



Revisiting the gendered division of labour in Swedish forestry: What has changed the last decade?

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ABSTRACT

The Swedish labour market is relatively gender segregated and the forest sector is no exception, with a dominance of men among forest owners, users and employees. Gender segregation affects working conditions and constitutes a significant obstacle to gender equality. Within the forest sector, awareness and efforts linked to gender equality have increased over the last decade through e.g., the sector's national gender-equality strategy launched in 2011 and a sector-specific #metoo appeal in 2017. In relation to the strategy, men and women with higher-education degrees in forestry were surveyed about their conditions and experiences in the forest labour market. The survey showed, among other things, clear patterns of gender segregation. A decade after, this study revisits the survey, with 860 responses and a response rate of 53 %, to investigate whether and how conditions, experiences and gender segregation have changed. The result shows a small decline in the overall gender segregation, but a persistence with respect to employer, work area and professional function. This affects and shapes men's and women's experience of, and conditions for, their work, which contribute to, for example, that women have been exposed to discrimination and harassment and left the sector to a greater extent than men.

1. Introduction

The Swedish labour market, from an international perspective, is relatively gender segregated, with different sectors and occupations dominated by women and men (Ellingsæter, 2013; JM, 2023; Bettio et al., 2009). The Swedish forest sector constitute an example of the later. In general, gender segregation affects working conditions for both men and women in all sectors (Reskin, 1993; England, 2005; SweGov, 2004a), reinforces the gender wage gap (e.g. Card et al., 2016; Blau and Kahn, 2017), and limits opportunities to prevent and counteract gender discrimination and sexual harassment (Acker, 1990; Cohen and Huffman, 2003). Therefore, occupational gender segregation constitutes a significant obstacle to gender equality as it reinforces different conditions for, and expectations of, men and women (SweGov, 2004a). These divisions take many different forms. Men and women may have unequal distributions in positions of power (vertical segregation), among fields, occupations and employers (horizontal segregation) and have chosen or been assigned different specialisations within a workplace or organization (internal segregation) (Abrahamsson, 2009; Blackburn et al., 2002; Acker, 1990). These dimensions can also be conceptualized in terms of functional and physical segregation of women and men in work tasks

and workplaces (Baude, 1992). In line with Blackburn et al. (2002) we conceptualize occupational gender segregation “through the examination of social reproduction and changing gender relations” (p. 531), meaning that gender segregation in employment is the result of complex, ongoing societal changes. To understand why men and women are still concentrated in different jobs and at different levels, gendered constructions must be considered as (re)shaped overtime through factors like education, technology, family life, and cultural attitudes.

Although overall gender segregation has declined in recent decades, the persistence of men's reluctance to enter women-dominated fields reinforces existing inequalities and limits the potential for true gender balance, this is mainly due to more women entering occupations previously dominated by men (Mandel, 2012; England, 2010), especially those with higher wages (England, 2010; Cotter et al., 2004). However, men are more reluctant to enter women-dominated occupations or professional areas due to their lower wages, social status and potential stigma (Levanon et al., 2009; England, 2010; Lupton, 2000). This suggests that hiring discrimination is not currently the primary cause of occupational gender segregation (Carlsson, 2011). Studies also show that organizations with a high gender imbalance continue to hire employees of their dominant gender (Bygren and Kumlin, 2005).

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Environments where most employees are men risk being a breeding ground for discrimination, harassment, and failure to use women's skills and potential, which affects both individuals and organizations (Lidestav et al., 2011; Johansson et al., 2018; Johansson et al., 2019; Folke and Rickne, 2022).

In Sweden, men dominate among forest owners, users and employees, shaping the culture, power structures and future of the industry, patterns that are recurring also internationally (cf. Ludvig et al., 2024; Katila et al., 2025). This gender imbalance raises critical questions about who holds decision-making authority and how inclusive the sector can become. But strong segregation can also contribute to different expectations and standards for men and women (Johansson et al., 2020), as well as uphold historical dualism between environment/femininity and production/masculinity, which could restrict change and adaptations (Bergstén et al., 2020; Cichecki et al., 2025). The forest sector directly employs more than 28,000 people. Just over 89 % of these are men, so barely one in ten are women (SFA, 2022b). Around half the area of Swedish forest is owned by about 311,000 private forest owners who are nearly two-fifths women (38 %) and three-fifths (60 %) men. In addition to the proportion of owners, there are also persistent gender differences in, for example, the number of owners per property and the sizes of properties (SFA, 2022a). Different actors describe these differences as challenges and obstacles. For instance, they may limit organizations' competitiveness by relying on an overly-narrow recruitment base and stifling business development and innovation (Lindberg et al., 2016; SweGov, 2011). Other actors highlight democratic aspects; strongly single-sex environments mean unequal access to resources and lack of representation (SweGov, 2004b; SOU, 2014).

Swedish employers are obliged to systematically assess the risks of discrimination, a responsibility that is particularly crucial in the forest sector due to its significant gender imbalance and the associated risks of exclusion, harassment, and unequal career opportunities and harassment and to actively promote gender equality. However, efficiently doing so requires knowledge and understanding of the specific conditions for, and the outcomes of, equality work. Within the forest sector, awareness and efforts linked to gender equality have increased through, among other things, the sector's national gender-equality strategy (SweGov, 2011) which was launched in April 2011. Further, a sector-specific #metoo appeal called #slutavverkat (clear-felled) brought attention to the vulnerability of women in this sector at the end of 2017 and beginning of 2018 (Johansson et al., 2018; Grubbström and Powell, 2020). Vulnerability in working life can take many forms and occur in different situations and relationships. One type of vulnerability is discrimination, a legal term for negative differential treatment or a disadvantage to someone based on gender, gender identity or expression, ethnicity, religion or other belief, disability, sexual orientation or age. Another type is harassment, which is a broader concept that is defined in legislation as an attack on a person's integrity. In the context of working life, when this can be linked to one of the grounds for discrimination, it can also be regarded as a type of discrimination. Harassment of a sexual nature can also be referred to as sexual harassment and/or sexual assault.

Connected to the previously mentioned industry-wide national strategy for increased gender equality called "Competitiveness requires gender equality – Gender equality strategy for the forestry sector" (SweGov, 2011), men and women with higher-education degrees in forestry were surveyed about their conditions and experiences in the forest labour market (Lidestav et al., 2011). The survey showed, among other things, clear patterns of gender segregation and that women are more likely to choose to leave the sector. Since this study, research on gender, gender-equality efforts and Swedish forestry has grown (e.g. Andersson et al., 2018; Johansson et al., 2022; Johansson et al., 2023; Johansson, 2020). However, most of this research has targeted a few specific organizations or used qualitative studies, with a few exceptions (e.g. Eriksson, 2018; Johansson et al., 2019). A more comprehensive sectoral-level understanding of forest working life and the effects of the

sector's gender-equality initiatives is largely missing.

This study revisits the conditions of forestry-educated men and women in the Swedish forest labour market (cf. Lidestav et al., 2011) to investigate whether and how conditions, experiences and gender segregation have changed in the ten years since the launch of the national gender-equality strategy. The overarching objective is to improve the knowledge and understanding of the gender structural conditions, and to achieve this we analyse survey data from 2021 and compare this with the 2011 survey to determine potential changes during this period. This paper thereby contributes to unpack gendered prerequisites for sectoral-level change and improvement of gender equality and related measures, as called for by for example Katila et al. (2025).

