

Gender equality in Nordic forest research – A literature review

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ABSTRACT

The article reviews and synthesises scientific research in the intersection of gender and the forest sector published during the past 20 years (2004–2023), focusing on the Nordic countries of Finland, Norway and Sweden. The systematic review of 88 scientific articles presents the state of the art of forest and gender-related research and examines how the main issue areas included in the eight key objectives of the European Union Gender Equality Strategy are addressed in the research and the related results. A large share of the reviewed research focused on non-industrial private forest owners, investigating the differences between male and female forest owners with respect to forest ownership, use and management and related objectives and values. A notable gap exists in the research on gender issues in decision making, policies and politics. While policy analyses from gender perspective are important for advancing gender equality and for avoiding unintended consequences, only two studies analysed forest policy from a gender perspective. Furthermore, a better understanding of gendered norms, culture and institutional stickiness that upholds gendered institutions and processes is needed. The politics of gender, i.e., gendered power relations, is a fundamental issue in advancing gender equality but it is not addressed in the reviewed research. The findings from the reviewed studies also emphasise the importance of moving beyond the female/male dichotomy and employing an intersectional approach.

1. Introduction

Transition towards a greener economy, nature-based solutions and bioeconomy aspire at harnessing natural resources sectors for sustainable economic development while providing ecologically sustainable solutions for mitigating environmental challenges that undermine sustainability. The EU Bioeconomy Action Plan's (European Commission, EC, 2018) main priority is to strengthen and scale up bio-based sectors. Sustainable and circular bioeconomy is envisaged to preserve nature and restore healthy ecosystems, create new jobs, and provide additional income for farmers, foresters and fishermen (EC, 2018).

Gender equality has been recognised as an important element in green transition and has been anticipated to bring new jobs and increase productivity (EU Gender Equality Strategy 2020–2025 [GES], EC, 2020). This is also clearly recognised in the EU Common Agricultural Policy (CAP 2023–2027, EC, 2021). One of the key objectives of CAP 2023–2027 is to “promote employment, growth, gender equality, including the participation of women in farming, social inclusion and local development in rural areas, as well as the circular bio-economy and sustainable forestry.”

Despite the wide acceptance of gender equality as a political and

social goal, its meaning is open and malleable to different understandings, making it adaptable to variable contexts but also allowing for different actors to frame it in different ways (Caglar, 2013; Lombardo et al., 2009). In broad terms, it encompasses the ideas of equal rights (human rights) between genders, equal opportunities, treatment, and access to resources and their benefits, recognition and dignity, as well as equal participation in institutions and decision making (Leach, 2016).

Gender mainstreaming has been widely adopted since mid-1990s as the strategy towards gender equality by governments and development organisations, as well as the EU (Arora-Jonsson, 2014; Daly, 2005; Lomazzi and Crespi, 2019; Squires, 2005; van Eerdewijk and Davids, 2014). It has also been widely criticized, and its success and achievements debated (see e.g., Arora-Jonsson, 2014; Bock, 2015; Caglar, 2013; Daly, 2005; Davids et al., 2013; Elomäki and Ylöstalo, 2021; Shortall, 2015). Based on a review of peer-reviewed articles published between 1995 and 2022, Caywood and Darmstadt (2024) analysed the critiques and challenges related to gender mainstreaming. They identified the following main issues in its conceptualisation and implementation: depoliticization of gender mainstreaming and focus on technical solutions, lack of conceptual clarity regarding definitions and objectives, integrating gender issues within existing policy priorities instead of

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recognising it as a structural problem requiring transformative change that would address the power imbalances, resistance and lack of political will, and prevailing governance models and organisational cultures. Daly (2005, p. 434) argues that “the most significant conceptual elaboration of gender mainstreaming” has been done within policy organisations, particularly the European Council.

The Council of Europe defined gender mainstreaming in 1998 as: “The (re)organisation, improvement, development and evaluation of policy processes, so that a gender equality perspective is incorporated in all policies at all levels and at all stages, by the actors normally involved in policymaking” (Council of Europe, 2004, p. 12). The GES (EC, 2020) emphasises gender mainstreaming in all policies and aims at equal participation of men and women in all sectors of the economy. It aims “to redistribute power, influence and resources in a fair and gender-equal way, tackling inequality, promoting fairness, and creating opportunity.” (EC, 2020, p. 15). The strategy’s key objectives are 1) ending gender-based violence, 2) challenging gender stereotypes, 3) closing gender gaps in the labour market, 4) achieving equal participation across different sectors, 5) addressing the gender pay and pension gaps, 6) closing the gender care gap, and 7) achieving gender balance in leadership positions, and in 8) decision making and in politics. Furthermore, a cross-cutting principle for the strategy’s implementation is intersectionality – specified as “the combination of gender with other personal characteristics or identities, and how these intersections contribute to unique experiences of discrimination” (EC, 2020, p. 2). In the EU policy and research context gender “refers to the social attributes and opportunities associated with being male and female and the relationships between women and men and girls and boys, as well as the relations between women and those between men. These attributes, opportunities and relationships are socially constructed and are learned through socialisation processes. They are context/ time-specific and changeable. Gender determines what is expected, allowed and valued in a woman or a man in a given context.”¹ Gender relations and gender equality are important constituents of social relations across scales from individual, household, community to societal scale (Elias et al., 2017; Lidestav and Reed, 2010; MacArthur et al., 2021).

Much of the research on gender and forests has concentrated on the Global South (Arora-Jonsson, 2014; Bergstén et al., 2020; James et al., 2021; Lidestav and Reed, 2010; Ota et al., 2024). The literature has focused on the differences between men and women and related inequalities in respect to forest dependency (e.g., Sunderland et al., 2014), forest ownership and tenure, including access to forests, their use and management, and the distribution of forest-related benefits (e.g., Ade-dayo et al., 2010; Agarwal, 2009a; Asfaw et al., 2013; Colfer et al., 2017; Duguma et al., 2022; Elias et al., 2017; Olumeh and Mithöfer, 2023; Ota et al., 2024; Sunderland et al., 2014). The literature has highlighted the prevalence of gender norms, roles and stereotypes that constrain women’s participation in forest related activities and employment (e.g., Pröbstl-Haider et al., 2020) and their ability to benefit from forests (e.g., Arora-Jonsson, 2014). Considerable literature has focused on gender differences and inequality with respect to participation in forest-related decision making, at household level (e.g., Nsenga and Mwaseba, 2021; Ota et al., 2024), in community forest management organisations (e.g., Agarwal, 2009a, 2009b; Coleman and Mwangi, 2013; Elias et al., 2017, 2020; Khasay et al., 2021; Mwangi et al., 2011; Nandigama, 2020; Ota et al., 2024) and in policy processes (e.g., Tyagi and Das, 2018) and on the constraints that hinder women’s participation (e.g., Duguma et al., 2022; Elias et al., 2017, 2020). Cross-cutting themes across gender research since the 1980s have been the acknowledgement of the crucial role of power relations (Cornwal and Rivas, 2015; Elias et al., 2017) and the related emphasis of women’s empowerment as well as a call for a change from a focus on individual empowerment to societal

transformations (Collins, 2018; Cornwal and Rivas, 2015).

