Dissertationes Forestales 348

Challenging the concept of active forest ownership: the perspective of women forest owners in Finland

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ACADEMIC DISSERTATION

To be presented, with the permission of the Faculty of Agriculture and Forestry of the University of Helsinki, for public examination in Metsätieteiden talo, Raisio-sali, on 8th March 2024, at 14.00.

Helsinki 2024

Title of the dissertation: Challenging the concept of active forest ownership: the perspective of women forest owners in Finland
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Dissertationes Forestales 348
https://doi.org/10.14214/df.348

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ISSN 1795-7389 (online)
ISBN 978-951-651-786-8 (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

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

ABSTRACT

In Finland, women comprise 41% of private forest owners. However, studies examining forest ownership from the gender perspective are scarce. Forestry and forest ownership is a field dominated by masculine and techno-economic values. For example, this is manifested in the ideal of 'active forest owner' in forest policy documents. Therefore, this dissertation studied the concept of 'active forest ownership' from the perspective of women forest owners. Different conceptual lenses were used, such as the gender theory and service-dominant logic. Specifically, the thesis focused on four questions: 1. Are women less active than men when a variety of forestry related activities are studied? (Article I); 2. How do women forest owners understand the concept of active forest owner, how does it differ from the one from Finnish forest policy and what kind of attributes impact women forest ownership? (Article II); 3. Do women forest owners have differing objective structure compared with men? (Article III); and 4. Is the relationship between objectives and activity different between women and men? (Article IV). Both quantitative (Articles I, III and IV) and qualitative (Article II) methods were applied. Articles I and III employ exploratory factor analysis and Article IV confirmatory factor analysis. Two sets of data were used: a questionnaire of the Finnish Forest Owner 2020 research project (n=6558) and 22 semistructured interviews. In this thesis, women were found to be less active than men when a selection of forestry related activities were studied (Article I). Women forest owners also had more diverse objective structure compared with men (Article III). In addition, the relationship between forest owner objectives and activity differed between genders (Article IV). Women also defined the concept of 'active forest owner' as a much wider concept than Finnish policies. (Article II). These findings suggest that forest ownership is a gendered performance and that there is a lack of service-dominant logic, that is, value cocreation corresponding to the objectives of women. More specifically, the results indicate that women owners need support, especially when forest ownership is something new. Furthermore, gendering and the prevailing forest values impact the whole forest owner population, their behaviour and forest owner research. Understanding this can enable the design of more equal and inclusive forest policies and services.

KEYWORDS: Forest owners, Active forest owners, Gender, Service-dominant logic, Forest owner objectives, Forest owner activity

ACKNOWLEDGEMENTS

When starting my thesis, I was discussing my topic with an older forest professional. He told me, ‘There is no point in focusing to women forest owners, all the new ideas are just wasted on them’. First, I was upset and disappointed by the comment, but then, I realised that this comment just proved that there was a clear need for this research. Clearly, women in forestry are still trying to fight their way through the masculine environment. My hope is that this research will help in creating a more equal future in forestry.

First, I want to express my gratitude towards my supervisors, Annukka Vainio and Sami Berghäll. They believed in me and my unrealistic plans from the beginning and were there to help and support me whenever I needed it. In addition, I would like to thank my coauthors Katri Hamunen and Henna Hurttala for their input and advice. I want to extend my thanks also to the pre-examiners Elias Andersson and Brett Butler and my opponent Teppo Hujala for their valuable input.

I would also like to acknowledge the funding this thesis received from the Ministry of Agriculture and Forestry of Finland, Suomen metsäsäätiö, Puumiesten Ammattikasvatussäätiö and Teollisuuden metsänhoitajat.

I would also like to express my gratitude for Eeva Kuhlman, Pertti Huttunen, Simo Rouhiainen, Heli Virtanen, Marjo Maidell, Reetta Karhunkorva and Tuulikki Halla for their help, Valentina Vignola in keeping me moving, Pamela Herrera Dominguez and Yuliana Cardozo Cozzani for their help in keeping our kids happy and house in order. Also, I want to thank all the ladies who shared their thoughts in the interviews.

Finally, I want to thank my husband, Ville Parkkinen, who enabled this whole project and supported me throughout it. Without you, I would not have even started.

LIST OF ORIGINAL ARTICLES

This thesis is based on the following four articles:

I Kuhlman J., Berghäll S., Hurttala H., Vainio A. (2022). Understanding the diversity of objectives among women forest owners in Finland. Canadian Journal of Forest Research, 52(10): 1367-1382. https://doi.org/10.1139/cjfr-2022-0028

II Kuhlman J., Hamunen K., Vainio A. (2023). (submitted manuscript) Women forest owners' concept of active ownership.

III Kuhlman J., Berghäll S., Vainio A. (2023). Making gender visible: Objectives and socio-demographic differences among women forest owners. Forerst Policy Economics, 151: 102966. https://doi.org/10.1016/j.forpol.2023.102966.

IV Kuhlman J., Berghäll S., Vainio A. (2023). Forest ownership objectives and their connection with forestry activities: a confirmatory approach to studying gender differences. Scandinavian Journal of Forest Research, 38(6): 401–412. https://doi.org/10.1080/02827581.2023.2235276

DIVISION OF LABOUR IN COAUTHORED ARTICLES

	I	II	III	IV
Concept and design	JK, SB, HH, AV	JK, KH, AV	JK, SB, AV	JK, SB, AV
Planning and implementation	JK	JK	JK	JK
Data collection	MO2020	JK	MO2020	MO2020
Data analysis	JK	JK, KH, AV	JK	JK
Writing manuscript	JK	JK	JK	JK
Editing and reviewing	JK, SB, HH, AV	JK, KH, AV	JK, SB, AV	JK, SB, AV
Overall responsibility	JK	JK	JK	JK

JK=Juulia Kuhlman, SB=Sami Berghäll, AV=Annukka Vainio, HH=Henna Hurttala, KH=Katri Hamunen, MO2020=Forest Owner 2020 project

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1. INTRODUCTION

Nonindustrial private forest owners (NIPF) own about 60% of the forests in Finland (Karppinen et al. 2020), providing around 80% of the domestic wood for the Finnish forest industry (Natural Resources Institute of Finland 2021). About 40% of private forest owners in Finland are women (Karppinen et al. 2020), making them an important group of forest owners. Forest owners are currently facing many intersecting and conflicting demands regarding their forests. For example, global warming is likely to increase forest disturbances such as insect outbreaks, floods, storms and fires. Additionally, forest management should be able to take carbon sequestration into consideration, and at the same time, forests play and important role in slowing down biodiversity loss. Moreover, forests should also provide a variety of ecosystem services like flood protection, providing food and a variety of cultural services. Forests are an important income and employment opportunity for many. At the same time, the forest industry seems to change constantly as new investments and mill closures occur. The current war in Ukraine has also impacted wood imports from Russia, increasing the pressure on Finnish wood procurement. All these changes and demands create increasing pressure on the forest industry, forest owners and the related service companies.

Although NIPFs have been substantially studied in Finland and around the world, gender perspectives have been analysed relatively modestly (Follo et al. 2017; Umaerus et al. 2019). Gender differences have been noted, for example, in the following forestry-related topics: biodiversity conservation practices (Vainio and Paloniemi 2013; Umaerus et al. 2019), timber sales (Kuuluvainen et al. 2014; Butler et al. 2017), forest planning and forest work (Redmore and Tynon 2010; Eriksson 2018), forest ownership objectives (Häyrinen et al. 2015), harvesting intensity (Coté et al. 2016) and land inheritance practices (Lidestav 2010). All these results suggest that gender is a key attribute when forest owners are studied (Brandth and Haugen 2005; Häggqvist et al. 2010; Lidestav 2010; Umaerus et al. 2013; Follo et al. 2017).

However, women are often underrepresented in forestry and the related fields; this is seen in women's participation in forest owner surveys, where men answer questionnaires more often than women (Karppinen et al. 2020) and the lack of women in forest organisations and in forestry professions (e.g., Lidestav and Wästerlund 1999; Kuhns et al. 2002). Indeed, the lack of women studying forestry professions and working in the field of forestry has been recognised as an issue for a long time (e.g. Sjølie 2020; Vennesland 2020). There is both lack of women applying for a forestry education, completing forestry-related education, and then opting for a forestry related career (e.g. Sjølie 2020; Vennesland 2020). The reasons why these differences between genders prevail are suggested to be connected to the masculinity of forestry excluding women, gender bias in academy and exclusion from work-related networks (Lidestav and Sjölander 2007; Follo 2011; Sjølie 2020).

The underrepresentation poses challenges both from the equality perspective and when studying forest owners (Umaerus et al. 2013). When women own forests jointly with men, questionnaires related to forests are more often responded to by men (Hänninen et al. 2011; Karppinen et al. 2020). Even when owning forests by themselves, analysis of nonrespondents implies that women respond to forest-related surveys less often than men, meaning that someone else than the owner (e.g., spouse) responds to these questionnaires (Karppinen et al. 2020). Even though there are societal differences between different countries and, thus, results might not be directly comparable, similar gender differences of forest owners outside Finland have been reported. Uliczka et al. (2004) found that women forest owners in Sweden describe themselves less actively and as having less forestry - related education than men forest owners. This results in a situation where women influence the use of their forests less than men (Uliczka et al. 2004). Follo (2008) reported that, in Norway, women forest owners felt less confident and less knowledgeable in forestry than males. Similar results were also found in Finland (Hamunen et al. 2020). In the US, Markowski-Lindsay et al. (2020) found out that women forest owners felt less confident, less prepared and less financially capable related to topics of land use when comparing to men. A number of studies in the Nordics have also reported that women find it difficult to be recognised as forest owners and/or take place in the forestry sector (Lidestav and Egan Sjölander 2007; Follo 2008; Lidestav 2010; Andersson and Lidestav 2016). Furthermore, women forest owners seem to struggle to access forestry information (Redmore and Tynon 2010). Thus, it seems that women forest owners feel less competent in managing their forest property in many areas in the Global North.

Numerous studies have reported that women are less active in harvesting and silviculture (Lidestav and Ekström 2000; Lidestav and Nordfjell 2005; Lidestav and Berg Lejon 2013; Häggqvist et al. 2014; Kuuluvainen et al. 2014). In Sweden, Lidestav and Berg Lejon (2013) reported that men are more likely to certify forests than women. Hänninen et al. (2020) found that, instead of doing forest work themselves, women forest owners hired outside help more often than men. The same study reported that women were not as active in participating in group events, were less likely to seek professional support, ordered less forestry-related magazines but indicated more interest in learning and finding support than men (Hänninen et al. 2020). When commercial forest management is considered, many studies suggest that women forest owners are more passive compared with men (Lidestav and Nordfjell 2005; Redmore and Tynon 2011; Lidestav and Berg Lejon 2013; Kuuluvainen et al. 2014; Butler et al. 2017; Eriksson 2018). Thus, it seems that women have a disposition to do different activities in forests, but they are less likely to act because of a number of barriers.

There are various reasons behind the gender differences observed (Table 1). Factors explaining the differences are smaller average forest size and the socialisation practices to forest ownership have supported men more than women (Lidestav and Nordfjell 2005; Lindroos et al. 2005; Häggqvist et al. 2010; Lidestav 2010). Furthermore, women forest owners seem to have differing forest ownership objectives compared with men. For example, when compared with men, women forest owners seem to value conservation of forests and aesthetics more than timber production (Häyrinen et al. 2015). In addition, studies have reported that women forest owners express greater environmental concerns than men (e.g., Nordlund and Westin 2011; Umaerus et al. 2019). However, in Finland

Vainio and Paloniemi (2013) found that preferring nature conservation increased readiness to protect forests only among male forest owners. These studies indicated that women forest owners are more passive also in nature conservation activities or that women can combine timber production and other values to a greater extent compared with men (Umaerus et al. 2013).

Another explaining factor of the gender differences in forestry could be the gendered norms in forestry. Forestry has been found to be dominated by masculine norms, leaving femininity marginalised (e.g., Lidestav and Ekström 2000; Reed 2003; Arora-Jonsson 2005; Brandth and Haugen 2005; Lidestav and Egan Sjölander 2007; Lidestav 2010; Lidestav and Berg Lejon 2013; Andersson and Lidestav 2016; Lidestav et al. 2017; Andersson et al. 2018; Johansson et al. 2019a; Johansson et al. 2019b; Lidestav et al. 2019; Laszlo Ambjörnsson 2020; Bergsten et al. 2020; Laszlo Ambjörnsson 2021). This makes gender aspects an interesting viewpoint to study. Even when women are studied separately, it is important to note the influence of men and masculine socio-cultural environment to the behaviour and thinking of women. Moreover, ignoring the feminine aspects of forestry might have repercussions to forest service design, forest policies and wood procurement of forest industry. As a result, the feminine aspects and questions of their inclusion in the field of forest ownership is explored through the conceptual view developed within the present thesis.

Because the reasons behind the observed gender differences are diverse, different types of activities have been proposed. For example, women-only forestry courses and events have been organised in Sweden (Lidestav and Berg Lejon 2013; Andersson and Lidestav 2016). Furthermore, women forest owner networks have been formed in Sweden (Lidestav and Andersson 2011), which have been found to increase member involvement and confidence in forestry activities (Lidestav and Andersson 2011). Similar networks are found in Finland, Norway and the US (Brandth et al. 2004; Redmore and Tynon 2010; Ma et al. 2012; Huff 2017; Hamunen et al. 2020). However, the results of the women-only activities are mixed. The networks for women forest owners have created a comfortable place for discussions (Huff 2017), increased access to forestry-related information and education (Redmore and Tynon 2010) and supported learning (Hamunen et al. 2020). Furthermore, women-only networks have been able to mobilise resources and increase the opportunities for women (Agarwal 2000; Brandth et al. 2004) and build social capital and support social development (Agarwal 2000; Arora-Jonsson 2005). However, Lidestav and Berg Lejon (2013) found that the impacts of these networks have been small, at least in Sweden.

Table 1. Reasons for discovered gender differences in forestry.

Difference	Source
Smaller average forest size	Lidestav 2010
Socialisation practices in forestry that support men more than women	Lidestav and Nordfjell 2005; Lindroos et al. 2005; Häggqvist et al. 2010; Lidestav 2010
Differing forest ownership objectives	Häyrinen et al. 2015
Women are more passive in forestry related activities	Umaerus et al. 2013
Gendered norms in forestry	e.g. Lidestav et al. 2019; Laszlo Ambjörnsson 2020; Bergsten et al. 2020; Laszlo Ambjörnsson 2021
Influence of men and the masculine environment	Häggqvist et al. 2010
Social structures including gender norms	Lidestav 2010
Exclusion of women from forestry	Laszlo Ambjörnsson 2021
Exclusion from forestry-related information	Redmore and Tynon 2010

Some limitations to the current understanding of women forest owner behaviour can be noted. Although gender is an important attribute in forestry, there are indications that women have differing objectives compared with men (e.g., Häyrinen et al. 2015). However, the objective structures of women forest owners have not been studied, nor the relationship of forest owner objectives and activity (Ní Dhubháin et al. 2007). Furthermore, there are indications that women might understand the concept of active forest owner differently than, for example, policy makers (Laszlo Ambjörnsson 2021). Nevertheless, what kind of differences there might be and how it could impact our understanding of women forest owners is unclear. Because of the gaps identified, further research on this topic has been called for by number of studies (e.g., Silver et al. 2015; Follo et al. 2017; Umaerus et al. 2019). The present thesis focuses on filling in some of the unanswered themes that have been identified. These themes have been summarised as research questions in Table 2.

Table 2. Research questions of the doctoral thesis.

	Research questions	Articles
I.	Are women less active when wide array of forest owner activities are studied?	Article I
II.	Do women have differing forest ownership objectives compared with men?	Article III
III.	What kind of objective structures women have?	Article III
IV.	Is the relationship between objectives and activity different between women and men?	Article IV
V.	How women forest owners understand the concept of active forest owner, and how does it differ from the one from Finnish forest policy?	Article II
VI.	What kind of attributes impact women forest ownership?	Article II

The purpose of the present thesis is to create a deeper understanding of the factors associated with the activity of women forest owners. The thesis consists of four articles. Each article focuses on different factors associated with women forest owner activity, thus creating a broader understanding of the topic. The factors that impact the activity of women forest owners are analysed through the lenses of gender, service-dominant logic and feminist political ecology. The first article studies if women are indeed less active than men when a wide array of forest owner activities are included, and if so, could socio-demographic attributes explain the differences? The second article discusses if there are differences in what women understand as active forest ownership compared with how policies define it and what kind of attributes impact women forest owners? The third article explores if women forest owners have different objectives that could explain the activity differences? Finally, the fourth article examines if the relationship between objectives and activity is different between women and men. In answering these questions, the present study hopes to further expand our knowledge of women forest owners.

2. BACKGROUND

This chapter presents an overview of the main empirical concepts and themes of the four articles forming the present thesis. All the articles give different viewpoints of the question what factors impact the activeness of women forest owners. Thus, ‘active forest owner’ as an empirical concept is presented in all the articles, in addition to gender and forest ownership. The existing studies around forest owners and their objectives are also discussed briefly because they form an important background for Articles III and IV. Additionally, the prevailing forestry culture, human–forest relationship and the power structures in forestry impact the research of this thesis. All the empirical and theoretical concepts are summarised in Figure 1. The theoretical concepts will be discussed in detail later in Chapter 3.

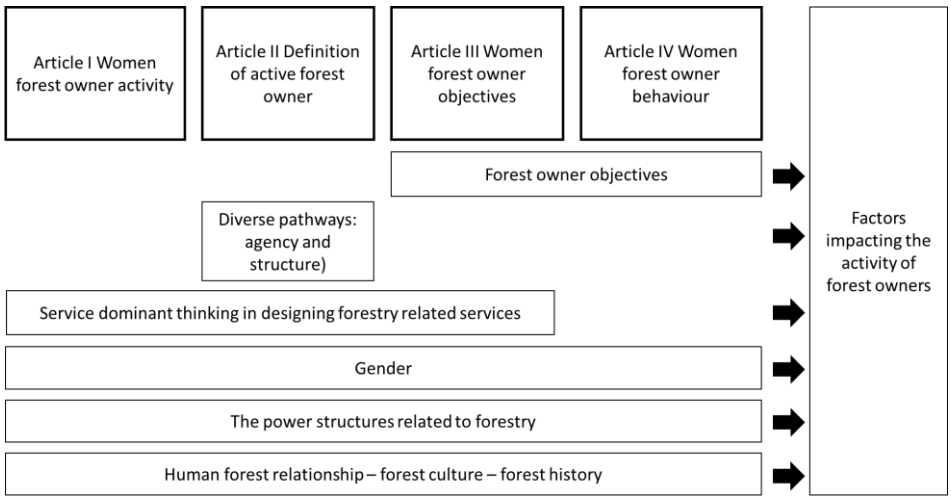

Figure 1. Overview of the empirical concepts and theories used across the articles.

2.1 The concept of 'active forest owner'

The concept of 'active forest owner' is used by policy makers and researchers in the Global North. The concept has been linked to the need of forest industry to engage all forest owners and 'activate' those forest owners that have not been involved in commercial wood production for the benefit of the industry and society. Numerous studies have found that women forest owners are not as active in many aspects of forest ownership as men (Lidestav and Wästerlund 1999; Lidestav and Ekström 2000; Kuhns et al. 2002; Lidestav and Nordfjell 2005; Lidestav and Berg Lejon 2013; Häggqvist et al. 2014; Kuuluvainen et al. 2014; Karppinen et al. 2020). However, most of the research has concentrated on economic aspects of forest management. This is not unexpected because forest ownership in Finland is understood to be dominated by economic values (Takala 2016).

