

Dissertationes Forestales 381

**Towards multiple use of forests with non-timber forest
products – forest owners’ perspectives**

Hanna Muttilainen

School of Forest Sciences
Faculty of Science, Forestry and Technology
University of Eastern Finland

Academic dissertation

To be presented, with the permission of the Faculty of Science, Forestry and Technology of the University of Eastern Finland, for public criticism in the auditorium N100 of the University of Eastern Finland, Yliopistokatu 7, Joensuu, on the 12th of December 2025, at 12 o’clock noon.

Title of dissertation: Towards multiple use of forests with non-timber forest products – forest owners' perspectives.

Author: Hanna Muttilainen

Dissertationes Forestales 381

<https://doi.org/10.14214/df.381>

© Author

Licensed [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)

Thesis Supervisors:

Professor Teppo Hujala

School of Forest Sciences, University of Eastern Finland, Joensuu, Finland

Programme Director, Principal Scientist Mikko Kurttila

Natural Resources Institute Finland, Joensuu, Finland

Pre-examiners:

Associate Professor, Dr. Laura Secco

University of Padova, Department of land, environment, agriculture and forestry, Italy

Associate Professor, Associate Chairperson, Director of Graduate Studies, Dr. Emily J. Silver

Michigan State University, Department of Forestry, USA

Opponent:

Director, Professor Sami Kurki

University of Helsinki, Ruralia Institute, Seinäjoki, Finland

ISSN 1795-7389 (online)

ISBN 978-951-651-852-0 (pdf)

Publishers:

Finnish Society of Forest Science

Faculty of Agriculture and Forestry of the University of Helsinki

School of Forest Sciences of the University of Eastern Finland

Editorial Office:

Finnish Society of Forest Science

Viikinkaari 6, 00790 Helsinki, Finland

<https://www.dissertationesforestales.fi>

Mutttilainen, H. (2025). Towards multiple use of forests with non-timber forest products - forest owners' perspectives. *Dissertationes Forestales* 381. 66 p.
<https://doi.org/10.14214/df.381>.

ABSTRACT

Growing pressures on forest ecosystems, such as climate change and biodiversity loss, highlight the need for more diverse forest use. Non-timber forest products (NTFPs) are seen as a key component of multifunctional and sustainable forest management, yet their economic potential is underused. As the largest group of forest owners in Finland, non-industrial private forest (NIPF) owners play a key role in decision-making, influencing the entire forest sector and the future use of forest resources. Therefore, understanding forest owners' perspectives on these issues is crucial to promote multiple use of forests and support the development of NTFP-related businesses.

This thesis examines Finnish forest owners' perspectives on NTFPs, identifies forest owners' motives and the challenges in NTFP production, defines the structure of forest owners' networks and identifies value creation within NTFP networks. The study uses a mixed methods approach that combines quantitative surveys and qualitative semi-structured interviews of forest owners. Multivariate methods, principal component analysis (PCA) and K-means clustering were used to analyse the survey data, while thematic coding and social network analyses (SNA) were applied to the qualitative interviews.

The results indicate that forest owners perceive NTFPs as a valuable opportunity to diversify both forest use and income generation. Although current commercial production remains limited, a considerable share of respondents expressed strong interest in engaging in NTFP-related activities in the future. Their motivation stems from both economic values, such as additional income and stable revenue streams, and self-actualisation -related values. However, access to relevant information was identified as a clear challenge. Forest owners' networks within the NTFP sector are diverse, underscoring the important role of forest organisations and buyers of varying scales. Alongside tangible exchange, intangible elements, particularly knowledge-sharing and social values, play a crucial role. To support the development of multiple use of forestry and advance the NTFP sector, institutional support, improved access to knowledge, and cross-sectoral collaboration are essential.

Keywords: Sustainable forest use, mixed method, motives, challenges, value creation, social networks

Mutttilainen, H. (2025). Luonnontuotteiden rooli metsänkäytön monipuolistamisessa – metsänomistajien näkökulma. *Dissertationes Forestales* 381. 66 s.
<https://doi.org/10.14214/df.381>.

TIIVISTELMÄ

Ilmastonmuutos ja biodiversiteetin väheneminen lisäävät painetta metsäekosysteemejä kohtaan ja korostavat metsien käytön monipuolistamisen tarvetta. Luonnontuotteet (NTFP) nähdään keskeisenä osana monipuolista ja kestävää metsänhoitoa, mutta niiden taloudellinen potentiaali on toistaiseksi hyödynnetty heikosti. Suomessa yksityiset metsänomistajat muodostavat suurimman omistajaryhmän ja vaikuttavat päätöksillään merkittävästi metsien käyttöön ja koko metsäsektorin kehitykseen. Tämän vuoksi metsänomistajien näkökulmien ymmärtäminen on keskeistä metsien monikäytön ja luonnontuotealan liiketoiminnan kehittämiseksi.

Tämä väitöskirja tarkastelee suomalaisten metsänomistajien näkemyksiä luonnontuotteista, tunnistaa metsänomistajien motiiveja lähteä luonnontuotealalle ja käsittelee tuotantoon liittyviä haasteita. Lisäksi väitöskirja määrittelee metsänomistajien luonnontuotealan verkostojen rakennetta sekä analysoi arvonmuodostusta niissä. Tutkimuksessa sovelletaan monimenetelmällistä lähestymistapaa, jossa yhdistetään määrällinen kyselytutkimus ja laadulliset puolistrukturoidut haastattelut. Kyselyaineiston analysoinnissa käytettiin monimuuttujamenetelmiä, pääkomponenttianalyysiä (PCA) ja K-means-klusterointia. Tutkimuksen haastattelut analysoitiin teemoittelemalla, ja sosiaalisten verkostojen analyysiä (SNA) käytettiin laadullisen analyysin tukena.

Tutkimuksen tulosten mukaan metsänomistajat näkevät luonnontuotteet merkittävänä mahdollisuutena monipuolistaa sekä metsien käyttöä että tulonmuodostusta. Vaikka kaupallinen tuotanto on toistaiseksi vähäistä, huomattava osa vastaajista oli kiinnostunut luonnontuotteiden kaupallista tuotannosta tulevaisuudessa. Motivaatiota ohjaavat taloudelliset arvot, kuten lisätulojen ja vakaiden tulovirtojen tavoittelu, mutta myös itsensä toteuttamiseen liittyvät arvot. Luonnontuotteiden tuottamisen haasteeksi tunnistettiin erityisesti relevantin tiedon saatavuus. Metsänomistajien verkostot luonnontuotesektorilla ovat monimuotoisia ja niiden toiminnassa korostuvat etenkin metsäorganisaatioiden ja erikokoisten ostajien merkitys. Verkoston toimijoiden välisessä arvon vaihdannassa aineellisen vaihdannan rinnalla merkittävässä roolissa ovat tiedon jakaminen ja sosiaaliset arvot. Metsien monikäytön edistämiseksi ja luonnontuotealan kehittämiseksi tarvitaan institutionaalista tukea, parempaa tiedonsaantia sekä eri sektorit ylittävää yhteistyötä.

Avainsanat: Kestävä metsien käyttö, monimenetelmällisyys, motiivit, haasteet, arvonmuodostus, sosiaaliset verkostot

ACKNOWLEDGEMENTS

“It is a journey,” I was told. Writing a dissertation truly is a journey, with its ups and downs, twists and turns. It is not only a journey into the world of science, but also a journey into oneself. However, every journey is better with good companions, and I would like to express my deepest gratitude to all those who have supported and accompanied me along the way. First and foremost, I wish to express my sincere gratitude to my supervisors, Professor Teppo Hujala and Program Director and Principal Scientist, Dr. Mikko Kurttila, for your invaluable support and inspiration. Teppo, your insightful guidance and ability to see the bigger picture have been truly encouraging. Mikko, your expertise and pragmatic advice have been of great value, and I am especially grateful for your patience in repeatedly encouraging me to embark on this work over the years – now was finally the right time. Thank you for believing in me.

I wish to express my gratitude to the pre-examiners, Dr. Laura Secco, whose valuable comments and suggestions greatly improved the coherence of the dissertation summary, and Dr. Emily J. Silver, for your encouraging, positive and supportive feedback. My warmest thanks also go to Professor Sami Kurki for kindly accepting the role of opponent.

I am grateful to my employer, Natural Resources Institute Finland (Luke), and to my supervisor Jaana Kotro, for supporting and enabling me to carry out this dissertation alongside my work. I also wish to thank the Finnish Cultural Foundation’s South Savo Regional Fund for funding my research and allowing me to focus on writing the summary.

Warm thanks go to my co-authors, Jari Miina, Juha Vornanen, Henri Vanhanen, Ville Hallikainen, Miina Jahkonen, and Teija Kanninen. I would especially like to thank Jari for his expertise and patience in explaining statistical analyses, and for his valuable comments on the summary. I also thank Juha for the great collaboration during the projects. I am also grateful to my colleagues for the cooperation throughout this journey. Rainer and Birgitta, our discussions have broadened my perspective, and your work in NTFP field is highly valuable. Terhi and Maija, many thanks for your peer support.

Fortunately, this journey has also included much more than work. Warm thanks to all my dear friends who have supported me in one way or another along the way. I wish to thank my dance friends for bringing me joy and energy through dancing together. Heidi, many thanks for supporting throughout this journey. Mikko, thank you for helping, commenting and encouraging along the way. A very special thanks goes to my dear friend Niina. Your support through the rocky and winding parts of this journey has been invaluable. My warmest thanks to my mother Anneli and sisters Marjo and Kirsi and their families for their support and help in everyday life.

Every journey brings unexpected turns and meaningful encounters. Marko, my heartfelt thanks for joining me on this path. You bring so much joy and light into my life.

Finally, my deepest gratitude goes to my beloved sons, Viljami, Kasper, and Veeti. You have kept me grounded in everyday life and reminded me about the important things in life. You are the dearest! It is not the destination that counts, but the journey itself – and the people with whom you share it.

Mikkeli, 23 October 2025

Hanna Muttilainen

LIST OF ORIGINAL ARTICLES

This thesis is based on data presented in the following articles, referred to by the Roman Numerals I–IV.

- I** Mutttilainen H, Hallikainen V, Miina J, Vornanen J, Vanhanen H (2022). Forest owners' perspectives concerning non-timber forest products, Everyman's Rights, and organic certification of forests in Eastern Finland. *Small-Scale Forestry* 22, 69–101, 2022, <https://doi.org/10.1007/s11842-022-09528-6>

- II** Miina J, Mutttilainen H, Vornanen J, Vanhanen H (2023). Supply chain actors' perspectives concerning the cultivation of specialty wood-decay mushrooms in Finland. *Forests*, 14(1), 134 <https://doi.org/10.3390/f14010134>

- III** Mutttilainen H, Vilko J (2022). Heterogenising forestry value production – drivers and barriers of entering the non-wood forest products sector. *Current Research in Environmental Sustainability*, 4:100141, <https://doi.org/10.1016/j.crsust.2022.100141>

- IV** Mutttilainen H, Hujala T, Jahkonen M, Kanniaainen T, Miina J, Kurttila M (2025). Social networks of forest owners producing non-timber forest products – network structures and dynamics of exchanges. *Scandinavian Journal of Forest Research*, 1–15. <https://doi.org/10.1080/02827581.2025.2563600>

AUTHOR'S CONTRIBUTION

Hanna Muttilainen (HM) is fully responsible for the summary of this doctoral dissertation and had overall responsibility in articles I, III and IV, in which she was the corresponding author. In article II, HM contributed to various stages of the research process and manuscript preparation, with Jari Miina (JM) as the corresponding author. A more detailed description of her contribution is provided below.

- I** HM was responsible for conceptualisation of the research work and shared responsibility for data collection with Juha Vornanen and JM. Ville Hallikainen and JM performed statistical analyses, and HM was responsible for interpretation with the co-authors. HM was responsible for writing the original draft of the manuscript. Henri Vanhanen was responsible for the acquisition of funding and the administration of the project that led to this article. Reviewing and editing of the manuscript were shared with all co-authors.
- II** JM was the corresponding author for article II and was responsible for data analyses and writing the original draft of the manuscript. HM contributed to conceptualisation of research work, data collection, interpretation and writing, reviewing and editing the manuscript.
- III** HM was responsible for data analyses, interpretation and writing the original draft of the manuscript. Jyri Vilko participated in the conceptualisation of the research work, writing and editing the manuscript.
- IV** HM was responsible for data analyses, interpretation and writing the original draft of the manuscript. Teppo Hujala, Mikko Kurttila and JM participated in the conceptualisation of the article. Miina Jahkonen collected the data with assistance from HM and Teija Kanninen. The same data as in article III were used. Reviewing and editing of the manuscript were shared with all co-authors.

TABLE OF CONTENTS

ABSTRACT	3
TIIVISTELMÄ	4
ACKNOWLEDGEMENTS	5
LIST OF ORIGINAL ARTICLES.....	6
AUTHOR’S CONTRIBUTION.....	7
TABLE OF CONTENTS	8
1. INTRODUCTION.....	11
1.1 Challenge to diversify forest use with non-timber forest products.....	11
1.2 Objectives of the thesis	14
2. CONCEPTUAL BACKGROUND.....	15
2.1 Towards multiple use of forests	15
2.2 Forest owners and their objectives	16
2.3 Use of non-timber forest products.....	18
3. MATERIAL AND METHODS.....	20
3.1 Methodological framework	20
3.2 Quantitative data collection and analyses	21
3.2.1 Data collection for Article I	21
3.2.2 Data collection for Article II.....	23
3.2.3 Statistical analysis for Articles I and II	24
3.3 Qualitative data collection and analyses	24
3.3.1 Data collection for Article III and IV.....	24
3.3.2 Data analyses for Article III.....	25
3.3.3 Data analyses for Article IV.....	26
4. RESULTS	26
4.1 Forest owners' perspectives on NTFPs and their utilisation.....	26
4.1.1 Forest owners’ motives for owning their forests and for NTFP utilisation (Articles I and II)	28
4.1.2 Forest owners’ perspectives concerning Everyone’s Rights (Article I)	31
4.1.3 Forest owners’ perspectives on organic certification of forests (Article I) .	32
4.1.4 Forest owners’ perspectives on cultivation of specialty mushrooms (Article II)	32
4.2 Entrepreneurship in the NTFP Sector	33
4.2.1 Forest owner's motives for entering the NTFP sector (Article III)	33
4.2.2 Forest owner’s challenges in the NTFP sector (Article III)	34
4.3 Social networks of NTFP-producing forest owners	35

4.3.1	Structure of forest owner networks in the NTFP sector (Article IV)	35
4.3.2	Value creation (Articles II and IV).....	36
5.	DISCUSSION	39
5.1	Forest owners' perspectives towards diversified forest use (RO1)	39
5.1.1	Variation in forest owners' interest in NTFP production	39
5.1.2	Forest owners as early adopters.....	40
5.2	Perceived opportunities and challenges in the NTFP sector (RO2).....	41
5.2.1	Need for knowledge	43
5.2.2	Acceptability and production of NTFPs.....	44
5.3	Structure of the forest owner networks and value creation in the NTFP sector (RO3)	45
5.3.1	Enhancing NTFP value through organic certification	45
5.3.2	Intangible values create more value for NTFPs	45
5.3.3	Information needs and forestry experts: navigating NTFP knowledge in Finland	46
5.4	Critical review of the results.....	48
5.5	Future research needs	50
6.	CONCLUSIONS: CONSIDERATIONS TO SUPPORT THE DEVELOPMENT OF THE NTFP SECTOR	51
	REFERENCES.....	53
	Appendix 1.....	66

1. INTRODUCTION

1.1 Challenge to diversify forest use with non-timber forest products

Non-timber forest products (NTFPs) have gained significant global recognition for their economic potential, which extends beyond developing and emerging economies where they play a crucial role in poverty reduction and biodiversity conservation (Wunder et al. 2014). They are recognised as a key component of multifunctional and sustainable forest management (Wiersum et al. 2018; Huber et al. 2019) and have been actively integrated into various international and national policy frameworks, such as the New EU Forest Strategy (European Commission 2021a) and the Finnish Bioeconomy Strategy (Ministry of Economic Affairs and Employment of Finland 2022). Moreover, support of the sustainable use of NTFPs has been identified as one of the priority actions in FAO Forestry's Roadmap (FAO 2024).

The need to diversify forest use is evident. The economic exploitation of forests for timber production has led to their homogenisation, which has resulted in various negative environmental and social impacts. At the same time, forests are subject to polycrisis (i.e. the interplay of multiple crises that affect the world simultaneously), which include climate change, the decline in biodiversity levels and the over exploitation of natural resources (IPCC 2018). As a result, there has been increasing focus on the need to adapt forest management to better address both current and future environmental and societal conditions, with growing recognition of the urgency to implement more sustainable and resilient practices (FAO and UNEP 2020). Enhancement of the carbon sequestration capacity of forests, the fostering of biodiversity and ensuring species viability, while simultaneously preserving forests as a source of livelihoods, are fundamental objectives to sustainable forest management (European Commission 2021a). Facilitating this transition towards sustainability necessitates comprehensive, cross-sectoral initiatives at all levels of the forestry sector. The development and implementation of more diverse and adaptive management strategies are essential to advance sustainable forest practices beyond conventional approaches (European Commission 2021a).

Non-wood forest products (NWFP), as defined by FAO (1999), are products of biological origin, excluding timber, sourced from forests, other wooded land, or trees outside forests. Throughout history, they have played a significant role in rural households by providing food, enhancing dietary diversity, and supporting income generation (Weiss et al. 2020; Sheppard et al. 2020). Non-timber forest products (NTFP), which is the term used in this summary, has a slightly different meaning than NWFP. NTFPs are all biological materials other than timber which are extracted from forests for human use (De Beer and McDermott 1989). In other words, NTFPs exclude timber while allowing the inclusion of certain minor wood products, for example fuelwood and small wooden items (e.g. Ros-Tonen et al. 1995; Sacande and Parfondry 2018). This broader definition is applied in this study because the data also include wood-based products such as ornamental plants, conifer twigs, and Christmas trees. It is widely recognized that terminology in this field is challenging and may lead to inconsistencies in data reported across countries (Shackleton and Pandey 2014; Vantomme 2003). However, as Muir et al. (2020) note, both terms can be used as long as the purpose of data collection is clearly defined from the outset. In the Finnish language, the commonly used

term *luonnontuotteet* (natural products) may further complicate interpretation, because it does not distinguish between wood-based products and non-wood or non-timber products. Therefore, in the surveys and interviews conducted in this study, a clear distinction was made between products that can be freely collected under Everyone's Rights, such as berries and mushrooms, and those that require the forest owner's permission, such as chaga (*Inonotus obliquus*), spruce sprouts (*Picea abies* (L.) Karst.) and birch sap (*Betula pendula* Roth and *B. pubescens* Ehrh.), in order to avoid misunderstandings. Recent publications have also introduced terms using "wild" such as "wild food plants" and "wild edible plants" (WEPs). Wild food is defined as anything edible that requires no human input to increase its production (Daubet 2012) like plants, berries, fruit, nuts, mushrooms and game that are collected in the wild, to be consumed as food or drink (Maes et al. 2013). WEPs are naturally occurring, non-cultivated plants consumed by humans, including species such as berries, mushrooms, herbs, and leafy greens, which contribute to nutrition, food security, and sustainable use of natural resources (Shumsky et al. 2014). For clarity, these alternative terms are not used in this thesis.

In Europe, the majority (90%) of consumers use NTFPs, and a significant number (26%) collect them for household use (Lovric et al. 2020). In Finland, the number is even higher, more than half of the population collects NTFPs, especially berries (Neuvonen et al. 2022), and this level of activity has remained stable over the years (Pouta and Sievänen 2001; Sievänen and Neuvonen 2011). The active utilisation of NTFPs in Nordic countries is facilitated by public access rights (i.e. Everyone's Rights), which allow individuals to collect some products from forests regardless of land ownership. However, the collection of products not covered by these rights, like chaga and spruce sprouts, requires the permission of the landowner. In Europe, the regulation of NTFPs varies across countries and regions, and may, for instance, include rules concerning the quantity of collection and the requirement of permits, particularly with respect to mushrooms (Nichiforel et al. 2018).

Forest ownership in Europe differs significantly between countries and regions. In areas dominated by public land, public sector perspectives are central in forest use. In contrast, in regions where non-industrial private forest (NIPF) ownership is dominant, such as in Finland and other Nordic countries, it is essential to understand the perspectives of private forest owners in forest use and management (Hannerz and Ekström 2023). In Finland, there are 26.3 million hectares of forest land, of which 59% is owned by NIPF owners (Finnish Statistical Yearbook of Forestry 2022). As the largest forest owner group in Finland, they supply a significant proportion (approximately 80%) of industrial roundwood (Finnish Statistical Yearbook of Forestry 2018), while also managing a diverse range of tangible and intangible forest ecosystem services. Consequently, their decisions on forest use have substantial implications for the entire forestry sector. Forest owners' motives and perspectives on forest use have been widely examined in national and international studies (Karppinen 1998; Wiersum et al. 2005; Ingemarson et al. 2006; Hujala et al. 2007; Hujala and Tikkanen 2008; Bengtson et al. 2011; Kuuluvainen et al. 2014; Ficko et al. 2019). However, forest owners' perspectives, particularly regarding NTFPs, have not been extensively studied in Finland. In the context of NTFPs, forest owners play a pivotal role in ensuring resource availability and granting collection rights, as also noted in the National Forest Strategy 2035 (Ministry of Agriculture and Forestry 2023). Therefore, it is important to explore forest owners' perspectives, as knowledge derived from them can play a crucial role in improving the profitability and functionality of NTFP-related businesses. This, in turn,

supports sustainable sectoral growth, enables the diversification of forest-based income streams, and contributes to the advancement of the bioeconomy.