2. Background

Forest professionals with a higher forest degree, often with the professional title of *Jägmästare* or *Skogsmästare*, has a historical long tradition and central role in the management of Swedish forests and in various parts and functions of the Swedish forest sector. Together with manual forest workers (Olofsson, 2024) and machine operators, these groups constitute the primary professional background in the more directly forestry-oriented working areas and functions. With the increased specialisation of different professional areas the last decades, their strong dominant position has decreased a bit within forestry organization – or more concentrated on forest planning and management. With their educational background, they often have an expert and a forestry leadership function, often in the role as timber purchaser and/or forest advisor (Curtis et al., 2023; Andersson et al., 2020). Almost nine out of ten these timber purchasers are men (NYKS, 2023), which highlight the dominance of men among forest professionals and its gendered conditions and meanings (Lidestav and Sjölander, 2007).

This knowledge, awareness and previous inquiries (e.g. SweGov, 2004b), provided the basis for a background report titled "Gender equal working life in the forest sector - Basis for Action" (Lidestav et al., 2011) for the national strategy launched the same year (SweGov, 2011). A survey, based on a previous study from 1998, "Working conditions for women and men forestry graduates" (Lidestav and Wästerlund, 1999), constitute the main empirical basis for the report and identified a clear gender-based segregation of the forest labour market (Lidestav et al., 2011). The survey that was designed to gather data on the career experiences of individuals with higher forestry education. It included all women with higher forestry degree and a comparative group of men matched by education, age, and graduation year. In total, 1236 questionnaires were sent out, with a response rate of 57 % (706 responses, 393 women and 313 men) and included questions about education, career paths, working conditions, experiences of gender-based discrimination, and suggestions for improving gender equality in the sector.

The study showed gender-based segregation within the Swedish forest sector, reflected in recruitment patterns, educational pathways, career trajectories, work roles, and workplace experiences (Lidestav et al., 2011). Within education, women were more likely to choose areas associated with environmental work, while men dominated technical and production-related fields, leading to a division that carried over into the workforce. While most women and men reported good experiences in forestry education, women disproportionately stated that they would not choose forestry education again if they could redo their choice. A significantly higher proportion of women also left the sector: 24 % of women with forestry education left the sector compared to 17 % of men. Women who remained in the sector often experienced sustained dissatisfaction or career stagnation, and their reasons for leaving frequently included poor career development opportunities, inflexible work structures, and exclusion from decision-making processes.

The survey found vertical gender segregation where leadership positions remained largely occupied by men, particularly at higher levels, which limited women's influence on decision-making (Lidestav et al.,

2011). Women were underrepresented in executive and senior managerial roles, while men were more likely to hold decision-making positions. Although the study observed some increase in the number of women employed in the sector compared to previous decades, their advancement opportunities remained limited. Women were more likely to work in specialist or advisory roles, with less influence over organizational strategy and policy. Even among those who advanced, women frequently reported feeling excluded from informal networks essential for career progression.

Horizontal gender segregation was another clear pattern; men and women generally worked with different tasks and different employers (Lidestav et al., 2011). Women were overrepresented in administrative, educational, and advisory functions, while men dominated technical and operational roles such as timber harvesting and machine operation. Women were also more likely to work in areas related to environmental sustainability or nature conservation, fields viewed as “soft” or “supportive,” whereas men occupied positions in core production areas that were often higher-paying and more prestigious. This division was also reflected in entrepreneurial forestry, where only 4 % of workers were women, primarily engaged in forest care rather than the more lucrative harvesting sector.

Both women and men reported occurrence of sexually inappropriate jokes or behaviours in the workplace, such as sexist jokes, pornographic imagery, and unwanted sexual attention as common aspects. This behaviour was often normalized within the sector’s masculine culture, making it difficult for victims to report incidents without fear of reprisal or being labelled as overly sensitive. Twenty-seven percent of women and 12 % of men said they had experienced gender-related discrimination. The men reported discrimination in connection with promotions and salary setting. Women also noted salary-setting discrimination, in addition to feelings of exclusion, experiences of having been made invisible and sexual harassment. Furthermore, women faced greater challenges balancing work and family life due to expectations of long, irregular hours and constant availability, while workplaces rarely accommodated the needs of working parents (Lidestav et al., 2011).

The report concluded that these patterns of vertical and horizontal segregation were deeply rooted in the traditional masculine culture of the forestry sector, reinforcing gender inequalities in career advancement, job responsibilities, and economic rewards. On this basis, increasing gender equality was identified as a key factor to make the sector a more profitable, sustainable and attractive employer for a broader recruitment base (SweGov, 2011). The strategy focused on three main areas; education, working life and private forest ownership, which were linked to specific actions and measures developed for implementation by key actors in the sector (Andersson et al., 2018). For each focal area, several indicators were formulated to estimate the effectiveness of the strategy. A follow-up evaluation of the strategy in 2018 showed that of the 16 indicators assessing the proportion of men and women in different areas, 12 had improved to some degree since 2011 (Wide and Högvall Nordin, 2019).

3. Materials and methods

To analyse the forestry labour market from a gender perspective, a survey was used to assess the condition and position of men and women with a higher forestry degree. To enable comparison over time, the study and survey design was based on a prior survey from 2011; “Gender equal working life in the forest sector - Basis for measures” (Lidestav et al., 2011), which in turn was based on a survey from 1998, “Working conditions for women and men forestry graduates” (Lidestav and Wästerlund, 1999). The focus and timeframe of the comparison relates to a decade of increased awareness and efforts to improve gender equality. In total, 1618 men and women with a higher forestry degree was invited to participate in the study base one a selection criteria of all women receiving a forestry higher education degree in Sweden until between 1969 and 2021 and a similar-sized subset of men with similar

education, age and graduation years. 1969 was the year that the first women received the degree in Sweden, which means that it’s a total sample of women. The degrees that are covered are bachelor of forest management, master of forest science, forest engineering, forest technician, and university engineer in forestry and wood technology. The last three of these degrees are now bachelor programs. Personal data on all graduates from forestry degree programs were obtained from the Swedish University of Agricultural Science (SLU), Linnaeus University and Dalarna University. Due to the increasing share of women in forest education the last decades, the subgroup of men has a lower average age compared to all forestry-educated men. Beyond minor adjustments to questions and wording, an expanded section addressed sexual harassment and discrimination more comprehensively than the prior survey. An additional section more extensively examines the experience of the last ten years’ gender equality efforts within the sector. Overall, the survey comprises of 38 groups of questions and additional sub questions. Beside some initial biographical questions, the first set of questions focus on their experience of their forest education. Followed by their present situation as employed, within of outside of the forestry sector, self-employed, student or jobseeker. The main focus is on inquiring about the employment conditions, including employer, work area, function, career and working time etc., but also the experiences and perceptions of the participants that have left the forestry sector and their potential motives for doing this. The majority of the questions where multi choice (e.g. present and prior work area/function, form/context of harassments etc), while Likert questions were used to inquire their perception of their education, their work, their work tasks, workload, coworkers and level of influence (five-point scale). On a four-point scale (unequal, partially unequal, partially equal and equal), the participants perception of gender equality with regards to salary, influence, competence is valued equally, career opportunities, norms and culture, and networking. Free text questions were also used to complement some of the other questions.

An invitation to participate was mailed to the participants at the end of October 2021, which included a link and QR code to the survey. A reminder was sent out by the end of November. When the survey closed at the end of 2021, 860 completed survey responses had been received, a 53 % response rate. The selection was made on the basis of legal sex, but the survey responses were analysed based on self-identified gender. Of the respondents, 454 were women, 404 men and two non-binary (Table 1). Given the few responses of non-binary people, they have been excluded from the analyses to ensure their anonymity.