While much of this literature is in general also relevant for the Global North, research has also emphasised the importance of situated, context specific and dynamic understandings of gender issues that acknowledge the role of shifting cultural and socio-political conditions (Ota et al., 2024; Tyagi and Das, 2018). This review focuses on the research conducted in three Nordic countries, Finland, Norway and Sweden. The forest sectors of these countries share many commonalities. In all three countries, forests are important for the national economies, provide livelihoods for both rural and urban residents and have an important cultural meaning. Private, non-industrial ownership is the predominant form of forest ownership in all three countries, accounting for 52 % of productive forestland in Finland, 84 % in Norway, and 47 % in Sweden (Bashir et al., 2020; Karppinen et al., 2020; Lidestav and Westin, 2023). Since the turn of the century, gender equality and gender mainstreaming have been established as important policy principles in the EU and in the Nordic countries.² From a global perspective, Finland, Norway and Sweden are performing comparatively well in gender equality, particularly regarding equal rights and treatment in legislation, and equal opportunities in education, employment, and access to social security. Yet, gender inequalities and differences persist in the forest sectors of these countries (Reed and Lidestav, 2023; Umaerus et al., 2019; Venesland et al., 2020). Research on gender issues in the forest sector is essential for building understanding of persistent gender inequalities and to support policy development and measures to advance gender equality and implement gender mainstreaming principles at both the EU and national levels.

This review focuses on the scientific research on gender and forests in Finland, Norway and Sweden published within the last 20 years, i.e., between 2004 and 2023. It examines and assesses the state of the art of the research on gender issues in forest research through the objectives of the GES by using the main issues that are included in the eight key objectives of the GES as broad themes for structuring the review. The focus on the issues covered in the GES objectives allows a broad, encompassing approach to gender issues and equality and helps to overcome the problem presented by the different understandings and framings of gender equality (Caglar, 2013; Lombardo et al., 2009). As noted above, the EC’s conceptualisation of gender mainstreaming, as a way towards gender equality, has been considered as conceptually elaborate (Daly, 2005) allowing to include in the analysis the different issues considered important for advancing gender equality. The research question guiding this review is “How have the main issues included in the GES’s objectives been addressed in the forest research in Finland, Norway and Sweden between 2004-2023 and what is the state of knowledge regarding these issues?” The paper also discusses what the results could imply about the understanding and importance of gender dimensions within the forest sector. The review identifies knowledge gaps and research needs for advancing gender equality and socially just transformation within the forest sector.

Earlier literature reviews focusing on these three countries, or some of them, have focused on narrower, specific themes, including gender issues in Swedish forest policy from 1990 to 2009 (Kleinschmit et al., 2012), the digitalisation of bioeconomy and its effects on gender equality in the Nordic region (Roos et al., 2021), and feminist and gender research in farming and forestry in Norway since 1990 (Gustavsson and Farstad, 2022). However, there are no previous systematic reviews covering the wider themes included in the gender mainstreaming. Also, beyond the countries this review focuses on, there is a general gap in knowledge regarding how gender equity is considered

¹ European Institute for Gender Equality 2024. Gender mainstreaming glossary. Www-page. <https://eige.europa.eu/gender-mainstreaming/glossary>

² For Finland see <https://thl.fi/en/web/gender-equality/promoting-gender-equality/gender-equality-policy>, for Sweden <https://swedishgenderequalityagency.se/gender-equality-in-sweden/>, and for Norway <https://www.regjeringen.no/en/topics/equality-and-diversity/likestilling-og-inkludering/gender-equality/id670481/>.

and how gender mainstreaming is carried out in public policies (Amri et al., 2024). One reason for this could be that gender is an integral part of all social relations. Studying gender equality and mainstreaming thus encompass a wide range of issues that cut across different disciplines as well as political and economic sectors, culture and history, and across different scales from individual to all structures and institutions in a society, making a more comprehensive analysis challenging. Furthermore, insufficient engagement between social relations and gender issues with natural resources sectors undermines the understanding of gender issues (Harrison and Watson, 2012).

In this review the forest sector is understood broadly, including all forest-related activities, meanings, perceptions and values, from cultural and recreational to forest protection and forest-related products, value chains and industries.

2. Literature search, review process and coding

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA, Page et al., 2021) was used to guide and structure the literature search and review processes (Fig. 1). The method was first developed for systematic reviews and reporting in medicine in 2009 but has since been used in literature reviews in other disciplines as well (e.g., see Abdeta, 2022 for willingness to pay, Grover et al., 2023 for ecosystem accounting, Nzunda and Yusuph, 2022 for forest degradation, and Vigna et al., 2021 for suicides among agricultural, forestry, and fishery workers).

The literature review was limited to peer-reviewed articles published in English and focusing on or including Finland, Norway or Sweden. For the literature search Scopus and Web of Science databases were used because they are considered as the most credible and comprehensive databases for peer reviewed scientific articles. The initial search aimed for wide inclusion of potentially relevant articles and the first keyword searches included a vast amount of non-relevant literature. To remove them from the search, keywords for exclusion were also included in the search sentence. The following search sentence was used for the search:

(TITLE-ABS-KEY ("gender*" OR "woman" OR "women" OR "female" OR "girl*" OR "man" OR "men" OR "male" OR "boy*" OR "feminin*" OR "masculin*") AND TITLE-ABS-KEY ("forest*") AND TITLE-ABS-KEY ("Nordic*" OR "Finland" OR "Finnish" OR "Norway" OR "Norwegian" OR "Sweden" OR "Swedish" OR "scandinavia*" OR "baltic") AND NOT TITLE-ABS-KEY ("man-made" OR "man made" OR "man-influenced forest*" OR "Norwegian forest cat*" OR "disease*" OR "predator*" OR "pest*" OR "specie*" OR "mammal*" OR "habitat*" OR "cancer*" OR "insect*" OR "patient*" OR "epidemiolog*" OR "DNA*")) AND PUBYEAR >2003 AND PUBYEAR <2024.

After removing overlapping records from the results of the searches from the two databases, the first screening concentrated on the title, abstract and keywords. The results included many records that did not relate to gender issues. These and records published earlier than 2004, and records that were not relevant (e.g., medicine and veterinarian studies) were excluded during the first screening. During the second screening, based on the full text, records where the search terms were used only to describe the data used in the study, but which did not analyse or report gender-related issues in any way were also eliminated. At the beginning of 2024 a new Web of Science search was conducted for articles published in 2023 to ensure that all articles published during 2023 would be included. This search yielded eight new relevant articles making the total number of reviewed articles 88 (Fig. 1).

The number of studies increased considerably during the second half of the review period. During the first 10 years the total number of studies included in the review was 29 (33 %) and during the second 10-year period 59 (67 %). Most of the studies focused or included Sweden (58

%), followed by Finland (34 %) and Norway (17 %).³ Gender was the main focus in 49 studies and a structural variable in 39 studies.

The codebook was developed on the basis of the broad themes derived from the objectives of the GES. Due to the lack of or very limited number of articles addressing labour market, gender pay and pension gaps, gender care gap, and gender balance in leadership positions, these themes were combined under one code. The codes and corresponding GES objectives are presented in Appendix A. N-Vivo programme was used for coding and the first author of this review coded all articles.