The idea of an 'active forest owner' can be connected to the general development of society, where the concept of active modern citizen was born (Helen and Jauho 2003). In medicine, the concept of active citizen has been connected to taking care of one's health in an active way for the benefit of the individual and society (Helen and Jauho 2003). The concept of active citizen is also related to the classification of citizens according to their health status and utilisation of power over citizens to guide them towards desirable behaviour (Helen and Jauho 2003). Similar features can be seen in the concept of 'active forest owner'. There is a generally an accepted and promoted way to be active in forestry, which reflects the values of those organisations who have power in forest industry and policy (Takala 2016; Vaara 2013).

In Finland ‘activity of forest owners’ and ‘activating forest owners’ are terms found, for example, in the National Forest Strategy (Ministry of Agriculture and Forestry of Finland 2019). The concept of ‘active forest owner’ is also utilised in research (e.g., Haltia et al. 2017). However, the term ‘active forest owner’ is not very well defined. The National Forest Strategy supports forest owners to make decisions based on their own values but at the same time asks for forestry that creates the basis for Finnish forest-bioeconomy and ensures raw material availability for new forest industry investments (Ministry of Agriculture and Forestry of Finland 2019). Furthermore, the National Forest Strategy states how active forest management, together with investments in wood production, will secure the sector growth potential in the future (Ministry of Agriculture and Forestry of Finland 2019). Thus, based on previous policy goals, activeness of forest owners is linked to timber production and economic values, much like is seen in Sweden (Holmgren and Arora-Jonsson 2015). Although it might not be very surprising, it is limiting what is seen as the behaviour of an active forest owner.

In a Swedish study (Holmgren and Arora-Jonsson 2015), the concept of ‘active forest owner’ was found to be a masculine concept linked to timber production. The concept was further studied by Laszlo Ambjörnsson (2021) in Swedish women-only networks; she showed that women felt the need to fit in to the identity of ‘active forest owner’ to be recognised as knowledgeable forest owners. However, Laszlo Ambjörnsson (2021) reported that women forest owners challenged the concept of ‘active forest owner’, including the related social and environmental values associated with it. Laszlo Ambjörnsson (2021) also found that women forest owners understood the concept of ‘active forest owner’ as something connected to commercial timber production, but also something that is up to the forest owners themselves to define. However, environmental protection was seen as something opposing the ‘active forest owner’ at least in some instances (Laszlo Ambjörnsson 2021).

The concept of ‘active forest owner’ could also be defined as the opposite of passive forest owner. Passive forest owners and their increasing amount has been a concern noted in many studies (e.g., Kline et al. 2000; Bieling 2004; Uliczka et al. 2004; Ingemarsson et al. 2006; Ní Dhubháin et al. 2007; Ficko et al. 2019; Karppinen et al. 2020; Matilainen and Lähdesmäki 2023). Like ‘active forest owner’, the concept passive forest owner does not have a common definition (Matilainen and Lähdesmäki 2023). In Sweden, passive forest owner has been understood as a forest owner managing their forests extensively, having small forest holdings that are unable to generate significant income, and who are not very concerned about their forests (Ingemarson et al. 2006; Trubins et al. 2019). In some studies, clear definitions of ‘passive forest owners’ have been given. For example, Kline et al. (2000) defined passive forest owners as someone not having a purpose for their forest land. Bohlin and Roos also used purpose in their definition of passive forest owner, stating that they did not ‘consider neither silvicultural, environmental nor economic concerns’ (2002, p. 47). In Finnish forest owner research, passive forest owners have been discussed by Korhonen et al. (2012) and Heinonen et al. (2020). Often, in research passive, forest ownership has been connected to economic values, that is, to a lack of forest management, timber production interest or sales of timber (e.g., Blanco et al. 2015; Hänninen et al. 2011; Mattila et al. 2013; Ní Dhubháin et al. 2007). However, there are also studies that have

differing understandings of passive forest ownership. Wiersum et al. (2005) and Malovrh et al. (2015) understood that passive forest owner is someone who is not interest about their forests. Passive forest owners have been found not to respond to policy incentives (Boon et al. 2004; Deuffic et al. 2018), making them a group of forest owners that are difficult to reach. Gender has also been connected to the group of passive forest owners. In the review of Matilainen and Lähdesmäki (2023), being female (Eriksson and Fries 2020) or being a highly educated male (Malovrh et al. 2015) were both attributes connected to passive forest owners.

Furthermore, the concept of engaged forest owner can be understood as partly overlapping with the concept of 'active forest owner'. For example, a study by Dominguez and Shannon (2011) explored the engagement and disengagement of forest owners in Spain; they found out that fulfilling a moral norm, reducing risk of forest fires, having an archetypal image of what their forest should look like and justifying forest management through economical means positively impacted the engagement of forest owners. In their study, an engaged forest owner was someone who managed their forests (Dominguez and Shannon 2011). Another study from Slovenia found that engaged forest owners were driven by forest policies addressing economic factors (Kumer and Pezdevšek Malovrh 2019). Within their study, engaged forest owners were defined as persons to whom all studied forest management objectives were relevant (Kumer and Pezdevšek Malovrh 2019). These studies noted that forest management and economic factors are central to the concept of engaged forest owner (Dominguez and Shannon 2011; Kumer and Pezdevšek Malovrh 2019). Moreover, these studies indicated that engaged forest owners are driven by several external factors comprising variety of socio-economical attributes.

Defining concepts that are connected to forests and forest ownership is always connected to politics (Takala 2016). The definitions can support or question the prevailing power relationships (Takala 2016). The concept of active forest owner as it is supports the dominating understanding of forest ownership being something connected to economic values, thus strengthening the power of this type of forest ownership. It is likely that the definition of active forest owner also reflects the power structures within Finnish forest management. The prevailing power structure can be described as a corporatistic system, where corporate groups such as agriculture or forestry organisations hold power in society (Vaara 2013). The power structures emphasise the economic values, which are then reflected in many aspects of forest management, forestry and forestry-related services (Vaara 2013).

Furthermore, the cultural context, that is, the interlinked concepts of human–forest relationship, forest culture and forest history impact how we view active forest ownership (Halla et al. 2021). Human–forest relationship has been defined as 'individual's or community's living relationship with the forest' (Halla et al. 2021, p. 172). Forest culture can be understood as 'activities, practices, values, meanings and viewpoints' formed in social interaction and constantly changing through time (Halla et al. 2021, p. 173). Forest history entails the description of a society's past related to forests (Fritzbøger 2001). Forest have been an integral part of the economic history of Finland, and that importance is still reflected in the understanding of forests and in the values connected to forests (Snellman et al. 2002). However, according to recent studies, forests create value also through activities other than the economic values related to timber production (Kantar 2018).

The dominance of economic values has been seen as limiting forest owners' actions (Takala 2016). If a society wants to enable the free expression of forest owners' values and objectives, more space for different types of ways to own forests is needed (Takala 2016). If activity is understood only as forest management aiming for timber production, it could be that the narrow definition of 'active forest owners' can explain the behavioural differences found between genders. In addition, this type of narrow definition could impact our understanding of forest owners in general, but also, it is likely to impact the forestry services provided. Therefore, the different attributions and definitions of the concept 'active forest owner' is studied in Article II. The different factors impacting activeness itself are further studied in Articles I, III and IV.

2.2 Forest owner objectives research

Forest owners' objectives and values have been widely studied (e.g., Ficko et al. 2019). Forest owner objectives have been seen as important part in understanding forest owners' behaviour, designing successful policy initiatives, promoting sustainable forest management or adapting services to serve forest owners better (Karppinen 1998; Ingemarson et al. 2004; Toivonen et al. 2005; Butler et al. 2007; Häyrinen et al. 2015).

Recent research suggested that forest owner objectives are changing, at least in Europe and North America. Traditionally, forest owner objective studies have been focusing on economic values, but now, the variety of ecosystem services, nature conservation, health and heritage values are included (e.g., Karppinen 1998; Majumdar et al. 2008; Urquhart et al. 2012; Häyrinen et al. 2015; 2016). It has also been suggested that, for some forest owners, the symbolic capital value of forest is more important than income generation (Niskanen et al. 2007). All these studies indicated that forest owner objectives are diversifying or that the forest research is better able to consider the wide variety of objectives.

Many different types of questionnaires have been used to study forest owner objectives. For example, Kendra and Hull (2005) used 67 objective statements, resulting in 12 different latent objective dimensions. Another study utilised 10 objective statements, resulting in two latent dimensions (Majumdar et al. 2008). In Finland, the most commonly used questionnaire includes 22 objective statements (Appendix I). Studies utilising this type of questionnaire have reported from three to five dimensions (Table 3). Articles I, III and IV are based on a questionnaire utilising 22 objective statements but adding three new statements to the questionnaire (Karppinen et al. 2020, Appendix I).

Table 3. Dimensions of forest owner objectives identified in different studies measured with the same scale (22 statements).

Study and sample size	Dimensions identified	Methodology
Kuuluvainen et al. (1996) n=146	Nontimber values Sales income and economic security Self-employment opportunities	Principal component analysis, varimax rotation
Karppinen (1998) n=245	Nontimber objectives Economic security and asset motive Sales income and self-employment opportunities	Principal component analysis, varimax rotation
Toivonen et al. (2005) n=880	Economy Intangible values and recreation Activities and products	Principal axis factoring, varimax rotation
Lindroos (2005) n=563	Economic objectives Intangible objectives Activity objectives	Maximum likelihood factor analysis, varimax rotation
Favada et al. (2009) n=3051	Economic security and regular sales income Nontimber benefits Self-employment opportunities	Principal component analysis, varimax rotation
Rämö and Toivonen (2007) n=731	Activity objectives Economic security Source of income Nature and emotional values Intergenerationality	Maximum likelihood factor analysis, varimax rotation
Hyvönen (2010) n=1418	Nature and emotional values Economic objectives Activity objectives	Maximum likelihood factor analysis, varimax rotation
Hujala et al. (2013) n=1685	Nontimber benefits Economic security Self-employment opportunities	Maximum likelihood factor analysis, varimax rotation
Häyrinen et al. (2014) n= 557	Recreation and leisure time Sense of economic security Aesthetics and conservation Income	Maximum likelihood factor analysis, varimax rotation and confirmatory structural equations analysis

There is notable variety in the dimensions identified in different studies (Table 3). When many of the studies present economic objectives such as sales income, economic security and self-employment opportunities, dimensions such as nontimber objectives, recreation and leisure time and aesthetics and conservation are also presented (Table 3). The most common methodologies utilised in the forest owner objective analysis has been exploratory factor analysis. One exception to this is Häyrinen et al. (2014), who employed both exploratory and confirmatory factor analysis (Table 3).

Even though a substantive amount of research has been focusing on the forest owners' objectives, gender perspective has gained less attention (e.g., Follo et al. 2017; Umaerus et al. 2019). As mentioned before, gender seems to be a key dimension when studying forest ownership (Follo et al. 2017), yet its relation to forest owner objectives has not attracted much attention. Many forest owner objective studies have collected information about gender, and some reported it as one of the socio-economic variables (e.g., Toivonen et al. 2005; Lindroos 2005; Rämö and Toivonen, 2007; Favada et al. 2009; Hyvönen, 2010; Hujala et al. 2013). However, Lidestav (2010) was one of the few who reported a forest owner classification focusing specifically on gender. Even though there is a lack of studies focusing on gender aspects, there are indications that women forest owners might have differing objectives compared with men. For example, the objectives connected to aesthetics and forest conservation have been found to be more important to women than men (Lidestav 1998; Lidestav and Ekström 2000; Palander et al. 2009; Häyrinen et al. 2015).

The results from forest owner objective studies have been widely utilised to form forest owner typologies that can classify forest owners into different groups (e.g., Kuuluvainen et al. 1996; Karppinen, 1998; Kline et al. 2000; Boon et al. 2004; Hogl et al. 2005; Kendra and Hull 2005; Mizaraite and Mizaras 2005; Wiersum et al. 2005; Favada et al. 2009; Rickenbach and Kittredge 2009; Bengston et al. 2011; Hujala et al. 2013; Takala et al. 2017). Some of the typologies are based on a theoretical background of behavioural theory on how attitudes impact behaviour (Boon et al. 2004; Hogl et al. 2005; Karppinen and Berghäll 2014), while others are based on empirical evidence (Boon et al. 2004). The somewhat weak theoretical background of the widely utilised typologies has been questioned lately (Ficko et al. 2019).

The classification of forest owners in the Nordics were driven by the forest industry's increased demand for timber around 1970 (Hänninen and Karppinen 2010; Ficko et al. 2019). The benefits of typologies are in helping understand diverse groups of people and the complex relationships related to human behaviour (Emtage et al. 2007). They have served as tools to organise and make sense of groups of people (Boon et al. 2004). Nevertheless, typologies often fail to demonstrate the similarities between groups because they are based on clustered differences. Furthermore, the connection between values and objectives has not been easy to prove (Karppinen 1998; Karppinen and Korhonen 2013). It has been suggested that this issue is because of the power structures that push forest owner behaviour in the direction of the dominating economic forest owner discourse, despite their own values (Takala 2016).

The impact of human–forest relationship, forest history and forest culture can be also seen within the forest owner studies. The dominance of economic objectives can be seen in

research settings and results (Table 4). This is understandable because the behaviour of forest owners has been and is interesting to forest industry. Private forest owners control 80% of the raw material used by the forest industry (Natural Resources Institute of Finland 2021). The focus on economic objectives has resulted in a situation in which all forest owners need to orient themselves in relation to the prevailing economic values of forest ownership, even if economic objectives are not important for them (Takala 2016). The present thesis challenges the prevailing masculine and economic dominance by concentrating to women forest owners.

Within Articles I and III, forest owners are grouped based on their objective profiles. However, the point of this classification was not to create another typology but to study the similarities and differences between groups, especially the socio-economic attributes and their impact. A similar approach has been used, for example, by Häyrinen et al. (2015), who found that gender, education and residential area impacted objective profiles.

3. THEORETICAL FRAMEWORK

This chapter discusses the theoretical background of the present thesis. Each of the four articles build on a slightly different theoretical background, as discussed in this chapter. All the articles utilise gender theory. In addition, Article I uses the approach of service-dominant logic and different theoretical conceptualisations of gender. Article II utilises the theoretical framework of feminist political ecology and gender. Articles III and IV use a more empirical approach to study forest owner objectives by focusing to gender. Different theoretical aspects are used to help in understanding the observed differences between women and men forest owners in their behaviour and objectives. All the empirical and theoretical aspects are summarised in Figure 1. Utilising many different theoretical viewpoints gives the opportunity to holistically study women forest owners' activity.

The ontological and epistemological ground of the four articles is related to postpositivist philosophy. Postpositivism generally entails the idea of objective truth. Postpositivists believe that reality can be defined objectively by measuring it (Lincoln et al. 2011). However, postpositivist scholars also see that reality can be known only imperfectly (Lincoln et al. 2011). Postpositivism was created as a criticism of positivism, rejecting the idea that reality has an objective nature and science can discern that reality (Fox 2008). Postpositivism includes a range of perspectives; of these, realism and constructivism are utilised within the current thesis (Fox 2008). Both realism and constructivism understand that the need of interpretation limits our capability to understand world. However, constructivism also rejects the idea that we would be able to measure society because of the primacy of language as a way to describe the understanding of reality (Fox 2008); they also reject that there would be an independent reality that could be uncovered (Fox 2008). Articles I, III and IV could be seen utilising postpositivistic realism, focusing on detailed measurements of forest owners and drawing conclusions about reality based on those measurements. However, Article II utilises a more constructivist approach to explore the concept of 'active forest owner'. Constructivism allows us to study the different versions of reality and thus study reality by approaching how individuals understand it (Raatikainen

2004). Even though the current thesis aims to challenge and deepen the current largely positivist understanding of forest owners, it still relies on the traditions of measuring forest owners and providing information about the phenomenon that can be observed within forest owners. By applying qualitative methods, the present thesis tries to deepen the understanding and explore a phenomenon in a deeper way than quantitative methods alone can. On the other hand, using quantitative methods, the present thesis tries to provide more information through measurements. Even if the results are an estimation of reality, it still provides us more detailed information about it. It can be argued that the approach of the present thesis has arisen from the practical need to understand forest owners, their behaviour and objectives. This type of approach is common because research often reflects theories in their individual ways (Häkli 1999).

3.1 Gender

Gender can be understood as a socially constructed system shaped by social differences, power relations, cultural institutions and social shifts that happen in the intersection of class, race, sexuality, age, religion, space and place (Rocheleau et al. 1996a). Because gender is generated from social interaction, it is a concept that constantly changes over time and place (Nightingale, 2006). Judith Butler (1997a) stated that gender is constructed by repetitive performances and that, without these performances, there is no gender. Gender can be seen as a discussion between the individual and surrounding society that is in constant movement (Butler 1999). Thus, gender is understood as a continuous process where gendered subjectivities are performed (see, e.g., Butler 1990, 1993, 1997b, 2004). Butler (1990) saw individuals as active agents constructing gender rather than passive bystanders. Although gender is impacted by the surrounding norms and socialisation environment, the individual is still actively constructing gender (Butler 1990).

Gender can be differentiated from sex, with sex being the biological attribute of a body, while gender is culturally defined (Butler 1999). Even though sex and gender are interlinked, gender does not causally result from sex or is not fixed to sex (Butler 1999). Sex has been traditionally understood as a biological fact, often seen as something binary that can be defined objectively and scientifically (Butler 1999). However, Järviluoma et al. (2003) stated that gender and sex are both cultural categories and that, although they might have some connection to biological features, they vary significantly between cultures, place, time, and personal situations. Both gender and sex are culturally constructed to help us explain and comprehend human bodies and relationships (Järviluoma et al. 2003).

It is difficult to consider individuals, social life or culture without the concept of gender (Connel 2002). Even though gender is such an integral part of our society, it has not been around for a very long time. Germon (2009) suggested that the origins of the concept of gender can be traced back to 1940s and John Money, who introduced it to understand hermaphroditism better (Money and Ehrhardt 1972; Germon 2009). Later, Money used the concept of gender to discuss how people in general develop their gender because the concept helped in understanding human subjectivity (Money and Ehrhardt 1972; Germon 2009). The ideas of Money have been later criticised and undermined (e.g., Colapinto 2000)

even though Money's theory about gender has had a significant impact of how we understand the interplay of sex and gender today (Germon 2009).

Even though some scholars have given Money credit for the concept of gender, there is no agreement about the origins. There are scholars that connect the origin of gender to Simone de Beauvoir (e.g., Braidotti 1996), sociology (e.g., Rubin and Butler 1998) or feminism (e.g., Seidman and Nicholson 1995; Hawkesworth 1997; Scott 1999). Marshall (2000) connected the concept of gender to the medical studies of the mid 1950s or 1930s. In 1960s, the concept of gender emerged in sexological and psychoanalytical texts (Glover and Kaplan 2000). Despite the discussions about the origin of gender, these days, most social scientists, behavioural scientists and governmental and intergovernmental agencies acknowledge the difference between sex and gender (e.g., Kimmel 2004; Reitman 2009; Lindsey 2010; WHO 2022).

