Chapter 1
Introduction

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Abstract

- In this book we summarize peer-reviewed scientific articles and research reports from Finland, Sweden, and Norway on continuous cover forestry (CCF), i.e. forestry without clearcutting
- This book originates from growing interest in CCF among various stakeholders, and aims to promote discussion, further research, and inform decision-makers
- The book targets those interested in boreal forests, forest management, and ecosystem services
- In this chapter we review the background to the use of CCF and the reasons that led to its prohibition and subsequent resurgence in the Nordic countries

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1.1 Why This Book

In this book we have compiled research results, mainly from Finland, Sweden and Norway, as a basis for describing the current state of knowledge about, and experience of, forestry using methods without clearcutting.

"Without clearcutting" opens up for a multitude of definitions and ambiguities. Clearcutting is the prevailing method of wood procurement in the three countries, involving a final felling of forests, creating clearcuts that are then regenerated to form even-aged stands. In this book, we will be addressing forest management methods that involve no clearcutting, and throughout the text we call this continuous cover forestry (CCF).

Our focus is on forestry and silviculture in the three Nordic countries, Norway, Sweden and Finland, now and in the near future, with the assumption that needs and demands relating to the ecosystem services will remain the same as today. The idea of writing this book originates from the increasing interest in CCF among practitioners, politicians and society in general. We saw an interest and a need to compile and summarise our knowledge as researchers.

Our geographical framework is the boreal forest of the Fennoscandian Peninsula, a region dominated by coniferous forests of primarily Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*). The most common broadleaves in the region are silver and downy birch (*Betula pendula*, *Betula pubescens*), aspen (*Populus tremula*), and alder (*Alnus incana*, *Alnus glutinosa*). The climate is shaped by the northerly latitude, with large contrasts between winter and summer light and temperatures, but is also influenced by proximity to the Atlantic current, the Gulf Stream, which moderates cold winter temperatures.

The potential reader of the book (you) is someone who has, in some way, invested in learning more about the boreal forest and/or the use of forest products and ecosystem services. You may be a forest owner, forest worker, timber buyer, farmer, or reindeer herder, or you may simply be interested in forests and how they are managed. The text offers valuable information for researchers and students of natural resources, and for any students who want to learn more about CCF. We hope this book can promote discussion and further research, and believe it could be useful for decision makers at local, national, or international levels.

Our aim is to give an overview of the complexity and scope of the subject in the region, and to provide pathways to further reading and inspiration.

1.2 How to Use This Book, and a Brief Summary of the Chapters

We have summarised the published knowledge, mainly from peer-reviewed scientific articles and research reports. Experts across a diverse range of scientific disciplines have contributed their insights and experience (Fig. 1.1), and each chapter is written by of a team of researchers from Norway, Sweden and Finland. The authors have validated the sources and synthesised the most relevant knowledge from their field. They have also identified current knowledge gaps regarding conversion to CCF and CCF methods.

Each chapter can be read more or less as a standalone review of a certain aspect of CCF, but we recommend the reader to begin with Chap. 2, where the authors clarify definitions and methods described in the remainder of the book. We define what we understand as CCF but also what we mean by conversion to CCF from other forest management types. We also introduce terminology and methods used in the three Nordic countries, and national legislation pertaining to the issue. Throughout the book, CCF methods are compared to forest management methods