3. Results

The results of the review are presented within broad, overlapping themes that relate to the main issues addressed in the GES's objectives: 1) participation in forest-related activities, entrepreneurship and related objectives; 2) gender roles and stereotypes; 3) leadership, work, labour issues and education; 4) gender-based violence and harassment; and 5) gender in decision making and politics. None of the reviewed studies addressed gender pay gap, pension gap or gender care gap. The articles included in the reviewed literature are in this section marked in bold and they are listed separately in the list of references.

3.1. Participation in forest-related activities, entrepreneurship and related objectives

The clearly largest group of the reviewed studies ($n = 35$) related to participation in forest-related activities, especially focusing on potential gender differences in non-industrial private forest owners' forest management behaviour and activity, related capacities, goals and values, and forest-related entrepreneurship.

Most of the reviewed studies indicate that female forest owners' ownership goals and related values are more diverse than those of male owners and that they value ecological, aesthetic, recreational and social aspects of forests more (Karppinen and Korhonen, 2013; Kuhlman et al., 2023a, 2023b; Nordlund and Westin, 2011; Palander et al., 2009; Umaerus et al., 2019; Westin et al., 2023) and income related aspects (Kuhlman et al., 2023a) and increased timber production (Nordlund and Westin, 2011) less than male forest owners. For men forest activities such as hunting and fishing are more important than for women. Women on the other hand value picking berries and mushrooms and maintaining contact with family and friends (Nordlund and Westin, 2011).

There is also some indication that the differences in values are reflected in forest management practices (Juutinen et al., 2020; Kuhlman et al., 2023b; Palander et al., 2009; Umaerus et al., 2019; Westin et al., 2023) and in the level of activity to undertake forest management operations. Several studies have reported male forest owners to be more active than female forest owners in silvicultural and harvesting operations (Häggqvist et al., 2014; Eriksson, 2018a; Eriksson and Fries, 2020; Kuhlman et al., 2022; Kuuluvainen et al., 2014; Lidestav and Berg Lejon, 2013; Westin et al., 2023), especially in heavy practical forest work (Häggqvist et al., 2014), and in selling timber (Kuuluvainen et al., 2014). In relation to forest harvesting methods female owners favoured selective harvesting over clear cutting more often than male owners (Juutinen et al., 2020). The differences in forest management behaviours between male and female forest owners have persisted over time (Lidestav and Berg Lejon, 2013).

However, female forest owners are not a homogeneous group, instead they have been found to represent different clusters of ownership-objective profiles. The largest of these was multi-objective forest owners, followed by the cluster valuing recreation and nature, the third cluster valued timber production, heritage and nature, and the last valued timber production, recreation and nature. Women belonging

³ Several studies focused on more than one country. The percentage indicates the share of studies a particular country was included in.

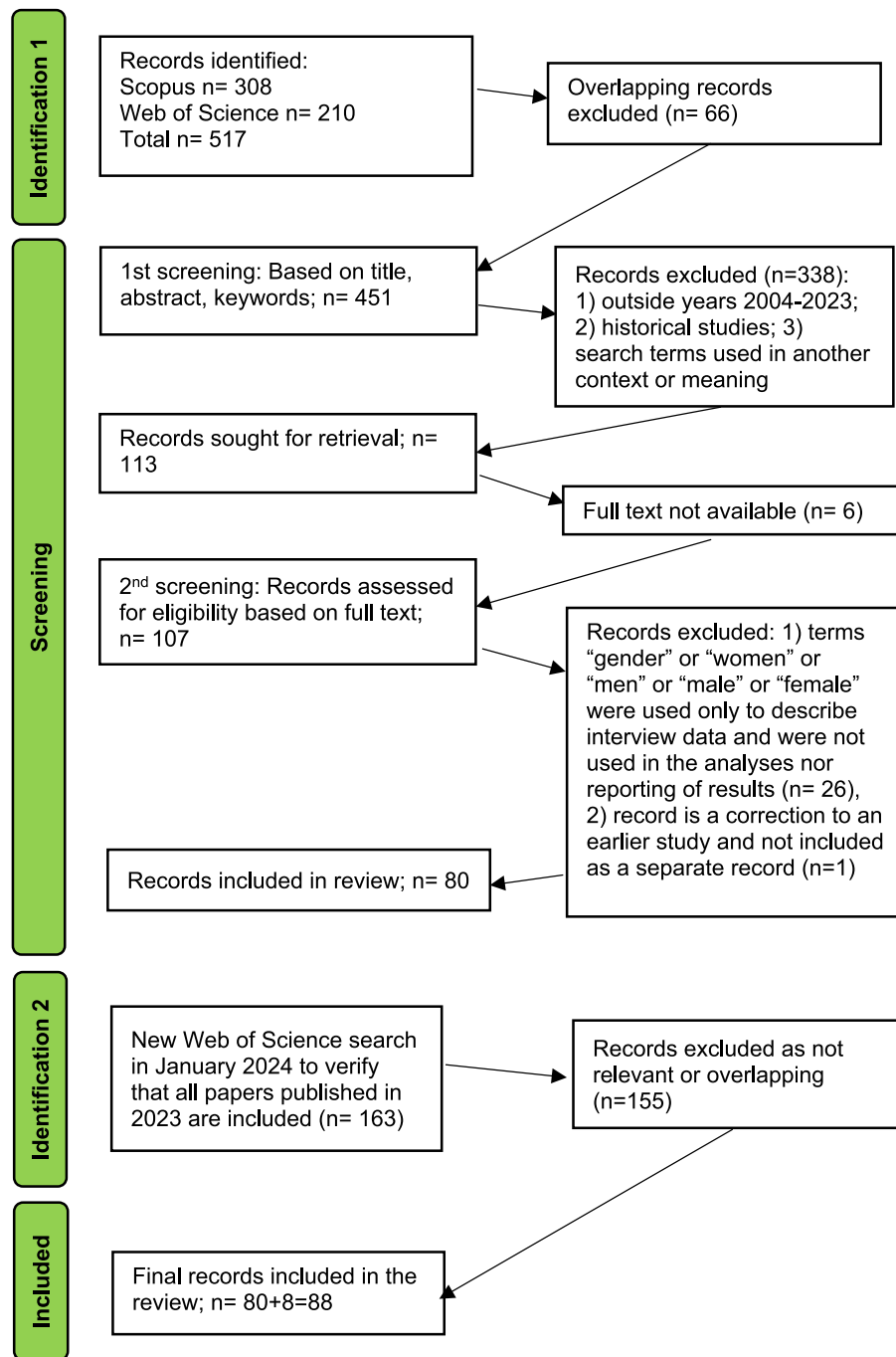


Fig. 1. PRISMA protocol for the systematic literature search. Adapted from Page et al., 2021.

to the multi-objective cluster were more active in forest management than the others, and those in the cluster valuing nature and recreation were the least active (Kuhlman et al., 2022). Characteristics such as age, education, manner of obtaining the forest, income and residential area may affect ownership objectives and forest management of female forest owners (Kuhlman et al., 2023a). Younger female forest owners seem to appreciate biodiversity and climate change mitigation arguments in connection with forest thinning services more than older female owners (Lähdesmäki and Matilainen, 2021). In relation to harvesting methods (clear cut vs. selective harvesting and even aged vs. uneven age forest management), especially young female forest owners preferred uneven-aged forest management (Juutinen et al., 2020). In contrast, older and male forest owners and agricultural entrepreneurs were less inclined to practice uneven-aged forestry (Juutinen et al., 2020).