Traditionally, forest management has primarily focused on timber production and other wood-based products, supported by well-established value chains and institutional frameworks (Wolfslehner et al. 2019; Weiss et al. 2020; Sheppard et al. 2020). However, this traditional approach is no longer sufficient to address the evolving demands of contemporary forest use. Expanding forest utilisation to encompass a broader range of products offers private forest owners and rural economies new income-generating opportunities beyond traditional wood production (Huber et al. 2023). In recent years, interest in NTFPs has resurged, as they are increasingly seen as viable business opportunities for private forest owners. This renewed interest is driven by growing demand across various sectors, including food, cosmetics, medicine, recreation, and tourism (Wong and Wiersum 2019; Weiss et al. 2020). Consequently, forest owners have shown increasing interest in joint production and are eager to explore whether managing their forests for both timber and for example mushroom production could provide additional income (Palahí et al. 2009), as well as whether trade-offs exist between timber and mushroom yields (Tahvanainen et al. 2018). Several studies have examined the economic feasibility of joint production of timber and NTFPs (Kurttila et al. 2018; Tahvanainen et al. 2018; see also Miina et al. 2020). The findings suggest that forest management can be optimized to account for both timber and mushroom production, supporting multifunctional forest use and the commercial utilization of wild mushrooms (Tahvanainen et al. 2018). Multifunctional forest management appears to be a feasible and recommended compromise between timber production and various NTFPs, as timber harvesting significantly reduces NTFP yields only near maximum harvest levels (Kurttila et al. 2018). One example of the joint production introduced to Finnish forestry is the specialty mushroom cultivation (Miina et al. 2021). For instance, chaga cultivation in living birch trees is already well-established in Finland; several companies offer forest owners chaga cultures and cultivation services. Although cultivating chaga on living birch trees causes wood decay, the economic risk is lower when applied to low-quality birch trees (Miina et al. 2021). In contrast, the cultivation of mushrooms such as reishi (*Ganoderma lucidum*) on stumps is a relatively new practice and can be carried out without affecting timber production. Due to the novelty of this method, the perspectives of forest owners, as well as other actors in the supply chain, remain largely unknown and need to be explored.

Despite the recognized potential of NTFPs in sustainable forest management, their economic value remains largely underutilized in many countries. The limited integration of NTFPs into existing forest-based value chains, coupled with the dominance of timber production, has resulted in a lack of incentives, knowledge, and infrastructure to support their commercial use (Tikkanen et al. 2020). A critical barrier to the growth of the NTFP sector has been the limited and inconsistent supply of raw materials, which has constrained the expansion of NTFP entrepreneurship and the market development (Rutanen 2018; Tikkanen et al. 2020). As global and national policies increasingly emphasize the diversification of forest use and more sustainable forest management, there is a growing need to better understand the factors that influence the supply of NTFPs, particularly from the perspective of forest owners, who play a key role in resource availability and management. Thus, it is essential to investigate the drivers and barriers that forest owners experience when considering or engaging in NTFP-related activities. These factors may include economic motivations (eg. Staniewski and Awruk 2015), social values (Akehurst et al. 2012; Stephan

et al. 2015), knowledge gaps (Smith and Beasley 2011), regulatory constraints (Klapper et al. 2006), and practical challenges in forest management. However, existing research has only partially addressed these aspects, especially in the Finnish context, and there remains a notable lack of comprehensive understanding of how these drivers and barriers influence forest owners' participation in NTFP-related business and their integration of NTFPs into forest use strategies.

In addition, forest owners' social networks and interactions with other actors in the NTFP value chain, such as buyers, advisors, and other producers, can significantly influence their decisions and opportunities. While forest owners' networks have been more extensively studied in the context of conventional forestry (e.g., Primmer 2011; Korhonen et al. 2012; Stoettner and Dhubbáin 2019), networks within the NTFP business remain largely unexplored. In the Finnish context, there is a clear gap in knowledge regarding how forest owners connect within the NTFP sector, what underpins collaboration and network dynamics and how these relationships affect business development and resource management. Addressing these gaps is essential for designing effective support mechanisms, policy interventions, and advisory services that promote multifunctional forest use and sustainable rural entrepreneurship.

1.2 Objectives of the thesis

Referring to above mentioned research gaps, the aim of this thesis is to bring new understanding of forest owners' perspectives to diversify the value creation of their forests, with a particular emphasis on the role of NTFPs in future forest use and management. The focus is on Finnish forest owners, who are essential providers and users of forest ecosystem services. Their decisions and values shape how forests are managed, and which benefits are prioritised. This thesis explores their perceptions of NTFPs' potential, examines the structure of their value networks, and identifies the motivations and barriers related to involvement in the NTFP sector. The findings of this research contribute to the broader discourse on sustainable forest use by offering practical insights that can promote the multiple use of forests and support the development of NTFP-related businesses, reinforcing their role as an integral part of Finland's bioeconomy.

The main aim of the thesis is divided into three research objectives (RO) as follows:

RO1: To create better understanding of forest owners' perspectives with regard to NTFPs and their utilisation in Finland (I and II).

RO2: To identify forest owners' motives for engaging in NTFP production and the challenges they face operating in this sector alongside traditional forestry (III).

RO3: To define the structure of forest owners' networks in the NTFP sector and to identify value creation within the networks (II and IV).

2. CONCEPTUAL BACKGROUND

2.1 Towards multiple use of forests

Multiple use of forests is not a new phenomenon. In pre-industrial times, European forests were primarily managed for subsistence purposes, offering a wide range of benefits such as food, fodder, medicinal plants and construction materials (Fritzbøger and Søndergaard 1995; Kardell and Bishop 2014; Tasanen 2015). With the onset of industrialisation, forest use became increasingly centered on timber production and wood-based products, driven by the economic significance of wood and the development of efficient and competitive value chains, such as those in wood products, pulp and paper, and bioenergy (Wolfslehner et al. 2019; Weiss et al. 2020), often neglecting other valuable forest goods and ecosystem services (Weiss et al. 2019a). Today, post-industrial forest management paradigms have shifted the focus back to the diverse values of forests. This shift includes timber production, recreational use, nature tourism, traditional practices such as hunting, fishing and foraging, all of which have both economic and cultural significance. It also highlights essential ecosystem services, and the role of forests as cultural heritage closely linked to national identity and traditions (Weiss et al. 2019b; Sheppard et al. 2020). This approach is known by various terms, which include multi-functional, multi-purpose, multiple use, and sustainable or ecosystem-based forest management (Buttoud 2000; Kennedy et al. 2001; Schlaepfer et al. 2002).

The concept of "multiple use" in land use planning generally refers to the simultaneous provision of various goods and services. This approach can be implemented through two main strategies: integrated and differentiated land use. The distinction between these strategies lies in the spatial organisation of land use, including forest management (Hoogstra-Klein et al. 2017). Integrated land use involves the concurrent production of multiple benefits within the same area, which typically requires trade-offs between the different uses. In contrast, differentiated land use designates specific areas for particular services and aims to maximise each service's efficiency within its designated zone. In practice, land use typically exists along a continuum between integration and differentiation, rather than representing a clear-cut distinction between two opposites (Tuulentie et al. 2024). In this thesis, the term multiple use is used to describe the forest management that aims to simultaneously produce several goods and services (Huuskonen et al. 2021) as well as values and functions (Solbär et al. 2019).

The fundamental principle of multiple forest use is to balance various ecological, economic, and social objectives in a sustainable manner. In recent years, the significance of multiple forest use has increased, and its importance has been emphasised for several reasons. These include the growing demand for sustainably provided resources, the need to mitigate climate change through carbon storage (IPCC 2018), the preservation of biodiversity (European Commission 2020) and the promotion of local economies through NTFPs (European Commission 2021a). In addition, forests play a vital role in providing numerous other ecosystem services, such as clean air and water, making the multiple use of forests more crucial than ever.

The growing recognition of the importance of multiple use of forests is strongly reflected in various European policy frameworks. The European Union (EU)'s Forest Strategy (European Commission 2021a) grounded in the European Green Deal (European

Commission 2019) and the EU's Biodiversity Strategy for 2030 (European Commission 2020), highlights the vital role of forests in delivering multiple benefits, as well as the significance of forest professionals and the wider forest sector in supporting the transition toward a sustainable and climate-neutral economy by 2050. In addition, it ensures the restoration, resilience and effective protection of all ecosystems. The strategy acknowledges that for the activation of forest owners, better knowledge of the motivations of the different types of owners is necessary, as well as how governance systems, institutional and economic factors affect their interests and influence their potential to act. In the Finnish National Forest Strategy 2035 (Ministry of Agriculture and Forestry 2023), multiple use is not directly emphasized, but forest use is expected to become more diverse, and the need to coordinate different uses is seen as increasingly important in the future.

Commitment to mitigating climate change through the Paris Agreement (United Nations 2015), the European Green Deal (European Commission 2019), and the Climate Adaptation Strategy (E 2021b) largely involves maintaining the carbon balance in all human activities. The maintenance of carbon sinks, such as in forest management, plays a key role in this effort. Activation of forest owners to diversify their business approaches is one important approach to achieve these objectives. In line with these commitments, the new Nature Restoration Regulation (European Union 2024), as a central part of the EU Biodiversity Strategy, introduces binding targets to rehabilitate degraded ecosystems, especially those that offer strong potential for carbon sequestration and storage, and aims to mitigate and prevent the impacts of natural hazards. In forest ecosystems, this involves promoting a rise in both standing and fallen deadwood, maintaining uneven aged forests, ensuring connectivity between forest patches, supporting healthy populations of common forest bird species, and increasing the amount of organic carbon stored (European Union 2024). This approach aims to promote more sustainable forest management practices in commercial forests, which also involves a reduction in the area allocated to timber production and therefore a decrease in the volume of logging.

As a result of increasing use restrictions and conservation efforts, forest land has become increasingly contested, as it must simultaneously support climate change mitigation, biodiversity conservation, renewable energy production, and recreational uses (Ministry of Agriculture and Forestry 2023; Kuehne et al. 2024). These competing demands often limit the space available for traditional forestry operations. In response, the New Forest Strategy highlights the importance of promoting the multiple use of forests, including the sustainable management of NTFPs and related economic activities, which can help sustain local economies and employment in rural areas (European Commission 2021a).

2.2 Forest owners and their objectives

Globally, forests are managed through various forms of public and private ownership. In Finland, private ownership is the most common form of forest ownership, with over 600,000 NIPF owners in a population of 5.6 million. They collectively own around 60% of the country's forest land (Finnish Statistical Yearbook of Forestry 2022) and play a significant role in commercial logging (Finnish Statistical Yearbook of Forestry 2018). Forest owners come from different socio-economic backgrounds and value different aspects of forests (Karppinen 1998; Karppinen et al. 2002; Hänninen et al. 2011; Karppinen et al. 2020; Hujala

et al. 2013). The structure of forest ownership has been in constant change for decades. Recent major developments include a decline in the proportion of farmers among forest owners, relocation of owners away from their properties, increasing urbanization, an aging owner population, and shifts in the size distribution of forest holdings. In recent years, forest holdings have shown a clear trend toward both fragmentation into smaller plots and expansion of large estates (Hänninen and Karppinen 2010). The objectives of forest ownership have also changed, with an increasing share of non-traditional forest owners with multiple goals, driven by changing lifestyles and intangible benefits, which have led forests to provide various lifestyle advantages beyond timber production (Majumdar et al. 2008; Urquhart et al. 2012; Weiss et al. 2019c).

Forest owners' values and objectives are considered essential for understanding their behaviour, developing effective policies, promoting sustainable management, and tailoring services. Here, literature often uses typologies to capture the diversity of forest owners' attitudes, values, beliefs, management objectives and behaviour (Kuuluvainen et al. 1996; Karppinen 1998; Wiersum et al. 2005; Favada et al. 2009). Categorisation of forest owners has a long history in Europe (Abetz 1955). In Finland, it started in the 1970s (Reunala 1974) and has continued with Finnish Forest Owner studies from 2000 to the present, which occur every decade (Karppinen et al. 2002; Hänninen et al. 2011; Karppinen et al. 2020). The most frequently used labels for typologies in the literature have been *Multi-objective owners*, *Recreationists*, *Investors*, *Farmers*, *Indifferent owners*, *Conservationists*, *Multi-functional owners* and *Self-employed owners* (Ficko et al. 2019). For example, Boon et al. (2004) categorized forest owners into five groups based on their management goals: economists, multi-objective owners, self-employed persons, recreationists and passive/resigning owners. Typologies have been used to explore forest owners' perspectives from several viewpoints to understand their behaviour in forest use. Traditionally, numerous small-scale forest owners across Europe relied on their woodlands for economic support, often using them for personal needs or business purposes, frequently in connection with agricultural practices (Wiersum et al. 2005), thus earlier studies focused more on economic values and timber production (e.g. Kuuluvainen et al. 1996; Karppinen 1998; Favada et al. 2009). In more recent times, a growing number of forest owners do not rely on their forests for financial support and tend to prioritize recreational and aesthetic values in their management instead of timber production. This is also reflected in forest owner studies and the variety of ecosystem services, nature conservation, health and heritage values included in them (Bieling 2004; Urquhart and Courtney 2011; Lähdesmäki and Matilainen 2013; Koskela and Karppinen 2021). These studies show that forest owner objectives are becoming more diverse, and that forest research is better equipped to address this wide range of goals. These evolving objectives also highlight the diverse motives behind forest owners' decision-making. Forest owners' decisions are influenced by a variety of motives, including economic, ecological and social factors. For instance, some owners have prioritised conservation and biodiversity, while others have focused on recreational and aesthetic values.

When considering the multiple use of forests, the variety in forest owners' motives is beneficial because it supports a wide range of policy objectives, including both tangible and intangible benefits (Weiss et al. 2019b). Further, since forest owners are also consumers influenced by market developments, it is interesting to see if their values influence how they view and manage their forests. Beyond timber harvesting, NIPF owners are placing growing importance on additional ecosystem services and the mere preservation of forests (Karppinen

1998; Majumdar et al. 2008; Urquhart et al. 2012; Weiss et al. 2019a). This transformation reflects a broader paradigm shift towards the multifunctionality of forests and their environmental and societal benefits. General lifestyle change, particularly the emphasis on green values, is also evident in the attitudes of forest owners. This may influence how forest owners perceive their forests in the future and the decisions they make regarding forest management (Häyrynen 2019).

It is important to recognise that actual behaviour does not always fully align with stated objectives, nor does it necessarily evolve consistently with changes in those objectives. Behaviour is influenced not only by intentions, but also by perceived control over actions and by prevailing social norms (Ajzen 1991). Actual decision-making is also strongly influenced by contextual factors, such as the availability of support structures and advisory services, the forest owner's own knowledge and competencies, access to networks and prevailing social norms. A nuanced understanding of forest owners' motivations, together with the constraints associated with other dimensions of the NTFP sector, can provide a more solid foundation to identify development targets that support the multiple use of forests and the sustainable production of NTFPs.

2.3 Use of non-timber forest products

Throughout history, NTFPs have played a vital role in rural households by providing both nutritional variety and an important source of income (Chamberlain et al. 2019; Weiss et al. 2020; Sheppard et al. 2020) and the value of NTFPs has been known for centuries. As Finnish senior lecturer Arwid Th. Genetz wrote in 1895 *"In recent years, lingonberries have been exported in large quantities abroad, especially to Germany, where they are considered more valuable than apples, plums and other domestic fruits. For good reason, lingonberries are held in such high regard, as hardly any other fruit is healthier. Many know from personal experience how refreshing lingonberry juice is and how beneficial it is for feverish illnesses"* (Genetz 1895). Yet even at that time, the same problems were evident as today. The availability of raw materials posed challenges, even though there would have been sufficient raw materials available, *"Although bilberries grow in very large quantities in our country, and not even a tenth of them are used, dried bilberries are imported into our country from abroad, especially from Germany..."* (Genetz 1895).

Stable availability of domestic raw materials remains, even today, the biggest challenge in the Finnish NTFP sector. In addition, NTFP-based businesses in Finland encounter several other obstacles, including limited domestic market size, lengthy distances to export destinations, insufficient institutional support, and fragmented collaboration across the value chain (Tikkanen et al. 2020).

Most collected NTFPs are used in households, with 90% of European households consuming them at least once a year, while only a small portion of collected NTFPs (13.9%) reaches the market (Lovrić et al. 2020). The product categories most commonly used include fresh or dried nuts, fresh or dried berries, as well as frozen and processed wild berries (Lovrić et al. 2021). In Finland, the most collected NTFPs are wild berries and mushrooms, which can be collected under Everyone's Rights (MARSİ 2023). According to the annual yield, Finns collect 34–56 million kilograms of berries for household use, while the quantity gathered for sale remains lower at 15–18 million kilograms (Turtiainen et al. 2015).

Obtaining precise values of the amounts collected is challenging. Official production volume reports are frequently incomplete, inconsistent, and unreliable because of complex, poorly understood value chains and a lack of transparency in the reporting system (Sheppard et al. 2020). As NTFPs are largely part of the informal sector and exhibit significant variability, comprehensive data on their quantity or economic value are lacking. Also, existing statistics are often fragmented or not comparable across countries (Vantomme 2003; Wiersum et al. 2018; Lovrić et al. 2021).

A key factor behind the widespread use of NTFPs in Finland and other Nordic countries is the public's right to access forests, known as Everyone's Rights. Everyone's Rights grants the ability to access and use natural resources regardless of ownership. It allows the picking of wild berries, mushrooms, flowers, and wild herbs for personal or commercial use without the landowner's permission, but prohibits the felling or damaging of trees, as well as the collection of mosses, lichens, soil, or wood (Ministry of the Environment 2016). Everyone's Rights applies to foreign citizens as well, which has allowed the berry industry to use foreign labourers. Recently, growing urbanization and higher living standards in Finland have led to a decline in local berry picking, with approximately 90% of wild berries for commercial markets now being collected by hired foreign pickers (MARSİ 2023). This has sparked intense debates concerning the boundaries of Everyone's Rights and the local residents' entitlement to natural resources. The main criticism targets organized commercial berry picking, where large groups of foreign pickers efficiently harvest berries from forest areas (Viljanen and Rautiainen 2007; La Mela 2014; Sténs and Sandström 2013; Peltola et al. 2014; Tahvanainen et al. 2016). At the same time, concerns have been raised about human rights issues in the berry industry. In particular, the working conditions and wages of seasonal workers have been questioned. Reports of underpayment, long working hours and inadequate living conditions have sparked debate about the fairness of the industry. Ensuring the acceptability of the sector requires transparency, fair working conditions and appropriate oversight to guarantee that berry production is both ethically and socially sustainable (Busk et al. 2024; see also ILO, UNEP and IUCN 2022).

As with social sustainability, economic sustainability is important to create acceptability of the NTFP business. However, the economic impact of NTFPs is still under-recognised and under-utilised compared to timber production, even though the economic potential of NTFPs has been recognised high in the future bioeconomy (Wiersum et al. 2018; Weiss et al. 2019b). In recent years, global demand for NTFP products has grown. The rising interest and use reflect global trends emphasizing health and naturalness, well-being, stronger ties to nature and forest leisure, environmental responsibility, and the broadening of income sources from forests (Pettenella et al. 2019; Weiss et al. 2019a; Wong and Wiersum 2019; Vacik et al. 2020).

One way to increase the value of NTFP products in the markets and highlight their environmental sustainability is through organic certification (McFadden et al. 2017). Organic certification is a quality system that prioritises environmental sustainability, biodiversity, natural resource conservation and high animal welfare standards (European Union 2007). In Finland, forests, wetlands and other potential natural areas can be certified as organic collection areas, if chemical fertilisers, pesticides and herbicides have not been used in these areas for 36 months. Finland has the world's largest organic collection area, nearly 6.96 million hectares, situated mostly in the northern part of Finland (Arktiset Aromit 2024). The NTFPs harvested from these regions may be considered organic provided that the complete

production chain is involved in the organic certification scheme (Evira 2018). Research indicates that organic labeling influences how consumers view products; for instance, organic food items are often regarded as healthier (Lee et al. 2013) or more flavorful (Apaolaza et al. 2017) compared to conventional alternatives, and as such, organic labeling can add perceived value to the product and influence purchasing decisions.

The collection of special NTFPs such as birch sap, spruce sprouts and chaga requires the permission of forest owners, while their production has the potential to generate significant supplementary income for forest owners. Despite their potential, NTFPs currently play only a minor role in Finland's bioeconomy; however, increasing their production and commercial utilization could strengthen local businesses and support rural livelihoods (Huber et al. 2019; Rutanen 2014). In Eastern Finland, NTFPs, particularly mushroom harvesting and the joint production of mushrooms and timber, have been shown to support the economies of remote areas by providing a significant source of income for disadvantaged rural residents (Cai et al. 2011; Tahvanainen et al. 2018).

Forest owners' NTFP enterprises are indeed often located in rural or remote areas and are typically micro enterprises operated by individuals or families (Wacklin 2021). This can make customer accessibility a challenge (Łuczaj et al. 2014). Successful market integration of NTFPs depends on close cooperation among key stakeholders and the advancement of local development strategies (Vacik et al. 2020). Social networks have been found to be crucial for micro and small NTFP enterprises as they help reduce transaction costs, create new business opportunities and facilitate knowledge spillover. These networks can range from formal inter-organisational collaborations to informal connections, such as friendships and family ties, all of which influence decision-making and business performance (Turkina and Thai 2013; Turkina et al. 2016).