There are many ways to approach gender in research. For example, gender can be used in analysis at different levels, ranging from individuals to social systems or ideologies (Marshall 2000). More specifically, gender can be used as a social variable, contemplating what different genders do; it can be a system analysis, focusing on what kind of systems genders generate; or a social construction analysis, studying how gender manifests itself in language, social action or cultural products (Järviluoma et al. 2003). Gender is often taken as something known, even though the understanding of gender in each situation should be thoroughly analysed. Gender has been studied both using a strong feminist ideology but also in connection to sociology and political science (Moi 1990; Järviluoma et al. 2003). Although feminism has been driving force in studying gender, it has not been the only one. Most gender studies are driven by the idea of identifying and resisting uneven relationships between and within the genders (Moi 1990). Thus, gender can also be a political tool when focusing on gender ideologies (Järviluoma et al. 2003). Gender analysis is not just about analysing what different genders are or what they do; it focuses on the world around us and studying how gender impacts it, us, our identity or activities.

Table 4. Approaches to analyse gender used within the thesis.

	Approaches to analyse gender	**Approach used in the following articles**
I.	Dichotomic empirical variable	Articles I, III and IV
II.	Relational and structuralising category	Articles I, II, III and IV
III.	Meaning category	Article I

The current thesis approaches gender in three different ways (Table 4). Often, gender is considered as a dichotomic empirical variable, especially in quantitative research. Although it is understood that gender is not something dichotomic but more of a continuum, it is treated as dichotomic in many questionnaires. This approach is good in revealing behavioural differences between genders in a larger scale. Thus, the approach is used in Articles I, III and IV, where large datasets are analysed. However, looking at gender only as an empirical variable does not give much room for analysing the reasons behind the observed gender differences. Thus, within the present thesis, gender is also analysed as a relational and structuralising and meaning category (Follo et al. 2017, Table 3). The relational approach to gender means that what is seen as masculine and feminine are defined in a relationship to each other and both can be performed by any gender. When women perform masculinities, the phenomena can be called as female masculinity (Halberstam 2019). It is not understood as an imitation of maleness; rather, it is performing what is understood as masculine (Kazyak 2012). Examples of this type of performances have been seen in girls' basketball, women working in a farm or in the behaviour of women forest owners (Kazyak 2012; Pascoe 2012; Laszlo Ambjörnsson 2021). There are many types of different masculinities present in the field of forests (see, e.g., Colfer 2020), but within the current study, the focus has been on the masculine narrative of forests as a place of timber production (Colfer 2020). These type of masculinities in the forest sector has been seen to result to policies addressing masculine interests, concerns and knowledge (Colfer 2020).

Analysing gender in different types of viewpoints is used, for example, by Follo et al. (2017) in their review of forest owner research. Although these concepts are represented as a separate approach when studying gender, the concepts are intertwined. For example, assessing gender as relational and structuralising category or as a meaning category requires the division of people to gender categories. In addition, gender as a meaning category entails seeing gender as a relational and structuring category.

When gender is seen as an empirical variable, it includes the notion that a person is a woman or man. It is something that we are. Gender is seen as connected to the biological male–female dichotomy and the related idea of biological reproduction. Within the questionnaires used in the present study, gender was studied with a question with three possible response options: woman, man and 'other'. Although we understand that gender is not a variable with three possible categories but rather a continuum, for the purposes of the current study, it was treated as a categorical variable. The term female forest owner has been used more often in forest research referring to women than the term women forest owners. However, often, the words female and male are used to refer to sex, whereas women and men are used to refer to gender (e.g., WHO 2022). Thus, the present thesis utilises the term women forest owners because it is seen as more appropriate.

Gender can be also analysed as a relational and structuralising variable. From this viewpoint, gender is understood as a social process which categorises people as women and men. This is described with the term of 'doing gender'. 'Doing gender' is understood as a process where the action of an individual is recognised by others as a behaviour belonging to a man or woman (West and Fenstermaker 1995a; 1995b; West and Zimmerman 2009). This process means that gender is something that grows from the interaction between

individuals and is an ongoing development. Together, all of these interactions form what we see as gender norms in society. Because forestry is understood as a masculine field (e.g., Andersson et al. 2018; Johansson et al. 2019a; 2019b; Lidestav et al. 2019; Bergsten et al. 2020; Laszlo Ambjörnsson 2020; Laszlo Ambjörnsson 2021), it is important to understand how gender norms could impact the behaviour of women forest owners. The gendered nature of forestry is discussed in the all articles comprising the current thesis. What is seen as an acceptable behaviour of women forest owners might impact, for example, the frequency and ways of how women utilise forestry-related services. Gender categories can also shape the objectives of women forest owners.

As a meaning category, gender connects gender with a number of things, such as actions, language or artefacts (see, e.g., Järviluoma et al. 2003). The meanings are developed from social interaction (e.g., Butler 1997a; Nightingale 2006). These representations are in constant change. In forestry, gender has been found in the concepts of a forester (Lidestav and Egan Sjölander 2007) and engagement in forestry (Appelstrand and Lidestav 2015). When gender is analysed as a meaning, it helps in understanding how gender influences individuals' actions (Follo et al. 2017). Gender as a meaning category might help in explaining the gender differences in the behaviour of women forest owners. This approach is employed in Article I.

3.2 Gender and feminist political ecology

Within the present thesis, Article II utilises the theoretical framework of feminist political ecology, which is one viewpoint that can be used when analysing gender and environment. The field and its background are discussed briefly within this chapter. The wider research on gender and environment suggests that gender is an important attribute when the management of natural resources is studied. There are four main research themes identified by the review of Arora-Jonsson (2014): 1. differences in valuing and understanding the environment by different groups; 2. topics such as property rights, economic security and women's labour in relation to natural resource management; 3. Environmental management and women as decision makers; and 4. changing roles of women and external supporting actors and their significance. The articles of the present thesis fall under topics 1 and 4. Article III focuses on the objective differences of forests by women forest owners, which falls into topic 1, whereas Article II focuses on the roles of women as forest owners and the of external actors within forest ownership.

The theoretical framework in the field of gender and environment has been quickly developing. The similarities in the control of women and nature was the focus of the ecofeminist approach, in addition to connecting women and environmental protection because of maternal roles of spiritual connections (Somma and Tolleson-Rinehart 1997). The ecofeminist approach has resulted in a situation where women were seen as the victims or protectors of the environment, pushing the responsibility of protecting the environment to women (e.g. Reed 2000; Lind 2002; Harris 2009; Arora-Jonsson 2011; Buechler and Hanson 2015; Gay-Antaki 2016). Recently, ecofeminism has involved intersectionality, enabling a wider understanding of the interplay of different dimensions of power such as race, class or age simultaneously (e.g. Elmhirst 2011a; Nightingale 2011; Truelove 2011;

Mollet and Faria 2013). Feminist political ecology can be seen as the next step in the research focusing on natural resources and gender. Elmhirst et al., who can be considered one of the pioneers of feminist political ecology, defined the field as 'gendered processes underpinning the politics of resource access as well as the gendered agency of subjects involved in negotiations over environmental resource struggles' (2017 p. 1137). Feminist political ecology can be defined as a subcategory of political ecology, focusing on gendered processes in connection to natural resource politics, thus intertwining gender and politics (Elmhirst et al. 2017). It is a field of studies influenced by the thoughts of Rocheleau et al. (1996b). Although there is a body of research combining the studies of gender and natural resource management, still feminist analysis of gender is asked for (Reed and Christie 2009; O'Shaughnessy and Krogman 2011; Arora-Jonsson 2014).

Feminist political ecology gives importance to space, place and scales and their impact to environmental governance and practices (Elmhirst, 2011a). Scales of importance range from the intimate (such as emotions or the body) to national or even global (e.g., Rocheleau et al. 1996b; Gururani 2002; Nightingale 2011; Sultana 2009; 2011; Elmhirst 2011a; 2011b; Truelove 2011; Mollet and Faria 2013; Bezner Kerr 2014; Buechler and Hanson 2015; Sundberg 2015; Gay-Antaki 2016; Elmhirst et al. 2017; Vaz-Jones 2018; Laszlo Ambjörnsson 2021). Article II utilises this approach to study the different scales of the attributes that are impacting forest ownership.

The studies on gender and natural resource management have often focused on the Global South, but there are also many exceptions. In North America, gendered discourses, representations, practices and women-only organisations and work identities have been studied (Reed 2003; Reed and Varghese 2007; Mills 2012; Huff 2017; Markowsky-Lindsay et al. 2020). In addition, forest management has been studied through the lens of intersectionality (Sweeney 2009; Reed 2010; Ekers 2013). There are a number of studies on gender and forest management and women-only organisations, some of them mentioned earlier (e.g., Arora-Jonsson 2004, 2009, 2010; Brandth et al. 2004, 2015; Andersson and Lidestav 2016; Laszlo Ambjörnsson 2020; Hamunen et al. 2020). Furthermore, gender constructions in forestry and gender mainstreaming have been studied in the Nordics based on the number of studies (Brandth and Haugen 2000, 2005; Lidestav and Egan Sjölander 2007; Johansson and Ringblom 2017; Andersson et al. 2018; Johansson et al. 2019a, 2019b; Ringblom and Johansson, 2020).

3.3 Service-dominant logic

In Article I, service-dominant logic (SDL) is used as a theoretical background to discuss the differences of women and men forest owners in their forest-related service usage. SDL is one of the most influential ideas focusing on the service-nature of economic exchange; SDL is based on Vargo and Lusch's (2004) idea that traditional economies focus on producing goods instead of adding value in exchange (Vargo and Lusch 2004; Vargo et al. 2008). They discussed the goods-dominant logic (GDL) that evolves around producing goods as efficiently as possible and then finding customers for them (Vargo and Lusch 2004; Vargo et al. 2008). In the SDL, the value creation process is key for successful business, and

products are just the means of adding value to customers (Vargo and Lusch 2004; Vargo et al. 2008).

A key concept of SDL is that the value is created in networks together with many players, not by a single firm creating and delivering it (Lusch et al. 2009). This is also called value cocreation (Lusch et al. 2009). In forestry-related services, value is not created just by the forestry service provider, but also in the network that includes, for example, the forest owner, forestry service provider, logistics provider, forest industry, a person who utilises forests for recreation or hunting or a neighbour who enjoys the view. The value creation networks are complex and differ in each case, although value creation has a systemic nature (Lusch et al. 2009). The value created in the networks spreads wide, and without considering the network as a whole, the value created cannot be captured completely (Lusch et al. 2009).

SDL has been used in recent research of forestry-related services (Mattila and Roos 2013; Mattila et al. 2013; Matthies et al. 2016; Berghäll 2018; Laakkonen et al. 2018). According to the studies, product dominant logic remains the dominant mode of forestry-related services (Mattila and Roos 2013; Berghäll 2018). This result is supported by Finnish forest owner studies. Pynnönen et al. (2018) stated that Finnish forest owners would like to combine economic objectives with other objectives but fail to find service providers who would be capable of doing this. Mattila et al. (2013) found that economic objectives dominate the services offered to forest owners and that differing customer needs were not often taken into consideration. In addition, Häyrinen et al. (2015) discovered that forestry service organisations were not able to take diverse forest owner objectives into account.

The lack of SDL in forestry service providers might explain some of the differences between women and men forest owners' use of services. If the objectives of women forest owners differ significantly from the traditional economic objectives, it might be the case that engaging in a service relationship with a forestry service provider simply does not add enough value to the neglected part of Finnish forestry decision makers (Pynnönen et al. 2018). SDL can help in understanding the mismatch between what is needed and what is offered, helping develop more appropriate services (Vargo and Lusch 2011). Furthermore, applying SDL might help in forming a fuller picture of the value creation of forests to the forest owners. If the feminine aspects of the value creation of forests are ignored, it is likely that our understanding of value created by owning forests will be limited.

3.4 Conceptual summary

Even though many different theoretical backgrounds are utilised within the present thesis, they are intertwined and come together (Figure 1). The human–forest relationship, forest culture and forest history form the background for this study (Halla et al. 2021). Forest culture and forest history intertwines with the power structures present in forestry (Takala 2016; Vaara 2013), and they all interact with our understanding of gender and the masculinity of forestry forming the structural framework (Figure 1).

The gendered nature of forestry (e.g., Bergsten et al. 2020; Laszlo Ambjörnsson 2021) made studying women forest owners an important approach. Studying women offers a) a viewpoint that differs from the mainstream and b) gives a more diverse picture of forest

ownership. The masculine environment of forestry with a focus on economic values trickle-down to many aspects in the present study. Forest owner studies have focused on studying the economic values and aspects of forest ownership throughout its history (Table 7). In addition, the gendered nature of forestry impacts how active forest ownership is understood (Laszlo Ambjörnsson 2021). Furthermore, it influences women and how they act and define themselves as forest owners (Laszlo Ambjörnsson 2021).

If the definition of active forest owner is based on industrial timber production and economical values (Holmgren and Arora-Jonsson 2015), by applying SDL, the activity can be understood as economic activity that has only instrumental economic value to those engaged in an exchange relationship. This translates to the notion that the active forest owner as a concept is repeating the product dominant logic of the industry sector. The current economic focus of active forest ownership can be seen as biased in the perspective of SDL because it disguises the value acquired by women forest owners only through economic (and traditional/masculine) valuations. Furthermore, it undermines the value that forests deliver to the forest owners, ignoring the diversity of values connected to a broader view of forest ownership.

The conceptual approach of the present thesis will strive to unveil some of the missing aspects from the current research and guide further research in mapping the diversity of forest owner values and objectives. It discusses how forest culture, gender and power structures of forestry show themselves in the world of women forest owners. This makes it possible to search for new frontiers of value-cocreation within the forestry and developing the industry through this new understanding. The present thesis will try to define some of the challenges ahead.

4. DATA AND METHODS

This chapter briefly discusses the used methodology and data used in each of the articles. Further details of the methodology and data can be found from the original articles. The articles of the present thesis employ both qualitative and quantitative methods. Three of them are based on quantitative methods (Articles I, III and IV) and one on qualitative methods (Article II). Table 5 gives an overview of the methods and data.

Table 5. Summary of methods and data of the four articles

Article	I	II	III	IV
Research question	Are women less active when wide array of forest owner activities are studied?	How do women forest owners understand the concept of active forest owner, and how does it differ from the one from Finnish forest policy? What kind of attributes impact women forest ownership?	Do women have differing forest ownership objectives compared with men? What kind of objective structures women have?	Is the relationship between objectives and activity different between women and men?
Methods	Exploratory factor analysis using principal axis factoring with varimax rotation K-means clustering	Thematic analysis	Exploratory factor analysis using principal axis factoring with varimax rotation	Structural equation modelling Confirmatory factor analysis Multigroup analysis
Data	Finnish Forest Owner 2020 questionnaire (n= 6 368)	22 semistructured interviews	Finnish Forest Owner 2020 questionnaire (n= 2 250)	Finnish Forest Owner 2020 questionnaire (n= 6 558)

Articles I, III and IV utilised data collected as part of the Finnish Forest Owner 2020 project. The data were collected by mail survey in 2019. Before sending the questionnaire, it was tested on random forest owners. The sample included individuals, spouses, private partnerships and heirs who had forests. The forest size was limited to over 5 ha in Southern Finland, over 10 ha in Central Ostrobothnia, Northern Ostrobothnia and Kainuu and over 20 ha in Lapland. This was done to capture the forest areas used for wood production. In Southern Finland, general forest areas and forest areas used for wood production are similar. When going north, the share of forest areas used for wood production becomes smaller.

The sample consisted of 2,250 questionnaires sent to seven wood procurement areas in Finland. This totalled 15,750 questionnaires. Finnish Forest Centre's forest owner register was used to select the sample utilising stratified systematic sampling (Laaksonen 2013). One hundred and nineteen forest owners that were part of the sample no longer owned forests, and 196 forest owners could not be reached. Thus, the final sample was 15,436 participants. The respondents received two reminders to answer the questionnaire. In the end, 6,558 responses were collected, resulting in a response rate of 42.5%. From the received responses, 162 were found lacking, making the final response rate 41.4%.

Different subsamples of this questionnaire data were utilised. Nonrespondent analysis was done by interviews and comparing nonrespondent data with Finnish Forest Service database. In the questionnaire, gender was asked giving three different options for answering: man, women or other. However, the amount of forest owners that answered other was so small, that to protect their privacy, these data were not used. It is understood that these three options do not give an adequate picture of the gender identities of forest owners because gender is more of a continuum than three different classes. Still, for the purposes of the present study, it was treated as such.

Article II was based on 22 semistructured interviews of women forest owners. The interviews were done with a Microsoft Teams application in February 2022. All the interviewees were recruited with an add posted in a Facebook group called LadyForest-naismetsänomistajat (LadyForest – women forest owners). This group is an open group for all women forest owners. Twenty-two women replied to the post and were consequently interviewed.

4.1 Article I

Article I is quantitative study comparing the activity of women and men forest owners across 14 binary variables. The study utilises survey data collected as part of the Finnish Forest Owner 2020 research project. The questionnaire sent to the forest owners consisted of two parts: a common section and three separate subsets of varying questions. All respondents were asked to answer the first common part and one of the separate subsets. The topics of the subsets were 1) utilisation of forest services 2) acceptability of forest economics and ecosystem services and 3) forestry, logging by the owner and work well-being. Subsets were used to cut down the length of the questionnaire. Answering all three subsets would have resulted in an excessively long questionnaire possibly impacting the response rate. Because of the topic of subset 3, it was not analysed within Article I. In total, 2,193 responses were received for subset 1 and 2,250 responses to subset 2, resulting in respective response rates of 42.7% and 42.9%. The characteristics of the respondents are reported in Table 6.

Table 6. Sample characteristics

	Whole dataset	Subset 1	Subset 2
	n=6,468	n=2,193	n=2,250
		% of respondents	
Professional status (n=6,468)			
Employee	33.4	32.2	35.3
Agriculture and forestry entrepreneur	8.3	7.8	8.7
Other entrepreneur	5.5	6.3	5.0
Retired	51	51.9	49.4
Other	1.8	1.8	1.6
Forest area, ha (n=6,542)			
5–9.9	14.7	14.6	14.9
10–19.9	21.7	21.8	21.4
20–49.9	33.6	34.4	33.2
50–99.9	17.3	17.3	17.9
100–	12.7	11.9	12.6
Age, years (n=6,385)			
–44	8.4	7.2	9.5
45–54	11.8	11.8	11.7
55–64	25.4	25.3	25.9
65–74	35.6	35.4	35.2
75–	18.8	20.3	17.7
Ownership type (n=6,540)			
Family ownership	82.7	82.9	82.3
Joint[a]	9.2	9.1	10.2
Estate[b]	8.2	8.0	7.5
Gender (n=6,110)			
Men	75.8	75.6	76.8
Women	24.2	24.4	23.2
Residential environment (n=6,365)			
Countryside	53.2	52.6	53
Small village	17.6	17.6	17.8
City	29.2	29.8	29.2

[a] Joint ownership refers to forest ownership of two or more individuals who own a forest together. Joint ownership has impact how taxes related to the forest are shared between the owners. [b] Estate refers to ownership type, which has been formed because of the death of a previous owner.