The forestry degrees included in the survey are grouped into three categories to facilitate the analysis. In the “Master’s SLU” category, the main degree is master of forest science (Jägmästare), but also includes other types of forestry master’s degrees. The “Bachelor’s SLU” category mainly includes bachelor of forest management (Skogsmästare), but also other bachelor’s degrees for which SLU is or has been responsible. The category “Forestry and wood technology” includes all forestry degrees from Linnaeus University and Dalarna University. As of mid-2021, almost 900 women had a forestry degree from any of these categories. Over time, the share of women in forestry higher education has increased and in recent years the proportion has reached 40 % in the two main forestry master’s and bachelor’s programs, which falls within the

Table 1

Number of responses and response rate, divided by gender and education category. SLU is the Swedish-language abbreviation for the Swedish University of Agricultural Sciences.

Education category	Number of responses (response rate)		
	Women	Men	Non-binary
Forestry and wood technology	38 (38 %)	45 (46 %)	1
Bachelor’s SLU	72 (42 %)	116 (68 %)	
Master’s SLU	344 (64 %)	244 (45 %)	1
Total	454 (56 %)	404 (50 %)	2

gender balance target. However, this development is too recent to have had a big influence on the overall labour market.

Analyses of statistical differences among groups of respondents were performed using R version 4.3.2 (R Core Team, 2023). As most variables were responses to yes/no questions, most analyses were χ^2 tests to look for deviations from random distributions among groups. In the case of three-way comparisons (e.g. changes in the proportion of women and men employed by owners' associations between 2011 and 2021), we used Cochran–Mantel–Haenszel tests, which are a higher-dimensional generalization of a χ^2 test. In a few cases *t*-tests were used to analyse continuous outcome variables (e.g. years to achieving a middle-management position). These were typically unpaired two-sample *t*-tests, although one-sample *t*-tests were used to compare 2021 distributions to average outcomes in 2011 for reasons explained in the next paragraph. Binomial tests were used to compare rates of reporting a particular outcome to the sample-wide rate. The significance threshold was set at $p < 0.05$ and is indicated by * in the text. The precise values of the analysed variables presented in the text is listed in an appendix.

Because the raw data from the 2011 survey has been lost, certain steps were necessary to statistically compare these results with 2021 outcomes. For categorical variables, the proportion of responses in each category is known to the nearest percentage point from the tables at the end of the 2011 report (Lidestav et al., 2011). The 2011 raw data was reconstructed by multiplying the percentages by the numbers of respondents in that survey (393 women and 313 men). This results in a value that deviates from the original data by at most 0.5 % due to rounding errors. This reconstruction was used for tests comparing yes/no responses between 2011 and 2021. In a few cases of continuous variables (e.g. years to achieving a middle-management position), the available information is insufficient to reconstruct the original data distribution. In that situation, we used one-sample *t*-tests for comparisons, with the null hypothesis that the mean of the 2021 distribution of the variable being tested was the same as the mean value from 2011.

4. Results

In this section, the results are divided into the following themes: (1) affiliation to the sector, (2) structures of forestry working life, (3) work conditions and work satisfaction, (4) vulnerability in working life and (5) comparison with 2011.

4.1. Affiliation to the sector

A large majority of those who have completed a forestry degree also work in the forestry sector – either as an employee or in self-employment. A slightly higher proportion of women (25 % or 114) than men (20 % or 80) has left the sector¹. A majority of these work in other sectors, such as IT, infrastructure, energy and municipal government, while just over 15 % have retired. Among respondents younger than 34, 21 % of women and 15 % of men had left the sector². Of those not working in the sector, a similar proportion of men (19 %) and women (16 %) have never worked in the sector³, or have left within 4 years of completing their education (26 % of men vs. 23 % of women)⁴. A similar proportion of women (54 %) and men (50 %) have worked at least 5 years before leaving⁵. Women also indicated more than men (24 % compared to 18 %) that they would make a different educational choice today⁶. Of the 114 women and 80 men who have left the sector, significantly more men (64 %) report having only or mostly positive experiences of the sector, compared to only 41 % of women^{7*}. Of the reasons behind the decision to leave the sector, most people cite “other reasons” regardless of gender, followed by wanting to try something new. Women cite family reasons⁸, an uncomfortable workplace^{9*}, and difficulties in reconciling their views with prevailing forest-sector views^{10*} to a greater extent than men. However, men to a significantly greater extent cite poor pay^{11*} as a reason for leaving. The largest group in the “other reasons” category consists of factors that are not

linked to the forest sector, such as relocation or family relationships.

4.2. Structure of forest working life

The largest employer category among both men and women is forestry companies, with employees of both sexes represented similarly relative to their numbers in the sector (Fig. 1). This was followed by forest owners' associations, where men are relatively more likely to work¹². Women of all surveyed educational levels work, to a greater extent than equivalent men, at the Swedish Forest Agency^{13*}. Men are more often self-employed than women¹⁴ (Fig. 1).

Geographically, there are some small differences among employer categories. Within the three largest employer categories, these can primarily be understood as differences in the organizations' areas of operation and market share between different parts of the country. In forest owners' associations, men's representation is marginally greater in southern than northern Sweden and vice-versa for women¹⁵.

The most common work area for women is education and advisory (28 %), while the equivalent for men is sales and purchasing (31 %; Fig. 2). Other common work areas for women were environmental protection (23 %), planning (21 %) and product/business development (22 %), while planning (27 %), education/advisory (26 %), harvesting (24 %) and management of forests (24 %) were the next most common among the men. Within the men-dominated work areas, there are also certain geographical differences. Different gender patterns in men-skewed work areas are greater in the southern parts of the country (sales and purchasing^{16*} and logging¹⁷) compared to the north, while the differences within the two work areas most preferred by women show no geographic pattern (education and advisory¹⁸ and environmental protection^{19*}).

Almost every fourth man and woman work as a specialist/expert, making it the most common occupational function among Swedish forestry graduates. The gender distribution among different professional functions is largely similar, with the exception of business management and “other functions” (Fig. 3). Men are over-represented in business management positions relative to their numbers in the industry²⁰. Regarding employer category, there are few strong differences. However, women who work in forest companies are more often middle-level managers compared to the men in the same employer category (15 % compared to 12 %)²¹.

Across all professional functions, time to achieve their current position is very similar between men and women²². Women achieve middle management positions in slightly, but non-significantly fewer, years than men²³.

4.3. Working conditions and work satisfaction

Permanent employment is the norm for both women and men. The majority of forestry graduates work full-time and men's working weeks are on average slightly longer (40.6 h/wk) than women's (39.2 h/wk)^{24*}, and women are a bit more likely to work part time²⁵, mainly for family-related reasons. Men who work part time are significantly much more likely to own their own business or company^{26*}. Men who work more than 40 h/week tend to work in felling^{27*}, management^{28*}, and to a non-significant degree purchasing and sales²⁹, and planning³⁰. Women exceeding 40 h/week work to a greater extent in environmental protection³¹ as well as education and advice³². Also, women working in logistics (11 women out of 22 total^{33*}) and wood processing (5 women out of 9 total^{34*}) are significantly more likely to work more than 40 h/week compared to the overall rate of women exceeding this threshold (24.1 %). Men's and women's work-week length difference persists when only those who work more than 35 h/week are analysed. Such women average 41.6 h/wk. and men 42.4 h/wk^{35*}.