In addition to structural connections, the concept of social capital plays a pivotal role in shaping the effectiveness of forest owners' networks. According to Górriz-Mifsud et al. (2016) social capital refers to the shared norms, trust, and reciprocity that emerge within communities and stakeholder groups, enabling smoother collaboration and collective action. In rural and remote contexts, where formal support structures may be limited, high levels of social capital can strengthen informal networks and foster resilience among NTFP entrepreneurs. These trust-based relationships not only facilitate access to resources and information but also enhance the legitimacy of joint initiatives and reduce the need for formal enforcement mechanisms. As such, social capital acts as a catalyst for network formation and sustainability, directly influencing the success of micro-enterprises in integrating into broader markets and value chains.

3. MATERIAL AND METHODS

3.1 Methodological framework

Pragmatism, which originated in the United States in the late 19th century (James 1995), offers a suitable framework for this research, as it emphasises practical solutions and context-driven knowledge, both essential for development of the NTFP sector and promotion of multiple use of forests. From a pragmatic philosophical perspective, human actions are

closely connected to past experiences and the beliefs formed by those experiences adjust future actions based on previous results (Morgan 2014). This perspective supports a broad definition of pragmatism as a philosophy where the significance of actions and beliefs is understood through their consequences (Biesta 2010). The production of NTFPs is strongly linked to the existing operational environment. Insights into forest owners' perspectives with regard to contexts and experiences can provide critical knowledge for the development of the sector and address the challenges that forest owners encounter within it.

To gain a more comprehensive and nuanced understanding, this thesis employs a mixed-methods approach, which is typical for pragmatic research as it uses methods that best align with the research question (Morgan 2014). By combining quantitative and qualitative methods, this approach capitalises on their complementary strengths, offering a more holistic perspective on the topic being explored (Biesta 2010; Patton 2015).

In this thesis, the use of quantitative surveys enabled the inclusion of a large number of respondents, thereby improving the generalisability of the results and offering a more comprehensive knowledge of the topic. The use of quantitative surveys aligns with post-positivist principles (Phillips and Burbules 2000) by emphasising the importance of statistical analysis to identify patterns, trends and correlations within the data. Post-positivism is more flexible than traditional positivism in that it allows for the consideration of subjective elements and acknowledges the role of the researcher's perspective in interpreting data. It also accepts that the findings, while significant, are not absolute truths but are based on the best available evidence and are subject to revision as new data emerge. This allows for more comprehensive assessment of the factors that influence forest owners' perspectives, while also acknowledging that the interpretations and conclusions drawn from the data are contingent on the context (Creswell 2014).

Interviews conducted in this thesis followed an explorative qualitative research approach with an information-oriented data selection strategy, which aimed to maximise the utility of information from the case (Flyvbjerg 2011). Explorative qualitative research aims to explore and understand phenomena without predefined hypotheses (Swedberg 2020). It seeks to uncover new perspectives, ideas and experiences, often focusing on behaviour patterns, attitudes and emotions. This approach is especially valuable to study complex or poorly understood topics where established concepts are absent. The NTFP sector in Finland is a relatively unresearched field and this approach allowed for a more nuanced understanding of the factors that influence forest owners' views and practices with regard to the use and management of forests for NTFP production, as well as the challenges and opportunities they perceive to diversify forest use.

The research strategies, data collection, study region and analysis methods used are summarised in Table 1 and are outlined in the following sections. A more comprehensive description of the methods and materials can be found in the original articles.

3.2 Quantitative data collection and analyses

3.2.1 Data collection for Article I

The web-based questionnaire was sent to all adult NIPF owners who had forest property in North Karelia region of Finland and who had registered an email address in the Finnish Forest

Centre's customer register, provided they had not opted out of marketing communications. This resulted in a sample size of 6,631 forest owners. The data were collected in November–December 2018 and the response time for the survey was four weeks with two reminders sent. A total of 1,132 responses was received, with a response rate of 17.1% (Table 1).

To assess the representativeness of the collected data, the background characteristics of the respondents were compared with those from the Finnish Forest Owner 2020 survey (Karppinen et al. 2020). The comparison showed that the survey respondents were somewhat younger and possessed larger forest properties compared to the forest owners in the Finnish Forest Owner 2020 study. Otherwise, the dataset in this study did not significantly differ from the population characterized in the 2020 survey. The questionnaire comprised both structured and open-ended questions. Four structured question sets were formulated to reveal forest owners' ownership motives and perspectives concerning NTFPs, Everyone's Rights and organic certification of forests. Each question set contained between 8 and 15 statements, which respondents assessed using a five-point Likert scale arranged in descending order. In the survey, we applied the Finnish term "luonnontuotteet" (natural products), which does not explicitly distinguish wood-related products from other NTFPs. To minimize potential misunderstandings regarding access rights and product categorization, the NTFP-related section of the questionnaire was structured to differentiate between products that can be gathered under Everyone's Rights (e.g., berries and mushrooms) and those requiring the forest owner's permission (e.g., chaga, birch sap, and spruce sprouts).

Table 1. Research strategy, data collection and data analysis methods of the individual articles. PCA=Principal component analyses, SNA=Social network analyses.

Article	Research strategy	Data collection	Study region	Methods
Article I	Quantitative	Web questionnaire (2018): n=6,631, response rate = 17.1%	North-Karelia region of Finland	PCA; K-means clustering
Article II	Quantitative	Web questionnaires: Forest owners (2021): n= 16,822, response rate=14.3% Harvest entrepreneurs (2021): n=962, response rate= 10.9% Forest professionals (2022): n= 2,095, response rate=10.9% Natural product entrepreneurs (2022): n=551, response rate= 6.9%	North-Karelia & South-Savo regions of Finland Finland Finland Finland	PCA; K-means clustering
Article III	Qualitative	Semi structured in-depth interviews (2020): n= 20	Mainly in North-Karelia, South-Karelia and Kymenlaakso regions of Finland	Thematic analysis
Article IV	Qualitative			Thematic analysis; SNA

3.2.2 *Data collection for Article II*

Article II focused on the production of specialty mushrooms, thereby providing a more detailed example of a specific NTFP and offering nuanced insights into the perspectives of the entire supply chain through the examination of this particular product group. A total of four different surveys were sent to various actors in the supply chain: forest owners, forest professionals, forest harvesting entrepreneurs and natural product entrepreneurs. Due to the significant role of forest owners within the supply chain, particular attention was directed towards understanding their motivations for forest use and their interests regarding mushroom cultivation on their properties.

The forest owner data were collected in September–October 2021 (Table 1). Web-based questionnaires were sent to all adult NIPF owners who owned a forest property in the North Karelia and South Savo regions in Finland and who had an email address in the Finnish Forest Centre's customer register, provided they had not opted out of marketing communications. This resulted in a sample size of 16,822 forest owners. A total of 2,405 responses were received, with a response rate of 14.3%. Forest owner questionnaire contained the same two question sets related to ownership motives and perspectives concerning NTFPs, differentiated by access rights (products collected under Everyone's Rights vs. those requiring the forest owner's permission), as in Article I. The distinction of access rights was applied consistently across all four questionnaires. Additionally, the concept of special mushrooms was clarified to avoid any misunderstandings. The respondents were asked whether they would be interested in participating as stakeholders in the supply chain of specialty mushrooms cultivated on stumps. Furthermore, each questionnaire included actor-specific questions addressing respondents' backgrounds and their roles within the supply chain.

The second questionnaire was sent to 962 forest harvesting entrepreneurs whose email addresses were obtained from the Trade Association of Finnish Forestry and Earth Moving Contractors (710 entrepreneurs) and the Finnish Forest Centre's customer registers (252 entrepreneurs, mainly from North Karelia and South Savo). A total of 105 responses were received, with a response rate of 10.9% (Table 1).

The third questionnaire was sent to 2,095 forest professionals to different forest organisation (a detailed list can be found in Article II) whose email addresses were obtained from the webpages of the forest organisations. A total of 229 responses were received, with a response rate of 10.9% (Table 1). Forest professionals and harvesting entrepreneurs were asked whether they would be able to promote and offer specialty mushroom cultivation services to forest owners as part of timber harvesting operations.

The fourth questionnaire was sent to 551 natural product entrepreneurs whose email addresses were obtained from the Finnish Forest Centre's customer register and the public lists of members of the Finnish Food and Drink Industries' Federation, the Finnish Nature-based Entrepreneurship Association and the Arctic Flavours Association. A total of 38 responses were received, with a response rate of 6.9% (Table 1). The questionnaire included items related to the enterprise itself, the natural raw materials employed, and the company's current and future intentions regarding the use of mushrooms in its operations.

3.2.3 *Statistical analysis for Articles I and II*

Principal components analysis (PCA) with varimax rotation was used to reveal the factors that affect forest owner motivations and perspectives towards NTFPs (I and II), Everyone's Rights and organic certification of forests (I). Based on the principal component score variables, forest owner typology groups were constructed using K-means cluster analysis (e.g. Boon et al. 2004). Analyses were used to condense the information and to create forest owner typologies (Ficko et al. 2019). The analysis was performed using SPSS Statistics 25 and 28 (IBM Inc. 2017 and 2021) (I and II).

Set correlations were used to analyse the overall relationships between PCA scores, such as ownership motives and perspectives on NTFPs (Cohen 1982). Set correlation was used to describe the amount of shared variance (R^2) between two sets of PCA scores (I and II).

Conditional Recursive Partitioning Trees (Ctrees) were used to analyse and illustrate how demographics and ownership motives influenced forest owners' perceptions of NTFP production, Everyone's Rights, and the certification of organic collection areas in forests (Hothorn et al. 2006) and to highlight the complex relationships between typology groups and demographic variables (I).

Logistic regression analysis was employed to examine differences among the identified forest owner groups with regard to their interest in cultivating specialty mushrooms (II). The model included background variables such as demographics, forest holding characteristics, and forest owner group classifications based on ownership motives and NTFP utilisation as predictors. The aim was to identify those forest owners who expressed interest in engaging with the supply chain and who either already commercialize NTFPs from their land or were open to doing so. These forest owners would be the primary candidates for guidance on cultivating specialty wood-decay mushrooms on stumps within their forests.

Pearson's χ^2 test of homogeneity was used to test for differences among and between the respondent groups (forest owners, harvesting entrepreneurs, forest professionals and natural product entrepreneurs), for example, their interest in specialty mushroom cultivation in connection with timber harvesting (II).

3.3 **Qualitative data collection and analyses**

3.3.1 *Data collection for Article III and IV*

In Articles III and IV, the same qualitative data were utilised; however, the data were analysed from different perspectives for these two articles. Twenty private forest owners producing different NTFPs were chosen as interviewees with an information-oriented selection method (Flyvbjerg 2011) to highlight differences in their value networks. The essential selection criterion was that the forest owners have operated as entrepreneurs in the NTFP sector. This ensured that the interviewees had established business networks and experience-based knowledge in the production of NTFPs. Informants were contacted through multiple channels, which included contacting value network actors to access relevant forest owners, leveraging researchers' networks, engaging forestry companies and related organisations, and through online searches.

The methodological approach applied in these studies was case study research, which enables a contextualized and in-depth examination of real-life phenomena within bounded systems (Creswell and Poth 2018). Commonly used in the social sciences and humanities, case study research draws on multiple sources of data, such as interviews, observations, and documents, to investigate complex and context-dependent issues (Yin 2014; Creswell and Poth 2018). Qualitative case studies can be differentiated according to two principal dimensions: the focus of analysis and the intent of the study (Stake 1995; Creswell and Poth 2018). The focus refers to the bounded unit under investigation, which may consist of an individual, a group, a program, or a specific activity. The intent reflects the underlying purpose of the inquiry and informs the selection of the case study type. Based on intent, three distinct types of case studies are commonly identified: 1) Intrinsic case study, which investigates a case of unique interest in itself; 2) Instrumental case study, where a single case is examined to provide insight into a broader phenomenon; 3) Multiple (or collective) case study, which involves the analysis of several cases to explore a shared issue across different contexts. In this study, a multiple case study approach was applied to enable comparative analysis across several private forest owners. This approach was particularly well-suited for examining the diversity of entrepreneurship, value networks, and contextual factors within NTFP sector. By analysing multiple cases, the study was able to identify both recurring practices and context-specific differences in how forest owners operate within NTFP-related business activities. This contributed to a deeper understanding of forest owner behavior and the structural characteristics of NTFP production.

The data were collected through semi-structured interviews, in which participants spoke freely on various themes, while the interviewer posed follow-up questions or returned to earlier topics as needed (Wengraf 2001). Themes discussed included exchange of values, value creation in the networks and the role of the forest owner in the network, as well as the motives of the forest owner to produce NTFPs, common bottlenecks, shortcomings and opportunities from their company's point of view (see Appendix 1 Interview guide). The interviews were conducted in October–December 2020 by phone and were recorded and verbatim transcribed.

The respondents had highly diverse backgrounds (detailed background information is presented in Table 3 in Article III). Forest holding sizes ranged from small (under 20 hectares) to large (over 200 hectares), with most owners holding their forests for over 20 years. Experience in NTFP production varied from beginner (1 year) to highly experienced (55 years). While many focused on specific NTFPs (the main product is presented in Table 3 in Article III), several had diversified by offering additional products.

3.3.2 Data analyses for Article III

Thematic coding was used to analyse the data from the interviews. Thematic coding is an experimental method used to identify, analyse and interpret themes that arise from qualitative data. Its purpose is to understand the thoughts, emotions and actions of the interviewees (Clarke and Braun 2017). The qualitative data analysis software NVivo (R14.23.0) was used as a tool to condense, classify and code the data (Bazeley and Jackson 2013). First, the interviews were read through and coded based on the interview guide. After the initial coding, new coding classes were formulated based on new aspects that emerged from the data and the theoretical background, which was derived from a literature review on existing drivers

and barriers. The new classes were used in the second coding. Afterward, a triangulation process involving two researchers was implemented: the first conducted the initial coding, while the second reviewed the coded material and provided feedback and recommendations for more thorough coding.

The thematic coding yielded 24 drivers that motivate forest owners to start their own businesses in the NTFP sector. Forest owners also recognised 77 barriers that hinder the production of NTFPs and complicate operations. In further analyses, recognised drivers were arranged into seven categories (Appendix A in Article III) and recognised barriers were arranged into 13 categories (Appendix B in Article III).

3.3.3 Data analyses for Article IV

Thematic coding was the main method to analyse the data for Article IV as well, but different codes were used in the analyses depending on the research question. Social network analyses (SNA) (Wasserman and Faust 1994) were used to support qualitative analyses and help reveal the essential actors and their connections. Connections refer to the relationships that forest owners had with various stakeholders. The connections were examined from an egocentric perspective, meaning that only connections between the forest owner (ego) and members of the forest owners' networks (alters) were examined (Hanneman and Riddle 2005; Korhonen et al. 2012). With a mind mapping tool, the interviewer investigated the extent of the forest owners' social networks with regard to NTFP production. Actors connected to forest owners were compiled into a mind map with Post-it notes. The interactions between the actors were illustrated with arrows, indicating what tangible and intangible assets were exchanged and what formed the basis of their cooperation.

The direction of exchange between actors was also identified: the direction of interaction can be from the forest owner to the actor (outdegree), from the actor to the forest owner (indegree) or it can be mutual. All actors (alters) connected to a forest owner were identified, calculated using Excel, and subsequently categorized into different actor groups. A single forest owner could have connections to multiple actors within the same category. The direction of connections was examined, and the value of the exchange was identified from the qualitative analyses. The value of exchange was categorised into intangible and tangible values.

4. RESULTS

4.1 Forest owners' perspectives on NTFPs and their utilisation

Forest owners' perspectives on forest ownership and NTFP utilisation were examined in Articles I and II (RO 1). Multivariate statistical analyses of web survey data identified four principal components (PC) based on the respondents' forest ownership motives in both articles, and they appeared to be exactly the same; 1) *Multiple-use, recreation*, 2) *Conservation*, 3) *Timber production*, and 4) *Inheritance*. The subsequent K-means clustering resulted in four groups in Article I: Conservationist (C); Inheritance (I); Timber producer (T); and Multi-objective (M), and two groups in Article II. The first group consisted of Multi-

purpose forest owners, since the PC score variables *Multiple-use, recreation* and *Timber production* contributed positively to this group. The PC score variables *Conservation* and *Inheritance* contributed to the second group, which represented the *Saver* type of forest owner (Table 2).

PC analysis based on NTFP utilisation resulted in almost the same PCs in both Articles I and II with the distinction that in Article I, four PCs emerged: 1) *Permission*, 2) *Additional knowledge*, 3) *Commercial use*, and 4) *Own use*, whereas in Article II, *Permission* and *knowledge* were loaded onto the same PC, which resulted in three PCs (Table 2). The K-means cluster analyses were made respectively and resulted into a four-group typology in Article I: *Permit provider*, *Knowledge needed*, *Commercial picker* and *Household user*, and a three-group typology in Article II: *Permit provider*, *Commercial picker* and *Household user*.

The PC analysis based on forest owners' perspectives with regard to Everyone's Rights and organic certification were only conducted in Article I. The analysis identified two PCs for Everyone's Rights: 1) *Positive*, and 2) *Negative*, and three PCs for organic certification: 1) *Positive*, 2) *Negative*, and 3) *Don't know, no opinion*. The K-means cluster analysis produced an equal number of groups based on the PC score variables, and these groups were named accordingly.

The following sections present the highlights of the results. Further details can be found in the individual articles.

Table 2. Principal components (PC) and clusters of forest owner typologies with regard to forest ownership motives, NTFP utilisation (I and II), Everyone's Rights and organic certification (I).

	Article I		Article II	
	PC	Cluster	PC	Cluster
Motivation	Multiple-use, recreation	Multi-objective	Multiple-use, recreation	Multi-Purpose owner
	Timber production	Timber producer	Timber production	
	Conservation	Conservationist	Conservation	Saver type of owner
	Inheritance	Inheritance	Inheritance	
NTFP	Permission	Permit provider	Permission and Knowledge	Permit provider
	Additional knowledge	Knowledge needed		
	Commercial use	Commercial picker	Commercial use	Commercial picker
	Own use	Household user	Own use	Household user
Everyone's Rights	Positive	Positive	-	-
	Negative	Negative		
Organic certification	Positive	Positive		
	Negative	Negative		
	Don't know; no opinion	No opinion		

4.1.1 Forest owners' motives for owning their forests and for NTFP utilisation (Articles I and II)

The results from Articles I and II were highly consistent, thereby complementing each other and strengthening the overall reliability and validity of the findings. Recreation and outdoor activities, physical exercise from forestry, preservation of biodiversity and the landscape were the most important motives that the forest owners identified for using their forest holdings (important or very important: 66–70% of respondents in I and II). More than half the respondents (53–57% in I and II) indicated that berry and mushroom picking was an important factor for their forest use, but approximately 11–12% forest owners (I and II) considered it important to collect special NTFPs, such as birch sap, chaga and spruce sprouts, from their forest. A minor proportion of forest owners (23% in I; 36% in II) considered the forest their primary source of income, and less than half or half (39% in I; 50% in II) viewed it as a regular supplementary source of income.

Most forest owners stated that they used their forests in a variety of ways with regard to NTFPs (Table 3). About four out of five forest owners had adopted berry and mushroom picking for personal use as a regular habit (83% in I; 79% in II), but only 14% collected them for sale (I and II), and only a small number engaged in the commercial collection of special natural products that required the forest owner's permission (4% in I; 6% in II). However, a significantly larger proportion of respondents expressed interest to produce special NTFPs in the future (37% in I; 49% in II). The results indicate a need for increased information regarding both the diverse uses of the forest (43% in I; 56% in II) and the impact of special collection product production on the forest and its growth (50% in I; 58% in II).

Canonical correlation analysis revealed that forest owners whose forest ownership motives were *Multiple-use*, *recreation* harvested NTFPs both for their own use and commercial use (I and II) (Table 4). Those who were *Conservationists* harvested for their own use but also needed more information about NTFPs (I and II) and were willing to give permission for their forests to be utilised in special NTFP production and tourism

Table 3. Percentage (%) of forest owners who agree or strongly agree with statements regarding utilisation of non-timber forest products (NTFPs) and multiple use of forests (I and II).

Statements	Article I, %	Article II, %
I collect NTFPs for own use (e.g. berries and mushrooms)	83	79
I use my forests in various ways	74	73
I need more information about how harvesting NTFPs affects timber	50	58
I need more information on how to diversify forest use	43	56
I can give permission to use special NTFPs	37	38
I am interested in production of special NTFPs	37	49
I can give permission for tourism and programme services	34	34
I am interested in handing over information about NTFPs for companies	25	29
I am interested in utilising my forests for tourism and programme services	14	15
I collect NTFPs for sale (e.g. berries and mushrooms)	14	14
I produce special NTFPs for sale	4	6

Table 4. Relationships between the principal components (PC) score variables (Table 2) on forest owners' motives for forest ownership and perspectives with regard to non-timber forest products (NTFPs) (I and II).

Motives for forest ownership	Perspectives concerning NTFPs	
	Article I	Article II
<i>Multiple-use, recreation</i>	Own use, Commercial use	Own use, Commercial use
<i>Conservation</i>	Own use, Additional knowledge	Own use, Permission and knowledge
<i>Timber production</i>	Permission, Additional knowledge, Commercial use	Permission and knowledge, Commercial use
<i>Inheritance</i>	Own use	Own use

programme services and were open to the provision of information to companies on the potential of NTFPs in their forests (II). *Timber producers* were a more heterogeneous group and were positively correlated with *Permission*, *Additional knowledge* and *Commercial use* groups. Owners with *Inheritance* motives collected NTFPs for their own use (I and II).

The Ctree analyses between forest owner demographics and typology groups revealed how these factors influence their perspectives on NTFP production (I). Only the most important nodes are presented here, and more detailed results can be found in Article I.