A nonrespondent analysis was conducted by phone interviews (n=197) and comparing data collected by the Finnish Forest Service and the Digital and Population Data Service Agency databases. According to a nonrespondent analysis, forest area was similar between respondents and nonrespondents. Nevertheless, there were also differences noted. Among the respondents, there were fewer heirs, forest owners living outside the forest estate and women than among the nonrespondents. The respondents were also older than the nonrespondents (Appendix III). Furthermore, the respondents contained fewer entrepreneurs and owners of estates or corporations (Appendix IV). In addition to the nonrespondent analysis, an analysis of characteristics by gender is given (Table 7). The majority of the respondents were sole owners of their forests. There are some gender differences that can be noted.

Table 7. Respondent characteristics in the whole Finnish Forest Owner 2020 survey by gender.

	Men respondents (n=4747)	Women respondents (n=1506)
Average age, yrs.	64	65
Average forest area, ha	51	37
Residential environment, %		
Countryside	57%	43%
Small village	17%	20%
City	26%	37%
Ownership type, %		
Sole owners	61%	58%
Family ownership	14%	27%
Joint	10%	9%
Estate	15%	6%

The majority of the respondents were sole owners of their forests. When the characteristics are compared, there are clear gender differences in the forest area, residential environment and ownership type (Table 7). Similar differences have been noted by earlier studies (e.g., Lidestav 1998; Lidestav and Nordfjell 2005; Karppinen et al. 2020). The questionnaire instructed that the person who is mainly responsible for the forest would answer the questionnaire (Karppinen et al. 2020). Furthermore, the questionnaire was addressing an individual, not multiple owners (Karppinen et al. 2020). Thus, it is reasonable to assume that the responses represent personal views, despite the ownership type. According to Karppinen et al. (2020), women forest owners respond less likely when they own forests together with their spouses and often do not respond, even if they are the sole owners of forests. Because of this phenomenon, it is likely that those women who have responded to the survey have expressed their personal opinions.

Forest owners' activity levels were measured with 14 binary variables (Table 8). The variables were combined into one sum variable (Table 8). Pearson's Chi square test was then applied to study the difference between the observed and expected values. Exploratory factor analysis using principal axis factoring with varimax rotation was selected to study the structure behind the items measuring forest owner objectives among women (Hair et al. 1998). A five-factorial solution was selected as the most suitable solution. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.906, and Bartlett's test of sphericity was significant (p=0.000), indicating sample suitability for factor analysis (Metsämuuronen 2009). Cronbach's alpha was calculated for all the factors varying between 0.882 and 0.780, suggesting suitable scale consistency. After iterations, the final factor values were calculated using the regression method.

Clustering was utilised to divide forest owners into groups based on their objectives. The assumption behind clustering is that the respondents within the group behave similarly and differ between the groups (Kaufman and Rousseuw 1990). K-means algorithm was then used to cluster the forest owners by factor scores. Although k-means clustering has been criticised as a method where researcher subjectivity has too much of an impact (Ficko et al. 2019), within the present study, different solutions were tested to find the most interpretable solution (Jain 2010).

Table 8. Activity variables and datasets in Finnish Forest Owner 2020 survey.

Activity	Dataset
1. Has electronic forest resource information	Common
2. Has a forest plan formulated by a professional	Common
3. Has used a forest plan	Common
4. Has been in contact with a forest professional	Common
5. Has been on a forest excursion[a]	Common
6. Has been on a forest course	Common
7. Follows forest-related journal(s)	Common
8. Has performed forestry work	Common
9. Has spent time in the forest	Common
10. Has used electronic forest-related services[b]	Subset 1
11. Has insurance for the forest[c]	Subset 1
12. Has evaluated the profitability of forestry	Subset 1
13. Applies continuous-cover management in forests	Subset 2
14. Has sold timber	Common

[a]Forest excursions relate to events organised in forest for example by local foresters. The events are organised to inform and educate forest owners. [b]Electronic forest-related services (number 10) relate to online services such as tendering of wood sales or forestry work, filling out tax forms, applying for state support for forests, selling forest estates or applying for insurance compensation related to the forest. [c]Insurance refers to voluntary insurance that a forest owner can have for their forests. Insurance usually covers losses related to storms, insects, fires, snow or theft in the forests.

4.2 Article II

Article II focuses on how women forest owners understand the concept of 'active forest owner' and how that compares with the understanding of Finnish forest policy. Furthermore, Article II explores the scales of the different attributes that impact forest ownership. This study is based on 22 semistructured interviews of Finnish women forest owners. The sample was recruited from a Facebook group called LadyForest – *naismetsänomistajat* (women forest owners). This is a group for women forest owners who are interested in forest ownership or are forest owners. The Facebook group is used by the participants to ask questions, share information and opinions and provide guidance and events related to forest topics. It is likely that the members of this group are more active than a random sample of women forest owners. This is a limitation of the interpretation of the results, but on the other hand, it enables analysing a group of women that a) belongs to a women-only organisation related to forestry and b) is likely to have a view what active forest ownership in Finland is. At the time of the interviews, the group had more than 4,600 participants. The thematic topics of the interviews focused on forest ownership,

womanhood, active forest owners and support (see Article II for details). The interviews were conducted through Microsoft Teams in February 2022.

The representativeness of the sample was studied comparing it to average forest owners (Karppinen et al. 2020). On average, the samples were 13 years younger than forest owners in general (Karppinen et al. 2020). About 60% of the sample had university degree and 40% higher vocational diploma, whereas bout 20% of Finnish forest owners in general have a university degree and 30% a higher vocational diploma (Karppinen et al. 2020). This generates further bias in the group of interviewees. About a third of the sample had inherited their forests (27%), where 23% had bought them and 23% acquired them during generational renewal process, a procedure where land is transferred from retiring farmers to the next generation (Ministry of Agriculture and Forestry of Finland 2022). About half of the interviewees had sole ownership and half owned them together with a relative or family member.

Thematic analysis were used to analyse the interviews (Braun and Clarke 2006). The concept of 'active forest owner' from Finnish forest policy and research was compared with the one emerging from the interviews (Table 9). Based on the interviews, eight new themes were added. The interviews were conducted by one researcher and transcribed simultaneously using Microsoft Teams. The raw transcriptions were later corrected by one of the researchers based on the recordings of the interviews. The transcripts were then analysed, and all themes connected to the concept of 'active forest owner' were collected and analysed. The results were then iterated by all researchers. Furthermore, the attributes impacting forest ownership were analysed in a similar manner, comparing the scales derived from the literature of feminist political ecology to the ones emerging from the interviews (Table 10). In the present study, we removed two scales that did not emerge in the discussions and replaced them with two others that did (Table 10).

Table 9. Thematic categories of 'active forest owner' based on the literature and interviews analysed for Article II.

Theoretical background	Literature-based themes	Interview-based themes
The concept of 'active forest owner'	Takes care of the economic potential of the forest	Takes care of the economic potential of the forest
	Has updated forest plan	Has updated forest plan
	Makes independent decisions based on their values	Makes independent decisions based on their own values
		Is aware of and interested in their forests
		Follows forest topics (politics, discussions, EU decisions, economy and industry)
		Visits forests
		Understands forest management
		Takes care of forests
		Collaborates with forest stakeholders
		Checks the quality of forestry work
		'Does' [activities] in forests
		Acts according to ones values

Sources: Korhonen et al. 2012; Haltia et al. 2017; Ministry of Agriculture and Forestry of Finland 2019

Table 10. Thematic categories of 'active forest owner' based on the literature and interviews.

Literature-based scales	Interview-based scales
The intimate	The intimate
Daily life	Family
Household	Education
Local community	Local community
National	National
Global	Global

Sources: Gururani 2002; Sultana 2011; Elmhirst 2011a; Truelove 2011

4.3 Article III

Article III is a quantitative study which goal is to deepen the understanding of women forest owners' objective structure. This study utilises women forest owner survey collected as part of the Finnish Forest Owner 2020 research project. The sample consisted of 6,558 responses, which was then randomly split into two subsamples. The first subsample was used in Article III, while the other was used in Article IV. The subsample used in this study contained 747 women forest owners and 2,319 men forest owners. Although we understand that gender is not a binary factor, it was treated as such for the purposes of this study. Table 6 presents the sample characteristics. More details of the data collection can be found in Karppinen et al. (2020).

To conduct a nonrespondent analysis, 43 female nonrespondents were interviewed by phone. There were some differences between nonrespondents and respondents based on to the analysis. The number of heirs were slightly higher among the respondents (13%) than nonrespondents (11%). Furthermore, the average age of the respondents (67 years) was somewhat higher than that of nonrespondents (61 years). Their residential environments also differed because the share of respondents living in countryside (44%), villages or small towns (20%) and cities (37%) were not corresponding to the nonrespondents living in countryside (49%), villages or small towns (14%) and cities (35%). The most common reason based on the interviews of nonresponding were the difficulty of the questionnaire and lack of time. Because the analysis was done during working hours, it is likely that more elderly than working age people were reached because of constrains answering to the phone.

The background data were also compared with the statistics about Finnish forest owners from Finnish Forest Service. The proportion of women respondents (32%) was lower than the proportion of women nonrespondents (35%), and the proportion of heirs among respondents (13%) was higher than among nonrespondents (8%). Furthermore, the respondents were somewhat older (67) than nonrespondents (61). The differences found in the nonrespondent analysis and comparative study show that there is a bias towards heirs and older forest owners living in villages and cities. The sample characteristics are summarised in Table 11.

Table 11. Women forest owner sample characteristics in Finnish Forest Owner 2020 survey.

Sample characteristics		%
Average age	67 years	
Age groups (yrs.)		
Under 40		4%
40–60		28%
over 60		68%
Education		
No vocational education		26%
Vocational education		19%
Higher vocational diploma		35%
University education		20%
How forest was obtained		
Inheritance		63%
Gift		7%
Purchased from parents		13%
Purchased from relatives		8%
Purchased on the open market		5%
Purchased through broker		3%
Annual income (€)		
Less than 20,000		20%
20,000–40,000		34%
40,000–70,000		26%
70,000–100,000		12%
Over 100,000		8%
Residential environment		
Countryside		44%
Village or small town		20%
City		37%
Place of residence		
Permanently on the holding		23%
In the same municipality as the holding		31%
Outside the municipality		46%

The latent structure behind the measured variables were studied using exploratory factor analysis, followed by principal axis factoring with varimax rotation (Hair et al. 1998). A number of variations were performed related to the number of factors and number of questions to perform the sensitivity analysis. Based on the analysis, a five-factorial solution was found to have the best conceptual clarity. Questions 3, 5, 9, 17, 22 and 23 were removed from the analysis because of low factor loadings (< 0.4) (Hair et al. 1998). Cronbach alpha varied between 0.78 and 0.87, suggesting good scale consistency. The KMO measure of sampling adequacy was 0.907, indicating suitability for factor analysis (Metsämuuronen, 2009). Also Bartlett's test of sphericity was calculated ($p = 0.000$), indicating suitability for factor analysis (Metsämuuronen, 2009). This study used only women forest owner data to form the factor solutions to avoid the fact that women's responses would have been affected by underrepresentation of women in the data. The factors based on women owners were saved and then compared with male forest owners' data. One way analysis of variance (ANOVA) was applied to study the factor score means between the different groups and factors. Further details of the analysis can be found in the original Article III.

4.4 Article IV

Article IV used the Finnish Forest Owner 2020 data described earlier within this chapter (Karppinen et al. 2020). Data representativeness was examined by nonrespondent analysis comparing the respondents to statistics from the Finnish Forest Service and Digital and Population Data Services Agency. Based on the comparison, nonrespondents had an average forest area of 47.3 ha compared with respondents with 48.8 ha (Karppinen et al. 2020). In the analysis, it was noted that women, Swedish-speaking Finns, parties to a forest holding and people living outside the municipality where their forests were located were underrepresented (Karppinen et al. 2020). Furthermore, the average age of the respondents was higher (64 years) than the one from the nonrespondents (60 years) (Karppinen et al. 2020). Nonrespondent analysis was also conducted by phone interviews. Based on the results, the respondents more commonly owned their forest holding alone or together with a spouse than nonrespondents (Karppinen et al. 2020). Furthermore, entrepreneurs were underrepresented (Karppinen et al. 2020).

This study used a randomly split sample while the other subsample was used in Article III. This split was conducted to minimise sample-specific biases that could be present when two different datasets are used (Hair et al. 1998). To check the representativeness of the split sample, it was compared with Finnish forest owner statistics (Forest centre 2022). Table 12 presents the sample characteristics. In the sample, the average age was higher (64 years) than the one of an average forest owner (60 years) (Forest centre 2022). Furthermore, the forest area owned on average was a bit higher (49.3 ha) compared with 31.8 ha of the average Finnish forest owner (Forest centre 2022). The share of women in our study was 23% when, on average, it was 42% (Forest centre 2022). In this sample, women respondents were more highly educated, more likely had inherited their forests and

more frequently lived in cities and outside of forest holding municipality than men. The details of the data collection and nonrespondent analysis can be found from Karppinen et al. (2020) and from the original Article IV.

Table 12. Forest owner sample characteristics in Finnish Forest Owner 2020 survey.

	Mean	Whole sample (n=3189)	Women (n=728)	Men (n=2367)
		Percentage (%)		
Age (in years)				
Average	64	5	5	5
Under 40		27	27	27
40–60		68	68	68
Over 60		5	5	5
Education				
No vocational education		30	25	32
Vocational education		28	21	31
Higher vocational diploma		26	32	24
University education		23	23	14
How forestland was obtained				
Inheritance		47	61	42
Gift		7	9	6
Purchased from parents		23	14	26
Purchased from relatives		10	7	11
Purchased from markets		9	7	10
Purchased from broker		5	3	5
Yearly income (€)				
Less than 2,000		19	23	18
20,000–40,000		28	30	27
40,000–70,000		30	27	31
70,000–100,000		13	10	14
Over 100,000		10	11	10
Residential environment				
Countryside		53	43	56
Village or small town		17	20	16
City		30	37	28
Place of residence				
Permanently on the holding		37	25	40
In the same municipality as holding		26	27	26
Outside the municipality		37	48	34

The data collected were analysed for kurtosis and skewness, suggesting suitable distribution for further analysis. The details of the analysis can be found in Article IV. To validate the five-dimensional forest owner objective structure presented in Article III, confirmatory factor analysis (CFA) was used. Within the present study, forest owner objectives were studied with 25 statements that included topics connected to economic, recreational, aesthetic, emotional and conservation values. The majority (22) of these statements have been used by number of previous studies (e.g., Kuuluvainen et al. 1996; Karppinen 1998; Favada et al. 2009; Häyrinen et al. 2014), but within the present study, three new statements were added. These were related to carbon sinks and storage, independent decision-making and family traditions. Of the 25 statements, 19 were used in the analysis of Article III because six statements had unsatisfactory factor loadings. Within the Article IV, all 25 statements were added, but only 19 had satisfactory coefficients. For interpretative purposes, the cut-off point of 0.4 was used (Stevens 1992).

These results were further utilised to build a structural equation model to study the relationship between objectives and activity. Wood sales, forestry work and sum variable of different activities were used to describe activity. The sum variable consisted of 12 different activities listed in Table 13.

Within this article, the goodness-of-fit index (GFI), comparative fit index (CFI), normed fit index (NFI) and root-mean-square error of approximation (RMSEA) were evaluated to study model fit (e.g. Lei and Wu 2007). The details of the selection of which indices were included can be found in the original Article IV. Because the forest owner objective structure from Article III was based only on women forest owner data, the model was tested with the whole sample, in addition to the subsamples of women and men. Both four- and five-dimensional structures were tested to find most sensible theoretical logic.

Table 13. Forest owner activities included in the sum variable.

Activity type
1. Forest owner has electronic forest resource information
2. Forest owner has a forest management plan formulated by a professional
3. Forest owner has used a forest management plan in the past
4. Forest owner has been in contact with a forest professional
5. Forest owner has participated in a forest excursion
6. Forest owner has participated in a forest course
7. Forest owner follows forest-related journal(s)
8. Forest owner has spent time in their forest
9. Forest owner has used electronic forest-related services
10. Forest owner has forest insurance
11. Forest owner has evaluated the profitability of forestry
12. Forest owner applies continuous-cover management in their forests

To test the suggested model and differences between genders, a multigroup analysis was conducted. This was done by using equality constraints on the structural covariances to study the similarities of the covariances connecting the objective dimensions and activity across the groups. If differences in the fit indices are found, the loadings are invariant across the two groups. Furthermore, an invariance test was conducted separately for each of the objective dimension–activity connections to study if there are further invariance between women and men. The unconstrained model was first compared with the model where all structural covariances were constrained. To continue, the acquired nine models were tested and compared with the unconstrained and constrained models. Further details of the method can be found in Article IV.

5. SUMMARY OF THE RESULTS

This chapter summarises the results of the four articles that form the research base of the present thesis. This chapter only includes the highlights of the results (Table 14). Further details of the results can be found from the individual published articles.

5.1 Article I: Are women less active when a wide array of forest owner activities are studied?

Article I is a quantitative study comparing the activity of women and men forest owners across 14 binary variables. Statistically significant differences were detected in 8 of the 14 studied activities. Women forest owners were found out to be less active in the following: has electronic forest resource information (1), has used a forest plan (3), has been in contact with a forest professional (4), has been on a forest excursion (5), follows forest-related journal(s) (7), has performed forestry work (8), has spent time in the forest (9) and has sold timber (14) (Figure 2). In the remaining six activities, women were more active only in evaluating the profitability of forestry (13), but no statistically significant differences were found (Figure 2). A sum variable indicated that, on average, women utilise less services (Figure 3).

Table 14. Summary of the results of each article

Article	I	II	III	IV
Research question	Are women less active when a wide array of forest owner activities are studied?	How women forest owners understand the concept of active forest owner, and how does it differ from the one from Finnish forest policy? What kind of attributes impact women forest ownership?	Do women have differing forest ownership objectives compared with men? What kind of objective structures women have?	Is the relationship between objectives and activity different between women and men?
Main findings	Women were less active in many forest owner–related activities. Multiobjective women forest owners were more active than other groups of women forest owners.	The concept of 'active forest owner' is much more diverse in the minds of women forest owners than described by Finnish policies or research. Furthermore, there are many attributes from different scales that impact forest ownership such as family, local communities and education.	New five-dimensional objective structure was discovered that indicates that women forest owners might have more diverse objective structure than men.	The five-dimensional objective structure was confirmed. Only the income objective had strong connection with activity. Furthermore, economic security decreased activity only in men.

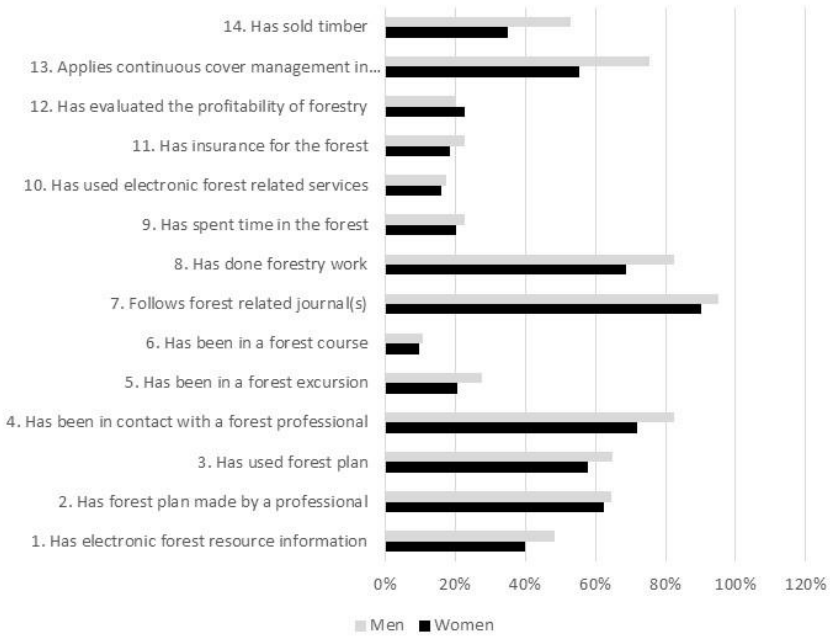

Figure 2. Forest owners' activity by gender.