Workload is a factor that influences work satisfaction within the sector. More than a tenth felt bad or very bad about their workload, while only about a tenth felt very good about it. Men and women enjoy

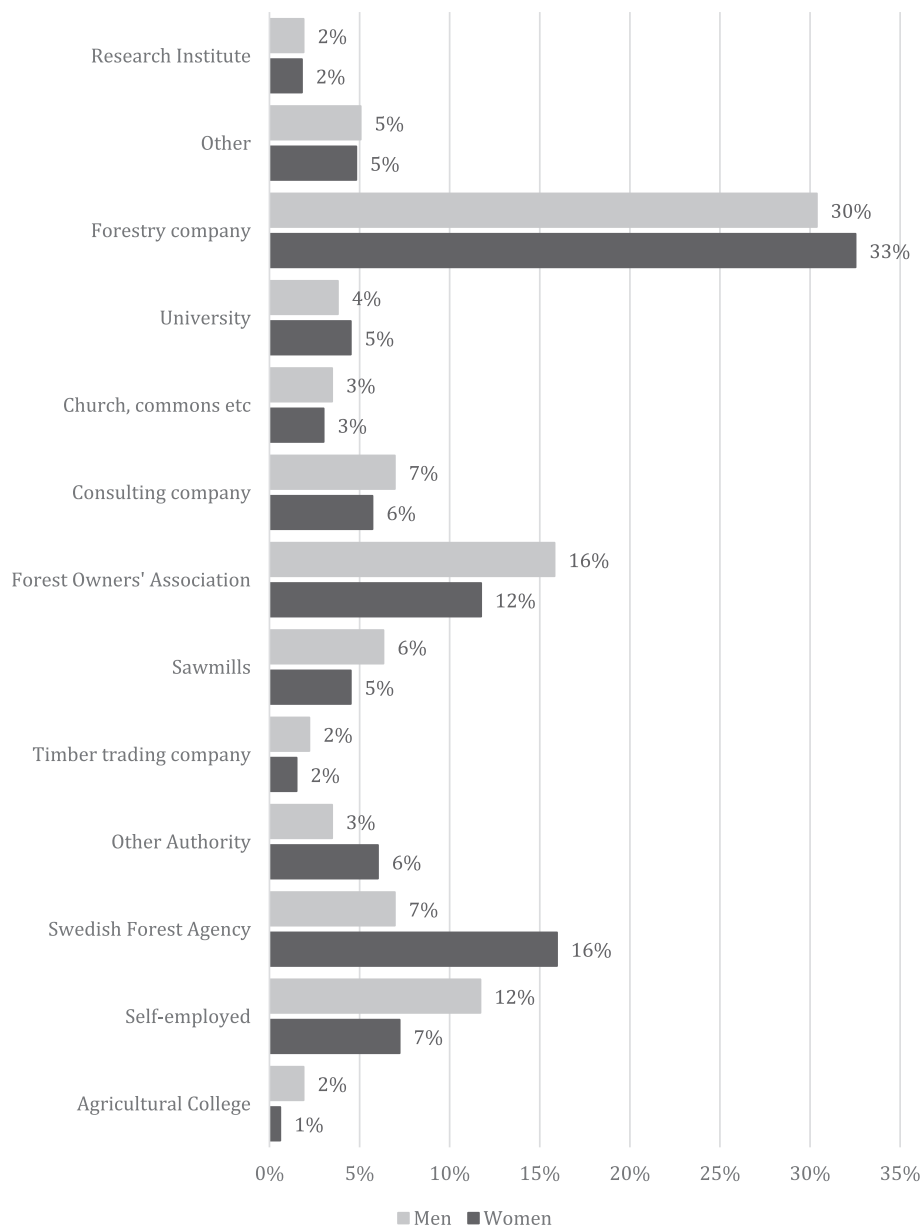


Fig. 1. Forest sector workers, divided by employer category and gender, and sorted from least to most gender segregated.

both their co-workers and work tasks. About 80 % of them felt that these aspects of work were good or very good. Women were significantly more positive, where about half felt that their relationship with co-workers was very good, while only a third of the men felt this way^{36*}.

4.4. Vulnerability in working life

4.4.1. Discrimination based on gender

Of the 841 respondents to the question, 23 % reported gender discrimination at some point in their work. Of women, 161 (36 %) reported having at some point felt negatively treated differently or discriminated against because of their gender in their work, a significantly higher rate than for men (29 cases, or 7 % of responses)^{37*}. When excluding those who have left the sector, this pattern remains virtually unchanged; 33 % of women and 8 % of men report experiencing gender discrimination^{38*}.

Four of the 17 work areas covered by the survey, relative to the proportions of respondents (51.1 % women). Two were disproportionately occupied by women: enforcement and monitoring^{39*} and

environmental protection^{40*}. The other two were disproportionately dominated by men: harvesting^{41*} and sales and purchasing^{42*}. Both women and men in the work areas dominated by men (harvesting and sales and purchasing) are more likely to experience discrimination compared to work areas dominated by women (enforcement and monitoring and environmental protection), although in neither case by a significant margin⁴³ (Fig. 4).

Among women, lower-level managers were the position most likely to report discrimination, with 60 % of such women report experiencing gender discrimination at some point, a rate significantly higher than women's overall rate of reporting discrimination^{44*}. This rate is also significantly higher than for men working as middle managers^{45*} (Fig. 5). For men, the middle-level manager category has the largest proportion reporting discrimination, at 21 %, significantly higher than the study-wide average of 7 %^{46*}; even in this category, women report a higher rate (38 %), although to a statistically-weak degree⁴⁷. Discrimination on the basis of gender appears relatively evenly distributed across age categories. Women over 64 stand out due to their significantly higher than average rate of reporting discrimination (80 %)^{48*}, despite

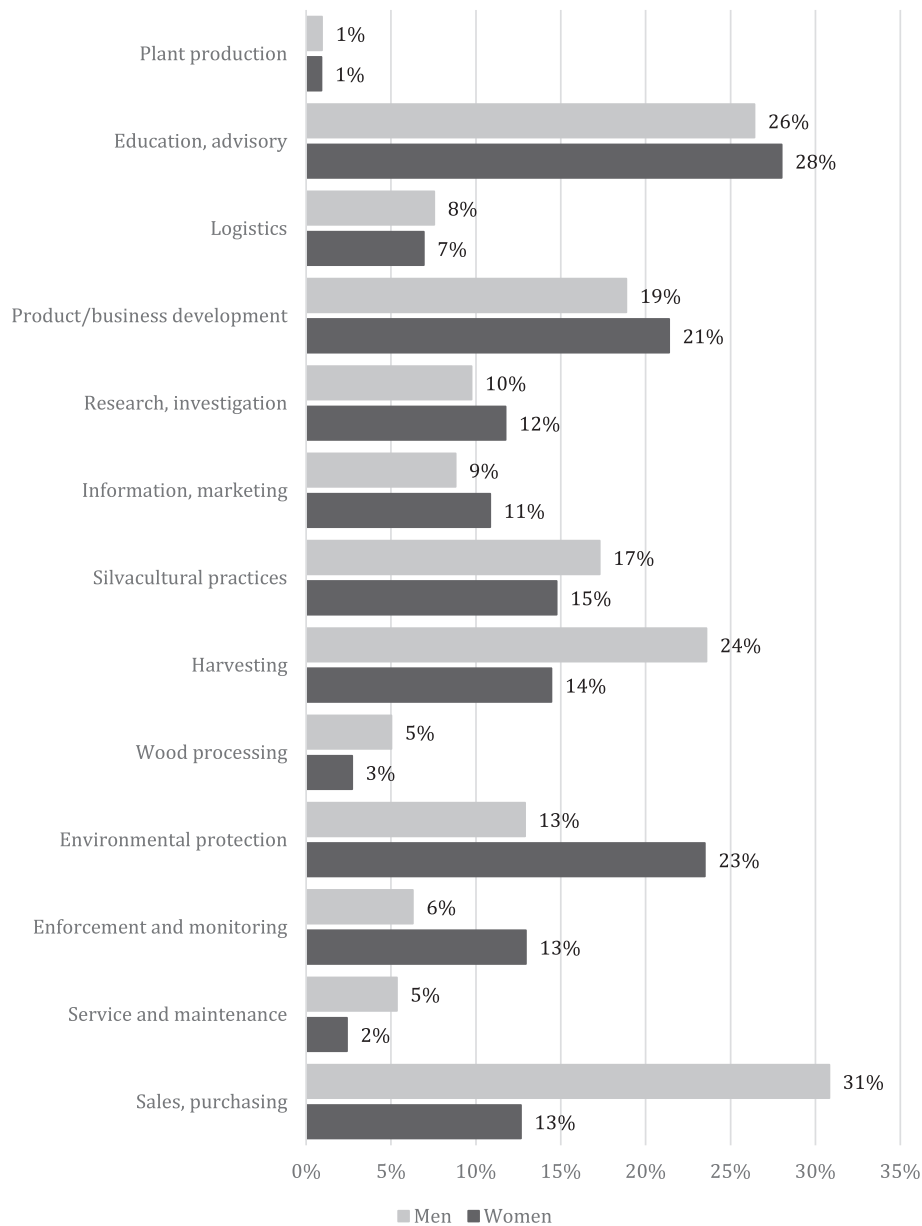


Fig. 2. The relative representation of men and women with forestry degrees by current work areas; the percentages for each sex sum to >100 % because individual respondents could indicate more than one work area. The areas are sorted from least to most gender segregated.

only 10 women in this age class answering the survey.