Timber producers were typically forest owners residing on their forest holding and had recently carried out harvesting activities (Node 10, the highest column, and a high number of respondents) (Fig. 1). Females who either did not reside or only lived part-time on the forest holding were typically *Timber producers* or *Conservationists* (Node 3). Forest owners who planned to leave the forest property to the next generation (*Inheritance*) were most often males who lived in the same municipalities or in the North Karelia region and had recently undertaken forest cuttings (Node 12). *Multi-objective* users were more frequently males under the age of 54 who either did not reside or lived only part-time on the holding (Node 5).

In the Ctree analysis, regarding perspectives and utilisation of NTFPs, the group that required additional information was large in almost all Nodes (Fig. 2). *Permit providers* were typically forest owners who had delegated forest management to others or were unable to specify their forest management practices (Node 2). Forest owners who collected for personal use were more likely those who undertook forest management themselves or did not manage forests at all and were located more than 60 km away from the forest holding (Node 5). The *Commercial pickers* group was larger if the respondents lived closer to the holding (Node 4).

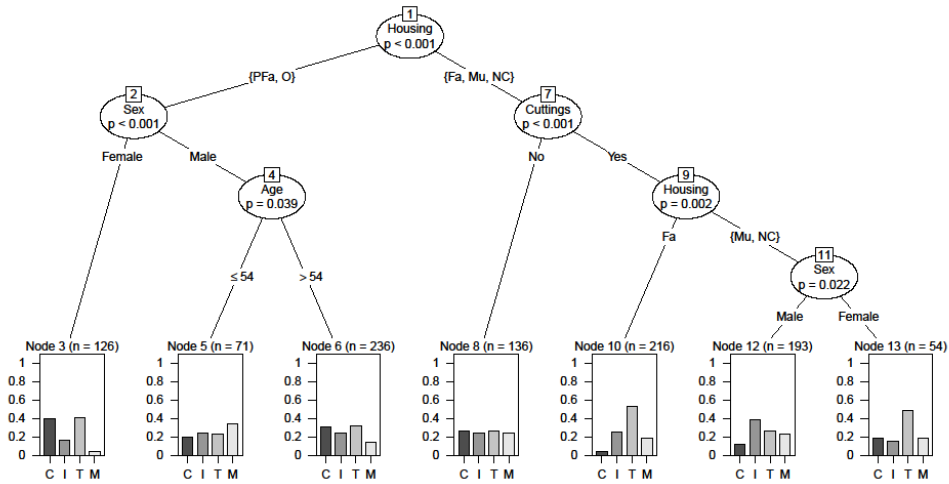


Figure 1. Conditional Trees (Ctree) analysis for forest owner typologies for forest ownership motives: C = Conservationist; I = Inheritance; T = Timber producer; M = Multi-objective. Abbreviations: Housing: Fa = Directly on the holding; PFa = Part of year on the holding; Mu = In the same municipality; NC = In North Karelia; O = Elsewhere; Cuttings = Cuttings carried out between 2015–2018 (Yes or No) (I).

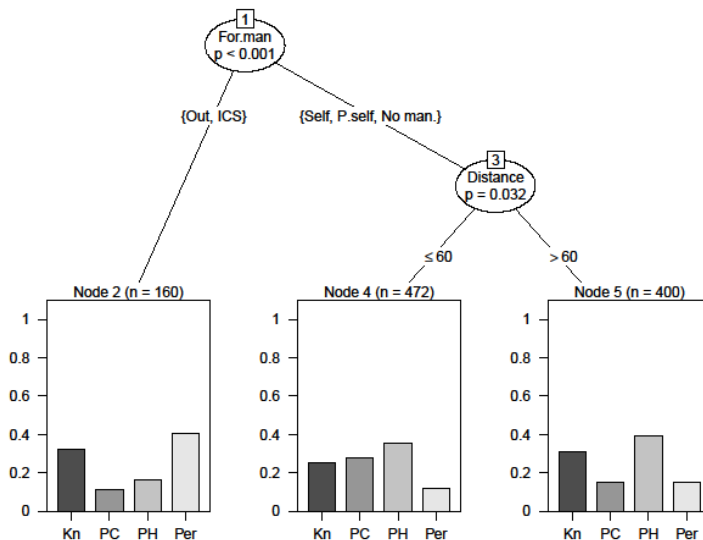


Figure 2. Conditional Trees (Ctree) analysis for forest owner typologies for perspectives and utilisation of non-timber forest products (NTFPs): Kn = Knowledge needed; PC = Commercial picker; PH = Household user; Per = Permit provider. Abbreviations: Forest management (For.man); Out = Outsource; Self = Do myself; P.self = I do partly myself; No.man. = No management; ICS = I cannot say; Distance = Distance from the holding if the respondent did not live there (I).

4.1.2 Forest owners' perspectives concerning Everyone's Rights (Article I)

Forest owners generally held positive views on berry and mushroom picking, appreciating Finland's Everyone's Rights (80%) for its role in boosting the national image and tourism, as well as contributing to rural income and vitality (73–75%) (I). However, 65% of owners believed that commercial collection should require contracts, one-half opposed commercial collection under Everyone's Rights, and one-fourth supported restricting these rights.

The canonical correlation analyses revealed that forest owners who had positive perspectives towards Everyone's Rights were those who would be willing to give permission for their forests to be utilised in tourism and program services, as well as provide information to companies about NTFP potential in their forests. They needed additional knowledge about such use, and they collected NTFPs for their own use.

In the Ctree analysis, forest owners who were wage earners or students, unemployed, people in nursing or job alternation leave (group other) had more positive perspectives concerning Everyone's Rights than entrepreneurs, retired or those whose motives were multi-objective (M in Cluster 1) (Fig. 3).

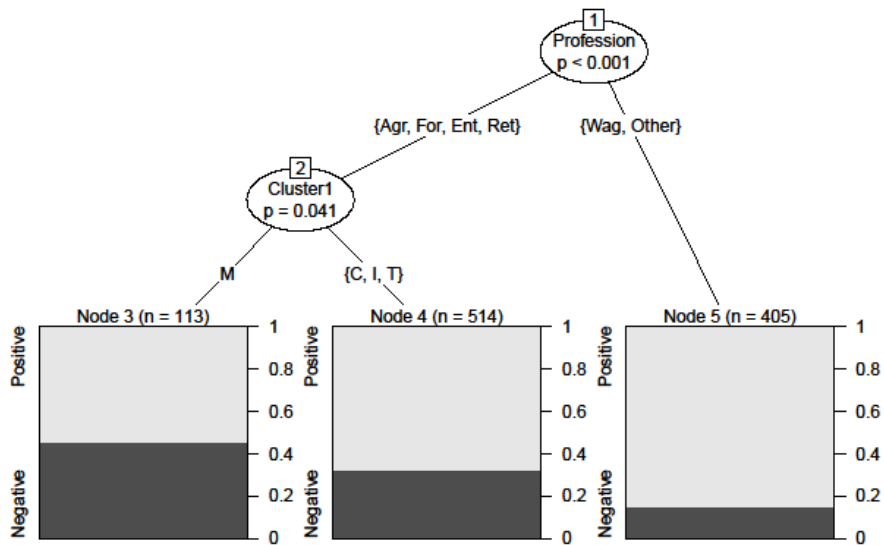


Figure 3. Conditional Trees (Ctree) analysis for forest owner typologies regarding perspectives concerning Everyone's Right: Negative or Positive. Abbreviations: Profession: Wag = Wage earners; Agr = Agricultural entrepreneur; For = Forestry entrepreneur; Ent = Other entrepreneur; Ret = Retired; Other = Other, Cluster 1 = forest owner typologies for forest ownership motives: C=Conservationist; I=Inheritance; T=Timber producer; M=Multi-objective (I).

4.1.3 *Forest owners' perspectives on organic certification of forests (Article I)*

Organic forest certification was an unfamiliar concept to many forest owners. Only 23% of the respondents had previously heard of certified organic collection areas (I). Half of the forest owners expressed a need for more information on organic collection area certification before deciding on the management of their forests. However, more than a third (35%) of the forest owners were willing to certify their forests entirely or partly, and even more were interested in the certification of organic collection areas if it would provide an economic benefit to the owner (40%) or if it did not involve costs or effort for the forest owner (45%). Around 22% of forest owners were hesitant to certify their forests as organic collection areas. Forest owners considered organic collection areas to be well-suited for North Karelia, with 70% believing they enhance the region's reputation as a clean environment and 58% seeing them as a valuable marketing tool. Half of the respondents regarded certification as a means to direct commercial picking away from residential and holiday areas, whereas 46% were concerned that it could lead to increased commercial harvesting pressure in certified organic forests.

In the canonical correlation analyses forest owners with positive views on Everyone's Rights were found to be supportive of organic certification, while those with negative views were opposed. Forest owners who were *Permission providers* and those who needed *additional knowledge* were uncertain or had no opinion on organic certification of forests.

In the Ctree analyses, the most positive perspectives towards organic certification were found among female forest owners with *Conservation* or *Timber production* motives, while the most negative perspectives were observed among owners over 60 years old with *Multi-objective* or *Inheritance* motives.

4.1.4 *Forest owners' perspectives on cultivation of specialty mushrooms (Article II)*

Nearly three-fifths (59%) of forest owners were aware of specialty mushroom species, with chaga, shiitake (*Lentinula edodes*), and champignon (*Agaricus bisporus*) the most widely known (II). However, only 15% were familiar with the cultivation of specialty mushrooms (Table 5). About a fourth of forest owners were interested in specialty mushroom cultivation in co-operation with companies selling cultures or buying mushrooms. One-third believed that mushroom cultivation could enhance the profitability of forest management. However, a significant proportion (54–63%) of forest owners were unsure or needed more information about the cultivation of specialty mushrooms on tree stumps and its potential benefits for forest management profitability. More knowledge was also needed on cultivation success, yields and costs, potential stands for cultivation and mushroom markets. The support of peer forest owners and the forest industry was found to play an important role in promoting the adoption of specialty mushroom cultivation on stumps.

According to the multinomial logistic regression model, forest owners classified as *Commercial pickers* and *Permission providers* were significantly more likely to have interest in specialty mushroom cultivation. Younger owners, males, respondents with higher levels of education, part-time forestry entrepreneurs and those who outsourced silvicultural operations or not conducted such activities at all were more likely *Commercial pickers* or *Permit providers*. The grouping based on *Forest ownership* motives was not a significant predictor in the logistic model.

Table 5. Forest owner's opinions on specialty mushroom cultivation. Extracted from Table 10 in Article II, p. 11.

Statement	Forest owners, n = 2,275–2,383
<i>Familiar with specialty mushroom cultivation?</i>	
Yes	15.0%
<i>Interested in cultivation in co-operation with companies selling cultures or buying mushrooms?</i>	
Yes	23.0%
No	23.3%
I cannot say; need more information	53.7%
<i>Could cultivation increase the profitability of forest management?</i>	
Yes	32.4%
No	4.8%
I cannot say; need more information	62.8%

4.2 Entrepreneurship in the NTFP Sector

This section aims to identify the factors that influence forest owners' decision-making with regard to engagement in NTFP production alongside traditional forestry, as well as their efforts to diversify forest use. In addition, it explores the challenges that forest owners face when operating in the NTFP sector (RO2).

4.2.1 Forest owner's motives for entering the NTFP sector (Article III)

Forest owners who engage in the NTFP sector are seldom driven by a single motivation. In this study, 24 different drivers that motivate forest owners to start their own business in seven categories were recognised (see Appendix A in III). Drivers were divided into external and internal drivers. External drivers are things outside the forest owners' control that will have an impact on its entrepreneurial success, whereas internal drivers are forest owner driven and can be controlled by the forest owner.

Economic or social-status and **operational environment** related drivers were considered as external drives for entrance to the NTFP sector. Many of the forest owners emphasised the importance of diversifying the economic value derived from their forests. They viewed forests as a source of multiple earning opportunities beyond traditional timber production. The NTFPs were perceived as a way to create alternative revenue streams from forests, particularly from sites with limited potential for timber production. Only a small number of forest owners viewed NTFP production as their primary source of income. However, NTFPs were more commonly valued as a secondary income stream, providing supplementary earnings to complement otherwise modest revenues. In addition, NTFP

production was seen as a way to ensure a more stable and consistent annual income from forest resources.

The motivation factors of forest owners varied from independent entrepreneurship and seasonal work to the creation of employment opportunities, while living in rural areas or near family farms made production more accessible.

Internal drivers that originated from the forest owners themselves were **self-actualisation, recreation, education or expertise** and **social networks**. Forest owners have their own internal interest in the NTFP sector and the utilisation and collection of NTFPs has been a traditional way of life for some of them. They were found to be eager to promote the well-being and therapeutic values of NTFPs, as well as to introduce “pure” and healthy products to the market.

For some forest owners, the recreational value of collecting and utilising NTFPs was an important motivator to enter the sector. They had long seen it as a hobby and were curious if it could also serve as a new way to earn income. For those with small forest holdings where timber sales offered limited profit, there was appeal in diversifying forestry activities and combining personal enjoyment with small-scale business opportunities that provided a sense of appreciation.

Some forest owners were motivated to pursue entrepreneurship in the field by acquiring knowledge and experience through education, professional work, or research projects. Social networks, such as support from friends, relatives or acquaintances, played a crucial role in helping some of them start their own businesses.

Some forest owners had experienced external changes in their life (e.g. unemployment) and this had led them to consider starting their own business, making entrepreneurship a viable option. On the other hand, for some forest owners, an internal change or personal motivation led them to pursue NTFP production. This change was often planned and driven by a desire to adopt a slower, more peaceful lifestyle, moving away from a hectic work routine.

4.2.2 Forest owner's challenges in the NTFP sector (Article III)

In this research, barriers were also defined as external and internal factors that prevent forest owners from becoming entrepreneurs in the NTFP sector and/or hinder the development of entrepreneurial activities. In this research, 77 barriers in 13 categories were found (see Appendix B in III).

Most of the identified barriers were external and were unrelated to the forest owners themselves. The most substantial challenge was nature itself. **Outside interferences**, such as weather and natural conditions, were seen as significant barriers to NTFP production. Yields fluctuated annually due to changing weather conditions, and unexpected disruptions, such as storms or pests could devastate crops. Moreover, **a lack of resources** hindered involvement in NTFP production, with high initial investment costs, insufficient equipment and supplies, and the heavy workload of working alone or with family members. Moreover, the short collection period for NTFPs further limited the number and quantity of products that could be gathered when working alone.

A lack of information also hindered many forest owners' activities. Obtaining research and practical knowledge on NTFP production proved challenging, requiring self-directed learning, sufficient resources, and specific skills. Information exchange was limited due to

one-on-one partnerships and occasional jealousy, which sometimes led to the spread of unreliable information. Furthermore, the **market** and **demand** for the products were seen as barriers to entering the NTFP sector by some forest owners. The limited number of buyers who dominate the market make it difficult for smaller producers to engage in trade, as many buyers require large volumes of products that small-scale producers are unable to provide. The absence of wholesalers to aggregate products from small producers and pass them on to buyers has also hindered market access. Some forest owners also perceived the NTFP market as small, generally low or uncertain, which limits the overall demand for the products.

Forest owners felt that limited **cooperation networks** have hindered their entry into the NTFP sector, as well as their production and expansion opportunities. In addition, **regulations and bureaucracy** have hindered their entrepreneurial activities, with complicated legislation and paperwork. The perishable nature of many NTFPs poses **quality challenges**, and poor-quality products risks damaging their reputation. **Low prices** and high production costs were also seen as obstacles. Difficulties in hiring skilled **employees** and **logistical challenges**, such as long transport distances and expensive or slow transportation, were mentioned as external barriers.

Human or personal factors, such as age and health concerns, were considered internal barriers to entering and operating in the NTFP sector. A lack of knowledge and education in the field was cited as a barrier and some older forest owners worried about their physical ability to continue, as NTFP collection is physically demanding.

4.3 Social networks of NTFP-producing forest owners

This section aims to define the structure of forest owner networks within the NTFP sector and to examine value creation within these networks (IV), with a case example focused on the interest of supply chain actors in special mushroom cultivation (II) (RO3).

4.3.1 *Structure of forest owner networks in the NTFP sector (Article IV)*

In this study, all forest owners mainly worked as individuals or with the family (IV). The size of forest owner networks engaged in NTFP production averaged 5.5 members and ranged from 1 to 10 persons. Several products were associated with larger and more diverse networks, as forest owners who produced more NTFPs maintained broader connections with various stakeholders.

Connections with buyers and resellers, such as cafeterias, restaurants and handicraft shops, were the most prevalent, with 12 respondents maintaining contact with at least one, and some engaging multiple actors, resulting in 20 total connections (Table 6). Industrial buyers, including larger companies that establish contracts with forest owners, formed the second most common type of connection. While selling products to other businesses or for further processing was the primary focus, nearly half of the respondents (7) also sold directly to consumers.

Table 6. Forest owner connections with different actors. Values in **bold** indicate the actors that forest owners had the most and least connections (IV).

Actors	Number of connections
Buyers and resellers	20
Industrial buyers	17
Forest Centre	11
Research and education	11
Other forest organisations	8
Consumers	7
Third sector	6
Peers	6
Relatives and acquaintances	6
Development organisations	6
Authorities	6
Organisations in NTFP sector	3
Employees	3
All	110

Forest organisations were well represented in forest owners' networks, especially the Finnish Forest Centre with 11 connections. Research and education organisations were also actors to which forest owners had many connections. The least number of connections were with organisations in the NTFP sector and with employees, such as collectors and seasonal workers.

4.3.2 Value creation (Articles II and IV)

Tangible value exchange

Forest owners primarily sold raw materials to a range of buyers; industrial buyers, smaller buyers, resellers and consumers, receiving compensation in return and thereby engaging in a mutual, tangible exchange of value (IV) (Fig. 4). Connections with industrial buyers often led to long-term contracts, ensuring a stable market for forest products. In some cases, forest owners also purchased products such as chaga inoculation plugs from suppliers or provided growing areas for industrial buyers in exchange for equipment and labour. These forms of cooperation were frequently driven by practical constraints, such as the limited availability of nearby buyers and perishability of NTFPs, which restricted delivery distances.

In addition to commercial transactions, forest owners maintained multiple connections with forest organisations, particularly with the Finnish Forest Centre (see Table 6). This state-funded body promotes sustainable forestry, offers advisory services, collects and disseminates forest data, and enforces forestry legislation. The value exchange between forest

owners and the Forest Centre was both mutual and indegree, often centred on the exchange of information through collaborative projects. While the distinction between tangible and intangible value was sometimes blurred, tangible value was evident when forest owners were compensated for sharing their expertise in training sessions or were paid participation fees to attend such events.

Other forest organisations, such as forest service entrepreneurs and Forest Management Associations (a regional body of forest owners that support sustainable forest use), engaged in more straightforward exchanges of tangible value, typically involving the implementation of forestry work and corresponding compensation.

Forest owners were also involved in project-based collaborations with research institutions, educational organisations and third sector actors. Their roles varied from acting as experts or trainers to offering land for research purposes. In these contexts, the value exchange was primarily tangible and based on clearly defined project activities.

Connections with NTFP organisations were relatively rare. One forest owner, for instance, was an active member of an NTFP association, where mutual value exchange occurred through membership fees and the information received in return. Similarly, forest owners had only limited interactions with employees, but these relationships were also characterised by mutual and tangible value exchange, typically in the form of compensation for labour performed.

Intangible value exchange

The exchange of information represented a crucial intangible value in nearly all connections (Fig.4) (IV). Forest owners actively sought expertise from forestry professionals as well as from research and education organisations. However, identification of specialists with the necessary knowledge remained a challenge. For instance, while approximately two-fifths of forestry professionals were familiar with specialty mushroom cultivation (Table 10 in II), 70% still reported needing more information, particularly with regard to cultivation practices and research findings (Table 13 in II). One-third expressed interest in collaborating with companies involved in selling cultures or purchasing mushrooms, viewing this as a potential way to enhance forest profitability. Nevertheless, nearly half of the professionals required further information and were unable to form a clear opinion (Table 10 in II). Harvesting entrepreneurs were even less familiar with the topic, only 13% had any knowledge, while their need for more information was significantly higher (58–72%) (Table 10 in II).

Forest owners also engaged in knowledge exchange with research and education organisations, not only through receiving information but also by contributing as experts. In addition to tangible knowledge sharing, intangible value was created through seminars and workshops. Cooperation with the Forest Centre in particular, provided access to both knowledge and networking opportunities. Information exchange often occurred informally, for example, during discussions about NTFPs in the context of other forest-related interactions (IV).

The exchange of knowledge and expertise was also central in relationships between forest owners and buyers (IV). Industrial buyers shared research insights and practical advice, while forest owners contributed hands-on, experience-based knowledge. This information was typically offered as a value-added element rather than as a separate transaction. The NTFP entrepreneurs were another valuable source of information: over 80% were familiar with

specialty mushroom species and showed strong interest in learning more (II). Although only 26% currently used specialty mushrooms in their operations, 40% saw potential for integration into their businesses in the future.

In contrast, relationships with smaller buyers and resellers were often rooted in social connections and emotional ties (IV). These partnerships emphasised not only the transactional aspects but also the social value of collaboration. Key factors included trust, familiarity, local products and operational efficiency. Forest owners frequently offered tailored services and flexible delivery arrangements. In many cases, buyer selection occurred by chance, through encounters at events or seminars, which later evolved into mutually beneficial relationships and, over time, personal friendships.

With NTFP organisations, intangible value was created through the exchange of expertise, knowledge and the development of cooperation networks (IV). These associations also supported professional development in NTFP entrepreneurship, facilitated product offerings and helped build connections to potential customers and broader information networks. Similarly, in collaborations with research and education organisations, forest owners not only received business development support but also contributed to project visibility and outreach.