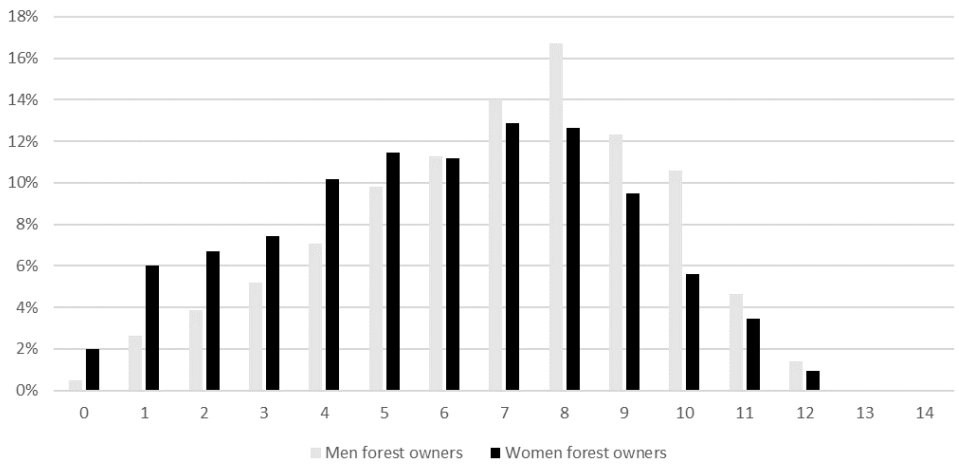

Figure 3. Share of men and women forest owners in each activity.

To study if forest owner objectives or socio-demographic attributes would explain the differences in activity of women forest owners, the structure of forest owner objectives were analysed. The discovered five-dimensional latent structure was used to cluster women forest owners into four different clusters (Figure 4). Article I followed a similar methodology as many previous forest owner studies by utilising exploratory factor analysis and clustering. Pearson's Chi square was used to study the socio-economic differences between clusters. Statistically significant differences were found in education, place of residence and how the forest had been obtained, as well as in residential environment and income. As can be seen in the Figure 4, the groups differed from each other, even though they also have many commonalities. For multiobjective forest owners, all objective dimensions were important. Those who valued timber production, heritage and nature seemed to value recreation and leisure time less than other groups. Furthermore, those who valued recreation and nature seemed to have less interest towards the economic objectives. Finally, those who valued timber production, recreation and nature seemed to value heritage less. Surprisingly, aesthetics and conservation were important for all of the groups.

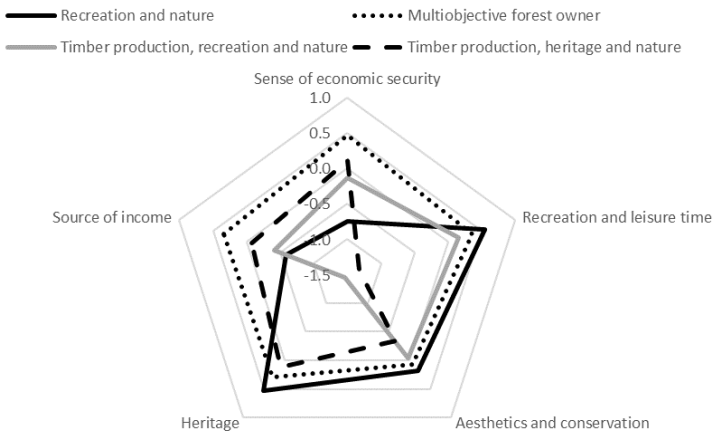

Figure 4. Four clusters of women forest owners in a five-dimensional forest ownership objective structure

The most active women forest owners cluster was the multiobjective forest owners (Figure 5). There were many commonalities between the clusters. Nevertheless, the differences in activeness between forest owner clusters were statistically significant in the following activities: possessing electronic forest resource information, contact with forest professionals, following forest-related journal(s), timber sales, possessing a forest plan, having participated in a forest excursion or forest course, having performed forestry work and spent time in the forest. This study used forest owner objectives as the basis for clustering, but other characteristics could have been also used, such as gender, income, living environment or area of forest owned.

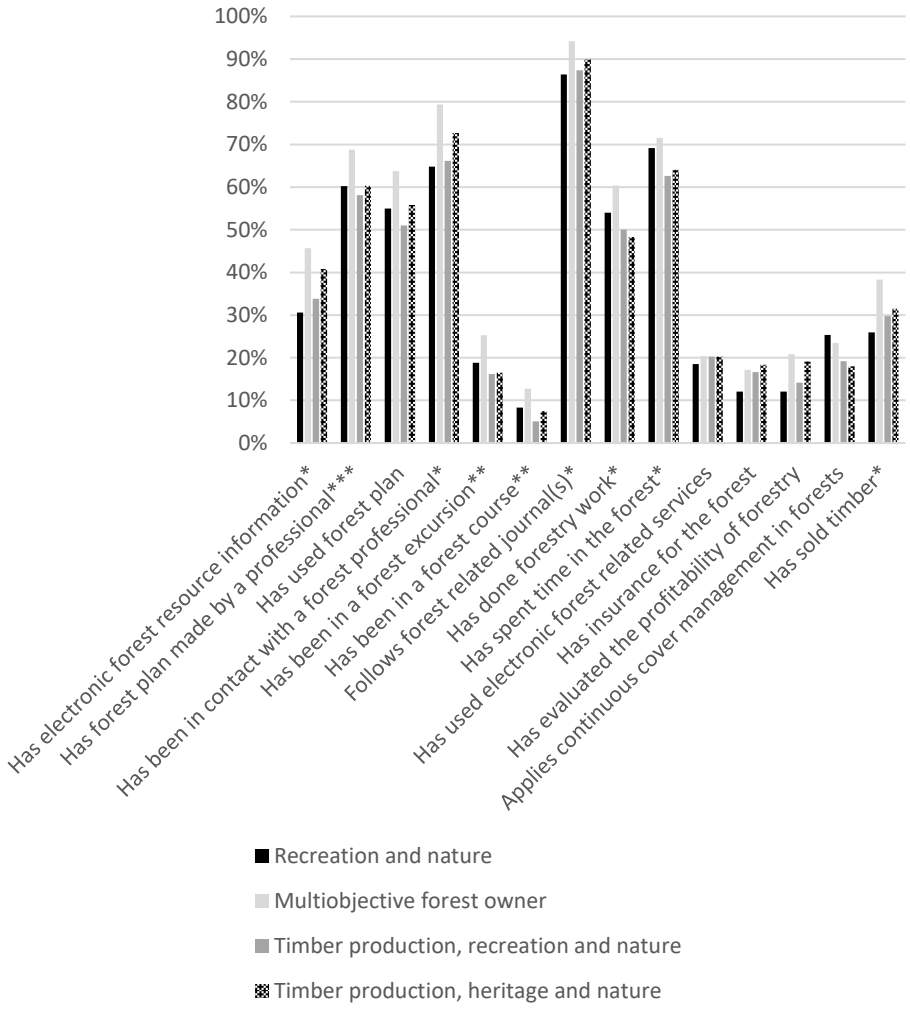

Figure 5. The activity profiles of different clusters among women forest owners. *Pearson Chi square significance levels *>0.000, ** >0.001, ***>0.005*

5.2 Article II: How do women understand active forest ownership?

To deepen the understanding of what active forest ownership is, a qualitative study was conducted. Article II is a study about how women forest owners understand the concept of 'active forest owner' and how that compares with the understanding of Finnish forest policy. Furthermore, the attributes impacting forest ownership are discussed. Twenty-two semistructured interviews were used to study the concept of 'active forest owner'. The results were analysed by utilising gender theory and feminist political ecology.

Most of the interviewees described themselves as active forest owners. The concept of 'active forest owner' had three key dimensions: awareness and interest, concrete activities and taking care of the forests (Figure 6). Timber production or economic values were not in the centre of the concept (Figure 6). 'Active forest owner' was seen as a concept that includes both economic and ecological values or anything else that the forest owner might value. Furthermore, the knowledge, awareness and interest of forests independent from production was seen as important. Additionally, it was seen as important to follow forest-related public discourse (Figure 6). In addition to awareness, concrete action was also seen as part of the concept. Action included traditional forestry work, such as planting, but also leisurely doing, such as walking or skiing. One important dimension of the activities was that they were based on forest owner values (Figure 6). The third important dimension that was found comprising of looking after or taking care of the forests. This included both economic values and nature conservation (Figure 6). Within this study, only women were interviewed because the focus of this study was to compare policy and how well it aligns with women forest owners. However, it is likely that similar dimensions could be also found from men.

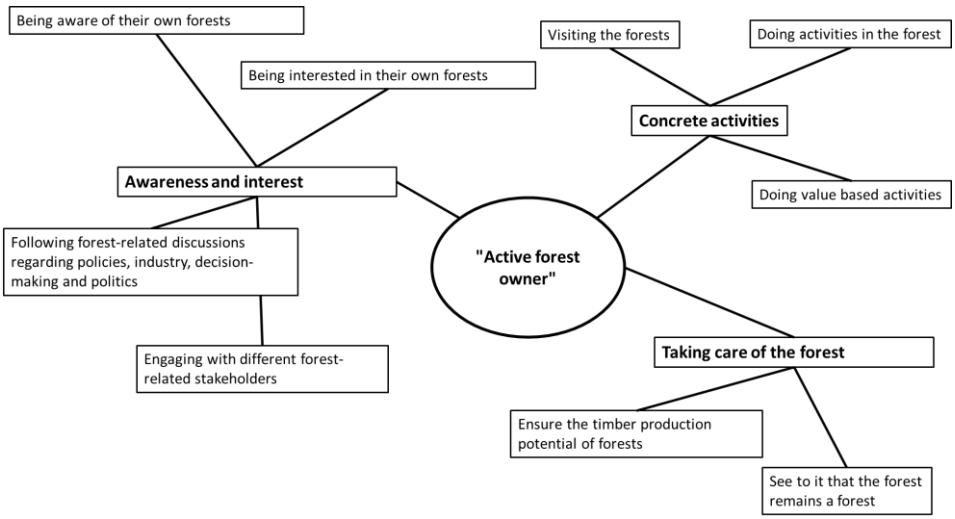

Figure 6. Dimensions of 'active forest owner' in Article II.

The attributes impacting active forest ownership were divided into five scales, including the intimate, family, education, local and national and global (Table 10). The attribute values was one of the most important in the scale of intimate but also empowerment from forestry work and livelihood was mentioned. One of the key scales that rose from the interviews was family, encompassing family traditions, childhood environment and family members. Some aspect of family was mentioned by all the interviewees as an impacting factor. Male family members were mentioned three times more often compared with female family members as a person who has impacted forest ownership. The concept of family forest, intertwining impact of family members and relatives, and heritage was also seen as important. A feeling of intergenerational continuity was also mentioned when managing forests was discussed.

Education emerged as a new scale from the interviews compared with the literature (Table 10). After inheriting land, forest owners felt the need to get more information about forests, and some decided to study forestry. Guidance from forestry professionals were seen in some cases as confusing, and clarity for forest management was sought from studies. The interviewees who had started to study forestry did not have a trusted person they would have mentioned to have impacted their forest ownership like many others did.

Local forestry professionals and local social groups were seen as important attributes. The relationships with these local professionals were described more as friendships than professional relationships. Furthermore, varying local group were mentioned, such as local hunting groups and local communities.

The national- and global-level attributes were not mentioned as impacting factors when directly asked from the forest owners. However, when active forest ownership was discussed, many national and international topics emerged as an important part of being active. These included following national and international forest policies, forest politics and the state of forest industry. For the detailed results with quotes can be found from the original article.

5.3 Article III: Does the objective structure of women forest owners differ from men?

Article I focuses on studying if there were differences in the activity of women and men forest owners, and Article II explores the concept of active forest owner. Article III examines if the objective structures of women forest owners differ from the objective structure of men and if any of the differences could partly explain women's lower activity connected to forestry-related activities.

Article III is a quantitative study that has the goal of deepening the understanding of women forest owners' objective structure. Only women were used as a basis for the structure to see if this approach could reveal structures that otherwise would stay hidden because of the underrepresentation of women in survey data. This study utilises women forest owner survey collected as part of the Finnish Forest Owner 2020 research project (n=2,250). An exploratory factor analysis was employed to study the objectives. The analysis revealed five-dimensional forest owner objective structure. The dimensions identified were *sense of economic security*, *recreation and leisure time*, *aesthetics and conservation*, *heritage* and *source of income* (Table 15). Together, these factors explained 57.8% of the total variance (Table 15). Although this is a reasonably good result, there are still factors that are unaccounted for.

Table 15. Factor loadings for five-dimensional structure of woman forest owners' objectives

	Factor 1 Sense of economic security	Factor 2 Recreation and leisure time	Factor 3 Aesthetics and conservation	Factor 4 Heritage	Factor 5 Source of income
Residential environment	0.009	**0.773**	0.188	0.128	0.13
Picking berries and mushrooms	0.085	**0.745**	0.144	0.082	0.063
Outdoor recreation	0.082	**0.815**	0.243	0.108	0.045
Regular income	**0.404**	0.1	0.005	0.109	**0.64**
Financial asset for major purchases	0.39	0.021	-0.022	0.135	**0.723**
Labour income	0.29	0.099	0.06	0.019	**0.549**
Biodiversity	0.104	0.266	**0.734**	0.17	0.067
Aesthetic experiences	0.066	**0.441**	**0.660**	0.176	-0.008
Nature conservation	0.061	0.178	**0.719**	0.084	0.005
Credit rating	**0.542**	0.1	0.079	0.116	0.313
Security for old age	**0.788**	0.036	-0.035	0.146	0.287
Security against exceptional situations	**0.776**	0.157	0.048	0.138	0.222
Hedging against inflation	**0.708**	0.023	0.068	0.086	0.064
Intrinsic value	0.148	0.167	0.096	**0.807**	0.041
Solitude and meditation	0.137	**0.619**	**0.404**	0.296	0.005
Connection to home	0.163	0.263	0.281	**0.548**	0.08
Investment object	**0.591**	-0.038	0.08	0.073	0.236
Opportunity for independent decisions	**0.54**	0.167	0.193	0.263	0.198
Part of family traditions	0.218	0.078	0.117	**0.768**	0.133
Explained variance (%) Σ 57.8	16.9	14.1	10.2	10.0	8.5
Cronbach's alpha	0.859	0.871	0.821	0.802	0.781

Factor loadings over 0.4 are marked in bold. Cumulative exploratory power was 57.8%.

To deepen the analysis, the connection between the five dimensions and socio-demographic characteristics were analysed by calculating the means of the five dimensions. The results indicated statistically significant differences in terms of gender, education, how the forest was obtained, income and residential area (Figures 7–11). Gender differences were statistically significant in all dimensions except recreation and leisure time (Figure 7). Women forest owners valued aesthetics and conservation, heritage more than men (Figure 7). Furthermore, women forest owners valued sense of economic security and source of income less than men (Figure 7).

In addition to gender, mean factor scores were compared against the level of education, how the forest had been obtained, income, residential area and place of residence. As seen in the Figure 8, the mean factor scores of different educational groups differed from each other. Especially those with university education differ from others in the areas of economic security and aesthetics (Figure 8). Statistically significant differences were found in *sense of economic security* and *aesthetics and conservation* (Figure 8).

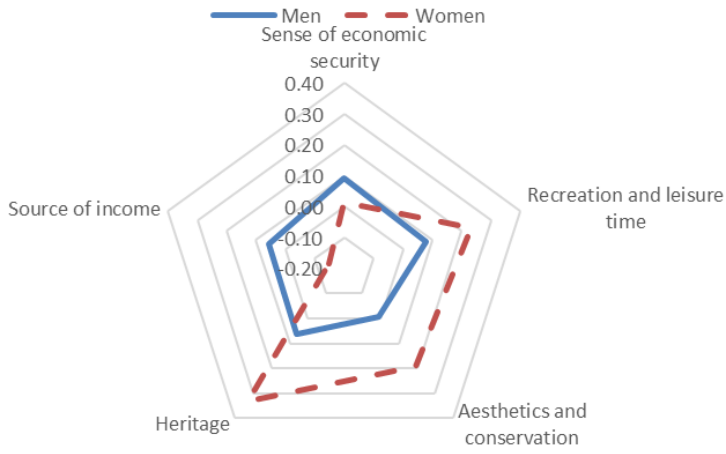

Figure. 7 Mean factor scores for the five objectives by gender

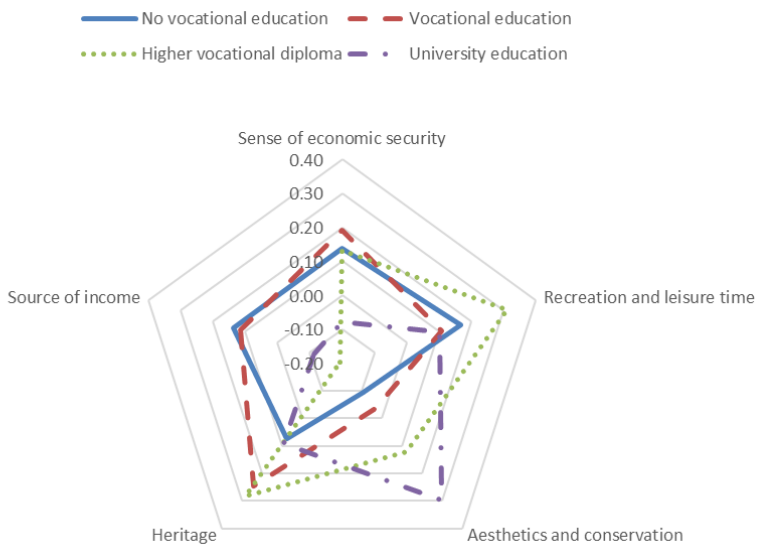

Figure 8. Mean factor scores for the five objectives by education.

Figure 9 shows the differences between forest owners who had obtained their forests in different ways. Two groups show a distinction from all others. Those who had purchased their forests from the market or from a broker had low mean factor scores in the *heritage* dimension. Statistically significant differences were found the *sense of economic security*, *heritage*, and *source of income*.

When comparing income, there is clear overlap between the groups (Figure 10). Although income can be an attribute explaining differences, it can also be misleading, for example, in situations where there is a significant share of retirees. In this study, 47% of the sample were retirees (Karppinen et al. 2020). The only statistically significant difference was found in the *source of income* dimension. When annual income levels were over 100,000 €, the mean factor scores for *source of income* seemed to be lower when compared with other groups.

Figures 11 and 12 show the comparisons of residential areas (Figure 11) and place of residence (Figure 12). There were statistically significant differences found in *sense of economic security* and *source of income* indicating that women forest owners living in cities generally have a lower average mean factor score in the economic dimensions. As can be seen in the Figure 12, when women forest owners were grouped based on place of residence, the profiles looked different. Statistically significant differences were found in *sense of economic security*, *source of income* and *recreation and leisure time* in place of residence. The mean factor scores were higher for those living permanently on the holding in the economic dimensions, as well as in recreation and leisure time compared with those not living on the holding.