4.4.2. Harassment

Among all survey respondents (not just those currently employed in the forest sector), more reported harassment than discrimination - a total of 179 women and 32 men (40 % and 8 %, respectively). These harassment rates are significantly higher than discrimination rates for women^{49*}, but not for men⁵⁰. In relation to occupational function, 52 % of women employed as lower-level managers state that they have been harassed (Fig. 6). Among both women and men, lower- and middle-level managers are the occupational functions where the percentage reporting harassment is higher than average. The professional function where harassment is least common is business management.

Harassment was reported to varying extents within all employer categories in the survey. There is no clear pattern of harassment being more common in work areas relatively dominated by women and men, either among women⁵¹ or men⁵². Only 6 % of the 32 men who reported harassment state that it was related to gender, gender identity or

expression, while a significantly higher proportion of the 179 women reporting harassment (84 %) said it was gender related^{53*}. About one in three harassed women (35 %) state their age as a basis, while the corresponding proportion among men is lower at 16 %⁵⁴. No one reported that religion or belief was the reason for harassment. Nearly half of the women (49 %) who experienced harassment stated that it was of a sexual nature, while 42 % of women said that it was not. The rate for men was significantly lower, at only 3 %^{55*}.

Women and men experienced different types of harassment to different extents. The majority of the men who reported harassment stated they had experienced psychological abuse, for instance by being made invisible or ostracized, which corresponds to 5 % of the 405 men who answered the survey. 3 % indicate that they have been subjected to verbal abuse such as profanity, unwelcome suggestions, or comments, while only one reported physical abuse such as groping or other unwelcome physical contact. About 24 % of the 457 women in the survey reported experiencing verbal abuse. Just over one in five women (21 %) reported psychological abuse, while just over one in ten (12 %) reported

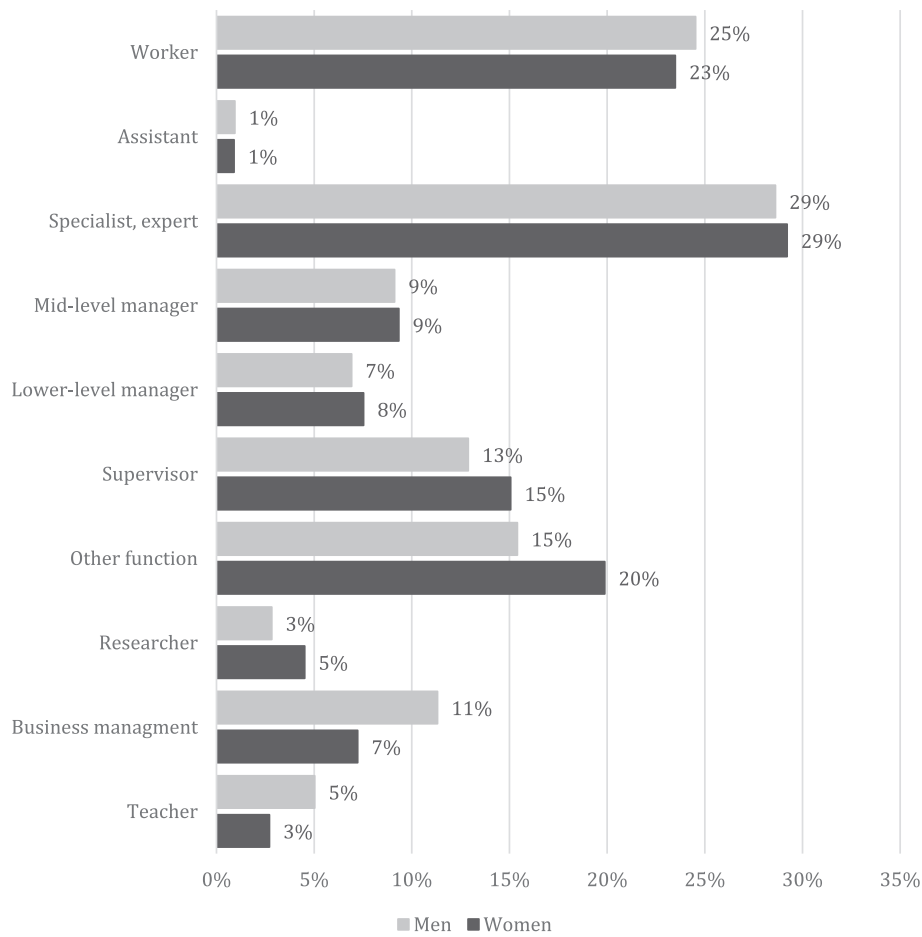


Fig. 3. Current professional function of Swedish forest graduates remaining in the forest sector. The x-axis separately shows the proportion of men and women that responded to the survey in each work function, which are sorted from least to most gender segregated.

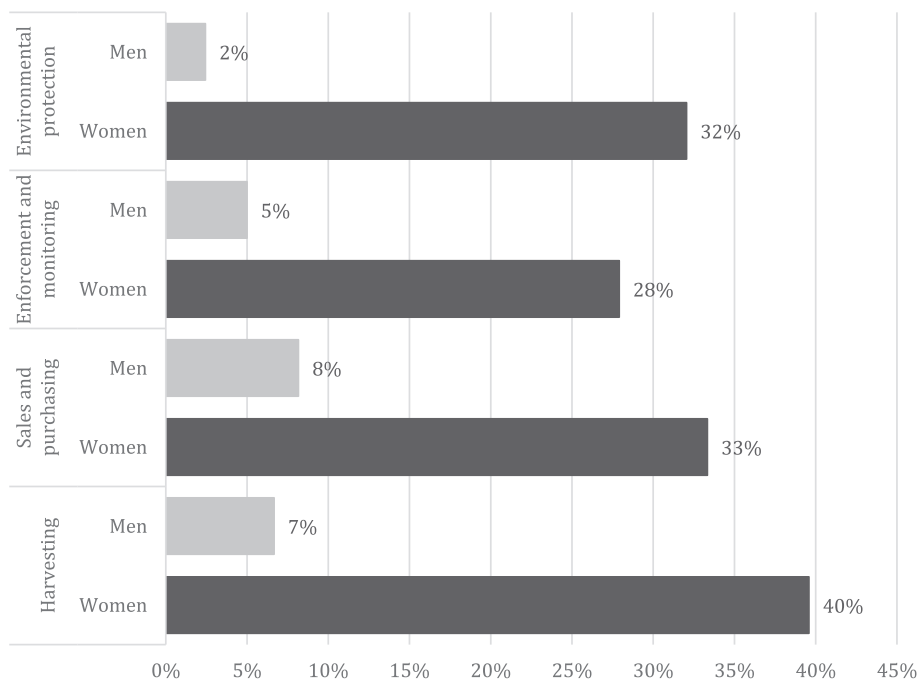


Fig. 4. Rates of reporting gender-based discrimination within the two most women- and men-dominated work areas.