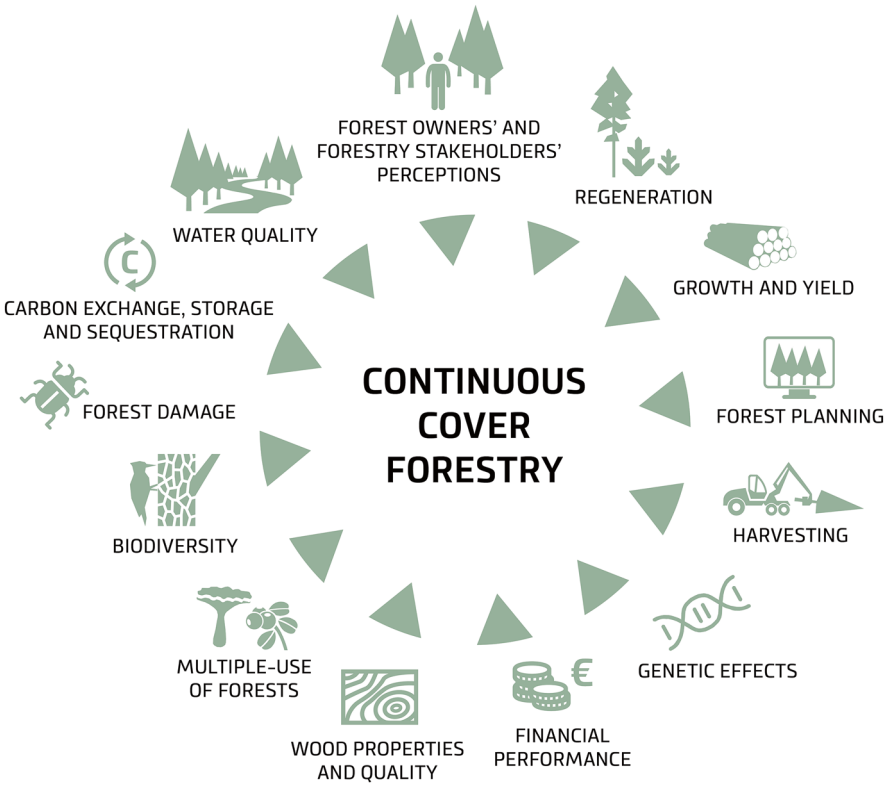

Fig. 1.1 Continuous cover forestry issues covered in this book

that do not aim to maintain a continuous forest cover. In practical forestry and media, these methods are commonly referred to as rotation forest management or rotation forestry (RF). Strictly speaking, this is not entirely accurate. As explained in Chap. 2, some cutting regimes under RF can also be considered CCF. However, the term RF, used as an alternative to CCF, has become established in the language of forestry professionals, media and even science. We therefore use the term RF also in this book in this context.

In Chaps. 3 and 4 we review cultivation of the boreal tree species under CCF, in terms of regeneration methods, growth and yield. Regeneration refers to active methods to achieve recruitment after one or more trees have been harvested, and includes both site preparation and the recruitment source (e.g., seeds or seedlings). In addressing growth and yield we highlight experiences gained from previous experiments, observations, and scenario analyses relating to CCF methods. In Chap. 5 we examine forest planning and how the national decision support systems can be applied to CCF systems.

Related to forest management are logging operations and possible similarities and differences between CCF and other management methods. These are addressed in Chap. 6, acknowledging that, even though the forest owner makes the decisions on which management system is to be used, the harvester operator is a crucial factor in the quality of the work.

Interest in the impacts of CCF methods on long-term growth and population genetics of trees will increase in view of a changing climate. In Chap. 7 the authors elaborate on what are important factors for breeding and how management can affect population genetics.

Chapter 8 addresses financial implications of CCF, together with a compilation of how financial aspects are analysed in many forest management systems. The financial outcome is also impacted by timber prices and management and harvesting costs, and how wood quality and characteristics are affected by the CCF method; the latter are outlined in Chap. 9. However, the forest produces more than wood, so in Chap. 10 we show how other provisioning services might be affected by CCF, in an overview of the multiple use of forests.

The effects of CCF on forest conservation and biodiversity are reviewed in Chap. 11, with emphasis on comparisons with clearcutting methods. Common to all the harvesting systems is the reduction in amount of large, old trees and dead wood. We consider biodiversity and forest conservation measures that can be important for CCF.

Forest health is important for the future provisioning of forest ecosystem services, so in Chap. 12 we assess how biotic and abiotic damage agents can interact with the choice of forestry system. Carbon exchange, storage and sequestration are in focus in Chap. 13, where we elaborate on how CCF methods might change the magnitude of carbon pool fluxes. In Chap. 14, the impact of CCF on water quality and riparian zones is discussed, and compared with corresponding existing knowledge regarding clearcutting systems.

Finally, in Chap. 15, we conclude by considering barriers to applying, and/or converting to, CCF, by reviewing the opinions and beliefs of stakeholders. We describe three main stakeholder groups: forest owners, the forest industry, and forest professionals, and discuss their attitudes towards CCF and potential implications.

1.3 Background to CCF in the Nordic Countries

1.3.1 Selection Cutting and Selective Logging

Discussions between advocates of CCF and RF have a long history in Fennoscandia. For Sweden, see e.g. Ström (1830), Kempe (1894) and Amilon (1930); for Norway, see Opsahl (1923), Eide (1936) and Barth (1937); for Finland, see Cajander (1910), Heikinheimo (1924), Hertz (1930) and Sarvas (1944).

Both systems can be traced back to the Middle Ages. There is evidence that regulated selective logging was applied in French broadleaved forests in the 1200s. Early development of selective logging included minimum periods between cuts (cutting cycles) and limits to harvesting rates (Hawkins 1962; Lundqvist 2005).

Policies and land tenure have changed considerably in Europe over the centuries. These often resulted in widespread use of exploitive and destructive forms of selection harvesting, today often referred to as selective logging (O'Hara 2014). Valuable trees were harvested, and stand recovery was left to chance. As a result, selective logging was restricted and banned in state- and company-owned forests in the mid-1800s. RF began to dominate in these forests instead.

In Fennoscandia, CCF was generally practised in the form of selective logging with pre-mature re-entries. One result was depleted stands with unstocked gaps (Lundqvist 2017), which led to general concern about future timber supplies (Leikola 1987). In Finland, for example, CCF was generally considered unsuitable for Finnish forests in the early 1900s (Cajander 1910).

