensure market recognition and increase demand.

As the forest industry advocates conventional forestry, they can affect forest managers' decisions and abilities to pursue CCF. However, there are CCF practitioners who are willing to discuss and teach mainstream professionals on CCF. Mainstream professionals should thus capitalise on their interest in acquiring, collaboratively developing and sharing competencies about CCF. These interactions can create intersecting circuits of fruitful feedback loops for CCF and the breaking of links to conventional forestry norms, ideas and methods. This process could then lead to broader advocacy for CCF practices within these organisations, resulting in increased resources and guidance for employers and more CCF service options for forest owners interested in transitioning to CCF.

Solving the challenges of research scarcity and inadequate research methodology on CCF is crucial in enabling more CCF. A governmental encouragement of increasing research on CCF within Skogforsk, the SFA and universities, including experienced CCF practitioners, can provide the necessary evidence to counter biases in research paradigms favouring conventional forestry.

To encourage more research on CCF, it is imperative to create incentives focusing on exploring its economic, social, and ecological viability. Increasing funding for living lab projects focused on testing CCF methods can provide valuable empirical data and insights to inform the refinement of CCF practices. Furthermore, experienced CCF practitioners should be actively involved in research endeavours. Their practical insights and on-ground experiences can significantly contribute to developing effective CCF methodologies and practices.

The general lack of theoretical and practical information on CCF was another significant obstacle in practising CCF. Promoting new networks for knowledge exchange on CCF methods, like investing in those already in place among devoted CCF practitioners (CCF specialised companies, research projects, private networks), can contribute to the dissemination and development of CCF knowledge among various actors. The SFA and Skogforsk should also allocate additional resources to develop practical courses in CCF to aid CCF endeavours further.

Public campaigns could serve as another effective method for increasing awareness regarding CCF's economic and ecological feasibility. Emphasising CCF's capacity to improve working conditions for operational professionals while achieving financial viability, creating forests suitable for recreational activities, and mitigating climate and ecological issues can strengthen the connections to various elements within interconnected practices, thereby generating greater interest in CCF.

6.6 Addressing Limitations and Future Research

The study has potential limitations affecting its validity and generalizability. By only considering CCF practitioners' views, it may not capture the complete influence of all forest management practices on CCF adoption. The study's online-only approach might lack depth compared to in-person insights. Thus, while the findings provide value within set parameters, caution should be exercised when applying these findings to broader contexts or making generalisable conclusions about CCF forest management in Sweden as a whole.

Future research could expand on this study, delving into unobserved practice settings like on-site forest operations, meetings between service providers and clients, or interactions among forest advisors. Collaborative research with experienced CCF practitioners, comprehensive economic-environmental viability studies, and cross-national comparisons can further deepen understanding. This would bridge theoretical and practical gaps in CCF research while addressing Sweden's environmental and economic forestry challenges.

7. Conclusion

By employing a social practice-based approach and qualitative interviews and observations to study the experiences of various forest management practitioners, it has been possible to uncover enabling factors and challenges within the complex web of CCF practices. Notably, the findings highlight collaboration among different practices and the motivation of service workers and forest owners as key enabling factors. Additionally, independent companies offering CCF education, research projects, and international knowledge exchange networks play pivotal roles in promoting and enabling CCF management. Prominent obstacles have been identified as lingering effects of historic policies, such as industry systems designed to foster high timber production, conventional forestry norms and a scarcity of information, advice, services and research in CCF.

Moreover, the study underscores the pressing need to re-evaluate the dichotomy between conservation and production forests, ensuring that CCF promotion extends to productive forests. This also involves a suggestion to clarify that CCF-managed forests will not be seized for conservation purposes, even if they attain exceptionally high ecological value. Another suggestion is to investigate alternative timber contracts and establish a new certification for CCF wood, together increasing CCF demands. Finally, the study emphasises the importance of diverse perspectives in advisory practices and calls for increased, nuanced, and collaborative research on CCF's viability within Sweden's evolving forestry landscape. This research contributes to understanding the intricate dynamics of CCF adoption in Sweden, offering insights into the complexities of sustainable forest management and its potential to reconcile production objectives with ecological conservation in the context of a changing bioeconomy.

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9. Popular Science Summary

Unlocking Sustainable Forest Management: The Rise of Continuous Cover Forestry in Sweden

In the heart of Sweden's vast forests, a delicate balancing act unfolds—one that seeks harmony between sustainable timber production and the preservation of biodiversity. Yet, this balance is a difficult challenge to maintain in practice. Policies and influential industry players in Sweden emphasise the crucial role of forests in combating climate change, advocating for increased production to meet the growing demand for forest resources and carbon capture. However, Swedish forestry is already intensive, necessitating more diverse management approaches and increased protection of forested areas to preserve biodiversity. Recent extensive storm damage and infestations, such as the spruce bark beetle, underscore the growing risks of the current monoculture and clear-felled dominated forestry, risks that are expected to worsen in a warmer climate.

Swedish Forestry is also facing increased scrutiny from the EU and the general public debate for its environmental impact. EU's new forest strategy for 2030 demands member states to improve ecological sustainability in forests, and there is increased critical focus on Sweden's forest model in research and media coverage. More sustainable approaches like Continuous Cover Forestry (CCF) are gaining momentum in addressing these concerns. CCF strives to maintain continuous forest cover by selectively removing individual trees or small patches, preserving the ecological integrity of the forest while enabling sustainable timber extraction. Scientific research has also illuminated the numerous advantages of CCF. Studies have highlighted its ecological benefits over clear-cut forestry, showcasing how it contributes to ecosystem services and climate resilience. CCF has the potential to store carbon, promote biodiversity, and offer social advantages. These findings emphasise its role in achieving climate and environmental goals while ensuring a sustainable timber supply.