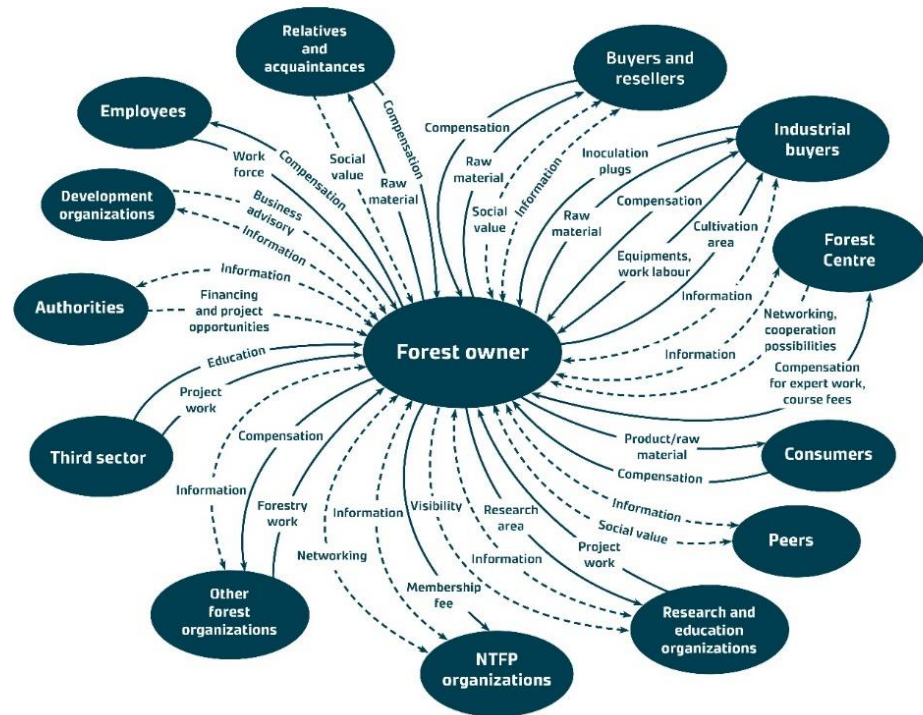


Figure 4. Value exchange between the forest owner and different actors in their network and the direction of exchange. Direction can be: indegree – value exchange from actor to forest owner, mutual – both forest owner and actor received value from each other, outdegree – value exchange from forest owner to actor. A continuous line represents tangible exchange, while a dashed line denotes intangible exchange (IV).

5. DISCUSSION

5.1 Forest owners' perspectives towards diversified forest use (RO1)

Forest owners' perspectives towards NTFPs were generally positive and the majority of them collected NTFPs under Everyone's Rights for their own use, but only a few collected them for sale (I and II). This is common for NTFPs, as they are frequently collected for personal purposes and are largely associated with leisure activities or social engagement (Weiss et al. 2019b). This makes it difficult to estimate the real amount of collected NTFPs and their true market value (Lovric et al. 2021).

5.1.1 Variation in forest owners' interest in NTFP production

The typologies derived from the forest ownership motives (*Multiple-use, recreation; Conservation; Timber production; Inheritance*) (I and II) were in line with previous forest owner studies (Karppinen 1998, Karppinen et al. 2020; Kline et al. 2000; Majumdar et al. 2008; Hallikainen et al. 2010; Song et al. 2014). The exploration of forest owners' motives is important as they have been identified as key factors that influence forest owners' decision-making in forest management (Kuuluvainen et al. 1996; Kline et al. 2000; Ní Dhubháin et al. 2007). The comparison of motives and perspectives toward NTFPs enhanced understanding of the reasons behind forest owners' behaviour with regard to NTFPs (I and II). In general, forest owners viewed NTFPs positively, and while few are currently engaged in commercial production, a substantial proportion expressed interest in producing NTFPs for economic purposes in the future. Notably, two groups demonstrated a higher level of interest in commercial use compared to the others: those with motives of *Multiple-use and recreation*, and *Timber producers* (I and II). *Multiple-use* owners place high importance on forest ownership as an investment, focusing on timber production and valuing regular annual incomes from forests (Ingemarson et al. 2006; Majumdar et al. 2008; Kline et al. 2000). At the same time, they value personal enjoyment through recreation, mushroom and berry picking, and also appreciate green spaces. They prioritise aesthetics, hunting, nature conservation and environmental quality, which includes water and soil conservation, climate change mitigation and pollution control (Ingemarson et al. 2006; Majumdar et al. 2008; Urquhart and Courtney 2011). These earlier results are in line with the findings of this thesis, which showed that forest owners who had engaged in the NTFP business prioritised recreation and valued well-being and intrinsic values alongside economical returns (III). These owners have actively sought ways to utilise their forests in a more diversified manner. According to C-tree analyses, *Multi-objective* users were more often males, younger and did not live or lived only part of the year on the holding (I). The dominance of males in the *Multi-objective* group has also been observed in Sweden, which shares numerous structural and cultural similarities with Finnish forest ownership (Ingemarson et al. 2006). Also, absentee forest owners, i.e. forest owners who do not reside on their forest land, have been described as more likely to allocate their forest to different forest uses and be less active in traditional forest management (Kittredge 2005; Rickenbach and Kittredge 2009; Sagor and Becker 2014; Wiersum et al. 2005). They are also more willing to engage in, for example, carbon offset (Miller et al. 2012) and public hunter access programs (Kilgore et al. 2008).

Timber producers are often described as valuing the economic security that forests provide, in tandem with the steady income generated from timber sales (Kline et al. 2000; Karppinen et al. 2020). In this thesis, *Timber producers* considered NTFPs as a way to diversify income from the forest. They were willing to give permission for their forests to be utilised in NTFP production and tourism and program services, and they had positive perspectives toward commercial use of their forests with regard to NTFPs, but they did not often collect NTFPs for their own use (I and II). This implies a production-oriented mindset, which has been identified as characteristic of timber producers in previous studies (Urquhart and Courtney 2011). They are often supportive of commercial utilisation, even though they do not actively collect these products for personal use (Frey et al. 2021). *Timber producers* also represent a heterogeneous group with diverse demographic characteristics. According to C-tree analyses (I), the largest group of *Timber producers* lived on the forest holding and had recently undertaken cuttings, which is similar to the findings of Juutinen et al. (2020) who found that forest owners living near their forests often preferred traditional rotation forestry, likely due to long-term residence and inherited management practices from their parents.

In Article II, the results indicated that *Commercial pickers* and *Permit providers* showed greater interest in the cultivation of specialty mushrooms. This is understandable, as individuals already engaged in commercial activities within the NTFP sector possess the relevant experience, making it easier for them to expand into new products. This finding is supported by Zacca et al. (2015), who found that entrepreneurial orientation, when combined with an existing market orientation, a well-developed infrastructure, a willingness to change and a strong development culture, positively influences new product exploration in small enterprises. In this context, commercial actors with an entrepreneurial mindset are more likely to pursue opportunities to expand their activities into novel product areas and for example joint production, such as the cultivation of specialty mushrooms.

The findings of this thesis suggest that development efforts in the NTFP sector would be more effective if targeted at forest owner groups according to their motives: *Multi-objective* owners and *Timber producers* (I and II) and at those who are already involved in commercial use of NTFPs (II). From the perspective of sustainable forest use, encouraging *Multi-objective* owners to engage in NTFP production can simultaneously promote diverse and sustainable forestry practices as they have been found to generally practice the most sustainable forms of forest management (Blanco et al. 2015). For *Timber producers*, NTFPs offer an opportunity to diversify and stabilise their forest-based incomes, which aligns with their primary objective in forest management. In addition, as NTFP production has been shown to enhance forest biodiversity, *Timber producers* also contribute to the promotion of multifunctional and sustainable forestry alongside their economic goals.

5.1.2 Forest owners as early adopters

Many forest owners had a positive attitude towards the new opportunities offered by NTFPs and were willing to experiment with them (I). According to the results, organic collection areas were largely unfamiliar to most forest owners. Nevertheless, the concept was generally viewed positively, and nearly half of respondents expressed interest in certifying their forests for organic collection, provided this activity did not demand extra efforts or additional costs from the forest owner.

Similarly, the cultivation of specialty mushrooms was a novel concept for many forest owners: 23% expressed interest in engaging in cultivation in collaboration with companies selling cultures or buying mushrooms (II). This corresponds to over 140,000 forest owners in Finland. Those interested in cultivation were more often male, younger, highly educated and part-time forestry entrepreneurs, or identified as *Commercial pickers* or *Permit providers*. These individuals can be characterised as early adopters within the NTFP sector. Early adopters tend to have a higher socioeconomic status and are often motivated by the potential for profit and cost savings (Rogers 2003; Dedehayir et al. 2017). This aligns with the classification of *Commercial pickers* and *Permit providers*, whose engagement in NTFP activities is often financially driven (I and II). Rogers (2003) further describes early adopters as individuals who are more open to change and better equipped to handle uncertainty and risk. Since the results of joint timber and NTFP production are encouraging (Tahvanainen et al. 2018; Kurttila et al. 2018), forest owners who show early interest in new forest management opportunities may also be eager to engage in joint production, although it requires more planning and potentially adjusting silvicultural practices to better support multifunctional forest use (Kurttila et al. 2018).

Early adopters also often serve as opinion leaders within their communities, providing information and guidance to others who are considering innovation. This dynamic was evident in Article III, where forest owners shared knowledge with peers. By adopting new practices and sharing their experiences, early adopters help reduce the uncertainty that surrounds innovations and lend credibility to new ideas through their social networks. In doing so, they not only legitimise new practices but also encourage broader participation among other forest owners (Rogers 2003), thereby contributing to sustainable forest management.

However, the successful implementation of such initiatives requires coordinated efforts across the entire value chain. From the forest owner's perspective, it is not enough to simply establish cultivation agreements with harvesting entrepreneurs; it must also be ensured that the mushrooms are harvested, marketed and sold. Effective collaboration depends on shared business interests and mutual benefits among all actors involved. Therefore, the NTFP sector must develop new business models that integrate NTFP entrepreneurship with forestry practices, enhance intersectoral cooperation and support the development of business networks.

5.2 Perceived opportunities and challenges in the NTFP sector (RO2)

The results presented in Article III showed that forest owners involved in the NTFP sector as entrepreneurs expressed a strong desire to align their business activities with their personal values and interests. They viewed forests as more than just a source of timber and sought to promote their diverse utilisation through entrepreneurial efforts. In particular, they placed high value on aspects, such as forest purity, human well-being, health benefits and recreational use. These values were not only central to their relationship with the forest but also influenced their decisions to engage in NTFP-related entrepreneurship. The decision to become an entrepreneur was often rooted in personal interest, previous hobbies or a lifestyle aligned with NTFPs (III). This aligns with earlier research that suggests that self-actualisation, such as the desire to live according to one's values and promote well-being, is

a strong motivator for starting a business (Staniewski 2009; Stephan et al. 2015). This also suggests that forest owners engaged in NTFP production can be defined as sustainable entrepreneurs. Sustainable entrepreneurs are characterised not only by their pursuit of financial gains but also by their commitment to personal values, environmental responsibility, and the desire to contribute to societal well-being (Hanohov and Baldacchino 2017; Sarango-Lalangui et al. 2018). This thesis highlights the fact that the forest owners who enter the NTFP sector exhibit many of these traits. Their motivations reflect the hybrid nature of sustainable entrepreneurship, where economic and non-economic drivers are intertwined (Battilana and Lee 2014; Haigh and Hoffman 2012).

Forest purity was perceived as a prerequisite to the production of high-quality, health-promoting products (III). This perception is consistent with findings that link natural environments to psychological restoration and health benefits (Lee et al. 2014; Tyrväinen et al. 2014). The collection and use of NTFPs were described by respondents as meaningful activities that contribute to personal well-being and cultural identity. These findings echo the work of Wong and Wiersum (2019), who argued that NTFP harvesting can be an intense nature experience with positive effects on mental and physical health.

The respondents in this thesis emphasised the importance of meaningful work, self-realisation and the opportunity to contribute to sustainable forest use (III). These motivations are in line with the broader entrepreneurship literature, which highlights the role of personal fulfilment and value alignment in entrepreneurial decision-making (Akehurst et al. 2012; Staniewski and Awruk 2015). While few forest owners considered NTFPs as their primary economic livelihood, economic considerations still played a crucial role in their decision to enter the sector (III). For many, NTFP production was seen as a means to combine a passion for nature with income generation, especially as a supplementary revenue stream alongside traditional timber production. This aligns with broader findings that NTFPs often serve as important components of diversified rural livelihoods, offering both subsistence and market-based income opportunities (Magry et al. 2025). One of the key economic advantages identified by forest owners was the potential for a more continuous and stable annual cash flow from NTFPs, which contrasts with the long-term financial cycles typical of timber harvesting (III). This perspective is supported by research that has shown that NTFPs can provide regular, small-scale incomes that complement other forest-based or agricultural activities, thereby enhancing household financial stability (Delgado et al. 2023; Magry et al. 2025).

The findings highlight that many of the challenges forest owners face in the NTFP sector are largely beyond their control (III). External factors, particularly those related to climate and weather, play a significant role in shaping both the availability and quality of NTFPs. Natural fluctuations in harvest seasons, driven by precipitation patterns and unexpected environmental events, directly affect the supply of mushrooms and berries. Previous research has confirmed that climatic conditions, such as precipitation during the yield season, positively influence the marketed quantities of mushrooms (Tahvanainen et al. 2019). In the case of berries, climatic factors regulate yields and market supply by affecting flowering and pollination success. However, these effects are more complex and less predictable, as different stages of berry development respond differently to climatic variations. In addition to influencing yields, weather conditions also may impact harvesting activity itself.

Additionally, significant structural barriers also hindered business operations. These included limited market access, lack of industry-specific knowledge, insufficient resources

and fragmented cooperation networks. Logistical constraints, bureaucratic hurdles, low product prices, quality control issues and workforce shortages were also commonly cited obstacles. These findings align with previous research that has identified similar constraints in the NTFP sector across different regions (Maso et al. 2011; Meinhold and Darr 2019; Tikkanen et al. 2020). In Finland, the NTFP market remains relatively small, with a small number of dominant organisations that control the sector, making it difficult for small-scale producers to meet the large production-lot requirements often demanded by buyers (III). Many NTFP entrepreneurs operate alone or within small family-based businesses, which is typical for micro-enterprises (Hewitt-Dundas 2006; Casals 2011). This industry structure, characterised by modest production volumes and limited aspirations for expansion beyond self-employment, has constrained the sector's overall development to date (Tikkanen et al. 2020). A notable structural challenge in the Finnish NTFP sector is the absence of a comprehensive wholesale system (III). In the berry industry, collection points serve as a form of wholesale mechanism, but such structures are largely absent for other NTFPs. This fragmentation creates inefficiencies in supply chains, making it difficult for forest owners to commercialise their products on a larger scale. Tikkanen et al. (2020) have reported similar challenges, with raw material acquisition identified as a bottleneck due to underdeveloped collection networks and a lack of technological advancements in NTFP supply chains.

5.2.1 Need for knowledge

All four articles (I–IV) highlighted the need for more information on NTFPs and their production. The forest owners indicated the need for information on both multiple uses of the forest and the effects of the production of special collection products on the forest and its growth (I and II). Certification of organic collection areas raised interest among forest owners, but half of the forest owners indicated that they would require more information before making decisions regarding certification on their own land (I). Knowledge gaps were also evident across the NTFP value chain. Awareness of specialty mushroom species and their cultivation varied considerably among respondents, with harvesting entrepreneurs the least familiar. All supply chain participants, forest owners, harvesting and NTFP entrepreneurs and forest professionals, expressed the need for more research-based information on cultivation, yields, production costs and profitability (II).

The findings of this thesis reveal that a lack of accessible and practical information is one of the most significant barriers to entering or operating within the NTFP sector (III). Forest owners and other actors reported difficulties in accessing both research-based knowledge and practical experience related to NTFP production. Acquiring such knowledge required considerable time, effort and resources, making it demanding for those without prior experience in entrepreneurship or forest-based business development.

These findings are in line with earlier research that has identified several common barriers to entrepreneurship, including limited general business knowledge, a lack of professional experience and inconsistent or even contradictory advisory support from external agencies (Staniewski 2009; Smith and Beasley 2011). In the context of sustainable entrepreneurship, these challenges are often amplified. Entrepreneurs in this field must navigate the complex interplay of economic, environmental and social goals, which increases the need for reliable, context-specific guidance (Hoogendoorn et al. 2019). The lack of information is not only a practical obstacle in the sector but also a structural one, shaping who are able to participate

in the NTFP sector and under what conditions. The difficulty in obtaining relevant knowledge, whether scientific data, cultivation techniques or business models, means that only those with sufficient time, networks or prior experience can realistically engage in NTFP entrepreneurship. This highlights the importance of strengthening knowledge infrastructures and support systems that can lower the threshold for entry and enable more inclusive participation in sustainable forest-based businesses. Practical institutional models could include regional or local NTFP networks and associations that facilitate collaboration among forest owners, businesses, and research institutions. By supporting these networks, public sector advisory services could expand their role, offering tailored guidance to NTFP actors and fostering information exchange among diverse stakeholders. Key policy instruments could include, for example, the EU Rural Development Programmes, which provide funding and support for collaborative projects and innovation activities. Furthermore, national forestry and economic policies could incorporate NTFP sector development into a broader sustainable forestry strategy, enhancing resource allocation and promoting cooperation among actors.

5.2.2 *Acceptability and production of NTFPs*

In this thesis, the entrepreneurial forest owners did not identify Everyone's Rights as a challenge in the NTFP sector. This may be explained by the fact that most of the forest owners in this thesis produced products not covered by Everyone's Rights and required the permission of the forest owner for collection. However, in Article I, the forest owners who identified as *Commercial pickers* (i.e. those collecting NTFPs for sale) were found to hold more critical views toward Everyone's Rights. For them, the open access principle was seen as undermining the value of their work and resources, especially when others could collect similar products without compensation or responsibility from their land. The role of Everyone's Rights in the NTFP sector has become a topic of increasing debate in Finland, particularly in relation to the commercialisation of NTFPs (Peltola et al. 2014). Public access is a culturally and legally embedded principle, but its implications for fairness and economic sustainability in emerging bioeconomy sectors are complex. As noted in recent public discussions (e.g. Peltola et al. 2025) the acceptability of NTFP entrepreneurship depends not only on legal frameworks but also on perceptions of fairness, ownership and value creation.

Another key factor that influences the perceived legitimacy of the sector is the pricing of raw materials and labour. Many entrepreneurial forest owners felt that the prices offered for NTFPs were too low to support viable business operations (III). This concern reflects broader questions of fairness in natural resource use. Fairness in forest-based value chains is increasingly tied to recognition, compensation, and the equitable distribution of benefits among actors (Schroeder et al. 2019). Human rights and the ethical dimensions of NTFP production are also gaining prominence in both national and international policy arenas (Busk et al. 2024). These debates highlight how natural resources should be accessed and used to ensure fair compensation for forest owners, collectors, and local communities, while maintaining a balance between sustainability and accessibility.

5.3 Structure of the forest owner networks and value creation in the NTFP sector (RO3)

5.3.1 *Enhancing NTFP value through organic certification*

Organic certification is one way to increase the value of NTFP products by highlighting the sustainability of the products (McFadden et al. 2017). The certification process requires the involvement of forest owners (Evira 2018). According to this study, forest owners' views on increasing certified areas were promising. More than two fifths were willing to certify their forests, either fully or partially, as organic collection areas, provided it brought financial benefits or incurred no additional expenses (I). However, a challenge arises because forest owners who do not utilise the NTFPs from their own forests do not benefit from certification. At the same time, the processing industry needs a secure and continuous supply of raw materials, but without guaranteed access to these materials, they cannot invest in NTFP production. Consequently, to ensure sufficient supply despite the significant annual and regional variations in NTFP yields, more certified areas are needed in southern Finland.

In general, consumers have positive attitudes toward organic products (Magnusson et al. 2001, Shepherd et al. 2005). Several studies have concluded that health concerns (e.g. low pesticide levels/high nutrient content) are the strongest motive for purchasing organic food (Hamzaoui-Essoussi and Zahaf 2012; Magnusson et al. 2003; Padel and Foster, 2005; Shepherd et al. 2005; Zanolini and Naspetti 2002), but also environmental friendliness (Kuhlman et al. 2007) and status (Puska et al. 2018) influence consumers' willingness to buy organic products. In this study, organic collection areas were seen as a positive phenomenon for multiple use of forests and a way to support the bioeconomy and sustainable use of forests (I). Adding organic certification to NTFP products could, therefore, increase their perceived value with consumers. According to Taivalantti (2019), also both forestry and NTFP experts considered organic certification to be a good way to verify the purity and origin of products. However, they also raised the question of whether tree-derived products, such as chaga and birch sap, should rather be certified through forest certification schemes like FSC or PEFC, while only products growing beneath the trees, such as berries and mushrooms, would be certified through organic certification. This is a discussion that should take place when developing the use of certification systems in Finland, especially when considering the limitations and challenges of organic certification of forests. However, the positive associations with health, environmental sustainability and ethical production practices enhance the appeal of organic certified products, potentially opening up new market opportunities and allowing for premium pricing. In the context of this thesis, recognizing organic collection areas as supportive of multiple forest uses and the bioeconomy further highlights their potential to contribute both ecological and economic value to NTFPs.