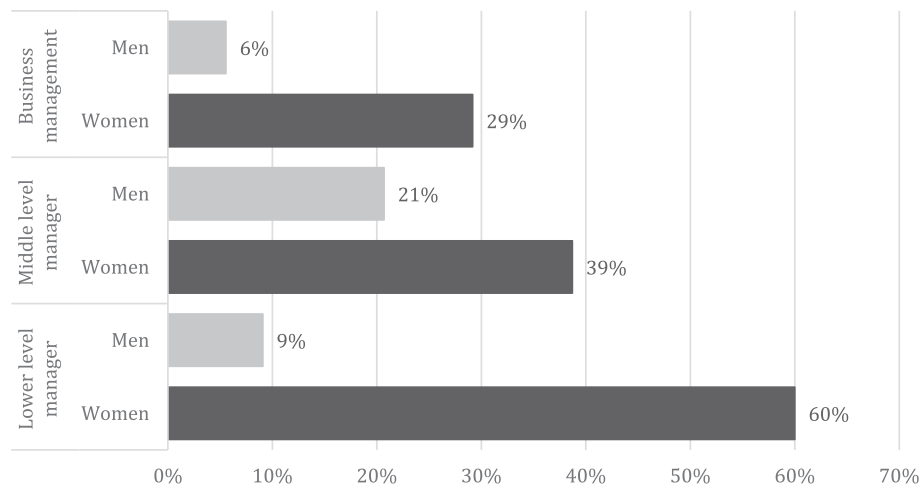


Fig. 5. Proportions of men and women reporting gender-based discrimination by occupational function.

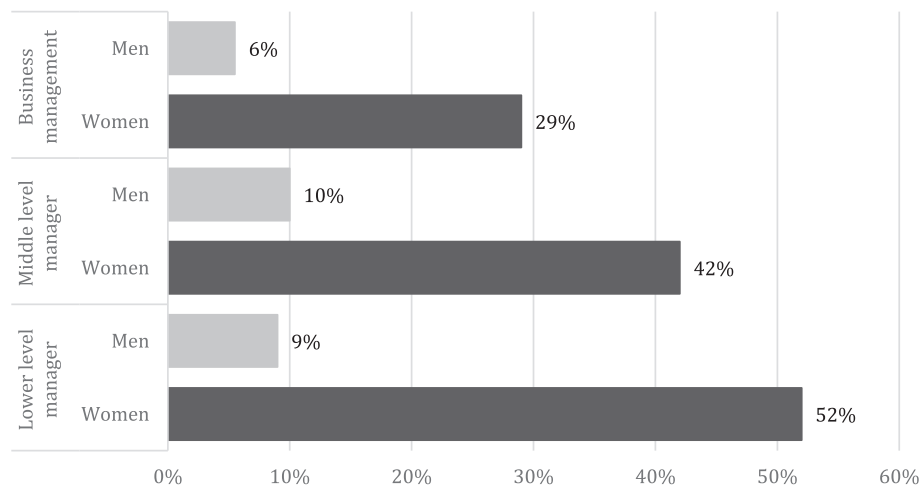


Fig. 6. Occurrence of harassment by occupational function and gender.

experiencing physical abuse such as groping or other unwelcome touching. These rates are significantly higher among women than men in all three categories^{56*}. None of the men or women stated that they had been hit, kicked, pushed or subjected to other physical violence. Daily work is the most common context in which harassment takes place, with just over 85 % of exposed women reporting this. Every fourth victimized woman reports harassment taking place in connection with party arrangements, while almost one fifth (19 %) at conferences. For women harassment taking place outside working hours (6 %) is least common. Men only occasionally indicate that harassment occurs in connection with conferences, party arrangements and outside working hours, but almost all indicate that it occurs in daily work. While the absolute numbers of women subjected to harassment is much higher than men, the locations of the harassment usually does not differ significantly between them (work⁵⁷, conferences^{58*} and outside work⁵⁹).

4.5. Comparison with 2011

Overall, in comparison with the results from 2011 (Lidestav et al., 2011), the differences between men and women has decreased in many aspects. Although that both the share of women and men that has left the sector has increased from 24 % of the women and 17 % of the men to 25 % of the women and 20 % of the men. The slightly higher increase of the share of men, has resulted in that the previous significant difference has

shrunk^{60*}. Also, the difference and proportion of those who have left the sector regret their choice of education has decreased compared to 2011^{61*}. The Swedish Forest Agency remains, to a greater extent than equivalent men, the employer of women^{13*}, although that the proportion has decreased from 23 % to 17 %⁶². While the higher proportion of men that are self-employed are stable, women are now more often self-employed (from 4 % to 7 %)⁶³. Also, in the largest employer type of forestry companies, the proportion of women increased from 29 % to 36 %⁶⁴. Among forest owners' associations, however, a reverse trend can be seen. In 2011, women were slightly more likely to be employed by owners' associations than men (15 % vs. 12 %)⁶⁵, while the present figures show a moderately reversed ratio (13 % vs. 17 %)⁶⁶. The difference between 2011 and 2021 was, however, statistically weak⁶⁷.

In 2011, education and advisory roles were also the most common work areas for women, involving about a third of the women and only a quarter of the men, while men and women now are nearly equally-represented in this work area. The work area that has decreased the most from 2011 is wood processing, employing only 3 % of women and 5 % of men today, compared to 17 % and 27 % respectively in 2011. In 2011, just over one in ten men indicated sales and purchasing as their main line of work, a proportion that has increased threefold in ten years, which has made the work area more men-dominated^{68*}. The previous difference between employment of men and women as middle managers from the 1998 and 2011 studies has now disappeared⁶⁹, however, the over-representation of men in executive positions persists⁷⁰.

In terms of work hours, the significant difference in work-week length only persists between men and women who work more than 35 h/week^{35*}. Overall, this indicates a further reduction in the average working time for full-time forestry graduates compared to the 2011 survey for both women^{71*} and men^{72*}, as well as the 1998 survey. In 2011, men had higher well-being with regard to co-workers than women^{73*}, but the opposite was true in 2021^{74*}. However, well-being with regard to co-workers has decreased between 2011 and 2021 for both women^{75*} and men^{76*}.

In the 2011 survey, questions with regards to gender-based discrimination was only asked of forestry graduates who remained in the sector. Then, 27 % of women had reported gender-based discrimination, over which the 2021 value of 36 % is a non-significant increase⁷⁷, while 12 % of men in 2011 had reported such discrimination, making the 7 % in 2021 an decrease, although not significant⁷⁸. In comparison with the 1998 survey, the share of reporting women and men in 2021 are similar. In the 2011 survey, the question about sexual harassment was worded slightly differently, and asked whether there were sexual innuendos at work. This means that the results are not completely comparable. In 2011, significantly more women (about two-fifths than men (about a quarter) indicated that they had experienced this at some point^{79*}.

5. Discussion

Although gender segregation appears to have declined in the last decade in Sweden, the results of this study show that the forestry sector remains highly gender-segregated across employers, work area and professional function (cf. Mandel, 2012; England, 2010). This persistent segregation continues to shape men's and women's experiences and working conditions in distinct ways. While the gender segregation previously identified in the sector has decreased in some respects since 2011 (Lidestav et al., 2011), significant disparities remain.