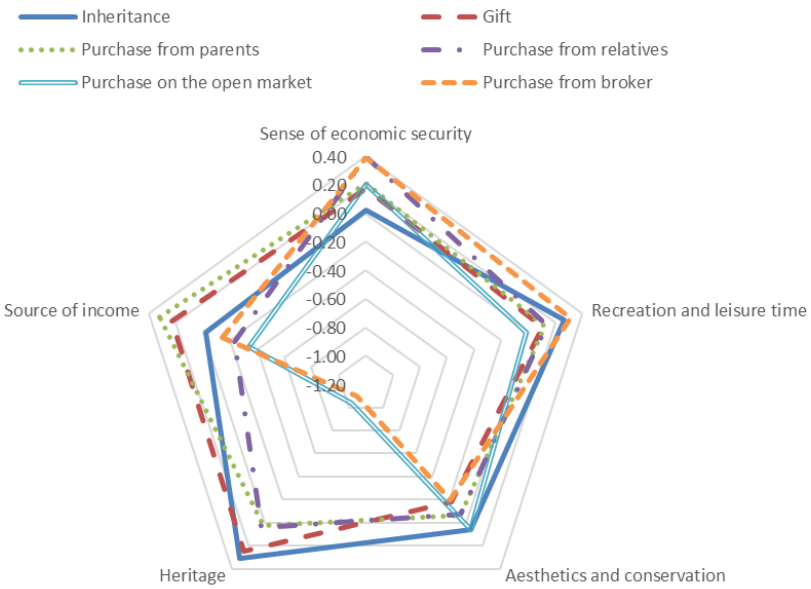

Figure 9. Mean factor scores for the five objectives by how forest was obtained

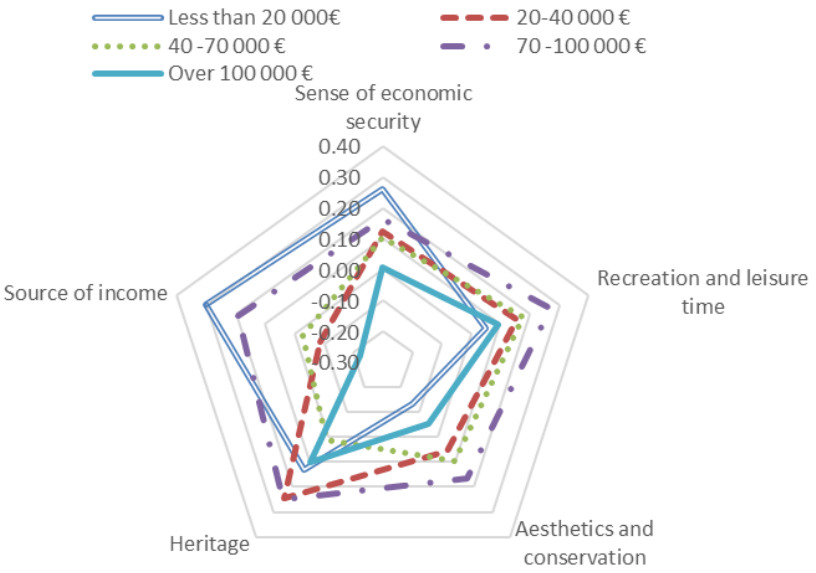

Figure 10. Mean factor scores for the five objectives by annual income

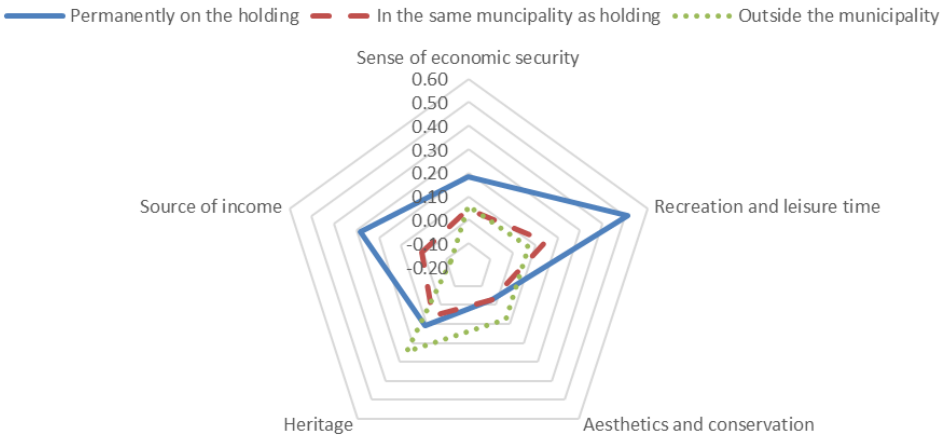

Figure 11. Mean factor scores for the five objectives by residential area

Figure 12. Mean factor scores for the five objectives by place of residence

5.4 Article IV: How does the identified objective structure connect with forest owner activity?

Article IV is a quantitative study focusing on verifying the five-dimensional structure identified in Article III and connecting the objectives with forest owner activity. The article utilises data from a questionnaire conducted in the Finnish Forest Owner 2020 research project (n= 6,558). CFA was employed to validate the five-dimensional forest owner objective structure. Furthermore, a structural equation model was built to connect the objective dimensions to forest owner activity, and multigroup analysis was employed compare the differences between genders.

The fit indices support the five-dimensional model that had a better fit compared with four-dimensional model (Table 16). In the five-dimensional model, the fit indices GFI, NFI, and CFI were all above 0.90 and RMSEA close to 0.06, indicating a good fit (Table 16). In addition, the model was tested separately for women and men to study the suitability of the model for both genders (Table 17). As can be seen in the Table 17, no significant differences in the model fit were found, indicating a good fit of the model for both women and men. The $\chi 2$ statistic test was also reported, which is a common method for evaluating models (Bagozzi and Yi 1988). However, when the studied model used large data sets, the $\chi 2$ statistic test often rejected the model (Bagozzi and Yi 1988). Because the present study was using a relatively large dataset, more weight was given to other fit indices. Figure 13 presents the model with the related correlations and coefficients. There were rather high correlations between some of the objective groups, such as recreation and leisure time, and economic security and source of income. This means that these objective groups were closely related to each other. However, combining them to one resulted in poorer model fit (Figure 13, Table 16). The five-dimensional model is also theoretically more sensible (see Rämö and Toivonen 2007). Further studies indicated a good fit of the model both for men and women (Table 17).

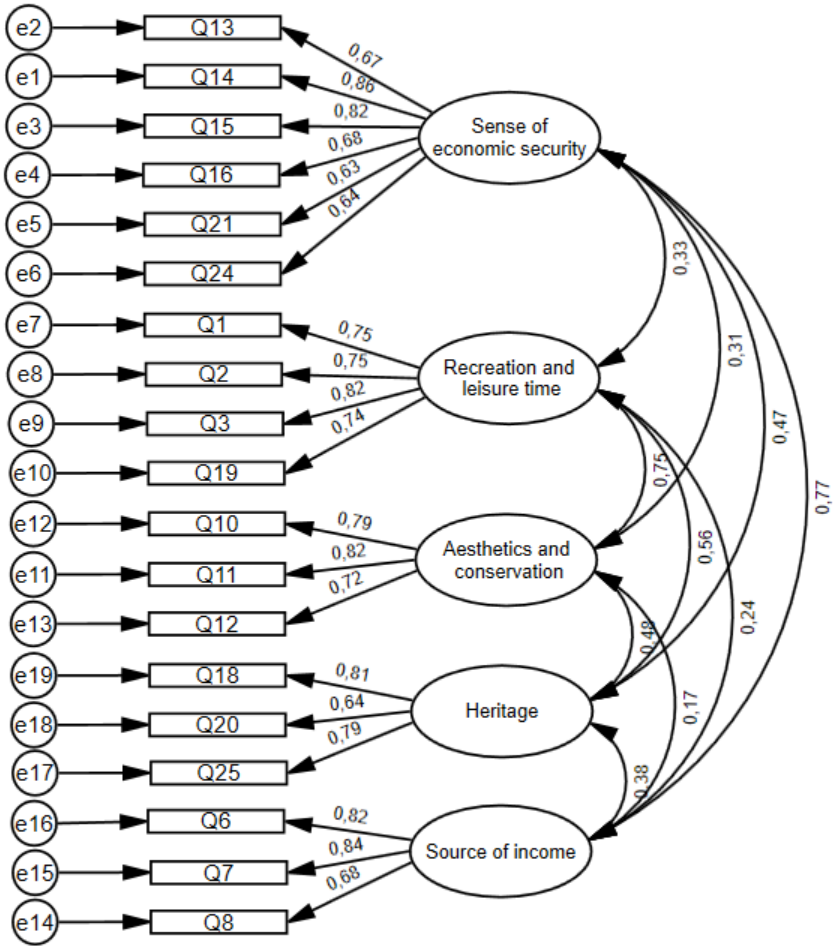

Figure 13. The five-factor SEM model of forest owner objectives. *All connections are statistically significant on a level of $p < 0.001$

Table 16. Model fit indices for the entire data

	χ2	Df	p-value	GFI	NFI	CFI	RMSEA
Four-factor objective model	3122.876	146	0.000	0.898	0.897	0.901	0.080
Five-factor objective model	2004.926	142	0.000	0.940	0.931	0.937	0.057
Activity model	2223.520	194	0.000	0.940	0.931	0.937	0.057

Table 17. Model fit indices for men and women for the five-dimensional model

	χ2	Df	p-value	GFI	NFI	CFI	RMSEA
Men	1584.169	142	0.000	0.934	0.928	0.934	0.066
Women	607.904	142	0.000	0.917	0.916	0.934	0.068

The forest owner objectives were connected to forest owner activity, which comprised wood harvesting, forestry work and a sum variable consisting of 12 different forest ownership activities (Appendix II). Using these dimensions a structural equation model was constructed (Figure 14). Fit indices indicated good fit, but two of the effects were nonsignificant (Table 16, Figure 14). The construction of this model was limited to the data available for the construction of activity. Unfortunately, activity had to be modelled with proxies that were focusing on techno-economic forestry activities, leaving out other types of activities such as activities related to culture, heritage or aesthetics simply because they were missing from the available data. This left the model biased because it was not possible to explore the nonmonetary dimensions that activity could entail. This resulted in a situation where the model did not measure the activity connected to tree objective dimensions (*recreation and leisure time*, *aesthetics and conservation* and *heritage*). Nevertheless, this model pointed out the gaps in the current forest owner research and that activities that connect to other than economic objectives were largely unexplored and unknown (Figures 14 and 16).

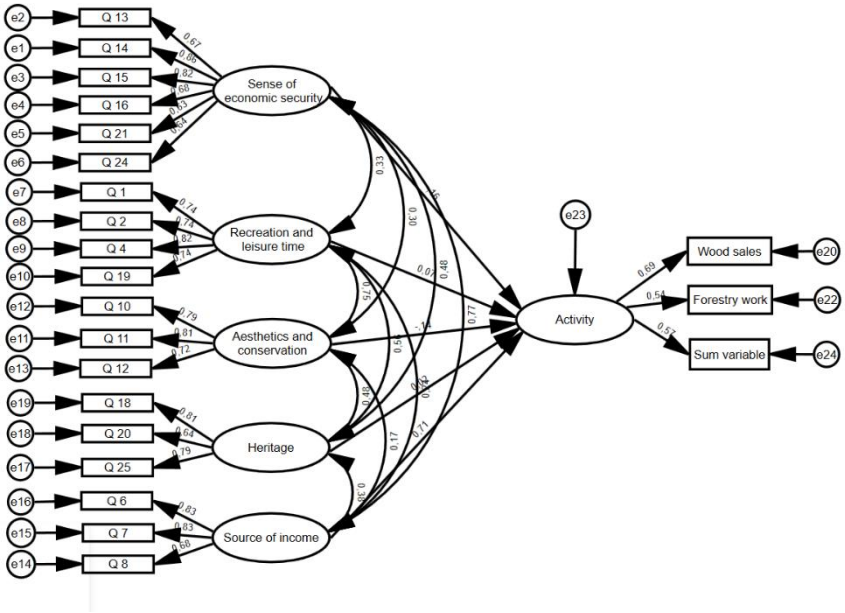

Figure 14. The activity SEM model. *All connections are statistically significant on a level of p < 0.001 except heritage to activity (p=0.452) and recreation and leisure time to activity (p=0.077)

To study the differences between genders, a multigroup analysis was applied. A stepwise constraint analysis indicated that the following connections had no significant difference between genders: recreation and leisure time p=0.062, aesthetics and conservation p=0.082, heritage p=0.646 and income p=0.067 (Figure 15). The model is presented in Figure 15. The only objective dimension with a positive relation to activity was source of income. Furthermore, the analysis suggested that the sense of economic security dimension was associated with decreased activity only in men (p<0.001).

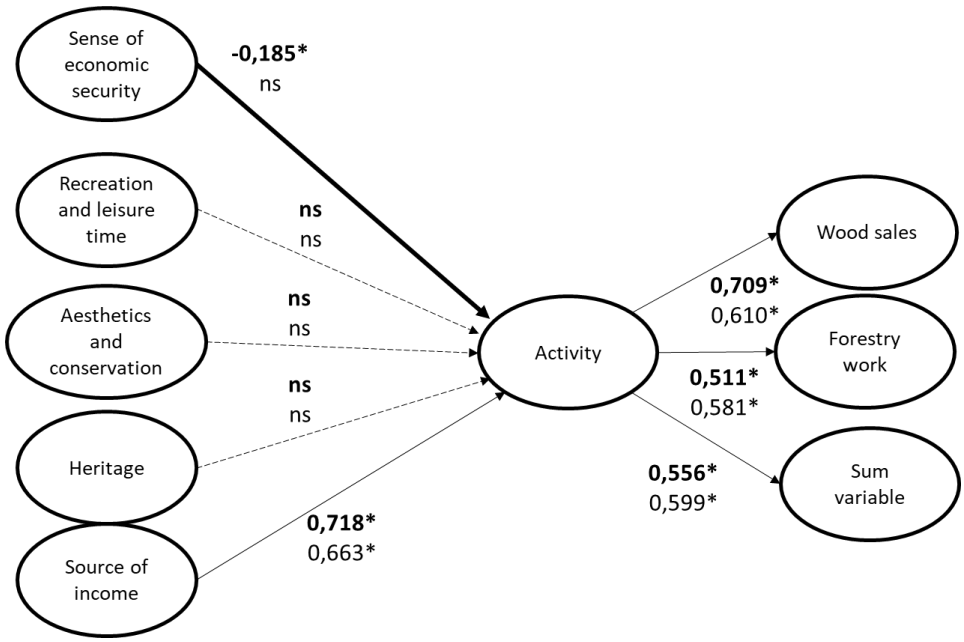

Figure 15. Gender differences in the associations between the main variables. The values for women and men are reported separately. Values for men are bolded. Bold arrow indicates statistically significant difference between women and men at $p < 0.001$. (ns = not significant, *$p < 0.001$). Dotted lines indicate statistically nonsignificant paths.

6. DISCUSSION

This chapter discusses the theoretical and practical contributions of the four articles presented in the present thesis. The four articles form a common theme around exploring gender and forest owner activity (Article I) before then diving deeper into the perceptions of women forest owner–related forest owner activity (Article II), continuing to explore the women forest owner objectives to search for an explanation (Article III) and finalising this into a study of the gender differences in the relationship between objectives and activity (Article IV). All these studies try to explore the intersection of gender and forest ownership (Table 5).

The contributions are discussed by addressing each of the research questions separately. The research questions include the following: RQ1 Are women less active in a wide array of forest owner activities, and if so, could socio-demographic attributes explain the differences? (*Article I*); RQ2 How do women forest owners understand the concept of 'active forest owner', and what kind of attributes impact forest ownership (*Article II*); RQ3 What kind of objective structures do women have? (*Article III*); RQ4 Is the relationship between objectives and activity

different between women and men? (*Article IV*). All research questions are also summarised in Table 2. By answering these questions, this study has aimed to deepen the understanding of women forest owners and the behavioural differences between women and men forest owners. The section concludes with observations about the limitations of the study and further research needs.

6.1 Contributions

6.1.1 Article I

Article I is based on the Finnish Forest Owner 2020 project survey, which focused on studying whether women are less active in their forest owner activities. The results of Article I verify forest owner activity differences between genders and form a basis with the other articles within the present study. The results support that women are less active in many aspects of forest owner activities. Specifically, women forest owners seem to be less active than men in eight different forestry activities: possessing electronic forest resource information, having used a forest plan, having been in contact with a forest professional, having participated in a forest excursion, following forest-related journal(s), having performed forestry work, having spent time in the forest and having sold timber and in the sum variable describing activity. Even though these activities are mainly related to economical values, they still give indication of gender differences related to forestry activities. This holds even if forest holding size differences are accounted for. These results are similar with earlier studies, even though studying a smaller selection of forest owner activities (e.g., Lidestav and Ekström 2000; Lidestav and Nordfjell 2005; Lidestav and Berg Lejon 2013; Häggqvist et al. 2014; Kuuluvainen et al. 2014; Hänninen et al. 2020). However, it has to be noted that, despite the differences, more commonalities between the genders were noted than differences. This indicates that, although on average gender differences prevail, there are both more active and passive individuals in both women and men.

The majority, but not all, of the studied activities can be understood as services provided for forest owners by different providers. One reason why women forest owners might be less active could be that the services provided are not seen as producing as much added value to women forest owners as for men. This result could show that SDL would be needed in the design of services for forest owners. Applying SDL could diminish the gap between the value-added women forest owners are looking and what the services provide. Earlier studies have indicated gaps in forest owner services between what is offered by the service providers and what is needed by forest owners, although the results are not focusing on gender differences (Mattila et al. 2013; Häyrinen et al. 2015; Pynnönen et al. 2018). Therefore, the forest owner objective profiles might give new ideas to develop a service offering on a broader than gender-only level. Furthermore, if the service provider fails to recognise the diversity of forest owner objectives, the number of forest owners describing themselves as nonactive could grow. Such a situation will impact the future timber availability, forest growth and ecosystem services in general in Finland. Thus, because forest management decisions have long-term impacts, it would be important to take the diversity of objectives into account now to avoid negative developmental paths in the future. Taking diversity into account, there are opportunities to address the so called ‘new’ forest owners, who more diverse backgrounds and objectives than the generations before (e.g., Hogl et al. 2005; Weiss et al. 2019).

Another explanation of the identified differences could be in the gendered nature of forestry. Forestry is seen as a masculine environment where femininity is marginalised (Appelstrand and Lidestav 2015). The gender differences in activity could be understood as the results of 'doing gender'. Most of the studied activities are connected to masculine techno-economical forest management and, thus, might be interpreted as more suited behaviour of a man rather than woman (Appelstrand and Lidestav 2015; Laszlo Ambjörnsson 2021). Furthermore, timber production was not the focus of any of the women forest owner clusters identified. This could be another result of 'doing gender'. Previous studies, however, have indicated that the share of multiobjective forest owners is increasing (e.g., Häyrinen et al. 2015; Feliciano et al. 2017; Pynnönen et al. 2018). Article I suggests that this increase with multiobjectivity might be accentuated among women forest owners. Currently, the share of men within this group is around 80%, and the amount of forest owners within this group has diminished (Karppinen et al. 2020). Furthermore, because multiobjective forest owner group was the largest group and more active compared with other clusters, the decisions of this group have a significant impact on forestry activities in general.