Contrary to the above cited studies, several studies have found no differences between female and male forest owners ownership goals (Olofsson and Jakobsson, 2023), attitudes (Kronholm et al., 2020), management choices (Brough et al., 2013; Eggers et al., 2014; Olofsson and Jakobsson, 2023) or intentions to adapt to climate change (Blennow et al., 2012; Vulturius et al., 2018). Furthermore, some studies have reported female forest owners harvesting more than male forest owners (Bashir et al., 2020; Berg Lejon et al., 2011).

The prevailing power structures limit women's participation in forest-related activities. Vainio and Paloniemi (2013) found no gender differences in forest owners' willingness to engage in voluntary conservation though the Finnish national biodiversity program (METSO). However, while male owners' conservation preferences led to a willingness to conserve their own forests, this did not happen with female

forest owners. The latter manage forests on their own much less often than male owners and lack confidence in forestry matters, which may be reflected in forest management. Studies have pointed out that female owners feel that they lack knowledge and capacities regarding forests and forest management (Eggers et al., 2014). This has contributed to lack of confidence in participating in forest related discussions and leaving the decision making regarding the forest property to male members of the family (Hamunen et al., 2020). The husband, partner or father were the most important sources of knowledge for women (Häggqvist et al., 2014). In addition, the influence of norm pressure from extension officers, local wood purchasers and from (male) family members is stronger than the role of attitudes and beliefs for female than for male forest owners (Karppinen and Berghäll, 2015). However, Eriksson and Fries (2021) found no differences in objective knowledge between male and female owners when the level of involvement in forestry was taken into consideration. The information needs of forest owners also vary; Kärhä et al. (2020) reported that gender, age and other personal characteristics, such as education, living environment and forest ownership objectives, have an important effect on forest owners' information needs.

In relation to forest-related business activities, traditional forestry has been found to be the main activity for both female and male forest owners, but there are differences in the interests to develop other forest-related activities (Miina et al., 2023). Women have been found to be more engaged with service-oriented business activities (Umaerus et al., 2013) or sawn more opportunities in the less traditional tourism- and health/rehabilitation-related business activities (Umaerus et al., 2019). Female forest entrepreneurs' entrepreneurship is opportunity based and linked to strong interest in nature and wildlife and related values regarding what is important in life in general. In many cases the nature-based business was not the sole source of income, it was often combined with other employment (Sörensson and Dalborg, 2017). While the economic performance of male run private micro-firms has been found to benefit from forest holdings, no significant effects were found for female entrepreneurs (Haugen and Lindgren, 2013). Gender differences in the willingness of forest owners to take financial risks have also been reported and female owner's willingness to take risks was in some cases higher than male owner's (Andersson, 2012; Andersson et al., 2010).

3.2. Gender roles and stereotypes

Of the reviewed studies, 11 addressed gender roles, socialisation and/or gender stereotypes. The role girls and women take in forestry and their interest to become forest owners has been found to be linked to the traditional patrilinear inheritance patterns (Bergstén et al., 2020) and the gender-biased socialisation process (Wästerlund, 2018). The lack of female role models that would challenge the current social norms and culture discourages girls'/women's interests in forest ownership. The socialisation process was also closely linked to the appreciation of forest income and upholding the forest ownership tradition, but forest ownership was not considered a "professional choice" (Wästerlund, 2018). Studies in Sweden have found clear gender differences in how forest properties were transferred and acquired: Women have inherited or received the forest property from their own family or relatives to a higher extent than men (Lidestav, 2010; Nordlund and Westin, 2011).

Forestry is still considered as a masculine domain associated with male bodies, physical labour and use of heavy machinery (Ambjörnsson, 2021; Bergstén et al., 2020). Traditional gendered expectations and norms related to femininity and masculinity emphasise differences and complementarities (Bergstén et al., 2020; Danielsson and Eriksson, 2022). Investigation on women's work and roles in combating forest fires revealed the existence of norms that directly and indirectly questioned women's abilities and authority. Women received positive attention when they did what was traditionally expected from them but were questioned when they undertook tasks that were traditionally perceived as men's. The domestic work (taking care of children,

livestock, farm and house) that made it possible for men to concentrate on combating fires was invisible (Danielsson and Eriksson, 2022).

Women have been found to adopt and perform masculinities and alternative femininities in different ways as a coping strategy to gain acceptance as forest owners and to be accepted 'as one of the boys' (Ambjörnsson, 2021; Bergstén et al., 2020) thus sustaining the dominant notions of masculinity in forestry and forest ownership (Ambjörnsson, 2021). Only one study has focused on the changes in masculinity; the changes reflected structural social changes including the raise of middle-class jobs and decline of manual forest work (Brandth and Haugen, 2005). The dominant types of masculinity changed from farmer/forest worker in the 1970's to professional forestry workers using machinery in the 1980's and towards white collar workers in organisations and experts in the 1990's. The boundaries between these dominant forms were considered flexible and reflecting the general developments in the forest sector and societal changes such as urbanisation. Yet, the masculinity based on practical forestry work was still the most appreciated in rural context (Brandth and Haugen, 2005).

3.3. Leadership, work, labour issues and education

Despite some signs of change, gendered, masculine culture persists in forest organisations and industry (Larasatie et al., 2019; Lidestav and Sjölander, 2007). Lidestav and Sjölander (2007) analysed how ideas of feminine and masculine qualities are reflected in job advertisements looking for employees with higher forestry education or degree in forestry, and the contents of Swedish forestry press in two 1-year periods (1990–91 and 2000–01). They found that the hegemonic masculinity had not changed and was based on a rural masculine identity despite the increased number of women foresters. This hinders women from reaching leadership positions in forest industry and to succeed women have been expected to adapt their behaviour to the male dominated culture (Bergstén et al., 2020; Baublyte et al., 2019). Social practices and traditions such as sauna and hunting, which still feature strongly in Nordic forestry, are part of networking, information sharing and decision making. Women are expected to adjust their professional image and behaviour to match the standards set by male colleagues, i.e., "adapting to 'being one of the boys'" (Baublyte et al., 2019, p. 521). At the same time women also still have a dominant role in care and household work, which limits women's participation and advancement in forest sector. Support systems for balancing work and family was emphasised by Finnish and Swedish female executives as a way to attract young females to the forest industry (Larasatie et al., 2019).

The dominant masculine culture is also likely linked to the observed differences in work satisfaction between female and male employees. Sjölie et al. (2023) reported that in the Norwegian forest sector, women have been found to be less satisfied than men. There were also clear differences between men and women regarding discrimination. Majority of men viewed that there is no discrimination regarding status, salary and internal recruitment, while about half of the women thought that men were better off regarding status and salary.