A key finding is that while most forestry graduates remain in forest-related work, one in four women and one in five men have left the sector. The majority of men and women with a forestry degree still do forest-related work but consistent with prior research, women are more likely to exit the sector, although the gender gap in attrition has narrowed slightly; one in four women and one in five men has left the sector. Similar to the previous study, the results show that women have left the sector to a greater extent than men - although the difference has decreased a bit. Women who leave the sector continue to report more negative experiences with their education and work environment and are more likely to regret choosing a forestry degree compared to their male counterparts. This reflects the interplay of "push" and "pull" factors: push factors such as poor job quality, a challenging work culture, or low pay, and pull factors including the broader applicability of forestry education outside the sector. However, these factors should be understood as relational and partly dependent on each other. The literature on leaky pipeline" phenomenon, where women disproportionately exit male-dominated fields, stresses the gendered differences in conditions and experiences as substantial factors (e.g. Clark Blickenstaff, 2005). Other studies also show that women leave workplaces, sectors and occupations that are dominated by men at a higher rate than their co-workers who are men (Kanter, 1993; Torre, 2014), often with experiences of harassment (Folke and Rickne, 2022; Willness et al., 2007). Thus, in the overall Swedish labour market, that women leave the forest sector to greater extent than men can be regarded as a process of horizontal segregation (cf. Abrahamsson, 2009; Blackburn et al., 2002).

Horizontal segregation remains evident within the forest sector although changes can be observed since 2011. Gender differences in employer type and work area reflect broader patterns where women are concentrated in specific roles. Notably, the proportion of women working at forest owners' associations has decreased, while their representation at forestry companies has increased. This can partly be the result of a more active focus on recruiting women among forestry

companies. The Swedish Forest Agency remains the employer with the highest proportion of women. These shifts aligns with broader trends where women increasingly enter occupations and workplaces in previously male-dominated fields (cf. Mandel, 2012; England, 2010; Cotter et al., 2004; Baublyte et al., 2019), while men are more reluctant to enter careers in fields dominated by women (cf. Levanon et al., 2009; England, 2010; Lupton, 2000). Concurrently, there are also differences in work areas between women and men, which is a product of both horizontal segregation at a sectorial level and internal segregation at an organizational/employer level. The two most women-dominated work areas are regulation enforcement and monitoring, and nature and environmental protection, while harvesting and sales and purchasing are the most men-dominated. This constitutes a functional and physical separation of men and women by work tasks and workplaces (cf. Baude, 1992). This reinforces a gendered division of labour previously identified in research and the hierarchical dualism of environment/femininities in contrast to forest production/masculinities in work identities (cf. Andersson and Lidestav, 2016; Bergstén et al., 2020; Cichecki et al., 2025; Laszlo Ambjörnsson, 2021; Brandth and Haugen, 2000).

Vertical segregation has declined at lower and middle management levels with women now attaining these positions somewhat faster than in 2011. This shift is partly explained by the increased representation of women overall and in mid-manager positions, at forestry companies. However, women remain underrepresented in executive positions, and notably, women in these senior roles also face a unique set of challenges. Paradoxically, women in managerial roles report the highest levels of gender discrimination and harassment at work (cf. Folke et al., 2020), which indicates both the costs to women pursuing leadership ambitions and that the numerical changes have not been fully followed by changes in organizational culture (cf. Baublyte et al., 2019; Ludvig et al., 2024). In research on harassment, this is described as the "paradox of power" in which women in power do seem to experience more rather than less sexual harassment (McLaughlin et al., 2012). Similar to the results of this study, other studies show that the risks are greater in lower- and middle-level positions of leadership and when subordinates are mostly men (cf. Folke et al., 2020), but also that challenging gender norms may trigger sexual harassment (cf. Fitzgerald et al., 1997; Akerlof and Kranton, 2000; Berdahl, 2007) as a way to revert norms and protect harassers' own gender identity (cf. Johansson et al., 2018; Collinson and Collinson, 1996). This suggests that while numerical representation has improved, workplace cultures remain resistant to deeper change (cf. Korhonen et al., 2025).

The persistence of gender discrimination and harassment underscores an ongoing challenge (cf. McDonald, 2012; Johansson et al., 2019; Lidestav et al., 2011; Sjølie et al., 2023), particularly among occupations and organizations dominated by men (cf. Gruber, 1998; Jackson and Newman, 2004; Kabat-Farr and Cortina, 2014; Folke and Rickne, 2022). Two out of five women experience this vulnerability to some extent, and this generally occurs throughout the sector, in daily work, and most perpetrators of harassment are people within the organization (cf. Antecol and Cobb-Clark, 2004; Folke et al., 2020; McDonald, 2012). Such experiences have far-reaching impacts, including negative health outcomes (Fitzgerald and Cortina, 2018; Collinsworth et al., 2009) and increased likelihood of leaving the job (Folke and Rickne, 2022).

6. Conclusions

So, what has changed during the last decade? While the pace is slow, changes in the gendered division of labour in Swedish forestry do occur and the overall conclusions in this study are threefold.

First, gender segregation still persists in the Swedish forestry sector. The representation of women has increased in some areas, particularly in middle management positions within forestry companies, but substantial gaps remain, especially in executive leadership. Women are still concentrated in specific work areas and remain underrepresented in

decision-making roles, reinforcing both horizontal and vertical segregation. Forestry companies have gone from a slightly larger proportion of men to a slightly larger proportion of women among the sample, although with a much smaller overall representation of women at these employers. A larger percentage of these women are also middle-level managers, which suggests that women generally have a faster path to achieving this position. Although the representation gap between men and women in different management levels has decreased, the difference remains in upper management, something that is also reflected in the executive boards of many companies in the sector (NYKS, 2023), and reflected in women's of less influence over business' goals and decisions. These results are best understood in relation to previous literature and the sector as a whole, by emphasizing that the sampling was designed to compare the conditions of women and men with the same age and time of degree, and the concentration and situation of women in employers and working areas relatively dominated by women should be understood in this context (cf. Torre, 2019; Folke and Rickne, 2022).

Second, the decrease in gender segregation can be seen as an effect of gender equality efforts, both on a national and on local level within many work organizations, the last decade. This development could be interpreted as that the gender-equality work of many organizations and companies has some effect in this regard, not least in relation to that increasing the share of women in leading positions have been an outspoken goal for many forestry work organizations in their gender equality efforts (cf. Johansson and Ringblom, 2017; Andersson et al., 2018).

Thirdly, while quantitative improvements in representation are visible, qualitative experiences of discrimination and harassment remain deeply entrenched and it is evident that carried out gender equality interventions have not adequately addressed the structural and cultural barriers that perpetuate gendered inequalities. The ongoing prevalence of discrimination and harassment highlights the need for more comprehensive and transformative approaches to gender equality (cf. Katila et al., 2025).

Looking forward, effective gender equality initiatives must go beyond increasing the proportion of women and address the broader structural and organizational factors that sustain gender imbalances. This includes recognizing how the dominance of men in both representation and organizational culture shapes working conditions and career trajectories (cf. Johansson et al., 2018; Johansson et al., 2019). Future efforts should prioritize not only representation but also the transformation of workplace cultures to reduce gender-based harms and create a genuinely inclusive environment (cf. Korhonen et al., 2025). Achieving gender equality requires not only sustained commitment to increasing women's representation but also deep cultural and structural reforms to create safer, more equitable workplaces (cf. Johansson et al., 2023).

