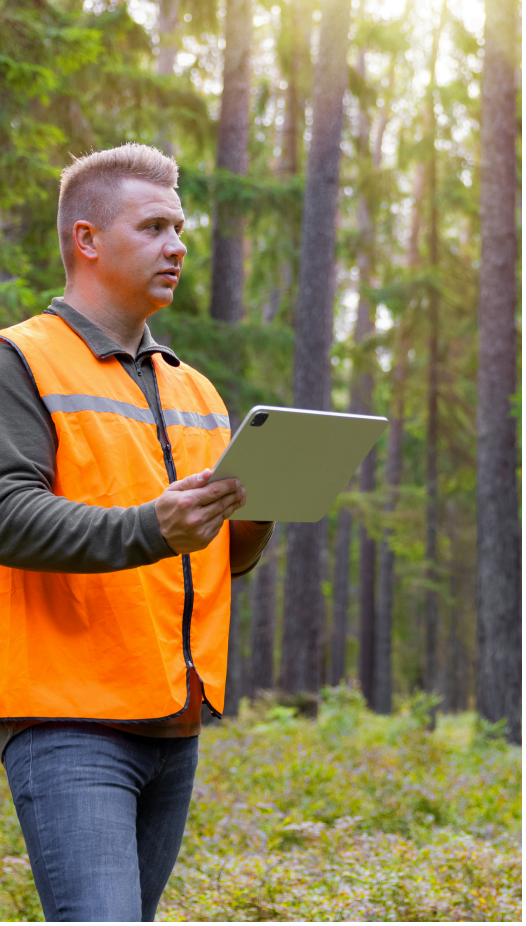



Forest and Wood Products Sector Workforce Analysis

Executive Report

2024

Arkansas Center for Forest Business
College of Forestry, Agriculture, and Natural Resources
University of Arkansas at Monticello

TABLE OF CONTENTS

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EXECUTIVE SUMMARY

The U.S. Forest and Wood Products Sector Inclusion Council (Inclusion Council) is actively engaging in initiatives to attract new talent, address workforce gaps, and develop sustainable, resilient, and welcoming workplaces within the Forest and Wood Products (FWP) sector. To support the Inclusion Council, the Arkansas Center for Forest Business conducted an online survey aiming to better understand patterns of entry to the FWP workforce, what people are looking for in natural resources careers (career values), and the challenges and opportunities companies experience to recruit and retain talent. The survey was distributed to 58 universities listed in the National Association of University Forest Resource Programs (NAUFRP) and 59 forest-related associations across the U.S. In total, we obtained responses from 583 individuals encompassing the three different roles surveyed: 111 students, 397 employees, and 75 recruiters.

Patterns of entry: Three emerging themes influence students to choose a career in forestry: intrinsic motivations, career versatility, and familial influence. A majority of student respondents feel highly confident in their educational qualifications for successfully entering the labor market. However, forestry and wood science/products students reported a slightly lower confidence level than their peers in natural resources programs. There is a general alignment between recruiters' need for skills and the training students are receiving, but recruiters tend to rate the importance of professional competencies slightly higher than the level of skill development reported by students.

Career values: The most important values that both students and employees are looking for in natural resources careers are work-life balance, social impact, and specialization. Students prioritize work-life balance and social impact, while employees value specialization. Diversity is ranked among the lowest in importance, with male and white individuals placing lower importance on working with individuals from diverse gender identities and racial backgrounds.

Recruitment: Most recruiters typically hire for forestry-related jobs, with transportation and trucking positions facing the greatest challenges. Four main recruitment challenges emerged: lack of qualified candidates, limited talent pool, uncompetitive benefits, and diversity challenges. The four factors that contribute to a successful recruitment process are internship programs, local networks, competitive benefits, and candidate-centric recruitment.

Retention: The majority of employees and recruiters agree on the importance of seven factors for employee retention and engagement: communication, trust, and relationships; pride, satisfaction, and value; positive climate and culture; effective, competent, and fair leadership; working conditions and environment; career training and development; and recognition, respect and appreciation. A higher percentage of employees rate these factors as important than recruiters, particularly in areas like job security, salary and monetary compensation, and benefits and perks. Diversity-related factors, such as diverse teams and leadership, were rated as important by fewer employees and recruiters alike. In addition, over 45% of employees and recruiters indicated that access to physical and mental health services and career navigation are important services for employee engagement and retention.

In addition to the survey, we conducted two other research methods: (1) systematic literature review (SLR) and (2) interviews.