Research on efforts to advance gender equality and gender mainstreaming in forest organisations or industry were limited to Sweden. The findings highlight how gender inequality is closely intertwined with intersectional issues such as class, place and age, and is associated with a particular type of masculinity. Gender inequality in the forest and mining industries was seen as a problem associated with 'rural working-class men' but not relevant for 'modern, enlightened urban men' (Ringblom and Johansson, 2020). In forest organisations it was perceived as a problem related to 'old men' (Johansson et al., 2017). The discursive resistance of male forest professionals to gender-equality interventions included three sets of arguments that made interventions unnecessary: 1) the negative impact on men, as gender-equality interventions were perceived to prioritize gender over merit in promotions and hiring decision; 2) the gender-equality interventions were deemed unnecessary because of the increasing number of women in forest

professions and as forest owners; and 3) placing the blame of gender inequality on 'old men' with the assumption that the problem would be resolved when they retire (Johansson et al., 2017). Johansson and Ringblom (2017) further found that framing gender equality as a business case supports companies to engage in gender issues but does not support the inclusion of conflicting interests and power issues.

In large forest companies gender equality actions have focused only on women, instead of both men and women, and have not considered the organisational structures and processes that create inequality, nor the gender-related politics and power dynamics. Gender equality was also found to be subordinate to other goals and interests (Andersson et al., 2018). This correlates with the way women professionals have experienced changes related to gender equality: while explicit sexism is no longer accepted, the underlying masculine structures and culture have changed very little (Johansson et al., 2023).

Three studies have addressed gender issues in forest education. Arevalo et al. (2012) investigated and compared Bachelor students' (in Brazil, China, Finland) views regarding subject-specific competencies and experiences, as well as their preferred areas of work and found great similarities across the countries regardless of students' gender. Focusing on female forest science students in Sweden, Grubbström and Powell (2020, p. 316) highlighted "how traditions, hierarchies, sexist jokes, and passive bystander behaviours together negatively influence the situation of women" and have supported the "culture of masculine domination". They conclude that efforts to promote gender equality have failed to address discrimination. In university forest education, Powell and Grubbström (2023) noted a gap between the importance given to gender equality and its practical implementation which tended to consist of individual seminars or lectures. Students emphasised the role of female leaders, teachers and working women as role models. Teachers were also seen to have an important role in driving the change in forest education.

Three studies focused on the health aspects of forest work, pointing out that the gendered differences in forestry, farm work and related activities are reflected in the occurrence of health issues and accidents (Dimou et al., 2020; Karttunen et al., 2019; Lindroos et al., 2008). Karttunen et al. (2019) investigated the gender division of farm work and related injuries and found significant differences in the allocation of farm work time and occupational injuries. "Crop production, construction, forestry, and machinery contracting work were dominated by men, whereas women took the main responsibility for domestic and care-taking work." (Karttunen et al., 2019, p. 117). In general, men suffered clearly more from injuries than women. Lindroos et al. (2008) found that women participated less in firewood production than men but that the difference was smaller than in other forms of forest work; most accidents also occurred to men. Dimou et al. (2020) analysis of the occurrence of musculoskeletal disorders in forest employees also showed that the type of work and related gender differences are related to the self-reported musculoskeletal disorder symptoms. Women were mostly involved in debarking and stacking of firewood and their frequent cumulative symptoms affected wrists/hands, followed by knees. Häggqvist et al. (2010) found that forest days and campaigns can be important for increasing awareness of safety measures especially for women.

3.4. Gender-based violence and harassment

Three studies have focused on harassment or discrimination in Sweden or Norway. The male dominated culture in the forest sector has been related to harassment, inequality and discrimination in forest sector organisations. Women's harassment has been reported to be wider than men's and included sexual harassment and sexualisation of social relations, which downplay women's knowledge and professionalism (Johansson et al., 2018; Johansson et al., 2019; Sjølie et al., 2023). The organisational culture, use of language, and status of gender equality was also perceived more negatively by women than men (Johansson et al., 2019). Women are also more likely than men to feel unsafe in urban green areas and to perceive dangerous animals or pests

as a problem (Dawson et al., 2023). Women's experiences of fear and insecurity have as well been found to influence neighbourhood forest use (Skår, 2010).

3.5. Gender in decision making and politics

Only two studies have explicitly analysed gender issues in forest policy, both in Sweden. Holmgren and Arora-Jonsson (2015) showed how the Swedish Government's vision for the forest sector represented women as potential employees and forest owners, and as economic actors linked to the needs of the forest industry instead of participants in political decision making. Ville et al. (2023) further showed that gender equality in the Swedish forest and rural policy documents is viewed as a technical problem that could be addressed by increasing the number of women within the forest sector. The forest policy "relies upon women to bring growth and sustainability to the forest industry, while rural policy expects women to halt rural population decline" (Ville et al., 2023, p. 46).

In addition, three studies have focused on specific women's networks that have been established in Norway (Kvinner i Skogbruket, Women in Forestry, WiF, former Jenter i Skogbruket, JiS) and Sweden to increase women's participation in forestry, strengthen women's voice in forestry matters and to provide information for women.⁴ Establishing a women's organisation specifically highlights gender, even though the organisation's aim was to make gender irrelevant. According to Brandth et al. (2004) JiS choose the strategy that deduced the particularity of women, embraced diversity in membership and looked for alliances with men. They concluded that JiS has succeeded to a certain extent in making women more visible within forestry. The strategy chosen by the Norwegian JiS was also visible in the Swedish context. Networks were also found to expand the "discursive space, establish alternative publics and empower their members by inventing and circulating counter discourses" (Andersson and Lidestav, 2016, p. 38). The authors concluded that "one single public sphere cannot encompass the diversity of the contemporary forestry sector, indicating a need to contain a multiplicity of publics, both to challenge the modes of deliberation that mask domination and to facilitate transformative processes." (Andersson and Lidestav, 2016, p. 38). Ambjörnsson (2021, p. 1592) found that separate women's networks "enabled women...[to] gain access to both material and symbolic spaces within forestry, as well as become recognized as (knowledgeable) forest owners." Furthermore, in a small Swedish village, one reason women organised themselves was that they did not identify with the existing village structures (Arora-Jonsson, 2004). Women also had a more holistic view on local development needs, emphasised social issues and saw that changes in the village were needed, while men focused on the opportunities that forest offered for generating employment. Comparing women's group in India to women's organisations in forest communities in Sweden Arora-Jonsson (2009) further illustrated how the dominant perception of equality in Sweden masked power imbalances and rendered women's organisation illegitimate. In contrast, the acknowledged differences between men and women in India made gender-related interventions more easily accepted.

A large share of the policy-related research has focused on providing information for developing forest policies that would reflect the citizens' societal values and related changes by investigating citizens' forest-related values, attitudes and concerns and related gender differences (Eriksson et al., 2013; Helseth et al., 2023; Liu et al., 2021; Matthies et al., 2018; Rahman et al., 2017), as well as possible differences between forest owners' and the general publics' nature and forest related attitudes, perceptions and values (e.g., Eriksson, 2018b; Karppinen and Korhonen, 2013).

⁴ The women's networks in Sweden include e.g., Spillkråkan (<https://spillkrakan.se/>) and Grenverket (<https://grenverket.se/>).

These studies have reported gender differences. Women have been found to support ecological, relational and intrinsic values more than men (Eriksson et al., 2013; Helseth et al., 2023; Matthies et al., 2018), and have stronger environmental concerns and ecological forest values, which have led them to appreciate ecological and the social policy principles more compared to men (Eriksson et al., 2013). Different values and beliefs were found to be more important than sociodemographic variables in explaining policy support (Eriksson et al., 2013).