5.3.2 *Intangible values create more value for NTFPs*

The structure and functionality of NTFP networks are highly influenced by the specific products being produced (IV), which highlights the fragmented nature of NTFP value chains. Different products require distinct forms of collaboration, market access and knowledge exchange. While previous studies have also acknowledged the heterogeneity of NTFP networks (Tikkanen et al. 2020; Huber et al. 2023), the specific value and dynamics of these

networks have been insufficiently explored. According to the results presented in Article IV, social values play a crucial role in shaping networks within the NTFP sector beyond transactional relationships. Trust, shared expertise and long-term cooperation among stakeholders were identified as key factors in the formation and maintenance of these networks, highlighting the complexity of value creation in NTFPs. These results refer to the importance of social capital in NTFP businesses, where trust, norms and shared values affects the cooperation and promote the development of businesses. In particular, bonding social capital, which emerges from close-knit relationships such as family ties and local community connections, provides emotional support and stability, while bridging social capital, meaning connections across different groups and institutions, facilitates access to new markets, knowledge, and innovation (Górriz-Mifsud et al. 2016; Rahe et al. 2025). Moreover, social capital enhances collective efficacy, enabling stakeholders to coordinate actions, share risks, and co-create value beyond economic transactions (Górriz-Mifsud et al. 2016). This is particularly relevant in the Finnish context, where social and cultural meanings attached to NTFPs foster a sense of shared identity and responsibility, further strengthening trust and cooperation (Tikkanen et al. 2020). Thus, social capital should be considered a strategic asset in policy and development initiatives aiming to support sustainable and inclusive growth in the NTFP sector, where understanding the added value of social aspects and recognising small-scale operations with embedded social values can foster profitability, enhance sectoral image, and support balanced rural development.

Information exchange was involved in almost all connections between actors in the forest owner networks (Fig. 4) (IV). Information was exchanged in both directions, from the forest owner to the actor and vice versa, and in many cases, it was vital for the existence of the connection. Information was sought from research and educational organisations through organised seminars and other events, but many forest owners had also actively participated in various projects related to NTFPs. This demonstrates the forest owners' activity in the field and their desire to acquire information and contribute to the advancement of the industry. The eagerness of forest owners to learn has been demonstrated in earlier studies as well. For example, Hujala et al. (2013) analysed the customer segments of family forest owners by combining their forest ownership objectives and decision-making styles. They found that forest owners, depending on their ownership objectives, exhibit differing decision-making styles. Multi-objective owners were more often studious learners, eager to learn but not self-reliant decision-makers, and thus needed external educative support. Also, a large number were deliberate thinkers who make decisions thoughtfully and analytically. These results, and those of this thesis, indicate that educative, interactive decision support and services are required to improve forest owners' participation in the NTFP sector.

5.3.3 Information needs and forestry experts: navigating NTFP knowledge in Finland

In this thesis, the forest owners indicated that they had extensively sought information from forestry organisations but not from NTFP organisations (IV). This has its roots in the history of Finnish forestry. Finland has had a strong tradition of an expert-driven forestry sector, where forest professionals from governmental organisations and forest management associations have provided information, guidance and advice to forest owners with the aim of engaging and encouraging forest owners in terms of decision making in relation to their forests (Sim and Hilmi 1987). There has been a societal need to develop governance practices

to manage and regulate the actions of private forest owners (Jokinen 2006; Peltola and Åkerman 2011). As a consequence, forestry organisations are often familiar to forest owners and for this reason, it is also easier for forest owners to turn to forestry professionals for matters related to NTFPs. This may also present an advantage, as certain services, such as specialty mushroom cultivation, are directly or indirectly connected to timber production and harvesting and could thus be offered by existing operators utilizing their current expertise and know-how. However, finding forest professionals with the relevant expertise is a challenge. Indeed, in some cases, the forest owners were more aware of NTFP production than the forestry experts (III). Moreover, if the information was not obtained from the professionals, it was sought from the peers and other actors in the network. Peers played a particularly significant role in sharing practical knowledge related to production (III), which aligns with previous findings that have suggested that peer learning groups tend to focus on practical issues rather than technical information (Kueper et al. 2013). However, not all aspects of forest owner's own production were openly shared with others (III). In particular, previous studies have found that sensitive topics, such as financial matters, are typically not openly discussed among peers (Hamunen et al. 2015). Nonetheless, peers have been found to provide supportive experiences, enhance knowledge and encourage action in forestry-related matters (Hamunen et al. 2020).

The results of this thesis indicate that knowledge management is crucial in the Finnish NTFP sector. Up-to-date information is required, and new tailored services are needed (e.g. advisory and information services, inventory and planning, mushroom cultivation, harvesting and marketing) (II). According to Tikkanen et al. (2020), enhancing education and gaining knowledge through various channels, such as research, dissemination, and awareness efforts, have emerged as key strategies and possible ways to address challenges in the NTFP sector. Effective information exchange is essential to support raw material suppliers in forming strategic connections and partnerships with primary producers and businesses involved in international markets. The goal of Finland's National Forest Strategy (Ministry of Agriculture and Forestry 2023) is that the services and incentives aimed at forest owners and stakeholders support active, sustainable and diverse use of forests, taking regional characteristics into account. Furthermore, expertise in the forestry sector is comprehensive and responsive to evolving demands. To reach these goals, information provision and decision support in relation to NTFPs should be included in the services provided by the forestry sector. Currently, the more dominant forestry service organisations do not fully address all aspects of forest ownership objectives. In particular, aesthetic values and biodiversity conservation motives, as well as the recognition of the diverse needs of forest owners, are crucial to develop more varied service offerings (Kuhlman 2024). It is also essential to recognise the significant influence that forestry actors may have on forest owners' decision-making. In terms of climate change adaptation, it has been observed that the perceptions and actions of forestry and wood industry actors influence the adaptive capacity of forest owners, as some adaptation measures are either supported or hindered by these actors (Van Gameren and Zaccai 2015). To create viable new businesses and positively impact economic rural development, it is important that support, communication and information sharing are effective and promote the expansion of NTFP production.

5.4 Critical review of the results

This thesis utilised three different forest owner data sets, which consisted of two quantitative data sets (number of respondents 1,132 in I and 2,405 in II) and qualitative data from in-depth interviews (20 forest owners). In addition, three quantitative data sets were gathered from forest professionals (number of respondents 229), harvesting entrepreneurs (number of respondents 105) and natural product entrepreneurs (number of respondents 38). Consequently, a mixed-methods approach incorporating a variety of analytical methods was adopted in this thesis to ensure a comprehensive analysis.

The response rates in the forest owner surveys in Articles I and II were low (17.1%; 14.3%), which has been the case in other surveys in northern Finland (e.g. Korhonen et al. 2004; Hallikainen et al. 2010). A comparison with the Forest Owner 2020 survey indicated that the data in Article I did not significantly differ from the population defined in the Forest Owner 2020 survey; in this thesis forest owners were slightly younger on average and owned larger forest holdings than the forest owners in the 2020 survey. In Article II, forest owners were slightly better educated, were more often female, were less likely to own an inherited forest, and had larger forest holdings than respondents in the Forest Owner 2020 survey. According to Karppinen et al. (2020), forest owners with larger non-inherited holdings were more likely to exhibit multi-purpose motives for their forests. Thus, owners who are interested in the diverse utilisation of their forests may be overrepresented in this sample.

Response rates from other actors were also low in the surveys, especially the NTFP entrepreneurs. Therefore, the results from these surveys could be primarily considered as case study results that do not represent the opinions of the whole population of NTFP entrepreneurs, forest professionals or harvest entrepreneurs.

Survey data were collected from forest owners from two different geographical regions: North Karelia (I and II) and South Savo (II). There was a three-year interval between the surveys conducted in North Karelia. The results obtained were very similar, thus supporting and reinforcing their validity. However, since the study's data were collected from specific regions, it weakens the generalisability of the research findings.

Use of electronic questionnaires may have caused coverage error in the data, as not all forest owners, particularly the elderly who may not be so familiar with electronic devices, may have had an equal opportunity to participate in the survey.

Widely used statistical methods PCA and K-means were applied to analyse the survey data. In the study by Ficko et al. (2019), they highlighted that PCA is sensitive to outliers, assumes linear relationships and can be difficult to interpret, as the PCs are linear combinations of the original variables. On the other hand, K-means clustering requires the number of clusters to be predefined, is sensitive to the initial placement of centroids, and assumes that clusters are spherical and of equal size. It has also been suggested that the set of questions used to express forest owners' objectives offers a limited view of ownership goals, as forest ownership is a multi-dimensional concept that may be difficult for owners to convey in just a few words. As a result, the statements may not have fully captured the underlying motivations for owning forest land (see Ficko et al. 2019; Takala et al. 2017).

The methodological approach of Articles III and IV was case study research, supported by 20 semi-structured interviews with forest owners, who produced a diverse range of NTFPs for the market. This approach is well-suited for gaining in-depth understanding of forest owners' perspectives and decision-making processes, as it allows the phenomenon to be

examined within its real-life context (Yin, 2014; Creswell and Poth, 2018). Several specific methodological choices contributed to the quality, reliability, and relevance of the data collected. First, the use of information-oriented sampling (Flyvbjerg, 2011) ensured that the selected forest owners had entrepreneurial experience in the NTFP sector, which strengthened the relevance and depth of the insights. This targeted selection increased the likelihood of capturing rich, experience-based knowledge, which is essential for understanding business practices, value networks and sector-specific dynamics. Semi-structured interviews provided a flexible yet systematic framework for data collection. This format allowed for thematic comparability across cases while also enabling the emergence of new, unexpected perspectives. The multiple case study approach enabled comparative analysis across different forest owner contexts. This approach facilitated the identification of both recurring practices and context-specific variations in NTFP-related entrepreneurship. These methodological choices influenced for the validity and utility of the findings. The contextual depth and diversity of perspectives strengthened the explanatory power of the results, making them valuable for both academic understanding and practical application in policy and NTFP-sector development. Moreover, the detailed case-based results offer a solid empirical basis for future research and contributes to the development of more targeted and contextually grounded support strategies for forest owners engaged in NTFP-related entrepreneurship. However, certain limitations should be acknowledged. First, case study research does not easily allow for statistical generalization, secondly, the relatively small sample size and the potential influence of sampling choices may restrict the breadth of perspectives included. Finally, as with many qualitative approaches, the role of researcher interpretation may introduce a degree of subjectivity. Despite these limitations, the chosen method enabled the generation of valuable, context-specific insights into forest owner behavior and the structural characteristics of NTFP production.

Article IV utilised SNA to support qualitative thematic analysis in examining the structure of the network. The use of SNA in qualitative analyses may be criticised, as it is typically employed in quantitative surveys with much larger samples. In this study, the number of interviewees was rather low, but semi-structured interviews offered the possibility to clarify questions and go back to previous questions, which enabled the researcher to deepen the information. This was especially important because challenges may arise in self-reported relationship data due to limitations in the interviewees memory or their desire to present themselves favourably. This can result in overstating connections with certain individuals while overlooking others, which potentially affects the accuracy of the data (Marsden 2016). Also, focusing on forest owners' egocentric network could be seen as a limitation. Critics argue that egocentric networks do not qualify as true "networks" because they cannot be depicted as a square array of actor-to-actor connections (Hanneman and Riddle 2005). Nevertheless, when egocentric networks are examined, it is still possible to adopt a structural or network perspective to comprehend the roles of actors within the network (Hanneman and Riddle 2005). However, SNA analyses and egocentric approaches have been used successfully in qualitative studies (e.g. Knoot and Rickenbach 2011; Korhonen et al. 2012). In this study, the egocentric approach provided valuable information about the egos (here forest owners), their neighbourhood and their positions in the network.

The challenge of using the terms NWFP/NTFPs when the national data gathering language only has one word for both was recognised and taken into account in the formulation of the survey questions as well as in the analysis of the results. The distinction

between products that could be collected under Everyone's Rights and those requiring forest owners' permission was made explicit in the questionnaires, which enabled the identification of differences in how forest owners perceive and categorize various NTFPs. This clarity in terminology and categorization was essential not only for avoiding misunderstandings related to access rights, but also to ensure that the responses captured forest owners' practical use of different NTFPs, along with their perspectives and related decision-making. However, survey-based approaches may not always reveal the nuances between different NTFP categories. To address this limitation, this thesis placed particular emphasis on one product group by exploring forest owners' interest in cultivating specialty mushrooms (II). Although the findings cannot be generalized to all categories of NTFPs, as they vary significantly in terms of their intended uses, production methods, and value chains, they offer valuable insights into forest owners' views on novel production methods. In particular, the results shed light on how forest owners perceive the potential of cultivating products such as specialty mushrooms and indicate their level of interest in NTFP production more broadly. These insights may also suggest a wider interest in the production of other types of NTFPs. The interviews conducted in Articles III and IV, provided a deeper understanding of different NTFP categories, shaped by the specific products that forest owners reported producing. This product-specific focus enabled more detailed insights into production practices and value chains relevant to each case.

It should be noted that each of the articles (I–IV) addressed themes like forest owners' goals and values, which may vary greatly across different cultures. Given that the data were gathered exclusively in Finland, the findings are particularly relevant to the Finnish setting. The findings are influenced by the unique history of Finnish forestry, the cultural practices related to the collection of NTFPs and other contextual elements. These perspectives have been addressed in the discussion section to provide a comprehensive understanding of the context of the study.

5.5 Future research needs

The findings of this thesis are case-specific and cannot be directly generalised to other countries. To improve the generalisability of the results, future research should be conducted not only in diverse geographical regions within Finland but also in international contexts. Comparative studies would enable a broader understanding of the applicability and scalability of NTFP production models, particularly with regard to the NTFP products not covered by Everyone's Rights.

Future research should also focus on the development and assessment of practical implementation measures, such as the operational conditions and requirements for cultivating specialty mushrooms on tree stumps in conjunction with timber harvesting (II). Successful pilot cases, peer support mechanisms and the involvement of forest owner associations, forest sector actors and bioeconomy stakeholders could provide valuable insights to support adoption and upscaling of such practices.

In addition, greater attention should be paid to knowledge management within NTFP value chains. Key actors require access to information, for example, on suitable cultivation sites, species-specific yield potentials, market conditions and other participants in the value chain. Efficient knowledge dissemination and coordination are crucial to build functional and

resilient networks. Also, strengthening the knowledge base around NTFPs would support forest owners seeking to diversify forest management beyond timber production, thereby contributing to the broader goals of sustainable and multiple use of forestry

Another important area for future research lies in the examination of network-based value creation and operational models specific to NTFP production. With regard to Article III, it is essential to understand how various drivers influence forest owners' decision making and how social, ecological and economic values interact in different contexts. A deeper understanding of value networks tailored to specific NTFP products could inform the development of more effective support structures and long-term strategies for the sector.

Alongside the applied and context-specific studies, there is a clear need for research on the role of NTFP production in multifunctional forest management. Future research could critically explore how the concept of multiple use is constructed and operationalised in forest policy, landowner discourses and value chain practices, particularly in the context of NTFPs. This could include analysing how different forest uses are prioritised, legitimised or marginalised in decision-making, and how NTFP production either challenges or complements prevailing forest management paradigms. Such a perspective could enrich our understanding of the socio-political dimensions of multiple use of forest and contribute to theoretical development at the intersection of forest policy, rural studies and sustainable natural resource governance.

6. CONCLUSIONS: CONSIDERATIONS TO SUPPORT THE DEVELOPMENT OF THE NTFP SECTOR

To establish sustainable and functional value chains that facilitate the growth and development of the NTFP sector, a more structured approach is needed at both national and EU levels. First, a stable market platform should be developed to connect producers with buyers, thereby ensuring a transparent and efficient trading environment for NTFPs. The development of cooperative models and wholesale organisations could also enhance market access for small and micro entrepreneurs and would facilitate the consolidation of production volumes, thereby addressing the current challenge of fragmented supply chains. Local authorities can support these efforts by leveraging existing regional clusters and stakeholder networks to strengthen coordination and promote long-term development in the NTFP sector.

In this context, it is essential to consider both the diversity of NTFP products and the varied motives of forest owners regarding their forest ownership and production of NTFPs. Since many of the challenges in the NTFP sector lie beyond the control of forest owners, the findings of this thesis suggest that there is a need to develop more targeted financial incentives and support measures. Local authorities can use this insight to design funding schemes that strengthen entrepreneurs' capacity to operate under uncertain weather conditions and seasonal fluctuations. For example, investment subsidies for logistics, storage, and processing could help stabilize supply and improve the marketability of products. Additionally, start-up grants for small entrepreneurs could lower the threshold for entering NTFP value chains and contribute to increasing the local value of forest-based products.

At the societal level, raising awareness and knowledge of all actors in the NTFP sector with regard to the economic and ecological value of NTFPs is crucial. In particular, strengthening information and advisory services for forest owners is essential for improving knowledge exchange and encouraging broader participation in the NTFP sector. Local authorities can play a key role by offering training, guidance, and accessible information on sustainable harvesting practices, market opportunities, and value-added processing. To support long-term development, targeted research and dedicated funding, nationally and internationally, should also be directed toward understanding NTFP value networks, developing innovative business models, and identifying best practices for integrating NTFPs into multifunctional forest management. Strengthening these objectives through regional forest programmes and other regional development plans, would provide continuity and clarity for the implementation of measures and reinforce the role of the NTFP sector as an integral part of diverse and sustainable forest use.

From an EU policy perspective, the integration of NTFPs into existing forestry and bioeconomy strategies should be strengthened and made more visible. The EU Green Deal (European Commission 2019) and the New EU Forest Strategy (European Commission 2021a) emphasise the importance of sustainable forest management and biodiversity conservation, presenting an opportunity to position NTFPs as a key component of multiple use forestry. Policymakers should ensure that NTFPs receive equal and genuine consideration alongside timber in funding schemes, research programmes and rural development initiatives. Furthermore, the fostering of cross-border collaboration among Nordic and European countries could help harmonise market structures, develop common quality standards and promote best practices in NTFP commercialisation.

By addressing these policy gaps and structural challenges, the NTFP sector can emerge as a viable and competitive alternative within the broader framework of sustainable multiple use of forests. A well-supported and strategically integrated NTFP sector would not only provide economic benefits to forest owners but also contribute to biodiversity conservation, climate resilience and the diversification of rural livelihoods, thereby aligning with broader societal and environmental goals.

REFERENCES

- Abetz K (1955) *Bäuerliche Waldwirtschaft–Dargestellt an den Verhältnissen in Baden*. Verlag Paul Parey, Hamburg.
- Akehurst G, Comeche JM, Galindo MÁ (2012) Job satisfaction and commitment in the entrepreneurial SME. *Small Bus Econ* 38(3): 277–289. <https://doi.org/10.1007/s11187-010-9283-7>.
- Ajzen I (1991) The theory of planned behavior. *Organ Behav Hum Decis Process*, 50(2), 179–211. doi:[10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T).
- Apaolaza V, Hartmann P, Echebarria C, Barrutia JM (2017) Organic label’s halo effect on sensory and hedonic experience of wine: a pilot study. *J Sens Stud* 32:e12243. <https://doi.org/10.1111/joss.12243>.
- Arktiset Aromit ry. (2024) Luomukeruu. [Organic collection]. <https://www.arktisetaromit.fi/fi/laatu/lainsaadanto/luomukeruu/>. Accessed 27 May 2025. [in Finnish]
- Battilana J, Lee M (2014) Advancing research on hybrid organizing – Insights from the study of social enterprises. *Acad Manag Ann* 8(1): 397–441. <https://doi.org/10.5465/19416520.2014.893615>.
- Bazeley P, Jackson K (2013) *Qualitative data analysis with NVivo*, 2nd ed. SAGE Publications, London.
- Bengston DN, Asah ST, Butler BJ (2011) The diverse values and motivations of family forest owners in the United States: An analysis of an open-ended question in the National Woodland Owner Survey. *Small-Scale Forestry*, 10, 339–355. <https://doi.org/10.1007/s11842-010-9152-9>.
- Bieling C (2004) Non-industrial private-forest owners: possibilities for increasing adoption of close-to-nature forest management. *Eur J Forest Res* 123: 293–303. <https://doi.org/10.1007/s10342-004-0042-6>.
- Biesta G (2010) Pragmatism and the philosophical foundations of mixed methods research. In: Tashakkori MA, Teddlie A, Mertens CB (eds) *SAGE Handbook of Mixed Methods in Social & Behavioral Research*, 3rd ed. SAGE Publications, London. <https://doi.org/10.4135/9781506335193.n4>.
- Blanco V, Brown C, Rounsevell M (2015) Characterising forest owners through their objectives, attributes and management strategies. *Eur J Forest Res* 134: 1027–1041. <https://doi.org/10.1007/s10342-015-0907-x>.
- Boon TE, Meilby H, Thorsen BJ (2004) An empirically based typology of private forest owners in Denmark: improving communication between authorities and owners. *Scand J Forest Res* 19: 45–55. <https://doi.org/10.1080/14004080410034056>.
- Busk H, Heimonen R, Määttä K, Norkio A, Vaahtoniemi S (2024) Luonnonmarjanpoimintaa koskeva selvitys: Ulkomaalaisten luonnonmarjanpoimijoiden työsuhteisuuden ja elinkeinonharjoittamisen taloudellisia vaikutuksia arvioiva selvitys [Report on wild berry picking: Economic impacts of foreign berry pickers' employment status and entrepreneurship]. Ministry of Economic Affairs and Employment of Finland, Publication 2024:19. [in Finnish]
- Buttoud G (2000) How can policy take into consideration the ‘full value’ of forests? *Land Use Policy* 17: 169–175. [https://doi.org/10.1016/S0264-8377\(00\)00015-6](https://doi.org/10.1016/S0264-8377(00)00015-6).