CRedit authorship contribution statement

Andersson Elias: Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Johansson Maria:** Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Elias Andersson reports financial support was provided by County administrative boards of Jämtland, Örebro, Gävleborg, Västernorrland, Västerbotten and Östergötland. Elias Andersson reports administrative support was provided by Forestry Research Institute of Sweden. Associate editor of Forest Policy and Economics: Elias Andersson If there are other authors, they declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

- ¹ $\chi^2 = 3.0279$, $df = 1$, $p = 0.0818$.
- ² $\chi^2 = 3.0308$, $df = 1$, $p = 0.0817$.
- ³ $\chi^2 = 0.11983$, $df = 1$, $p = 0.7292$.
- ⁴ $\chi^2 = 0.14498$, $df = 1$, $p = 0.7034$.
- ⁵ $\chi^2 = 0.20812$, $df = 1$, $p = 0.6482$.
- ⁶ $\chi^2 = 3.7392$, $df = 1$, $p = 0.05315$.
- ⁷ $\chi^2 = 8.6595$, $df = 1$, $p = 0.00325$.
- ⁸ $\chi^2 = 2.8202$, $df = 1$, $p = 0.0931$.
- ⁹ $\chi^2 = 6.297$, $df = 1$, $p = 0.0121$.
- ¹⁰ $\chi^2 = 6.5691$, $df = 1$, $p = 0.0104$.
- ¹¹ $\chi^2 = 9.4341$, $df = 1$, $p = 0.00213$.
- ¹² $\chi^2 = 2.2744$, $df = 1$, $p = 0.1315$.
- ¹³ $\chi^2 = 10.156$, $df = 1$, $p = 0.00144$.
- ¹⁴ $\chi^2 = 3.2083$, $df = 1$, $p = 0.0733$.
- ¹⁵ Mantel-Haenszel $\chi^2 = 0.67409$, $df = 1$, $p = 0.4116$.
- ¹⁶ Mantel-Haenszel $\chi^2 = 13.72$, $df = 1$, $p = 0.0002$.
- ¹⁷ Mantel-Haenszel $\chi^2 = 2.7824$, $df = 1$, $p = 0.0953$.
- ¹⁸ Mantel-Haenszel $\chi^2 = 0.0031345$, $df = 1$, $p = 0.9554$.
- ¹⁹ Mantel-Haenszel $\chi^2 = 7.8503$, $df = 1$, $p = 0.00508$.
- ²⁰ $\chi^2 = 3.7525$, $df = 1$, $p = 0.0527$.
- ²¹ $\chi^2 = 0.063915$, $df = 1$, $p = 0.8004$.
- ²² t -test, $t = 0.06953$, $df = 550.25$, $p = 0.9446$; this result is virtually identical whether or not the values are logged to reduce skewness.
- ²³ t -test, $t = -1.1005$, $df = 44.674$, $p = 0.277$.
- ²⁴ t -test, $t = -2.293$, $df = 647.14$, $p = 0.0222$.
- ²⁵ $\chi^2 = 3.1863$, $df = 1$, $p = 0.0743$.
- ²⁶ $\chi^2 = 28.433$, $df = 1$, $p < 0.00001$.
- ²⁷ $\chi^2 = 7.4272$, $df = 1$, $p = 0.00643$.
- ²⁸ $\chi^2 = 4.9993$, $df = 1$, $p = 0.0254$.
- ²⁹ $\chi^2 = 0.55397$, $df = 1$, $p = 0.4567$.
- ³⁰ $\chi^2 = 0.0094841$, $df = 1$, $p = 0.9224$.
- ³¹ $\chi^2 < 0.00001$, $df = 1$, $p = 1.000$.
- ³² $\chi^2 = 1.9685$, $df = 1$, $p = 0.1606$.
- ³³ $p = 0.009778$.
- ³⁴ $p = 0.04223$.
- ³⁵ t -test, $t = -2.3161$, $df = 538.57$, $p = 0.0209$.
- ³⁶ $\chi^2 = 18.715$, $df = 1$, $p = 0.00002$.
- ³⁷ $\chi^2 = 98.351$, $df = 1$, $p < 0.00001$.
- ³⁸ $\chi^2 = 64.28$, $df = 1$, $p < 0.00001$.
- ³⁹ Exact binomial test, 43 women among 63 responses, $p = 0.00768$.
- ⁴⁰ 78 women among 119 responses, $p = 0.00173$.
- ⁴¹ 50 women among 125 responses, $p = 0.0154$.
- ⁴² 41 women among 139 responses, $p < 0.00001$.
- ⁴³ women: $\chi^2 = 1.5767$, $df = 1$, $p = 0.2092$; men: $\chi^2 = 0.5705$, $df = 1$, $p = 0.4501$;
- ⁴⁴ binomial test, $p = 0.004837$.
- ⁴⁵ χ^2 test, $\chi^2 = 11.024$, $df = 1$, $p = 0.0009$.
- ⁴⁶ binomial test, $p = 0.03287$.
- ⁴⁷ $\chi^2 = 1.5382$, $df = 1$, $p = 0.2149$.
- ⁴⁸ binomial test, $p = 0.003478$.
- ⁴⁹ $\chi^2 = 4.9078$, $df = 1$, $p = 0.02674$.

- ⁵⁰ $\chi^2 = 0.0019266$, $df = 1$, $p = 0.965$.
⁵¹ $\chi^2 = 0.0017612$, $df = 1$, $p = 0.9665$.
⁵² $\chi^2 = 2.7842$, $df = 1$, $p = 0.0952$.
⁵³ $\chi^2 = 77.244$, $df = 1$, $p < 0.00001$.
⁵⁴ $\chi^2 = 3.6931$, $df = 1$, $p = 0.05464$.
⁵⁵ $\chi^2 = 32.174$, $df = 2$, $p < 0.00001$.
⁵⁶ $\chi^2 > 46$, $df = 1$, $p < 0.00001$.
⁵⁷ $\chi^2 = 2.2226$, $df = 1$, $p = 0.136$.
⁵⁸ $\chi^2 = 4.0816$, $df = 1$, $p = 0.04335$.
⁵⁹ $\chi^2 = 0.070283$, $df = 1$, $p = 0.7909$.
⁶⁰ $\chi^2 = 5.017$, $df = 1$, $p\text{-value} = 0.025$.
⁶¹ $\chi^2 = 13.509$, $df = 1$, $p = 0.00024$.
⁶² $\chi^2 = 3.5074$, $df = 1$, $p = 0.0611$.
⁶³ $\chi^2 = 2.8632$, $df = 1$, $p = 0.0906$.
⁶⁴ $\chi^2 = 3.2702$, $df = 1$, $p = 0.0706$.
⁶⁵ $\chi^2 = 0.9825$, $df = 1$, $p = 0.3216$.
⁶⁶ $\chi^2 = 2.2744$, $df = 1$, $p = 0.1315$.
⁶⁷ Mantel-Haenszel $\chi^2 = 0.11836$, $df = 1$, $p = 0.7308$.
⁶⁸ $\chi^2 = 36.772$, $df = 1$, $p < 0.0001$.
⁶⁹ $\chi^2 < 0.00001$, $df = 1$, $p = 1.000$.
⁷⁰ $\chi^2 = 3.7525$, $df = 1$, $p = 0.0527$.
⁷¹ one-sample t-test, $t = -2.7546$, $df = 277$, $p = 0.0063$.
⁷² one-sample t-test, $t = -8.6013$, $df = 282$, $p < 0.00001$.
⁷³ t-test; $t = 2.1204$, $df = 373.5$, $p = 0.03463$.
⁷⁴ t-test, $t = 127.32$, $df = 649$, $p < 0.00001$.
⁷⁵ t-test, $t = 7.6497$, $df = 499.1$, $p < 0.00001$.
⁷⁶ t-test, $t = 12.172$, $df = 493.36$, $p < 0.00001$.
⁷⁷ $\chi^2 = 1.5005$, $df = 1$, $p = 0.2206$.
⁷⁸ $\chi^2 = 3.6573$, $df = 1$, $p = 0.0558$.
⁷⁹ $\chi^2 = 12.064$, $df = 1$, $p\text{-value} = 0.0005$.

Data availability

The data that has been used is confidential.

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