Gender differences have also been reported in relation to ecosystem services (ES) and landscape preferences. Ranacher et al. (2017) found that female respondents perceived ‘consumable ES’ (such as food and pharmaceuticals), as more important than ‘primary ES’ (such as air and water quality, raw materials), and ‘social cohesion related ES’ (such as cultural heritage and spiritual values). Liu et al. (2021) found clear heterogeneity among people’s landscape preferences in Norway, and a link between earlier land uses and cultural issues and preferences. Women had stronger preferences for open landscapes (pasture vs. dense spruce forest) than men. Women have also been found to appreciate urban fringe forests for personal wellbeing and emphasise their preservation and easy access more than men in Sweden (Eriksson et al., 2012). However, Koivula et al. (2020) found that background variables, such as gender, forest ownership and education were insignificant in explaining the differences in Finnish citizens’ perceptions of the attractiveness of pine forest scenery photos which featured various harvesting methods, including unharvested forests and forests managed using continuous cover forestry, seed tree and clear-cut methods.

With climate change the incidence and severity of forest risks, such as storms, insects and fire will increase. Overall, the perceptions of forest risks among forest owners and the general public have been found to be coherent (Eriksson, 2018b), but women were more alarmed of the forest risks than men. Of the different mechanisms for governing forests risks, forest owners appreciated free advice and economic incentives and were less in favour of regulations and advice for a fee. The two latter mechanisms were considered more favourably by the general public. Women trusted the Swedish Forest Agency more than men and were more positive towards information, free advice, economic incentives and regulations as measures to reduce long term damage.

The transition towards bioeconomy involves an increasing use of bioenergy, wood for construction and wood-based products. Several studies have investigated or reported gender differences in views and attitudes towards these trends. Halder et al. (2012, 2014) found that of young students (15–19 years old), girls and urban students were less critical about bioenergy than boys and rural students. However, in a more recent study Ranta et al. (2020) found that respondents’ gender had no effect on university students’ attitudes towards the use of forest-based biomass for energy production, which most of the students considered to be sustainable. Regarding wood construction, men’s views have been reported to be more positive than women’s (Roos et al., 2023). The most negative views were held by women, urban residents and young people. Toppinen et al. (2013) found that the most environmentally and socially conscious consumer group of wood products was profiled as female, relatively older age and owning a summer cottage, whereas younger consumers belonged more often to the less environmentally sensitive group. Veisten and Solberg (2004) studied the potential for eco-labelled wood in the UK and in Norway and concluded that the consumers in the ‘eco-segment’ cluster placed a higher value on environmentalism with highest willingness to pay for certified wooden furniture, but demographically they did not differ significantly from the other segments, except in the UK where they had a greater female majority. Mattila et al. (2018) estimated life cycle impacts of Finnish wood products and found that health and safety and gender inequality were the main social issues at the global level, but mainly occurring in other sectors than the forest sector and outside Finland. Gender inequality was not considered important by local stakeholders, whose views on social sustainability concentrated on local conditions, employment and co-operation between companies.

4. Discussion and conclusions

4.1. Gender issues in the reviewed research

The research question guiding this review was “How have the main issues included in the GES’s objectives been addressed in the forest research in Finland, Norway and Sweden between 2004–2023 and what is the state of knowledge regarding these issues?” To answer this question the reviewed studies were analysed with respect to the GES’s eight main objectives. The results were presented within broad, overlapping themes that relate to the main issues addressed in the GES’s objectives: 1) participation in forest-related activities, entrepreneurship and related objectives, 2) gender roles and stereotypes, 3) leadership, work, labour issues and education, 4) gender-based violence and harassment, and 5) gender in decision making and politics.

The reviewed studies were unevenly distributed among these main themes. The largest group of the reviewed studies focused on topics under the *first theme*, especially on the potential gender differences in non-industrial private forest owners’ forest management behaviour and activity, forest ownership goals and related values and capacities, and forest related entrepreneurship. Most of these studies reported differences between female and male forest owners in relation to forest ownership goals, related values, forest-related activities (Karpinen and Korhonen, 2013; Kuhlman et al., 2023a, 2023b; Nordlund and Westin, 2011; Palander et al., 2009; Umaerus et al., 2019; Westin et al., 2023), management practices (Juutinen et al., 2020; Kuhlman et al., 2023b; Palander et al., 2009; Umaerus et al., 2019; Westin et al., 2023) and forest management activity (Häggqvist et al., 2014; Eriksson, 2018a; Eriksson and Fries, 2020; Kuhlman et al., 2022; Kuuluvainen et al., 2014; Lidestav and Berg Lejon, 2013; Westin et al., 2023). Female forest owners’ ownership goals and related values were found to be more diverse, and they valued ecological, aesthetic, recreational and social aspects more than male owners (Karpinen and Korhonen, 2013; Kuhlman et al., 2023a, 2023b; Nordlund and Westin, 2011; Palander et al., 2009; Umaerus et al., 2019). They were also less active in forest management and harvesting operations (Häggqvist et al., 2014; Eriksson, 2018a; Eriksson and Fries, 2020; Kuhlman et al., 2022; Kuuluvainen et al., 2014; Lidestav and Berg Lejon, 2013; Westin et al., 2023). Similar findings on the differences between female and male forest owners have been reported for e.g., Austria (Pröbstl-Haider et al., 2020), the United States (Butler et al., 2018) and Canada (Coté et al., 2016).

Female forest owners have also been found to be more active in service-oriented forest-based businesses and more interested in the less traditional tourist- and health-related activities than male owners (Umaerus et al., 2013, 2019). Women’s predominance in the service sector and care work is thus also reflected in forest-related business (Umaerus et al., 2019).

In spite of great differences in the socioeconomic, cultural and ecological conditions, there are some similarities between the findings of the reviewed studies and the findings of the global literature on gender and forests, which have shown that the access, opportunities, roles and responsibilities of men and women differ. Despite regional variations in gender roles, women often specialize in collecting non-wood forest products and fuelwood, for subsistence or household use, as well as for sale, while men dominate in the commercial use of higher value forests products, especially timber (Bitzer et al., 2024; Elias et al., 2017; Kimanzu et al., 2021; Ota et al., 2024).

However, contrary to the above cited studies, several of the reviewed studies found no differences between female and male forest owners’ ownership goals (Olofsson and Jakobsson, 2023), attitudes (Kronholm et al., 2020) and management choices (Blennow et al., 2012; Brough et al., 2013; Eggers et al., 2014; Olofsson and Jakobsson, 2023; Vulturius et al., 2018). One explanation for these somewhat contradictory results may be cultural differences among countries or regions within countries (Kuhlman et al., 2022). The studies mentioned above that reported no differences between male and female owners, or that female owners

harvested more than male owners, were conducted in Sweden or Norway. There is also some indication that the behaviours of active and inactive forest owners differ within both female and male forest owners (Sjölje et al., 2019) and the analyses of female and male forest owners' attitudes, objectives and behaviour may hide differences that relate to issues other than gender, such as forest owner's age, place of residence, education and incomes (Juutinen et al., 2020; Kuhlman et al., 2023a; Lähdesmäki and Matilainen, 2021) and/or to the characteristics of the forest property, such as size and type of forest (Hansen et al., 2024). Research in the United States suggest that both female and male forest owners' level of education might affect forest management objectives, and instead of timber harvesting those with higher education might prioritize e.g., conservation, recreation and non-timber products (Mook and Dwivedi, 2022). Vulturius et al. (2018) further showed that also cognitive factors such as trust in climate science and risk assessment can influence forest owners' behaviour.