- Cai M, Pettenella D, Vidale E (2011). Income generation from wild mushrooms in marginal rural areas. *Forest Policy and Economics*, 13(3), 221–226. <https://doi.org/10.1016/j.forpol.2010.10.001>
- Casals FE (2011) The SME co-operation framework: a multi-method secondary research approach to SME collaboration. In: *Proc Int Conf E Bus Manage Econ*, vol 3. IPEDR, pp 1–5.
- Chamberlain JL, Small CJ, Baumflek M (2019) Sustainable forest management for nontimber products. *Sustainability* 11(10): 2626. <https://doi.org/10.3390/su11102626>.
- Clarke V, Braun V (2017) Thematic analysis. *J Posit Psychol* 12: 297–298. <https://doi.org/10.1080/17439760.2016.1262613>.
- Cohen J (1982) Set correlation as a general multivariate data-analytic method. *Multivar Behav Res* 17(3): 301–341. https://doi.org/10.1207/s15327906mbr1703_2.
- Creswell JW (2014) *Research design: qualitative, quantitative, and mixed methods approaches*, 3rd ed. SAGE Publications, Thousand Oaks.
- Creswell JW, Poth CN (2018) *Qualitative inquiry and research design: Choosing among five approaches* (Fourth Edition). SAGE Publications.
- Daudet A (2012) “Wild” foods and their potential for undernutrition prevention. *Action Contre La Faim*.
- De Beer JH, McDermott MJ (1989) *The Economic Value of NTFPs in South East Asia*. The Netherlands Committee for IUCN. Amsterdam.
- Dedehayir O, Ortt JR, Seppänen M (2017) Roles during innovation ecosystem genesis: a literature review. *Technol Forecast Soc Change* 136: 18–29. <https://doi.org/10.1016/j.techfore.2016.11.028>.
- Delgado TS, McCall MK, López-Binnqüist C (2023) Non-timber forest products: small matters, big significance, and the complexity of reaching a workable definition for sustainability. *Small-scale For* 22: 37–68. <https://doi.org/10.1007/s11842-022-09517-9>.
- European Commission (2019) *The European Green Deal*. COM(2019) 640 final. Brussels.
- European Commission (2020) *EU biodiversity strategy for 2030: bringing nature back into our lives*. Brussels.
- European Commission (2021a) *New EU forest strategy for 2030*. Publications Office of the European Union. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0572>.
- European Commission (2021b) *Forging a climate-resilient Europe – the new EU strategy on adaptation to climate change*. Communication COM(2021) 82 final. Brussels.
- European Union (2007) Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91. *Off J Eur Union L* 189: 1–23. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007R0834>.
- European Union (2024) Regulation (EU) 2024/1991 of the European Parliament and of the Council of 17 June 2024 on nature restoration. *Off J Eur Union L* 199. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024R1991>.
- Evira (2018) *Luonnonmukainen tuotanto 1. Yleiset ja kasvintuotannon ehdot* [Organic production 1: General and plant production conditions]. *Eviran ohje* 18219/7. [in Finnish]

- FAO (1999) Towards a harmonized definition of non-wood forest products. *Unasylva* 50(3): 3–6.
- FAO (2024) FAO forestry roadmap: from vision to action 2024–2031. Food and Agriculture Organization of the United Nations. <https://openknowledge.fao.org/server/api/core/bitstreams/3d9485c1-d215-42fe-9899-48fc50c16c32/content>.
- FAO, UNEP (2020) The state of the world's forests 2020: forests, biodiversity and people. FAO, Rome. <https://doi.org/10.4060/ca8642en>.
- Favada IM, Karppinen H, Kuuluvainen J, Mikkola J, Stavness C (2009) Effects of timber prices, ownership objectives, and owner characteristics on timber supply. *For Sci* 55(6): 512–523. <https://doi.org/10.1093/forestscience/55.6.512>.
- Ficko A, Lidestav G, Ní Dhubháin Á, Karppinen H, Zivojinovic I, Westin K (2019) European private forest owner typologies: a review of methods and use. *For Policy Econ* 99: 21–31. <https://doi.org/10.1016/j.forpol.2017.09.010>.
- Finnish Statistical Yearbook of Forestry (2018) Finnish statistical yearbook of forestry 2018. Natural Resources Institute Finland (Luke).
- Finnish Statistical Yearbook of Forestry (2022) Finnish statistical yearbook of forestry 2022. Natural Resources Institute Finland (Luke).
- Flyvbjerg B (2011) Case study. In: Denzin NK, Lincoln YS (eds) *The Sage handbook of qualitative research*. Sage, Thousand Oaks, pp 301–316.
- Frey GE, Chamberlain JL, Jacobson MG (2021) Producers, production, marketing, and sales of non-timber forest products in the United States: a review and synthesis. *Agrofor Syst* 95: 1–17. https://www.srs.fs.usda.gov/pubs/ja/2021/ja_2021_frey_003.pdf.
- Fritzbøger B, Søndergaard P (1995) A short history of forest uses. In: Hytönen M (ed) *Multiple-use forestry in the Nordic countries*. METLA, Jyväskylä, pp 11–41.
- Genetz ATh (1895) Marjojen säilyttäminen ja käyttäminen taloudessa. [Storage and use of berries in the household] Kansanvalistusseura, Helsinki. [in Finnish]
- Górriz-Mifsud E, Secco L, Pisani E (2016) Exploring the interlinkages between governance and social capital: A dynamic model for forestry. *Forest Policy and Economics*, 65, 25–36. <https://doi.org/10.1016/j.forpol.2016.01.006>.
- Haigh N, Hoffman AJ (2012) Hybrid organizations: the next chapter of sustainable business. *Organ Dyn* 41(2): 126–134. <https://doi.org/10.1016/j.orgdyn.2012.01.006>.
- Hallikainen V, Hyppönen M, Pernu L, Puoskari J (2010) Family forest owners' opinions about forest management in northern Finland. *Silva Fenn* 44(2): 363–384. <https://doi.org/10.14214/sf.158>.
- Hamunen K (2013). Forest owner's social networks – possibilities to enhance knowledge exchange. *Dissertationes Foestales* 169. 48p. <http://dx.doi.org/10.14214/df.169>.
- Hamunen K, Virkkula O, Hujala T, Hiedanpää J, Kurttila M (2015). Enhancing informal interaction and knowledge co-construction among forest owners. *Silva Fennica* vol. 49 no. 1 article id 1214. 15 p. <https://doi.org/10.14214/sf.1214>.
- Hamunen K, Muttilainen H, Tikkanen J, Hujala T (2020) Towards gender equality in family forestry: building self-efficacy together with other female forest owners. *Scand J For Res* 35(8): 577–587. <https://doi.org/10.1080/02827581.2020.1843702>

- Hamzaoui-Essoussi L, Zahaf M (2012) Canadian organic food consumers' profile and their willingness to pay premium prices. *J Int Food Agribus Mark* 24: 1–21. <https://doi.org/10.1080/08974438.2011.621834>.
- Hanneman R, Riddle M (2005) Introduction to social network methods. PDF publication, University of California, Riverside.
- Hannerz M, Ekström H (2023) Nordic forest statistics 2023 – resources, industry, trade, prices, environment and climate. Nordic Forest Research (SNS).
- Hanohov R, Baldacchino L (2017) Opportunity recognition in sustainable entrepreneurship: an exploratory study. *Int J Entrep Behav Res* 23(4): 614–632. <https://doi.org/10.1108/IJEBr-12-2015-0295>.
- Hewitt-Dundas N (2006) Resource and capability constraints to innovation in small and large plants. *Small Bus Econ* 26: 257–277. <https://doi.org/10.1007/s11187-005-2140-3>.
- Hoogendoorn B, van der Zwan P, Thurik R (2019) Sustainable entrepreneurship: the role of perceived barriers and risk. *J Bus Ethics* 157: 1133–1154. <https://doi.org/10.1007/s10551-017-3646-8>.
- Hoogstra-Klein MA, Brukas V, Wallin I (2017) Multiple-use forestry as a boundary object: from a shared ideal to multiple realities. *Land Use Policy* 69: 247–258. <https://doi.org/10.1016/j.landusepol.2017.08.029>.
- Hothorn T, Hornik K, Zeileis A (2006) Unbiased recursive partitioning: a conditional inference framework. *J Comput Graph Stat* 15(3): 651–674. <https://doi.org/10.1198/106186006X133933>.
- Huber P, Hujala T, Kurttila M, Wolfslehner B, Vacik, H (2019) Application of multi-criteria analysis methods for a participatory assessment of non-wood forest products in two European case studies. *Forest Policy and Economics*, 103, 103–111. <https://doi.org/10.1016/j.forpol.2017.07.003>.
- Huber P, Kurttila M, Hujala T, Wolfslehner B, Sanchez-Gonzalez M, Pasalodos-Tato M, de-Miguel S, Bonet JA, Marques M, Borges JG, Enescu CM, Dinca L, Vacik H (2023) Expert-based assessment of the potential of non-wood forest products to diversify forest bioeconomy in six European regions. *Forests* 14(2): 420. <https://doi.org/10.3390/f14020420>.
- Hughner R, McDonagh P, Prothero A, Shultz C, Stanton J (2007) Who are organic food consumers? A compilation and review of why people purchase organic food. *J Consum Behav* 6: 1–17. <https://doi.org/10.1002/cb.210>.
- Hujala T, Pykäläinen J, Tikkanen J (2007). Decision making among Finnish non-industrial private forest owners: the role of professional opinion and desire to learn. *Scand. J. For. Res.* 22 (5), 454–463. <https://doi.org/10.1080/02827580701395434>.
- Hujala T, Tikkanen J, (2008) Boosters of and barriers to smooth communication in family forest owners' decision making. *Scand. J. For. Res.* 23 (5), 466–477. <https://doi.org/10.1080/02827580802334209>.
- Hujala T, Karppinen H, Kurttila M (2013) Customer segments among family forest owners: combining ownership objectives and decision-making styles. *Small-scale For* 12(3): 335–351. <http://dx.doi.org/10.1007/s11842-012-9215-1>.
- Huuskonen S, Domisch T, Finér L, Hantula J, Hynynen J, Matala J, Miina J, Neuvonen S, Nevalainen S, Niemistö P, Nikula A, Piri T, Siitonen J, Smolander A, Tonteri T, Uotila K, Viiri H (2021) What is the potential for replacing monocultures with mixed-

- species stands to enhance ecosystem services in boreal forests in Fennoscandia? *For Ecol Manage* 479: 118558. <https://doi.org/10.1016/j.foreco.2020.118558>.
- Hänninen H, Karppinen H (2010) Yksityismetsänomistajat puntarissa. [Private forest owners at a crossroads] In: Sevola Y (ed) *Metsä, talous, yhteiskunta. Katsauksia metsäekonomiseen tutkimukseen*. [Forest, economy, society: Perspectives on forest economics Research]. *Metlan työraportteja* 145, pp 55–67 [in Finnish]
- Hänninen H, Karppinen H, Leppänen J (2011) Suomalainen metsänomistaja 2010. [The Finnish Forest Owner 2010] *Metlan työraportteja* 208, 94 s
- Häyrinen L (2019) Finnish forest owner objectives as indicators for a diversifying use of forests on the road to a bioeconomy. *Dissertationes Forestales* 280. <https://doi.org/10.14214/df.280>.
- ILO, UNEP & IUCN (2022) Decent work in nature-based solutions 2022. Geneva. Licence: CC BY-NC-SA 3.0 IGO.
- Ingemarson F, Lindhagen A, Eriksson L (2006) A typology of small-scale private forest owners in Sweden. *Scand J For Res* 21(3): 249–259. <https://doi.org/10.1080/02827580600662256>.
- IPCC (2018) Global warming of 1.5°C. An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways... Summary for Policymakers. World Meteorological Organization, Geneva.
- James, W (1995) *Pragmatism*. New York, NY: Dover.
- Jokinen A (2006). Metsänomistajien roolit puuntuotannon hallinnoinnissa. [Forest owners' roles in timber production governance]. In: R. Jalonen, I. Hanski, T. Kuuluvainen, E. Nikinmaa, P. Pelkonen, P. Puttonen, K. Raitio, O. Tahvonen, editor. *Uusi metsäkirja* [New forest book]. Gaudeamus; p. 157–163.
- Juutinen A, Tolvanen A, Koskela T (2020) Forest owners' future intentions for forest management. *Forest Policy Econ* 118: 102220. <https://doi.org/10.1016/j.forpol.2020.102220>.
- Kardell Ö, Bishop K (2014) Mångbruk i skogen är ingen ny idé. In: Mårald E, Nordlund C (eds) *Idéer och värderingar. Future Forests 2009–2012. Future Forests rapportserie nr 3*, Sveriges lantbruksuniversitet, Umeå.
- Karppinen H (1998) Values and objectives of non-industrial private forest owners in Finland. *Silva Fenn* 32(1): 43–59. <https://doi.org/10.14214/sf.699>.
- Karppinen H, Hänninen H, Ripatti P (2002) Suomalainen metsänomistaja 2000. [The Finnish Forest Owner 2000]. *Metsäntutkimuslaitoksen tiedonantoja* 852, Helsinki. <http://urn.fi/URN:ISBN:951-40-1832-X>. [in Finnish]
- Karppinen H, Hänninen H, Horne P (2020) Suomalainen metsänomistaja 2020. [The Finnish Forest Owner 2020] *Luonnonvara- ja biotalouden tutkimus* 30/2020. Natural Resources Institute Finland. <http://urn.fi/URN:ISBN:978-952-326-961-3>. [in Finnish]
- Kennedy JJ, Thomas JW, Glueck P (2001) Evolving forestry and rural development beliefs at midpoint and close of the 20th century. *Forest Policy Econ* 3(1–2): 81–95. [https://doi.org/10.1016/S1389-9341\(01\)00034-X](https://doi.org/10.1016/S1389-9341(01)00034-X).
- Kilgore MA, Snyder SA, Schertz J, Taff SJ (2008) What does it take to get family forest owners to enroll in a forest stewardship-type program? *Forest Policy Econ* 10(7–8): 507–514. <https://doi.org/10.1016/j.forpol.2008.05.003>.

- Kittredge DB (2005) The cooperation of private forest owners on scales larger than one individual property: International examples and potential application in the United States. *Forest Policy Econ* 7: 671–688. <https://doi.org/10.1016/j.forpol.2003.12.004>.
- Klapper L, Laevena L, Rajan R (2006) Entry regulation as a barrier to entrepreneurship. *J. Financ. Econ.* 82, 591–629. <https://doi.org/10.1016/j.jfineco.2005.09.006>.
- Kline JD, Alig RJ, Johnson RL (2000) Fostering the production of nontimber services among forest owners with heterogeneous objectives. *Forest Sci* 46: 302–311. <https://doi.org/10.1093/forestscience/46.2.302>.
- Knoot TG, Rickenbach M (2011) Best management practices and timber harvesting: the role of social networks in shaping landowner decisions. *Scand J For Res* 26: 171–182. <https://doi.org/10.1080/02827581.2010.545827>.
- Korhonen T, Leskinen M, Räsänen H, Väisänen M (2004) Kainuun metsäkysely 2003. The Kainuu Forest Survey 2003]. *Metsähallituksen Metsätalouden Julkaisuja* 52, Vantaa, ISBN 952-446-428-4. [in Finnish]
- Korhonen K, Hujala T, Kurttila M (2012) Reaching forest owners through their social networks in timber sales. *Scand J For Res* 27(1): 88–99. <https://doi.org/10.1080/02827581.2011.631935>.
- Koskela T, Karppinen H (2021) Forest owners' willingness to implement measures to safeguard biodiversity: values, attitudes, ecological worldview and forest ownership objectives. *Small-scale For* 20(1): 11–37. <https://doi.org/10.1007/s11842-020-09454-5>.
- Kueper AM, Sagor ES, Becker DR (2013) Learning from landowners: Examining the role of peer exchange in private landowner outreach through landowner networks. *Soc Nat Resour.* <https://doi.org/10.1080/08941920.2012.722748>.
- Kuhlman J (2024) Challenging the concept of active forest ownership: The perspective of women forest owners in Finland. *Dissertationes Forestales* 348, 94 p. <https://doi.org/10.14214/df.348>.
- Kuehne C, Holmström E, Routa J, Huuskonen S, Cedergren J, & Rautio P (Eds.) (2024) Concluding remarks from the editors. In P. Rautio et al. (Eds) *Continuous cover forestry in boreal Nordic countries. Managing Forest Ecosystems*, Vol. 45. <https://doi.org/10.1007/978-3-031-70484-0>.
- Kurttila M, Pukkala T, Miina J (2018). Synergies and Trade-Offs in the Production of NWFPs Predicted in Boreal Forests. *Forests*, 9(7), Article 417. <https://doi.org/10.3390/f9070417>.
- Kuuluvainen J, Karppinen H, Hänninen H, Uusivuori J (2014). Effects of gender and length of land tenure on timber supply in Finland. *J. For. Econ.* 20 (4), 363–379. <https://doi.org/10.1016/j.jfe.2014.10.002>.
- Kuuluvainen J, Karppinen H, Ovaskainen V (1996) Landowner objectives and nonindustrial private timber supply. *Forest Sci* 42(3):300–309. <https://doi.org/10.1093/forestscience/42.3.300>.
- La Mela M (2014) Property rights in conflict: Wild berry picking and the Nordic tradition of allemansrätt. *Scand Econ Hist Rev.* <http://dx.doi.org/10.1080/03585522.2013.876928>.
- Lee J, Park BJ, Tsunetsugu Y, Kagawa T, Miyazaki Y (2014) Restorative effects of viewing real forest landscapes, based on a comparison with urban landscapes. *Scand J For Res* 29(6): 566–572. <https://doi.org/10.1080/02827581.2014.927527>.

- Lee W, Shimizu M, Knifn K, Wansink B (2013) You taste what you see: Do organic labels bias taste perceptions? *Food Qual Prefer* 29: 33–39.
<https://doi.org/10.1016/j.foodqual.2013.01.010>.
- Lovrić M, Da Re R, Vidale E, Prokofieva I, Wong J, Pettenella D, Verkerk PJ, Mavsar R (2020) Non-wood forest products in Europe – A quantitative overview. *Forest Policy Econ* 116: 102175. <https://doi.org/10.1016/j.forpol.2020.102175>.
- Lovrić M, Da Re R, Vidale E, Prokofieva I, Wong J, Pettenella D, Verkerk PJ, Mavsar R (2021) Collection and consumption of non-wood forest products in Europe. *Forestry: Int J For Res* cpab018. <https://doi.org/10.1093/forestry/cpab018>.
- Łuczaj Ł, Bilek M, Stawarczyk K (2014) Sugar content in the sap of birches, hornbeams and maples in southeastern Poland. *Cent Eur J Biol* 9(4): 410–416.
<https://doi.org/10.2478/s11535-013-0284-8>.
- Lähdesmäki M, Matilainen A (2013) Born to be a forest owner? An empirical study of the aspects of psychological ownership in the context of inherited forests in Finland. *Scandinavian Journal of Forest Research*, 29(2), 101–110.
<https://doi.org/10.1080/02827581.2013.869348>.
- Maes J, Teller A, Erhard M, Keune H (2013) Mapping and assessment of ecosystems and their services: an analytical framework for ecosystem assessments under action 5 of the EU biodiversity strategy to 2020. JRC, Ispra, Italy. In Schulp, C. J. E.
- Magnusson MK, Arvola A, Koivisto Hursti U-K, Åberg L, Sjöden P-O (2001) Attitudes towards organic foods among Swedish consumers. *Br Food J* 103: 209–226.
<https://doi.org/10.1108/00070700110386755>.
- Magnusson MK, Arvola A, Koivisto Hursti U, Åberg L, Sjöden P-O (2003) Choice of organic foods is related to perceived consequences for human health and to environmentally friendly behavior. *Appetite* 40(2): 109–117.
[https://doi.org/10.1016/S0195-6663\(03\)00002-3](https://doi.org/10.1016/S0195-6663(03)00002-3).
- Magry MA, Cahill D, Rookes J, Narula SA (2025) Do socioeconomic factors impact non-timber forest products-based incomes? *Hum Ecol* 53: 165–179.
<https://doi.org/10.1007/s10745-025-00582-0>.
- Majumdar I, Teeter L, Butler B (2008) Characterizing family forest owners: A cluster analysis approach. *Forest Sci* 54(2): 176–184.
<https://doi.org/10.1093/forests/54.2.176>.
- Marsden PV (2016) Survey methods for network data. In: Scott J, Carrington PJ (eds) *The SAGE Handbook of Social Network Analysis*. SAGE Publications Ltd.
<https://dx.doi.org/10.4135/9781446294413>.
- MARSI (2023) Luonnonmarjojen ja -sienten kauppaantumäärät vuonna 2023. [Marketed volumes of wild berries and mushrooms in 2023]. *Ruokavirasto* 3/2023. [in Finnish]
- Maso D, Matilainen A, Pettenella D (2011) The role of networks in non-wood forest products and services market development. In: Weiss G, Pettenella D, Ollonqvist P, Slee B (eds) *Innovation in Forestry—Territorial and Value Chain Relationships*. CABI, Wallingford, pp 154–168. <https://doi.org/10.1079/9781845936891.0154>.
- McFadden JR, Wallace E, Huffman WE (2017) Willingness-to-pay for natural, organic, and conventional foods: The effects of information and meaningful labels. *Food Policy* 68: 214–232. <https://doi.org/10.1016/j.foodpol.2017.02.007>.