It seems likely that a transformation is on the horizon for Sweden's forestry sector, and there are already signs of growing recognition of CCF within Swedish forest policy. Since 2005, the Swedish Forest Agency (SFA) has been actively accumulating knowledge about CCF to understand suitable methods for alternative forestry practices better. In 2021, a significant step was taken when the SFA

introduced guidelines and a formal definition for CCF in Sweden. However, its adoption in actual production forests remains scarce, emphasising the pressing need for further investigation into how CCF adoption can increase in Sweden's forests. To understand why CCF adoption faces challenges and how it can be increased, it's crucial to consider Sweden's complex forest management landscape.

Navigating the Forest Management Maze: The Role of Various Stakeholders

The forest sector in Sweden involves a lot of different people and organisations, like politicians and governmental institutions, forest owners, forest owners' associations, timber sellers, educational institutions, service providers and the SFA. They all influence how the forests are managed. All these stakeholders play a vital role in introducing and transitioning to new forest management methods, making changes complex. It's like solving a puzzle with many pieces, and each piece represents someone's thoughts and decisions. This thesis aims to explore how these puzzle pieces fit together.

The Missing Piece in Research: Exploring the Journey to Sustainable Forest Management

Previous research on implementing CCF in Sweden has identified various challenges and facilitators, such as power dynamics in policy governance, the influence of other actors, and the need for collaborative learning among CCF practitioners. However, there needs to be more research to understand the experiences of successful CCF practitioners and the specific factors that enable or challenge their transitions. This thesis fills this gap by exploring the unique perspectives of successful CCF managers and shedding light on the decision-making processes that contribute to sustainable forest management in Sweden.

Aim and Research Design

The thesis aims to learn from forest managers who are using CCF methods in their forest management. By exploring the experiences of different forest managers engaged in CCF, we can discover what has enabled them and made it challenging for them to transition to CCF management. Focusing on their experiences in all aspects of practising CCF, including how they engage with others in their forest management, helps us to see how multiple components affect their transition to CCF. This can help us understand the processes involved in successful transitions and navigate pathways to ensure a successful shift towards more CCF in Sweden's forestry.

Theory and Methods Used to Collect and Understand Forest Managers' Experiences

This thesis has used a theoretical framework called "social practice theory" to analyse how CCF forest management practices evolve and are influenced by various factors. This theory examines practices as routine activities influenced by individual actions, social structures, and material resources. This framework examines the complex connections of elements between different practices. The elements consist of materials, competencies, and meanings. Materials are the physical things and resources needed for a particular activity. For CCF management, this includes materials like people, rules, contracts, trees, tools, and the wood itself. Competence refers to people's knowledge, skills, and abilities to do an activity successfully. In the case of CCF management, competencies involve forest planning, learning about biodiversity and mastering felling techniques. Meanings are about the ideas and norms within the activity. For CCF management, it could be about preferring specific methods, considering others' opinions, feeling responsible for nature, and people's emotional connection with forests. By understanding these integrated and complex connections, we can gain insights into how different practices affect the adoption of CCF.

The research relies on interviews and observations of various forest management practitioners actively involved in CCF. The research participants were a diverse set of forest management practitioners, including foresters, forest advisors, forest entrepreneurs, and forest service workers.

Uncovering the Enabling and Challenging Factors Influencing the Implementation of CCF

Through the social practice-based approach, the study was able to reveal the interplay of elements within various forest management practices, including timber, research, policies, advice, services, and ownership, and how they influence the adoption of CCF. The findings reveal a complex interplay of factors within CCF practices, confirming previous research and shedding light on fresh insights into the subject. The study finds that forest policies and regulations, particularly the "Freedom under responsibility" policy, grant forest owners agency in shaping CCF adoption. However, this agency is hindered by the influence of other practices, such as FOAs and service companies, favouring conventional forestry methods.

Historical policies, like the Production-oriented Forestry Act, continue to impact the industry, obstructing CCF practices. Timber objectives and quotas also pose significant challenges, limiting the adoption of CCF. Forest research practices shape the perception of CCF's viability, and the scarcity of CCF research hinders its adoption. Forest advisory practices predominantly favour conventional forestry, creating obstacles to CCF implementation.

Furthermore, CCF services play a crucial role, but challenges arise due to existing industry norms and timber contracts. Competencies in CCF are essential for forest owners and service providers to navigate these challenges. The study also highlights that family dynamics in shared forest ownership can either support or hinder CCF adoption.

Toward a Greener Future: Recommendations for Sustainable Forest Management

To promote CCF in Sweden, the study suggests reevaluating the division between conservation and production forests, addressing challenges in timber contracts, broadening advocacy for CCF within advisory services, increasing research on CCF's viability, involving experienced CCF practitioners in research, promoting international knowledge exchange, and utilising public campaigns to raise awareness about CCF's benefits.

Beyond the Thesis: Future Frontiers in Sustainable Forestry

While the study offers valuable insights into CCF adoption, it has limitations, such as focusing solely on CCF practitioners' perspectives and conducting research primarily in online settings. Future research should explore interactions among various forest management practitioners, including those practising conventional forestry, and examine unobserved practice spheres. Cross-national comparative studies and assessments of CCF's economic and environmental impacts are also recommended to advance our understanding of sustainable forestry practices.

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