The results of Article I indicate that there are some activities in which women forest owners are engaged independent of their objectives. These were using forest plans, electronic forest-related services, insurance, evaluating the profitability of forestry and applying continuous-cover management in forests. These activities and services seemed to bring similar value to women and men forest owners. When different clusters of women forest owners were studied, those who valued recreation and nature and timber production, recreation and nature were the most passive ones. On average, those women forest owners belonging to these clusters were more educated, had higher income and lived more often in cities. It is likely that a large share of these forest owners has the understanding, the means and need to utilise various different types of forestry services but, for various reasons, are still withdrawn from these activities. It might be that the added value offered does not meet the needs of these forest owners and that some redesigning of the services may be needed. Earlier studies have identified that forestry related services lack SDL (Mattila et al. 2013; Häyrinen et al. 2015; Pynnönen et al. 2018).

Drawing together the results of the Article I, even when a wide array of forestry activities are studied, women forest owners are less active. These results offer two explanations. One reason might be that the needs of women forest owners and services provided do not meet. The study implicates that forest service providers might benefit from taking the diversifying objectives of forest owners into account and applying the idea of value cocreation to develop their service offering. These results support earlier studies such as Häyrinen et al. (2015) and Mattila et al. (2013). It seems obvious that focusing on economic values is not enough to address the majority of forest owner's needs. This mismatch of services offered and services used could have an impact on timber availability on the Finnish market. Developing services with the principles of value cocreation would increase the value created for both service providers and forest owners.

Another reason behind the behavioural differences is the gendered nature of forestry or forestry service culture. Women might be less active in forestry or some forestry related activities because they feel that this is not what 'women do' in society. Almost all the studied forest owner activities were connected to the masculine, techno-economical aspects of forestry, such as harvesting or silvicultural work. This is a clear weakness of this study and often repeated in forest owner research (e.g. Table 3). Studying a wider array of forest owner

activities might give a deeper picture of the objectives of women forest owners. Furthermore, developing the current service offering and understanding of forest owner diversity might give opportunities to women forest owners to choose more feminine ways to do forestry and help reflect the objectives of women forest owners in their actions. Finding ways to own forest that resonates more closely with objectives such as heritage might also have an impact on the activity of women forest owners.

6.1.2 Article II

Article II presents the results of a qualitative study based on semistructured interviews. The goal of this article was to explore how women understand the concept of 'active forest owners' and what attributes impacted forest ownership. The article studied whether the differences in forest owner activity were because of different understanding of the concept of 'active forest owners' among women forest owners than among policy makes and researchers. Furthermore, the goal was to see what type of attributes impact women forest owners.

The concept of 'active forest owners' was a key topic in the interviews. In Finland, 'active forest owner' is connected to entrepreneurship, profitability, income and raw material availability in the National Forest Strategy (e.g., Ministry of Agriculture and Forestry of Finland 2019). In Sweden, Holmgren and Arora-Jonsson (2015) analysed the 'active forest owner' concept in forest policy and found out that it is also business and timber production oriented like in Finland. When looking at the definitions of passive or engaged forest owners, similar features can be found from Europe and the US (Matilainen and Lähdesmäki 2023). These results are not surprising because the prevailing discourse of a forest owner is strongly connected to economic values (Takala 2016). Therefore, the concept also reflects the power structures of forestry operations (Vaara 2013) and forest culture (Halla et al. 2021). Based on the results of the present study, the definition of active forest owner could be something like 'Being aware and interested about forests and forest-related topics, visit and do activities in the forests based on one's own values and take care of the forests'. The concept of "active forest owner" encompasses both feminine and masculine attributes and gives room for any type of action (or nonaction) based on owners' values.

In Article II, the interviewees defined what 'active forest owner' means to them and commented of the issue of whether they saw themselves as being active or not. The majority of the interviewees described themselves as active. This was expected because recruiting of the interviewees was conducted from a social media group that likely encompassed more active than average forest owners. Furthermore, those women forest owners who volunteered to do the interview might describe themselves as active more often that forest owners on average. This was intended because we wanted to have the viewpoint of women who have seen the value of being part of a women-only group related to sharing forestry related information. These forest owners were likely to have a view about active forest ownership and also about being a woman in a masculine environment. The weakness of this approach is that the viewpoints were more biased than in a random sample and that no comparison to men was possible.

Awareness, interest, doing in the forests and taking care of forests were central topics in the concept of 'active forest owner'. These results differ from earlier studies of women forest owners participating in women only networks in Sweden who reported that timber production and the activities connected to it were central to the concept (Laszlo Ambjörnsson 2021). Awareness, which was key here, was not present in earlier studies (Laszlo Ambjörnsson 2021; Holmgren and Arora-Jonsson 2015) nor in the National Forest Strategy (Ministry of Agriculture

and Forestry of Finland 2019). Nevertheless, Laszlo Ambjörnsson (2021) reported that, to Swedish forest owners, the ability to make individual decisions in forest management was important. A similar definition of 'active forest owner' was found from the women forest owners interviewed in this study.

Some studies have found opposition between nature protection and 'active forest owners' (Laszlo Ambjörnsson 2021). This type of opposition did not surface in the interviews. On the contrary, values such as nature protection, heritage, climate change mitigation and timber production seemed to coexist in the thoughts of Finnish women forest owners. This was particularly evident in the idea of 'taking care of forests' as such. Taking care can be understood as femininely coded concept encompassing environmental values (Laszlo Ambjörnsson 2021). Nevertheless, here, taking care seemed to also include ensuring the wood production potential of the forests.

Figure 16 presents the three concepts as spheres of 'active forest owner' discussed. The disciplinary concept of 'active forest owners' used in some Swedish studies (Holmgren and Arora-Jonsson 2015; Laszlo Ambjörnsson 2021) overlapped with the concept in Finnish literature (Haltia et al. 2017; Ministry of Agriculture and Forestry of Finland 2019). These concepts focus on the techno-economic spheres of forest ownership, with some aspects of biodiversity conservation, nature protection or other environmental sustainability parts (Holmgren and Arora-Jonsson 2015; Haltia et al. 2017; Ministry of Agriculture and Forestry of Finland 2019; Laszlo Ambjörnsson 2021). However, the 'active forest owner' concept defined by the women in this study seems to be somewhat broader. In the interviews, the techno-economic dimension was not the only one defining active forest ownership, but others, such as 'taking care' of forest or making a decision to do nothing in the forest, were also considered as part of being active. The definition of this study encompassed both previous definitions but also broadened it towards a more diverse understanding of what it means to be an active forest owner (Figure 16).

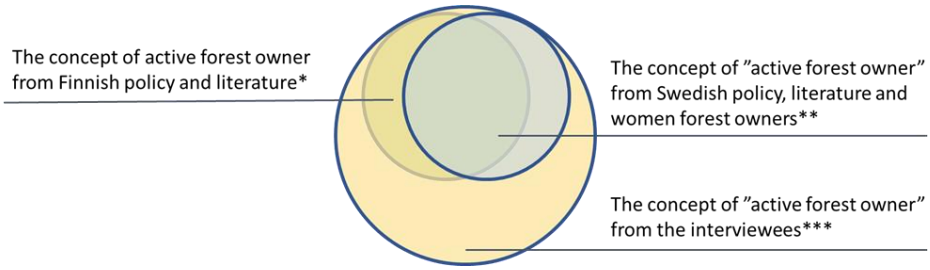

Figure 16. Activity above and beyond economic objectives

*Sources: * Haltia et al. 2017, Ministry of Agriculture and Forestry of Finland 2019 ** Holmgren and Arora-Jonsson 2015, Laszlo Ambjörnsson 2021 *** Results from this study*

The results of Article II indicate that many different scales of factors impacted forest ownership, ranging from the intimate to national and global. This might partly explain why the 'active forest owner' concept was understood as a much diverse concept than in the Finnish forest policy documents (e.g., Holmgren and Arora-Jonsson 2015; Laszlo Ambjörnsson 2021). It is likely that gender also impacts how the concept of 'active forest owner' is seen. However, because comparative data from men are not available, the impact is hard to assess. Nevertheless, it is clear that the timber production centric understanding of active forest ownership differs from that of the interviewed forest owners.

The importance of the childhood environment to forest ownership was undeniable. Spending childhood in the countryside and close to the forests had a big impact on the forest ownership. However, there tend to be less forest owners with this type of opportunities because of urbanisation (Rehunen et al. 2018). This development might further change forest ownership in the future to a more detached direction.

Fathers and other male family members were mentioned more often as an important person impacting forest ownership than female family members. The impact of male support has been studied in other fields such as transferring businesses to daughters (Overbeke et al. 2013). Previous research has suggested that good father–daughter relationships increase the success of transitions and support in building legitimacy (Overbeke et al. 2013; McAdam et al. 2021). This supports the idea that father-daughter relationships in forestry could also be a significant factor in building forest owner identity.

According to this study, many women forest owners identified themselves as a transitional element between generations (Lidestav 2010). They saw themselves as enabling the elements in the chain of generations passing the forests from past generations to the next ones. However, other forest owners saw themselves more as a transforming element, taking forest management into the direction they preferred (Lidestav 2010). The majority of the women in the present study saw themselves as transformative, acting based on their own values and needs.

Previous research has suggested that forest owners tend to adopt forest policies that support their existing views more than those who oppose them (Deuffic et al. 2018). Although the policies were not mentioned as something that would have had a big impact on forest ownership, they were mentioned as being an important part of being an active forest owner. Could the distance between the policy and forest ownership be explained with a different understanding of what it means to be active? If the women interviewed do not feel that the existing policies address them, women might feel disconnected from the policies. Deuffic et al. (2018) also pointed out that there are emerging groups of forest owners that might not be interested in following rules but define themselves based on what it means to be a forest owner. Based on the results of the present study the "active forest ownership" is challenged, or at least differs greatly from the existing policies.

Trust between forest owners and forestry professionals have been studied by Hujala and Tikkanen (2008); they argued that trust is one of the key features for a successful interaction between forest owners and forestry professionals (Hujala and Tikkanen 2008). However, this can be also seen as a risk when the power relationships in forestry are considered (Takala 2016). Here, trusted professionals can lead forest owners to comply with the dominating forest ownership discourse (Takala 2016). This might have a major impact on what forest owners understand as 'active forest owner' behaviour. Support for the women forest owners were often given by a trusted person. These persons were family members or forestry professionals. In the case of family members, these trusted persons were three times more often men than women, reflecting the masculine dominance of forestry. These persons helped in forestry-related

decision-making. The respondents saw the relationship as being based on mutual trust. Some interviewees stated that the guidance of forestry professionals was confusing and mixed. In the cases where the interviewees did not have a trusted person to discuss forestry-related topics with, they felt that they lacked the education and understanding to take care of their forests. In some cases, this led the responder to study forestry. This is in line with earlier studies where women forest owners were found to have a need for information before they could make forest management decisions (Hamunen et al. 2020). It can be argued that, in the absence of a trusted person (social capital), these people filled the void with studies (human capital).

A key part of active forest ownership was awareness and information both related to one's own forests, but also the wider area of forest-related matters. It could be argued that this type of silent information is a key part of being an active forest owner. Both trusted persons and own activity can be seen as important in acquiring this type of information. The current National Forest Strategy emphasises active forest management but does not mention the importance of availability of information, awareness, and knowledge sharing (Ministry of Agriculture and Forestry of Finland 2023). If active forest management is desired by policy makers, maybe the focus should be on providing information and advice for forest owners to support them in their active forest ownership.

The results related to the concept of "active forest owner" indicate that policy makers have a more narrow view of forest owner activity than women forest owners. This might be because of the power structures in forestry (Vaara 2013) and dominance of economical values in the field (Takala 2016). In analysing these results through the lens of cocreation (e.g., Vargo and Lusch 2008), it can be argued that the definition of 'active forest owner' is biased, disguising the value creation potential of forests only to include economic exchange. The narrow 'active forest owner' definition including only economic values results in a situation where the 'active forest owner' has just an instrumental economic value on the systemic level. Thus, this definition repeats the product dominant logic ideas that seem to dominate the forest industry (Mattila and Roos 2013; Berghäll 2018). However, because of the limited sample, further studies with a larger audience are needed to support or reject these results.

To design policies that include a wider variety of forest owners, the definition of active forest owners might need to be reconsidered or segmented. Furthermore, the results suggest that women forest owners have been seeking support when the forests were inherited or transferred to their ownership. Especially when there were no 'trusted persons' to support the new forest owners, women forest owners seemed to feel confused and lack the ability to manage their forests. By improving the support offered to new forest owners, there might be less confusion related to forest management. However, it seems that support should be based on a more value-dominant thinking to ensure the value added to forest owners exists. Ensuring that all different types of needs are addressed in forest owner engagement is important to plan suitable service portfolio for each of the forest owners.

6.1.3 Article III

Article III was based on the Finnish Forest Owner 2020 survey, which examined if women forest owners have a different objective structure than men that could help in further understanding the behavioural differences between men and women forest owners from Article I. Furthermore, Article III studied if the women forest owner objective structure would reflect

the results from Article II. The results indicate that women might have a more diverse objective structure compared with men. Four- and three-dimensional structures were reported by earlier studies (e.g., Kuuluvainen et al. 1996; Karppinen 1998; Lindroos 2005; Toivonen et al. 2005; Favada et al. 2009; Hyvönen 2010; Hujala et al. 2013; Häyrinen et al. 2015). Furthermore, the results indicate that women forest owners value economic and income–related objectives less than aesthetics, conservation and heritage compared with men. These results support earlier findings (e.g., Lidestav 1998; Lidestav and Ekström 2000; Palander et al. 2009; Nordlund and Westin 2011; Häyrinen et al. 2015; Pynnönen et al. 2018).

One reason behind the discovered differences in objective structures could be because of the underrepresentation of women in forest owner surveys. Fewer women means that their viewpoints are buried under the majority. However, it must be remembered that both four- and five-dimensional forest owner objective structures need further verification because they are both recent discoveries.

Heritage was one of the dimensions reported by this study, which was not been present in the earlier three or four-dimensional structures (Kuuluvainen et al. 1996; Karppinen 1998; Toivonen et al. 2005; Lindroos 2005; Favada et al. 2009; Hyvönen 2010; Hujala et al. 2013; Häyrinen et al. 2015). Previous research has indicated that women might value heritage and long-term future planning more than men (Redmore and Tynon 2010; Catanzaro et al. 2014). This supports the notion that the importance of heritage might remain hidden when genders are analysed together. However, despite the differences, there are more commonalities within the objective structures of women and men than differences. Although gender differences prevailed on average, forest ownership objectives were more of a continuum of individual preferences that could change over time.

The socio-economic attributes of women forest owners were also analysed to discover if differences could be found between different types of women. Based on the results, the following socio-economic attributes impacted the objectives: education, how the forest was obtained, income, residential area and place of residence. For example, those women forest owners who had university education valued aesthetics and conservation more than other groups. This also supports earlier studies that have included both genders (Hallikainen et al. 2010; Koskela 2011; Häyrinen et al. 2015). Furthermore, when women forest owners had bought their forests from their parents, the forests had an important meaning as source of income more than to those women forest owners who had bought their forests from the markets or relatives or had inherited them. Source of income was also important to women forest owners with lower incomes and who lived in the countryside and on the holding. Those women who lived in cities valued economic security and source of income less than the other groups. This supports earlier findings where both genders were included (Karppinen et al. 2020). Thus, it seems that the socio-economic differences of women forest owners compared with men forest owners could also partly explain the differences in objective structures.

This study did not find any differences between forest owners living in different environments. This result differs from earlier studies that included both genders (Häyrinen et al. 2015). Earlier studies have also reported that age might impact the objective structures. Hänninen et al. (2011) found out that older forest owners valued economic security more than income. In this study, no differences were found in the objectives between different age groups. It has to be noted that comparing of earlier results with the results of this study is challenging because the dimensional structure differs. Nevertheless, it seems that, when genders are studied together, some objective structures remain undetected.

Article III implies that women forest owners have more diverse objective structure compared with men. This might be one reason behind the behavioural differences identified by earlier studies and in Article I. These results might reflect the societal understanding of what is acceptable for a women forest owner and of doing gender. It might also reflect the dominance of economic values and masculinity that prevails in forestry. This means that some women who have answered the questionnaire might feel the pressure to identify themselves as part of the dominating forest owner discourse (Takala 2016), whereas others might feel that women forest owners should not step into the area of men, thus providing answers that they think are acceptable for women.

The results can be utilised in developing the understanding of the diversity of forest owners and their needs. Not all forest owners are interested in economic objectives and timber production. When a variety of forest owners are targeted by policies or services, it is important that the multitude of objectives are also considered. Furthermore, it is important to note how the information is conveyed to the forest owners, for example through an institution or a trusted person. When the genders are analysed separately, objectives that might have before been undetected might be discovered. This might help service providers further understand the diversity of forest owners.

6.1.4 Article IV

Article IV focuses on the relationship between objectives and activity and explores if there are any gender differences. It contributes to the relatively scarce literature focusing on how objectives and activity are connected. Furthermore, it tries to verify the objective structure presented in Article III and contribute to explaining the gender differences noted in the activity in Article I. The results of Article IV indicate a strong link to the income dimension and the activities, whereas other dimensions (*recreation and leisure time, aesthetics and conservation, heritage,* and *sense of economic security*) were found to have weak or no impact on activities. This implies that those forest owners who value income utilise the services studied. Thus, forest owners with differing objectives might need other types of motivational factors to search for the services offered and that different services need to be codeveloped by service providers and forest owners. When gender differences were studied, it was found that an emphasis on economic issues had an impact on activity but only with men. This result seems to suggest that a similar objective structure causes different behaviour in women and men.

CFA was applied to the five-dimensional objective structure presented in Article III. The main advantages of CFA are connected to its ability to bridge the gap between theory and observation (Mueller and Hancock 2001). However, CFA does not take secondary factor loadings as part of the output, resulting in a situation where it is not possible to determine if certain items would better fit in another cluster (Barret 2007). The challenges were overcome by testing the different types of solutions and ensuring that the factor loadings were adequate. The verified the structure indicated that forest owner objective structures were diverse. The reported dimensions were *sense of economic security*, *recreation and leisure time*, *aesthetics and conservation*, *heritage*, and *source of income*. The fit indices indicated a good model fit. Additionally, Article IV has validated a forest owner objective structure based purely on women forest owner data.

The questionnaire applied within Article IV has been used in Finland for more than 20 years. Previous studies have reported three (Kuuluvainen et al. 1996; Karppinen 1998), four (Häyrinen et al. 2014) and five (Rämö and Toivonen 2007) dimensional structures. Previous studies have often combined the economic and income–related objectives (Kuuluvainen et al. 1996; Favada et al. 2009) although Rämö and Toivonen (2007) and Häyrinen et al. (2014) separated them. The present study supports the separation of economic and income dimensions because their associations with forest owner activity is different. Whereas the *income* dimension had a strong positive connection with activity for both genders, the *economic* dimension had a negative connection with activity only with responses from men.

The relationship between the factors of *heritage and recreation* and *leisure time* was low when contrasted to activity. Furthermore, *aesthetics and conservation* and *economic security* had a negative relationship with the activities. All these objectives were important to the forest owners, but their importance was not reflected in an increase towards the studied activities as such. Additionally, those forest owners who valued *aesthetics and conservation* and *economic security* seemed to be less active than those valuing other aspects (e.g., *heritage* and *income*). Another technical point to remark is that, in opposition to traditional orthogonal rotation of explorative factor analysis, the confirmatory analysis clearly shows that the different objective dimensions correlate.