- Meinhold K, Darr D (2019) The processing of non-timber forest products through small and medium enterprises – A review of enabling and constraining factors. *Forests* 10: 1026. <https://doi.org/10.3390/f10111026>.
- Miina J, Kurttila M, Calama R, de-Miguel S, Pukkala T (2020) Modelling Non-timber Forest Products for Forest Management Planning in Europe. *Current Forestry Reports*, 6(4), 309–322. <https://doi.org/10.1007/s40725-020-00130-7>.
- Miina J, Peltola R, Veteli P, Linnakoski R, Cortina Escribano M, Haveri-Heikkilä J, Mattila P, Marnila P, Pihlava J-M, Hellström J, Sarjala T, Silvan N, Kurttila M, Vanhanen H (2021). Inoculation success of *Inonotus obliquus* in living birch (*Betula* spp.). *Forest Ecology and Management*, 492, 119244. <https://doi.org/10.1016/j.foreco.2021.119244>.
- Miller KA, Snyder SA, Kilgore MA (2012) An assessment of forest landowner interest in selling forest carbon credits in the Lake States, USA. *Forest Policy Econ* 25: 113–122. <http://dx.doi.org/10.1016/j.forpol.2012.09.009>.
- Ministry of Agriculture and Forestry (2023) National Forest Strategy 2035. Ministry of Agriculture and Forestry of Finland. <https://urn.fi/URN:ISBN:978-952-366-748-8>.
- Ministry of Economic Affairs and Employment of Finland (2022) Sustainably towards higher value added: Finland's Bioeconomy Strategy 2022–2035. Publications of the Finnish Government 2022:5. <https://julkaisut.valtioneuvosto.fi/handle/10024/163969>.
- Ministry of the Environment (2016) Everyman's right – Legislation and practice. <https://www.ymparisto.fi/download/noname/%7B2469D5DE-38E6-4BE5-8CCA-3D0F480ADF0E%7D/162263>.
- Morgan DL (2014) Integrating qualitative and quantitative methods: A pragmatic approach. SAGE Publications, Inc. ISBN 978-0-7619-1523-2.
- Muir G.F, Sorrenti S, Vantomme P, Vidale E, Masiero M (2020) Into the Wild: Disentangling Non-Wood Terms and Definitions for Improved Forest Statistics, *International Forestry Review*, 22 (1), s. 101–119. <https://www.jstor.org/stable/10.2307/27101492>.
- Neuvonen M, Lankia T, Kangas K, Koivula J, Nieminen M, Sepponen A-M, Store R, Tyrväinen L (2022). Luonnon virkistyskäyttö 2020. [Recreational Use of Nature 2020] Luonnonvara- ja biotalouden tutkimus. 41/2022. Luonnonvarakeskus. Helsinki. p.112. <https://urn.fi/URN:ISBN:978-952-380-429-6>.
- Nichiforel L et al. (2018) How private are Europe's private forests? A comparative property rights analysis. *Land Use Policy* 76: 535–552. <https://doi.org/10.1016/j.landusepol.2018.02.034>.
- Ní Dhubháin Á, Cobanova R, Karppinen H, Mizaraite D, Ritter E, Slee B, Wall S (2007) The values and objectives of private forest owners and their influence on forestry behaviour: The implications for entrepreneurship. *Small-scale For* 6(4): 347–357. <https://doi.org/10.1007/s11842-007-9030-2>.
- Padel S, Foster C (2005) Exploring the gap between attitudes and behaviour – Understanding why consumers buy or do not buy organic food. *Br Food J* 107(8): 606–625. <https://doi.org/10.1108/00070700510611002>.
- Palahí M, Pukkala T, Bonet JA, Colinas C, Fischer CR, Martínez de Aragón JR (2009) Effect of the inclusion of mushroom values on the optimal management of even-aged pine stands of Catalonia. *Forest Science*, 55(6), 503–511. <https://doi.org/10.1093/forestscience/55.6.503>.

- Patton MQ (2015) *Qualitative research & evaluation methods: Integrating theory and practice*. Thousand Oaks, CA: SAGE Publications Ltd.
- Peltola R, Kilpeläinen P, Partane B (2025) Yliö: Maailman muuttuu, luonnonmarjat ja -tuotteet pysyvät. [Editorial: The world changes, but wild berries and natural products remain]. *Maaseudun Tulevaisuus* 26.2.2025. [In Finnish]
- Peltola R, Hallikainen V, Tuulentie S, Naskali A, Manninen O, Similä J (2014) Social license for the utilization of wild berries in the context of local traditional rights and the interests of the berry industry. *Barents Stud Peoples Econ Pol* 1(2): 24–49.
- Peltola T, Åkerman M (2011). Roskapuuta vai raaka-ainetta? Laskelmien ja luokittelujen metsäpolitiikkaa. [Waste wood or raw material? Forest policy through calculations and classifications]. In: Alastalo M, Åkerman M, editor. *Tieto hallinnassa. Tietokäytännöt suomalaisessa yhteiskunnassa*. [Knowledge in control: knowledge practices in Finnish society]. Vastapaino, p. 199–220.
- Pettenella D, Corradini G, Da Re R, Lovric M, Vidale E (2019) NWFP in Europe: Consumption, markets and marketing tools. In: Wolfslehner B, Prokofieva I, Mavsar R (eds) *Non-Wood Forest Products in Europe – Seeing the Forest Around the Trees. What Science Can Tell Us Series*. European Forest Institute, Joensuu, pp. 31–54.
- Phillips DC, Burbules NC (2000) *Postpositivism and educational research*. Lanham, NY: Rowman & Littlefield.
- Pouta E, Sievänen T (2001) Luonnon virkistyskäytön kysyntätutkimuksen tulokset – Kuinka suomalaiset ulkoilevat. [Results of the recreation demand survey – how finns spend time outdoors] In: Sievänen T (ed) *Luonnon virkistyskäyttö 2000 [Nature recreation 2000]*. Metsäntutkimuslaitoksen tiedonantoja 802: 32–76. <https://urn.fi/URN:ISBN:951-40-1772-2>.
- Primmer E (2011) Policy, project and operational networks: Channels and conduits for learning in forest biodiversity conservation. *Forest Policy and Economics*, 13, 132–142. <https://doi.org/10.1016/j.forpol.2010.06.006>.
- Puska P, Kurki S, Lähdesmäki M, Siltaoja M, Luomala H (2018) Sweet taste of prosocial status signaling: When eating organic foods makes you happy and hopeful. *Appetite* 121(1): 348–359. <https://doi.org/10.1016/j.appet.2017.11.102>.
- Rahe ML, Van Leuven AJ, Malone T (2025) Leveraging social ties to financial gains: Exploring the impact of social capital in rural development. *Journal of Rural Studies*, 114, 103539. <https://doi.org/10.1016/j.jrurstud.2024.103539>.
- Reunala A (1974) Structural change of private forest ownership in Finland. *Commun Inst For Fenn* 82(2): 1–79.
- Rickenbach M, Kittredge DB (2009) Time and distance: Comparing motivations among forest landowners in New England, USA. *Small-scale For* 8: 95–108. <https://doi.org/10.1007/s11842-008-9071-1>.
- Rogers EM (2003) *Diffusion of innovations* (5th ed). Free Press.
- Ros-Tonen M, Dijkman W, Lammerts van Bueren E (1995) *Commercial and sustainable extraction of non-timber forest products: Towards a policy and management oriented research strategy*. The Tropenbos Foundation, Wageningen, the Netherlands.
- Rutanen J (2014) *Luonnontuotteet monipuolistuvissa arvoverkoissa – Luonnontuotealan toimintaohjelma 2020*. [Non-timber forest products in diversifying value networks – Action plan for the natural products sector 2020]. Raportteja 145. Helsingin yliopisto Ruralia Instituutti. <http://hdl.handle.net/10138/229380>. [In Finnish].

- Rutanen J (2018) Luonnontuotealan raaka-aineiden saatavuuden parantaminen. [Enhancing raw material availability in the natural products sector]. Helsingin yliopisto, Ruralia-instituutti. Raportteja 178. <http://hdl.handle.net/10138/234319>. [In Finnish].
- Sacande M, Parfondry M (2018) Non-timber forest products: from restoration to income generation. Rome, FAO. 40 pp. License: CC BY-NC-SA 3.0 IGO.
- Sagor ES, Becker DR (2014) Personal networks and private forestry in Minnesota. *J Environ Manage* 132: 145–154. <https://doi.org/10.1016/j.jenvman.2013.11.001>.
- Sarango-Lalangui P, Santos JF, Hormiga E (2018) The development of sustainable entrepreneurship research field. *Sustainability* 10(6): 2005. <https://doi.org/10.3390/su10062005>.
- Schlaepfer R, Iorgulescu I, Glenz C (2002) Management of forested landscapes in mountain areas: An ecosystem-based approach. *Forest Policy Econ* 4(2): 89–99. [https://doi.org/10.1016/S1389-9341\(02\)00009-6](https://doi.org/10.1016/S1389-9341(02)00009-6).
- Shackleton CM, Pandey AK (2014) Positioning non-timber forest products on the development agenda. *Forest Policy Econ*. 38: 1–7. <https://doi.org/10.1016/j.forpol.2013.07.004>.
- Schroeder D, Chatfield K, Singh M, Chennells R, Herissone-Kelly P (2019). Equitable research partnerships: A global code of conduct to counter ethics dumping. Springer Nature Switzerland AG. <https://doi.org/10.1007/978-3-030-15745-6>.
- Sheppard JP, Chamberlain J, Agúndez D, et al. (2020) Sustainable forest management beyond the timber-oriented status quo: Transitioning to co-production of timber and non-wood forest products – A global perspective. *Curr For Rep* 6: 26–40. <https://doi.org/10.1007/s40725-019-00107-1>.
- Shepherd R, Magnusson M, Sjöden PO (2005) Determinants of consumer behavior related to organic foods. *Ambio* 34(4–5): 352–359.
- Shumsky S, Hickey GM, Johns T, Pelletier B, Galaty J (2014) Institutional factors affecting wild edible plant (WEP) harvest and consumption in semi-arid Kenya. *Land Use Policy*, 38, 48–69. <https://doi.org/10.1016/j.landusepol.2013.10.014>.
- Sievänen T, Neuvonen M (2011) Luonnon virkistyskäytön kysyntä 2010 ja kysynnän muutos. [Demand for nature-based recreation in 2010 and its change over time] In: Sievänen T, Neuvonen M (eds) Luonnon virkistyskäyttö 2010 [Nature recreation 2010]. Metlan työraportteja 212: 37–79. <http://www.metla.fi/julkaisut/workingpapers/2011/mwp212.pdf>.
- Sim D, Hilmi HA (1987) Forestry extension methods. FAO Forestry Paper 80. 171 p. <http://archive.org/details/forestryextensio034891mbp>.
- Smith K, Beasley M (2011) Graduate entrepreneurs: Intentions, barriers & solutions. *Educ Train* 53(8/9): 722–740.
- Solbär L, Marcianó P, Pettersson M (2019) Land-use planning and designated national interests in Sweden: Arctic perspectives on landscape multifunctionality. *J Environ Plan Manag* 62(12): 2145–2165. <https://doi.org/10.1080/09640568.2018.1535430>.
- Song N, Aguilar FX, Butler BJ (2014) Cost-share program participation and family forest owners' past and intended future management practices. *Forest Policy Econ* 46: 39–46. <https://doi.org/10.1016/j.forpol.2014.06.003>.
- Stake RE (1995) The art of case study research London: Sage Publications Ltd.
- Staniewski MW (2009) Motivation of entrepreneurs in the light of challenges of the contemporary economy. *Econ Sociol* 2(1): 124–131.

- Staniewski MW, Awruk K (2015) Motivating factors and barriers in the commencement of one's own business. *Bus Theory Pract* 16(1): 53–61.
<https://doi.org/10.3846/btp.2015.437>.
- Sténs A, Sandström C (2013) Divergent interests and ideas around property rights: The case of berry harvesting in Sweden. *Forest Policy Econ* 33: 56–62.
- Stephan U, Hart M, Drews CC (2015) Understanding motivations for entrepreneurship. Enterprise Research Centre, Research Paper No. 20.
- Stoettner EM, Dhubbáin ÁN (2019) The social networks of Irish private forest owners: An exploratory study. *Forest Policy and Economics* 99, 68–76.
<http://dx.doi.org/10.1016/j.forpol.2017.09.008>.
- Swedberg R (2020) Exploratory research. In: Elman C, Gerring J, Mahoney J (eds) *The Production of Knowledge: Enhancing Progress in Social Science*. Cambridge University Press. <https://doi.org/10.1017/9781108762519>.
- Taivalantti T (2019) Expert perceptions of non-wood forest product certification in Finland. Master's thesis, Faculty of Agriculture and Forestry, Department of Forest Sciences, University of Helsinki, Finland.
- Tahvanainen V, Kurttila M, Miina J, Hujala T, Väkeväinen T, Salo K (2016) Pohjoiskarjalaisten ja kainuulaisten metsänomistajien mielipide marjastuksesta ja sienestyksestä yksityismetsissä. [Opinions of forest owners in north karelia and kainuu on berry and mushroom picking in private forests] *Metsätiet Aikak* 2: 95–110.
<https://doi.org/10.14214/ma.5958>.
- Tahvanainen V, Miina J, Kurttila M (2019) Climatic and economic factors affecting the annual supply of wild edible mushrooms and berries in Finland. *Forests*, 10(5), 385.
<https://doi.org/10.3390/f10050385>.
- Tahvanainen V, Miina J, Pukkala T, Kurttila M (2018). Optimizing the joint production of timber and marketed mushrooms in *Picea abies* stands in eastern Finland. *Journal of Forest Economics*, 32(1), 34–41. <https://doi.org/10.1016/j.jfe.2018.04.002>
- Takala T, Hujala T, Tanskanen M, Tikkanen J (2017) Forest owners' discourses of forests: Ideological origins of ownership objectives. *J Rural Stud* 51: 1–14.
<https://doi.org/10.1016/j.jrurstud.2017.01.014>.
- Tasanen T (2015) Metsät ennen, nyt ja tulevaisuudessa. [Forests: past, present and future] In: Salo K (ed) *Metsä. Monikäyttö ja ekosysteemipalvelut*. [Forest. Multiple use and ecosystem services] Luonnonvarakeskus (Luke), Helsinki, 25: 328–332.
<http://urn.fi/URN:ISBN:978-952-326-123-5>.
- Tikkanen J, Takala T, Järvelä M-L, Kurttila M, Vanhanen H (2020) Challenges and solutions for non-timber forest product businesses in Finland—An application of the SODA analysis. *Forests* 11: 753. <https://doi.org/10.3390/f11070753>.
- Turkina E, Thi Thanh Thai M (2013) Social capital, networks, trust and immigrant entrepreneurship: A cross-country analysis. *J Enterprising Communities* 7(2): 108–124. <https://doi.org/10.1108/17506201311325779>.
- Turkina E, Van Assche A, Kali R (2016) Structure and evolution of global cluster networks: Evidence from the aerospace industry. *J Econ Geogr* 16(6): 1211–1234.
- Turtiainen M, Salo K, Saastamoinen O (2015) Mustikka- ja puolukkasatojen talteenotto. [Harvesting of bilberry and lingonberry yields] In: Salo K (ed) *Metsä. Monikäyttö ja ekosysteemipalvelut*. [Forest. Multiple use and ecosystem services] Luonnonvarakeskus (Luke), Helsinki, pp. 125–127.

- Tuulentie S, Bjärstig T, Hansen I, Lande U, McLean P, Pellikka J, Peltola R, Zhang J (2024) Multiple use of forests. In: Rautio P et al. (eds) Continuous Cover Forestry in Boreal Nordic Countries. Managing Forest Ecosystems 45. https://doi.org/10.1007/978-3-031-70484-0_10.
- Tyrväinen L, Ojala A, Korpela K, Lanki T, Tsunetsugu Y, Kagawa T (2014) The influence of urban green environments on stress relief measures: A field experiment. *J Environ Psychol* 38: 1–9. <https://doi.org/10.1016/j.jenvp.2013.12.005>.
- United Nations (2015). Paris Agreement. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/english_paris_agreement.pdf.
- Urquhart J, Courtney P (2011). Seeing the owner behind the trees: A typology of small-scale private woodland owners in England. *Forest Policy Econ* 13: 535–544.
- Urquhart J, Courtney P, Slee B (2012). Private woodland owners' perspectives on multifunctionality in English woodlands. *J Rural Stud* 28(1): 95–106. <https://doi.org/10.1016/j.jrurstud.2011.08.006>.
- Vacik H, Hale M, Spiecker H, Pettenella D, Tomé M (2020). Non-wood forest products in Europe. Ecology and management of mushrooms, tree products, understory plants and animal products. In: Outcomes of the COST Action FP1203 on European NWFPs, BoD, Norderstedt, p. 416.
- van Gameren V, Zaccai E (2015). Private forest owners facing climate change in Wallonia: Adaptive capacity and practices. *Environ Sci Policy* 52: 51–60. <https://doi.org/10.1016/j.envsci.2015.05.004>.
- Vantomme P (2003). Compiling statistics on non-wood forest products as policy and decision-making tools at the national level. *Int For Rev* 5: 156–160. <https://doi.org/10.1505/IFOR.5.2.156.17412>.
- Viljanen P, Rautiainen A (2007). Jokamiehen oikeuden toimivuus. [Functionality of the Everyman's Right] Ympäristöministeriön raportteja 19/2007, 36 p. [In Finnish].
- Wacklin S (2021). Toimialaraportit. Tulevaisuuden luonnontuoteala. [Industry reports: The future of the natural products sector]. 2021:6. Työ- ja elinkeinoministeriö. <https://urn.fi/URN:ISBN:978-952-327-923-0>. [In Finnish].
- Wasserman S & Faust K (1994) Social network analysis. Cambridge, MA: Cambridge University Press. <https://doi.org/10.1017/CBO9780511815478>.
- Weiss G, Emery MR, Miina J, Kurttila M, Corradini G, Huber P, Vacik H (2019a). Value creation and innovation with non-wood forest products in a family forestry context. In: Hujala T, Toppinen A, Butler BJ (eds) Services in Family Forestry. Springer Nature Switzerland AG, Cham, Switzerland, pp. 185–224. *World Forests* 24. https://doi.org/10.1007/978-3-030-28999-7_10.
- Weiss G, Ludvig A, Asamer-Handler M, Fischer C, Vacik H, Živojinović I (2019b). Rendering NWFPs innovative. In: Wolfslehner B, Prokofieva I, Mavsar R (eds) Non-wood forest products in Europe: Seeing the forest around the trees, What Science Can Tell Us 10. European Forest Institute.
- Weiss G, Lawrence A, Hujala T, Lidestav G, Nichiforel L, Nybakk E, Quiroga S, Sarvašová Z, Suarez C, Živojinović I (2019c). Forest ownership changes in Europe: State of knowledge and conceptual foundations. *Forest Policy Econ* 99: 9–20. <https://doi.org/10.1016/j.forpol.2018.03.003>.
- Weiss G, Emery MR, Corradini G, Živojinović I (2020). New values of non-wood forest products. *Forests* 11: 165. <https://doi.org/10.3390/f11020165>.

- Wengraf T (2001). *Qualitative Research Interviewing*. Sage Publications, London, 424 p.
- Wiersum K, Elands B, Hoogstra M (2005). Small-scale forest ownership across Europe: Characteristics and future potential. *Small-scale For* 4: 1–19.
<https://doi.org/10.1007/s11842-005-0001-1>.
- Wiersum KF, Wong JLG, Vacik H (2018). Perspectives on non-wood forest product development in Europe. *Int For Rev* 20(2): 250–262.
<https://doi.org/10.1505/146554818823767546>.
- Wolfslehner B, Prokofieva I, Mavsar R (eds) (2019). *Non-wood forest products in Europe: Seeing the forest around the trees. What Science Can Tell Us 10*. European Forest Institute, Joensuu.
- Wong JLG, Wiersum FK (2019). A spotlight on NWFPs in Europe. In: Wolfslehner B, Prokofieva I, Mavsar R (eds) *Non-wood forest products in Europe: Seeing the forest around the trees What Science Can Tell Us 10*. European Forest Institute, Finland, pp. 11–30.
- Wunder S, Börner J, Shively G, Wyman M (2014). Safety nets, gap filling and forests: A global-comparative perspective. *World Dev* 64: 29–42.
<https://doi.org/10.1016/j.worlddev.2014.03.005>.
- Yin RK (2014) *Case study research: Design and method* (5th ed.). Sage Publications, Thousand Oaks.
- Zacca R, Dayan M, Ahrens T (2015). The effect of entrepreneurial orientation, willingness to change, and development culture on new product exploration in small enterprises. *J Small Bus Enterp Dev* 22(3): 538–552. <https://doi.org/10.1108/JSBED-03-2014-0056>.
- Zanoli R, Naspetti S (2002). Consumer motivations in the purchase of organic food: A means-end approach. *Br Food J* 104(8): 643–653.
<https://doi.org/10.1108/00070700210425930>.

APPENDIX 1

Interview guide (Translated from the Finnish interview guide)

1 Background information on the forest owner and the property

2 Exchange of values

Different actors and connections between them and the forest owner.

Interactions between actors: What exchanges take place between the actors (tangible and intangible)?

What is the collaboration based on?

Which do the actors feel is most important? Who do you have the most in common with? And the least?

3 Value creation in the network

The interviewee's various inputs and outputs for different stakeholders.

How is the production of NTFPs carried out? Why were these specific products chosen?

Why were the partners selected?

What benefits do you perceive from them?

What risks, shortcomings, or problems are associated with them?

Are there sufficient partners, resources, skills, or knowledge?

Who benefits from your activities? Do the beneficiaries perceive the benefits in the same way?

4 The role of forest owner in the network

More general discussion the shortcomings and the actor's perspective on their role.

Forest owners' perceived role in the network, their strengths and weaknesses, and support needs.

Gaps and bottlenecks in the network, as well as in their own operations and the network's activities.

Future prospects and the desired role in the network.