Another explanation for why female forest owners' values and objectives may not be reflected in management practices can be the dominant power structures and norm pressure from male family members and e.g., extension officers that limit women's participation. The husband or a male relative often makes forest-related decisions even when the forests is owned or co-owned by a woman (Bergstén et al., 2020; Eggers et al., 2014; Hamunen et al., 2020; Karppinen and Berghäll, 2015; Vainio and Paloniemi, 2013). These practices are upheld by the gender-biased socialisation process (Wästerlund, 2018) and gender stereotypes (Bergstén et al., 2020; Danielsson and Eriksson, 2022). Women's more active participation in forestry and related decision making is also undermined by their reported lack of confidence that relates to their lack of knowledge, experiences and capacities – either as a subjective feeling or actual (Bergstén et al., 2020; Eggers et al., 2014).

In congruence with the results from the research across different geographies, the reviewed research focusing on the *second theme*, gender roles and stereotypes, showed that despite some changes, forestry is still regarded as a masculine domain where gender norms and stereotypes have persisted (Ambjörnsson, 2021; Bergstén et al., 2020; Bitzer et al., 2024; Elias et al., 2024; Ota et al., 2024). However, the research has also shown that the differences in gendered practices and roles are closely related to societal changes and changes in the intersectional dimensions of class, urban-rural as well as sexuality (Ambjörnsson, 2021; Brandth and Haugen, 2005). The ongoing societal changes including the increasing number of female forest owners, owners living in urban areas or some distance from the forest property and increasing use of contractors have been anticipated to weaken gendered practices and the role of traditional socialisation process in forestry and forest ownership (Bergstén et al., 2020). This can allow for a wider acceptability of diverse ways of practicing forestry and forest ownership through the increasing heterogeneity and acceptability of differences associated with women and femininity in relation to forest values and management (Bergstén et al., 2020).

The studies focusing on the *third theme*, leadership, work, labour issues and education, demonstrated how the gender roles and the abovementioned stereotypes and prevailing social practices and traditions are clearly reflected in workplaces, in forest organisations and industry (Baublyte et al., 2019; Larasatie et al., 2019; Lidestav and Sjölander, 2007), where women are expected to adjust and behave according to the male standards impeding women from reaching leadership positions (Baublyte et al., 2019).

The research on the efforts to advance gender equality and gender mainstreaming in forest organisations, industry and education was largely limited to Sweden (Andersson et al., 2018; Grubbström and Powell, 2020; Johansson et al., 2017, 2023; Powell and Grubbström, 2023; Ringblom and Johansson, 2020). It showed that gender inequality is intertwined with intersectional issues, such as class, place and age and associated with a particular type of masculinity (Johansson et al., 2017; Ringblom and Johansson, 2020). In large forest companies, actions promoting gender equality were not prioritised, focused on women – not

men and women – and did not address the structures and processes within the organisation that created inequality (Andersson et al., 2018). These results indicate that the important positive social, ecological and economic effects of gender equity that go beyond achieving gender balance for its own sake have not been fully understood. Increasing gender equality and equal opportunities can e.g., have important impacts on organisations' economic (Nakagawa, 2014), financial (Hansen et al., 2016) and environmental performance (Lu and Herremans, 2019). A recent study in Austria concluded that while gender balance is considered important within forestry organisations, it does not realize in practice, and women face both discriminatory structures and practices. The study also showed how gender blindness undermines forest sector's innovativeness and resilience (Ludvig et al., 2024).

Gender-based violence and harassment are widespread across societies affecting both women and men, but women are especially at risk in traditionally male-dominated sectors such as the forest sector (Castañeda Carney et al., 2020; Lo et al., 2024). Yet, research on this *fourth theme* was limited to forest sector organisations in Sweden and Norway. Women's harassment, including sexual harassment and sexualisation of social relations, and discrimination are linked to the dominance of masculine culture in the forest sector (Johansson et al., 2018; Johansson et al., 2019; Sjölje et al., 2023). Further research on the prevalence of gender-based violence and harassment in various areas of forestry is needed. Evidence from e.g., Canada (British Columbia) indicates that gender-based violence is widespread in the tree planting industry (Long et al., 2022). In addition, better understanding of the sexualisation of social relations and its effects is needed for designing policies and measures for reducing gender inequality (Johansson et al., 2018).

There is an important knowledge gap in the research on the *fifth theme*, gender in decision making and politics. Only two of the reviewed studies analysed gender issues in forest policy (Holmgren and Arora-Jonsson, 2015; Ville et al., 2023), both focusing on Sweden. They showed that gender equality is perceived as a technical problem that could be solved by increasing the number of women in the forest sector (Ville et al., 2023). Women's role in political decision making has been downplayed, with them often being viewed as economic actors linked to the needs of the forest industry, such as potential employees and forest owners (Holmgren and Arora-Jonsson, 2015). Policies can have important effects on gender issues and equity and can unintentionally strengthen gender stereotypes and traditional gender roles (Tyagi and Das, 2018). Yet, there is a lack of research on the inclusion of gender issues in forest policies and on gender-related impacts of forest policies and policy changes as well as on how women have participated in forest-related policy processes.

Research on women's networks in Sweden and Norway has shown their potential in empowering women and increasing their visibility in forestry (Andersson and Lidestav, 2016; Brandth et al., 2004). The establishment of the "Ladyforest" facebook group for female forest owners in Finland also exemplifies the need for dedicated forums where women forest owners can network and share information (<https://yle.fi/a/3-12188316>). Further research is also needed on the potential roles of women's networks in facilitating women's participation in forest-related political decision making.

A group of policy-relevant studies has analysed citizens' forest-related values, attitudes and concerns and related gender differences (Eriksson et al., 2013; Helseth et al., 2023; Liu et al., 2021; Matthies et al., 2018; Rahman et al., 2017) as well as views and attitudes towards bioenergy, wood construction and wood-based products (Halder et al., 2012; Halder, 2014; Mattila et al., 2018; Ranta et al., 2020; Roos et al., 2023; Toppinen et al., 2013; Veisten and Solberg, 2004) in order to provide information that could be used for developing forest policies that would reflect citizens' societal values. The divergent values are, however, not necessarily reflected in forest policies. Helseth et al. (2023) argue that institutional arrangements that shape forest values emphasise utility, efficiency and instrumental values of forests (especially timber)

and empower actors (mainly male and forest owners) whose values align with these. “The opportunity to express relational values associated with ecosystem services such as spirituality, inspiration, and aesthetics, are mostly restrained, and actors holding such values are largely disempowered.” (Helseth et al., 2023, p. 9).

4.2. Implications for gender equity and future research needs

Based on the above review and discussion this section provides some observations about what the results imply about the understanding of and prioritisation of gender issues within the forest sector and related theoretical underpinnings. It concludes with the main research needs for advancing gender equality.