The results from this study have two types of implications. First, if the forest owner objective structure is five-dimensional instead of three or four, how does that impact how we study and classify forest owners? Due to the five-dimensional structure, the classification used in the literature might be somewhat misleading. Second, understanding the connection between objectives and activity will help forest companies and policy makers understand the intrinsic value of forest to different forest owner groups. If only one objective dimension (income) relates to the activities studied, would it be reasonable to assume that including other dimensions might make policies and services more inclusive and accessible? Taking diversity into account might even make services more profitable.

6.2 Combined results of the articles

Finnish forest ownership is generally regarded as masculine, reproducing the narrative of managing forests to produce timber (Colfer 2020). The recent National Forest Strategy reproduced this but added that forests should be actively managed so that forests can produce also other goods such as carbon sequestration for mitigating climate change (Ministry of Agriculture and Forestry of Finland 2023). In part, the present study has reproduced these masculine norms because it is based on the data collected in the project of Finnish Forest Owner 2020. The content of the questionnaire was dominated by forest management– and timber production–related questions. The available data limited the ability of the study to assess, for example, objective structures, activity and the relationship between the two. This could have been avoided by conducting a separate data collection, but because of financial limitations, this was not possible. Nevertheless, the reproduction of the timber production centric masculinity can be one reason why women seemed to be less active in the studied activities in Article I. If only masculine, timber production–related activities are studied, it is impossible to assess what more feminine activities are conducted in forests. The women of the present study saw that active forest ownership is also about being aware of what is going on in the forest; this can comprise many different types of activities that have not been studied, such as camping, bird or

wildlife watching or visiting forests to relax or calm down. The same limitation applies to the results of Article IV. If only masculine timber production–oriented activities are studied, it is difficult to say much about the relationship between objectives and activities.

Even with these limitations, the results of the study have indicated that women might see forest ownership in a different light. Articles II and III have suggested that, at least for some women forest owners, forest ownership includes intergenerational continuity, taking care of forests including biodiversity, timber production and nature conservation and awareness of forests and forest-related topics. Furthermore, the results of Article IV show that there are many objective groups that are not related to the activities studied within the present thesis. I feel that studying those objectives closer is a key in finding the true diversity of forest ownership activities, whether for women or men.

6.3 Limitations

The majority of the studied activities were connected to traditional masculine forest management practices. It is clear that this selection cannot describe the wide array of activities that are connected to owning forests. Hence, the study was limited by the data availability. In further studies of forest owner activity, it would be important to cover a wide array of activities connected to heritage, conservation, culture or recreation. Furthermore, most of the activities can be connected to masculinity, so it would be important to include activities that are understood as feminine. It is likely that including the activities connected to culture, heritage or conservation would increase the activity of women forest owners.

Articles I, III and IV have utilised survey data where the women respondents most commonly owned their forests alone. However, owning forests together with family, relatives or through a joint ownership was also present. The respondents were instructed that the person responsible for managing the forest should also respond to the questionnaire, but it is possible that some respondents were answering on behalf of someone else. We know from other studies that, when the forest is owned by family members, it is often the male forest owner who responds to the questionnaires (Karppinen et al. 2020); thus, women are often underrepresented in forest owner studies utilising questionnaires. This was the case also in the questionnaire utilised within the present study and likely caused bias in the results towards more active women forest owners.

Nonrespondent analysis indicated some differences between respondents and nonrespondents. There were more heirs, and the respondents were older and lived more often in cities than the countryside, villages or small towns than nonrespondents. This might bias the results and leave groups such as young women forest owners living in the countryside as being underrepresented.

Because Articles I, III and IV were based on a self-reported questionnaire, the study is correlational in nature and the results do not imply causality (Hair et al. 2010). The questionnaire part related to objectives was based on statements that have been utilised by many earlier studies. The statements were predetermined, so the respondents did not have the opportunity to express new objectives. Hence, these results might emphasise the objectives studied and hide others. In the questionnaire, gender was measured using three options; man, woman or other. This type of categorisation enabled the study of those forest owners who

identify themselves more as women compared with the other two classes. However, because gender is more of a continuum than category, the results might be different if forest owners could identify their gender, for example, in a scale. This type of approach would enable, for example, a deeper analysis how gender identity and forest owner objectives are interlinked, revealing the complexity behind it. It might be worthwhile considering the measurement of gender in future forest owner studies, especially if the diversity of forest owner objectives is the focus.

Social desirability bias is often a key issue in tackling survey studies. Furthermore, as mentioned earlier, forestry is a masculine environment, and gender norms of what is acceptable for women might impact the results. The questionnaire mainly covered topics related to forest management for timber production, which might have been conceptualised based on masculine norms and traditions. This might further impact the results because the objectives and values might not fit those of the women forest owners. The questionnaire used within the present thesis has been used for years and tested in practice. This partly increased the reliability of the results. Furthermore, more diverse understanding of forest owner activities were studied in Article II, where the qualitative approach revealed that owning forests entails more than just forest management for timber production. Forestry norms and structures are known to be gendered even though gender awareness within the field is found to be low (e.g., Lidestav and Ekström 2000; Arora-Jonsson 2005; Lidestav and Egan Sjölander 2007; Lidestav 2010; Lidestav and Berg Lejon 2013; Andersson and Lidestav 2016; Lidestav et al. 2017; Andersson et al. 2018; Johansson et al. 2019a, 2019b; Lidestav et al. 2019; Laszlo Ambjörnsson 2020, 2021). Karppinen and Berghäll (2014) also reported that norm pressure impacts women forest owners more than men. This observed gender difference might also impact the results.

It should be noted that all the articles discussed topics such as the objectives and values of forest owners, which can differ significantly between cultures. Because all the data were collected in Finland, the results are applicable only in Finland. The results are impacted by the Finnish forest culture, forest–human relationship in Finland and the long forest history in Finland. It would be interesting to study if similar phenomena could be found from other areas and cultures.

Article II was based on qualitative analysis of a small number of interviews. Thus, the results of the study are relevant for only this small group of people interviewed. The selection of this group caused a likely bias towards active forest owners and concentrated less to those who define themselves as nonactive. The results might be different if the sample would be, for example, a random sample of Finnish forest owners. It must be noted that the results of the present study are not representing the whole population of women forest owners in Finland but are individual examples. Nevertheless, it is likely that similar phenomena would be found from other women forest owner samples.

6.4 Future research needs

Even though the present thesis deepens our understanding of the behaviour of women forest owners, many questions remain unanswered. However, studying this minority forest owner group has proven to be fruitful. Thus, although the current research presents the five-dimensional forest owner objective structure as validated through CFA, it should be verified with further studies of similar testing (e.g., city dwellers, full-time farmers forest owners). Are similar structures found from other studies, or do new type of structures arise? Furthermore,

future studies should find out if the five-dimensional objective structure indicated here is related to other forest owners displaying a diversifying objective structure.

Forest owner objective studies could be further developed also by applying a qualitative approach to dive deeper into the diversity of forest owner objectives, especially in terms of aesthetics, recreation, heritage, culture, emotions, religions and politics. This might help in understanding the relationship between gender dimensions and forest ownership objectives but also deepen the understanding of forest owner objectives despite gender differences. It is likely that a qualitative approach would reveal a deeper objective structure that the current questionnaires fail to recognise. Thus, this deeper understanding of objectives could help in applying SDL thinking to forestry service development. Therefore, considering gender dimensions in future research and forestry service development could enable the consideration of the effect of gendered norms on forest management and ownership.

The five-dimensional forest owner objective structure might also have implications to how forest owners are classified in the future. Does the current clustering of forest owners serve a purpose if the objective structure behind the clustering has changed? Furthermore, if we can see a change now, what could the objective structure look like in the future? In addition, the gender differences found in objective structures further pose questions related to the forest owner classifications. If genders differ in their objectives, is it adequate to classify them when utilising the same structure? Further studies could compare the identified forest owner objective structures to some other landowner groups objectives to validate the objectives utilised in forest owner studies.

Because gender differences were found in objective structures and the relationship between objectives and action, it would be interesting to gauge if these differences are found also from other geographical areas. Studies focusing on women forest owners could reveal a more complex setting of reasons behind the behavioural differences, thus helping understand how to reach new forest owner groups now and in the future.

Because Article II studied the activity of women forest owners, it would be interesting to discover if similar results are obtained from men forest owners. For example, do men turn to educating themselves if they feel confused about forest management choices? Do men have trusted persons supporting decision-making connected to forests? Are these trusted people more often men than women? Furthermore, an exploration of what type of actions ‘active forest ownership’ include would be worth of studying.

The results of Article II have indicated that forest owners feel confused with the advice coming from forestry professionals. This confusion is so profound that they feel the need to study forestry for years to obtain the necessary knowledge to manage their forests. This phenomenon would require more attention. Is this result from the lack of SDL in forestry-related services, as suggested by earlier studies (Mattila et al. 2013; Häyrinen et al. 2015; Pynnönen et al. 2018), or is there something else behind it? Understanding this in detail could significantly improve the forest service industry in Finland.

For the first time, Article IV connected forest owner objectives with a selection of forestry-related activities. However, the majority of the activities were related to economic values. Because the results have indicated that only income dimension was connected to the activities studied, it would be exciting to find out what kind of activities might be connected to the other objective dimensions such as heritage or aesthetics and conservation. The SEM model developed in the present study could be further developed to include other types of land usage,

in addition to forestry. Because the model has been developed based on Finnish data, data from other geographical areas should be tested to develop the applicability of the model in other geographical areas. Developing the model further, it could be utilised to identify active forest owners based on objective analysis or study future land use based on changes in objective structures. All these suggestions call for further research.

7. CONCLUSIONS

The objective of the present thesis was to deepen the understanding of women forest owners' activity in forestry. The current thesis focused on the concept of activity, structural and cultural dimensions affecting activity and relationship of gender and activity. Furthermore, more research about women forest owners, especially the reasons behind the observed behavioural differences, has been called for by earlier studies (e.g., Silver et al. 2015; Follo et al. 2017; Umaerus et al. 2019). Finland was used as a case study because it has a long history in forest utilisation and forest owner research but limited number of studies focusing on gender. Women are also an underrepresented minority of forest owners, who nevertheless form a significant share of private forest owners in Finland.

To study the gender differences in forest owner behaviour, the present thesis has utilised multiple approaches, such as the empirical definition of the concept of 'active forest owner', gender theory, feminist political ecology and SDL in value creation. All of this has been studied in the context of the human–forest relationship, forest culture, forest history and power structures existing in forestry activities and operations. The theoretical approaches give a multidimensional view of women forest owner activity that extends far beyond the sphere of purely economic actions.

In sum, the present thesis contributes to the field of private forest owner research by especially focusing on gender perspective. The articles show that the behavioural differences observed between women and men forest owners have many possible reasons. Women on average are less active in some areas of forest ownership but not in others. This might indicate that some of the activities or services studied do not add value to women like to men. The differences could also reflect the gendered norms within forestry, meaning that women do not feel that some forestry activities are seen as acceptable for a women forest owner. Furthermore, on average, women seem to have a more diverse objective structure compared with men, which might also explain why their needs and offered services might not match. Women also seem to have a diverse understanding of active forest ownership, including awareness, activities in forest and, especially, taking care of forests. In applying SDL theory, the traditional understanding of active forest owner focusing on economic values does not seem to describe the full value that forests have for women forest owners. This gap reflects the Finnish forest culture history, the values of those organisations who hold power in forestry and dominating forest owner discourses. The definition of active forest owner within the present study adds to the understanding that women forest owners might have more diverse view of forest management compared with men or policymakers. However, many of these differences noted are more dominant feature in women compared with men; however, this can be understood more of a continuum than unique feature of women forest owners. It is very likely that there are many men forest owners that use fewer forest services and that value heritage over other values.

According to the results of the present thesis, these features are more dominant with women on average.

Moreover, women forest owners have a different relationship between objectives and active forest management compared with men. Only one of the identified objective dimensions—income—had a positive relationship with the studied activities. Most of the objectives (recreation and leisure time, aesthetics and conservation, heritage and income) did not impact the studied activities within this present study. This result indicates that there could be other ways to demonstrate these objectives. Also, the present study was limited in measures tapping into other than economic activities. The current thesis calls for further research to discover all the dimensions and diversity of the ways that Finnish forests create value for their owners.

The attributes that impact women's forest ownership are varied but have commonalities in them. Childhood environment, family and trusted advisers have significant impact forest ownership. Obtaining forest has also an important impact to forest ownership. Attributes such as family members, childhood environment and the concept of a 'family forest' were common in impacting forest ownership. Studying these attributes gives clues to a deeper understanding of what the most important motivational factors (i.e., family, heritage, childhood environment, education, hobbies) in forest ownership are and where support might be needed. The results of the present thesis suggest that trusted advisers are important in supporting active forest ownership. In their absence, many women forest owners turn to education to feel confidence as forest owners, but this is a longer path to being active.

The five-dimensional objective structure discovered suggests that forest owner objectives are more diverse than previously have been thought. The five-dimensional structure seems to fit both men and women. The implications of the change should be reflected in future forest owner studies, especially when objective structures are utilised as a base of forest owner typologies, policies and designing forest services. Studying a minority group of forest owners has opened new aspects to understanding Finnish forest owners. Might these results indicate the future changes of forest ownership objectives? Those forestry organisations that can embrace the diversifying objectives are more likely to be able to engage the forest owners in a positive relationship that provides value for both sides.

Women forest owners also operate in a masculine environment, where gendering can have an impact on what is seen as appropriate behaviour. The prevailing power structures and forest owner discourses, forest–human relationship, forest history and culture have their own impact on the social environment and, thus, the predisposition by which forest owners engage in exchange relationships. Hence, the past can impact women forest owner behaviour, objectives, results of questionnaires and the relationship of objectives and behaviour. Going forward, the role of forestry professionals being able to address a variety of objectives while emphasising the objectives of each individual forest owner instead of pushing the prevailing discourses is important. It seems that there is a need for women forest owner–only groups, which can give space for women to express their needs, concerns and seek advice from a peer group. These topics are also discussed more and more in the media, giving room for more diverse discourses of what forest owning is and what are the diverse ways to see forest ownership. These include, but are not limited to, continuous-cover forestry, biodiversity protection, different conservation schemes and strategies, other income streams from forests than timber production and the cultural and emotional value of forests. Addressing the more feminine values in forest

management could also change our thinking of forest management of an extractive use of natural resources towards regenerative practices of forest management.

Nevertheless, the picture of women forest owners and their behaviour is far from complete. Similar studies in other geographical areas and cultural environments could reveal interesting aspects of forest ownership. Additionally, how men see active forest ownership and the path towards it could help us further understand the gender differences of forest owners' behaviour. Forest owner objective research could benefit from qualitative studies mapping the diversity of forest owner objectives. The currently used 22 or 25 objective statements might be gendered in their approach and focus on masculine norms. Revising them could present new objectives and behavioural patterns. The objective-action model could be developed further by applying data from other countries or other landowner groups. Furthermore, a wider selection of possible actions as depicters of activity would benefit from the applicability of the model. All this can help in understanding the land usage changes in the future connected to, for example, climate change, increased pressure for timber procurement and other land use challenges. Additionally, the identified gender differences are still not considered, for example, in policies or the provision of forestry services. To plan more inclusive forest policies, a wide array of different types of forest ownerships should be taken into consideration. Although gender differences are known in forestry and further knowledge was created within the present study, much remains undiscovered.

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SUPPLEMENTARY INFORMATION

Appendix I. Forest ownership objectives statements

1	My forest is part of my leisure time or residential environment (residential environment)
2	My forest offers me opportunities for picking berries and mushrooms (picking berries and mushrooms)
3	Forest owning offers me possibilities for hunting (hunting)
4	My forest offers me opportunities for outdoor recreation (e.g., walking, jogging, hiking) (outdoor recreation)
5	My forest offers me opportunities for performing silvicultural work (forest work)
6	My forest offers me regular income for consumption (regular income)
7	My forest is a financial asset for me for major purchases (financial asset for major purchases)
8	My forest offers me labour income (labour income)
9	I gain household timber from my forest (household timber)
10	My forest offers me an opportunity for maintaining and treasuring biodiversity (biodiversity)
11	My forest offers me aesthetic experiences (aesthetic experiences)
12	My forest is an object of nature conservation for me (nature conservation)
13	My forest property improves my credit rating (credit rating)
14	My forest offers economic security for my old age (security for old age)
15	My forest offers security against exceptional situations (security against exceptional situations)
16	My forest property is an asset for hedging against inflation (hedging against inflation)
17	My forest comprises a bequest for my heirs (heritage)
18	Forestland ownership has intrinsic value for me (intrinsic value)
19	My forest is a site for enjoying silence and meditation (solitude and meditation)
20	Through my forest I am connected to my native region (connection to native region)
21	My forest is an investment object for me (investment object)
22	Summer cottage and recreational building price level rises raises the value of my forests (building price levels)
23	My forest acts as a carbon sink and carbon storage (carbon sink and storage)
24	Forestland ownership offers opportunity for independent decisions (opportunity for independent decisions)
25	Forestland ownership is part of my family tradition (part of family traditions)

Appendix II. Forest owner activities included in the sum variable

Activities in the sum variable
1. Has electronic forest resource information
2. Has a forest plan formulated by a professional
3. Has used a forest plan
4. Has been in contact with a forest professional
5. Has been on a forest excursion
6. Has been on a forest course
7. Follows forest-related journal(s)
8. Has spent time in the forest
9. Has used electronic forest-related services
10. Has insurance for the forest
11. Has evaluated the profitability of forestry
12. Applies continuous-cover management in forests

Appendix III. Nonrespondent analysis. Information provided by Finnish Forest Service and Digital and Populations data service agency.

	Respondents	Nonrespondents
	% share of forest owners	
Ownership type		
Family or joint ownership	93.7	88.3
Estate	6.3	11.7
Owners age		
–44	15.7	15.8
45–54	22.4	22.3
55–64	34.0	33.1
65–74	16.8	16.8
75–	11.1	11.9
Owners gender		
Women	26.0	28.1
Men	74.0	71.9
Forest area in the province, ha		
5–9.9	15.7	15.8
10–19.9	22.4	22.3
20–49.9	34	33.1
50–99.9	16.8	16.8
100-	11.1	11.9
Average		
Forest ownership in the province, ha	47.3	48.8
Forest ownership elsewhere, ha	26.0	23.7
Age of the forest owner, age	64.0	59.6

Appendix IV: Nonrespondent analysis of phone interviews

	Respondents	Nonrespondents
	% share of forest owners	
Ownership type		
Family ownership	82.7	75.9
Joint	9.2	6.3
Estate	8.1	6.8
Multiple types		11
Professional status		
Employee	33.4	24.7
Agriculture and forestry entrepreneur	8.3	14.7
Other entrepreneur	5.5	10
Retired	51	49.5
Other	1.8	1.1
Gender		
Women	24.2	21.9
Men	75.8	78.1
Residential environment		
Countryside	53.2	65.5
Small village	17.6	16.5
City	29.2	18
Age		
–49	13	10.8
50–74	68.3	68
75–	18.8	21.1
Average		
Forest ownership, ha	50.7	54.8
Age of the forest owner or respondent, age	64	64.7