During the 1940s in Fennoscandia, it was concluded that selection harvesting had not produced well-regenerated forests (e.g. Sarvas 1944; Opsahl 1953). This was partly a result of misuse of the selection system, as emphasised by its advocates (Barth 1937; Bøhmer 1957), and partly because the system was applied in unsuitable forests. Consequently, selective cutting and associated systematic forms of the selection system were effectively banned in Sweden and Finland (Söderström 1971). Research on selective alternatives to RF stopped, and experimental plots were abandoned in these two countries. In Norway, selective cutting was more gradually replaced by RF, because forest administrations endorsed and eventually promoted a shift towards RF advocated by influential actors in forest research (Andreassen 1994; Nygaard and Øyen 2020).

1.3.2 Shelterwood and Group Selection

There is evidence to suggest that a shelterwood approach was used in Central Europe in the 1600s (Hånell and Holgén 1997). The system in its present form seems to have first emerged during the 1800s in Prussia. Uniform shelterwood dominates present approaches, but there are other variants.

Although shelterwood cutting has only played a minor role in the management of spruce and pine stands in Norway, the system has inspired various research initiatives, summarised in Lexerød (2001). Irregularity of seed production of Norway spruce in northern Sweden and susceptibility of both pine and spruce to wind damage has limited the use of shelterwood in Sweden (Hagner 1958, 1962; Karlsson et al. 2017). In Finland, shelterwood cutting has generally been used in RF as a method of natural regeneration for spruce (Metsänhoidon suositukset – Metsien kestävän hoidon ja käytön perusteet 2022).

Group selection has been the subject of few studies in Fennoscandia. Group selection in combination with thinning from above was advocated as early as the study by Wallmo (1897). Group selection was also recommended for Norwegian spruce and pine stands by Barth (1937), Bøhmer (1957) and Børset (1986). In recent years, gap cutting has attracted more interest in Finland, and has been studied in pine (Hallikainen et al. 2019) and spruce forests (Valkonen et al. 2011) on both mineral soils and on peatland (Hökkä et al. 2011).

1.3.3 Renaissance of CCF

Interest in conservation started to grow in the mid-1970s, but did not initially impact timber production. Social concerns, archaeological sites, reindeer husbandry, and other public interests also started to leave their mark. It took until the early 1980s for research on the subject to start afresh. Interest in alternatives to RF has increased over time, and alternatives are now practised, although still on a modest scale. Forest laws are more permissive, and forest policies can be said to encourage diversification of forest management. The same period has also witnessed changes in RF, with conservation and social aspects playing a bigger role than before.

Much attention is currently paid to a number of concepts, for example close(r)-to-nature forestry or Pro Silva, new forestry, Liberich, and the Lubeck method. However, these concepts are approaches for individual operations rather than silvicultural systems. They could be called forest management philosophies within the realm of CCF (Albrektson et al. 2008).

Another important message from history is the relatively long timescale in boreal forest systems, from a tiny seed to an old giant tree. The forest we see today is the result of decisions made in a previous society, and the changes we decide on today will take another hundred years to manifest fully.

1.4 Looking Ahead, Forest Land Use and Needs for Adaptation to CCF, Sustainability, and Societal Needs

Forest management must meet many different objectives, and discussion is ongoing about how to reconcile these objectives. The production of raw materials for various purposes, as well as carbon sequestration, biodiversity conservation, and adaptation to climate change, all create new challenges. Aiming simultaneously at different goals can also result in conflicts. Geographical location, different types of growing conditions, and the history of forest management shape our forests and affect management options.

There is an urgent need for information on the various effects of different CCF methods. To fulfil the multiple goals of forest utilisation, we need not only diversified forests but also versatile and appropriate management methods. However, the mere choice of forest management method does not guarantee the realisation of all goals. For example, securing forest biodiversity requires active conservation strategies, both in RF and CCF.

Unlike much of central Europe, CCF has not been practiced on a large scale in the past 30–40 years in Fennoscandia. Whether greater implementation of CCF in the region is realistic, and suitable for a more balanced provision of forest ecosystem services, is currently the subject of heated debate. This book aims to provide an overview of the current state of knowledge about CCF in the Nordic region, so that the discussion can be based on scientific facts, while acknowledging knowledge gaps and associated research needs.

In recent years, several new projects and research focusing on CCF have been funded in the Nordic countries, reflecting the renewed interest among forest owners and society. Current research focuses on conversion and how a broader implementation of CCF might affect the outcomes of forest management at regional and national levels. Interest in CCF and its implementation is growing rapidly across the three countries, in part because of the new EU forest strategy for 2030. Implementation particularly applies to Norway, where CCF has already been adopted in the new PEFC standards. A key question is whether calls for more CCF in the Nordic countries are appropriate and realistic. This book does not offer a definitive answer to that question, but does provide an up-to-date review of scientific knowledge relevant to the Nordic region.

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