A clear overarching feature of the reviewed studies is the use of women/men and female/male as descriptive categories and focusing on the differences between them and their values, objectives and behaviours. Reflecting ecofeminist ideas that postulate women having closer connections with nature and being more environmentally concerned than men, many of the reviewed studies found women, and especially female forest owners, to value ecological, aesthetic, recreational and social aspects of forest more than male forest owners (Karppinen and Korhonen, 2013; Kuhlman et al., 2023a, 2023b; Nordlund and Westin, 2011; Palander et al., 2009; Umaerus et al., 2019) and to be less active in commercial forest management (Eriksson, 2018a; Eriksson and Fries, 2020; Håggqvist et al., 2014; Kuhlman et al., 2022; Kuuluvainen et al., 2014; Lidestav and Berg Lejon, 2013; Westin et al., 2023). Although this research has mostly ignored the critical ecofeminist premise about how the patriarchal society dominates women and nature (as an exception see Umaerus et al., 2019), notions of the male domination have been included through the analyses of gendered expectations and norms, gender roles and stereotypes (e.g., Ambjörnsson, 2021; Bergstén et al., 2020; Danielsson and Eriksson, 2022).

Gender research has clearly demonstrated the importance of demographic and contextual issues in shaping human-environment behaviour (Arora-Jonsson, 2014; Hansen et al., 2024). The research emphasis on gender differences, between the dualistic categories of women/men and feminine/masculine, can be criticized for risking to reproduce and emphasise gender roles and stereotypes and failing to recognise the underlying norms, expectations and structural inequalities (Arora-Jonsson, 2014). There is a need for sex-disaggregated data, but it is not sufficient. It should be accompanied with context specific gender analysis that includes socio-cultural aspects (Lau et al., 2021).

Gender has also been used as a descriptor, ignoring that it is only one of many constituents of human identity. While several of the reviewed studies have included contextual dimensions such as place (urban/rural) and age into the analysis more systematic inclusion of contextual issues related to e.g., place, age, class, education and income are needed for analysing the interlinkages between and influences of societal changes and gender issues in forestry (Ambjörnsson, 2021; Brandth and Haugen, 2005; Gustavsson and Farstad, 2022; Pröbstl-Haider et al., 2020). This is closely linked to the increasing recognition of the need to incorporate an intersectional approach to forest-related research for drawing attention to the interdependencies and interconnections between social categories and how gender interacts with them leading to different experiences of inequality (Ambjörnsson, 2021; Elias et al., 2024; Kaijser and Kronsell, 2013; Ringblom and Johansson, 2020; Sanz-Hernández et al., 2022). Inequalities and power relations are intrinsically related. Kaijser and Kronsell (2013), p. 417 argue that an intersectional approach “can illustrate how power structures and categorisations may be reinforced, but also challenged and renegotiated” and that “an intersectional framework must go beyond naming categories to an analysis of how they are related to broader power relations, to politics and institutional practices and to norms and symbolic representations.” (p. 423). The reviewed research did not acknowledge the importance of gendered power relations and the politics of gender, which cut across social relations from the household to societal scale (cf., Colfer et al., 2018).

The weaknesses and gaps in the reviewed research reflect some of the critics directed to gender mainstreaming, mainly the depoliticization of gender issues, ignoring the power imbalances and inequalities, focusing on technical solutions, not questioning the existing policy priorities and structural problems, and not articulating the transformations needed to address gender inequalities. The lack of conceptual clarity is often illustrated by equating gender with binary categories of women/men or female/male instead of employing intersectional approaches (cf., Caywood and Darmstadt, 2024).

One of the reasons for the dominance of the research on gender differences in forest management and use and related activity has been the concern about a reduction in forest harvesting and availability of wood for forest industries. Hence, a better understanding of the motivations related to forest use and harvesting among the growing number of female forest owners can inform the design of policies and policy instruments aimed at maintaining a wood supply for industrial use (cf., Coté et al., 2016), which has largely been the main objective of Nordic countries’ forest and bioeconomy policies (Fridén et al., 2024; Harrinkari et al., 2016; Lindahl et al., 2017).

The bioeconomy discourse is currently driving societal changes. It is advocated to change bio-based sectors, including forestry, towards more sustainable and competitive production and generate environmental and social benefits (EC, 2018). Lidestav et al. (2019) argue that if the turn to bioeconomy includes a proper recognition of gender and power issues, it could also challenge the gendered forestry practices and male dominated forest sector and support the development of a more diverse forest sector.

Overall, the literature review uncovered serious gaps in the knowledge on issues that are at the political strategy level considered important for advancing gender equality. There are also important differences among the issues studied in the tree countries, in terms of the number of studies and topics addressed. The largest number of studies was conducted in or focused on Sweden. An important knowledge gap is the lack of information about the gender impacts of forest-related policies, especially in Finland and Norway. It is possible that national level studies, policy and policy impact analyses exist but were left out from this review because they had not been published in scientific journals in English. However, a better understanding of gendered norms, culture and institutional stickiness that upholds gendered institutions and processes is needed. The politics of gender, i.e., gendered power relations, is a fundamental issue in advancing gender equality but it is not addressed in the reviewed research. The findings from the reviewed studies also emphasise the importance of moving beyond the female/male dichotomy and employing an intersectional approach.

The reviewed research has concentrated on women (cf., Ota et al., 2024; Roos et al., 2021), yet gender issues and equality concern both women and men. Further research is needed to better understand changes in masculinities, as well as in the roles and expectations for men within the context of societal changes. Men are increasingly expected to take an active role e.g., in childcare and domestic tasks. How this challenges the dominant masculine norms and roles, and the performance of both masculinities and femininities, and how it is reflected in forest ownership, work and related decision making, are important questions in this context.

Further analyses on the implementation and impacts of gender equality policies and gender mainstreaming in forest organisations, companies and in education in different national contexts is needed for assessing their effectiveness and for devising more effective measures. This would require paying attention both to the process of gender mainstreaming, i.e., the mechanisms or tools employed, and their impacts (Hafner-Burton and Pollack, 2009). Furthermore, research on the role of education, media and social media in shifting the male-dominated forest culture could provide insights for designing campaigns that promote gender equality (cf., Ross and Padovani, 2017). Another knowledge gap relates to gender pay gap, pension gap and gender care gap; these issues were not addressed at all in the reviewed

research.

CRedit authorship contribution statement

Pia Katila: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Kristina Svells:** Methodology, Conceptualization. **Domna Tzemi:** Writing – review & editing, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Codes used for analysing the articles

Codes	Related GES objectives
1. Research method	
a. Qualitative	
b. Quantitative	
c. Mixed	
2. Gender	
a. Main focus	
b. Structural variable	<i>Achieving gender balance in decision making and in politics</i>
3. Decision making and politics	
a. Laws, policies	
b. Networks, institutions	
c. Values (citizen's)	<i>Achieving equal participation across different sectors</i>
4. Participation	
a. Ownership	
b. Forest use	
c. Entrepreneurship and business	
d. Ownership objectives and values	
5. Leadership, work, labour issues and education	<i>Closing gender gaps in the labour market, addressing the gender pay and pension gaps, closing the gender care gap, achieving gender balance in leadership positions</i>
6. Violence and harassment	<i>Ending gender-based violence</i>
7. Gender roles and stereotypes	<i>Challenging gender stereotypes</i>

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