Relevant articles in SLR were identified from the Web of Science database by Thomson Reuters. In total, we finalized 28 articles as our study population. Based on the content analysis, we found three themes: (1) The USDA Forest Service (USFS) has been a lead agency in developing the research in the FWP sector; (2) Discussion on diversity, equality, and inclusion largely focuses on gender and race/ethnicity; and (3) The concepts of equity and justice are investigated concomitantly. Across the FWP sector, workplace equality progress is perceived to be slow due to bias, microaggressions, discrimination, isolation, lack of support, and networking struggles. Despite these challenges, positive developments are being made towards a more diverse and inclusive workforce in the forest sector.

In total, we interviewed 12 individuals with related diversity equity inclusion leadership positions across the United States: three companies, four universities, and five non-profit organizations. Interview population was identified through internet searches (investigating potential individual respondents through the organization's website) and snowball sampling (respondents helping to recruit potential respondents). We designed the questions to gain a comprehensive understanding of (1) the leader's background, (2) the respondents' diversity equity inclusion leadership, and (3) their future predictions for diversity equity inclusion (interviews were done in the first semester of 2024, before the U.S. presidential election). One respondent has an academic background in forestry, while the other four have backgrounds in natural resources and related sciences, and the remaining seven have a diverse background including higher education administration, business administration, and leadership.

FOREST SECTOR OUTLOOK

The U.S. forest sector plays an important role in the economy, contributing $427.3 billion in Gross Domestic Product (GDP), generating $254 billion in labor income, and providing jobs for 3.4 million people (Arkansas Center for Forest Business, 2023). Beyond its economic impact, forest landscapes also provide invaluable ecosystem services, including wood and non-wood forest products, biodiversity conservation, carbon (C) sequestration and storage, soil protection, water regulation, aesthetic amenities, and recreation (Food and Agriculture Organization of the United Nations, 2020). For instance, private working forests under the National Alliance of Forest Owners, which comprise just 6% (46 million acres) of total U.S. forestland, sequester 60 million metric tons of CO_2e annually, about 80% of the nation's net forest-carbon sequestration. These forests also protect streamside management zones that provide 24 trillion gallons each year, enough to meet U.S. water consumption for nearly 2.5 years. Additionally, they support landscape-scale species conservation through sustainable management practices that prioritize wildlife and biodiversity. This highlights the importance of a robust, sustainable forest sector that can manage these resources and deliver the associated goods and services to communities.

The forest and wood products (FWP) sector faces significant challenges, particularly in attracting young and diverse talent (Larasatie et al., 2020). Undergraduate enrollment in forestry programs remains less diverse than overall undergraduate population in the U.S. (Sharik et al., 2015). While female enrollment in Natural Resources (NR) programs has increased, from 34.8% in 2005 to 46.6% in 2017, forestry continues to have the lowest female representation among NR disciplines, with 23% in 2017. Similarly, racial and ethnic minority enrollment in NR programs grew from 6.4% in 2005 to 16.1% in 2017 (Sharik et al., 2019). Despite this progress, minority representation in NR remains below the overall undergraduate level of 44% (National Center for Education Statistics, 2019), with forestry lagging further behind at just 11.1% (Sharik et al., 2019). Concerns about an adequate supply of forest professionals also highlight the need to explore what attracts individuals to the forest sector. According to Sharik and Frisk (2011), students are drawn to majoring in forestry due to their passion for nature and the outdoors; however, concerns about low wages, limited job opportunities, and negative public image of forestry (e.g., utilitarian perspective) causes hesitation about pursuing a career in the field.

Securing a trained and proficient workforce across all levels of the FWP sector is also challenging (Forest Resources Association, 2023). Over the last two decades, the sector has experienced a significant workforce decline. For example, the logging and forestry sector has experienced a 40% decline, paper manufacturing has seen a 27% decline, and wood product manufacturing has declined by 24% (Korhonen et al., 2024). Moreover, the FWP public sector has also faced challenges, with a 20% decrease in workforce between 1995 and 2017 (USDA Forest Service, 2023).

The FWP sector in the U.S. also has workforce aging problems and disparities in gender and racial diversity across industries, jobs, and ownership structures (Korhonen et al., 2024). The forest sector is also interconnected with broader trends affecting rural communities and economies generally, with an estimated 40-60 percent of

young adults predicted to leave rural forest-based economies for other employment prospects (Forest Resources Association, 2023). Men have historically dominated the forest sector (Larasatie et al., 2019), and are still overrepresented in forest sector positions (Korhonen et al., 2024). Women only represented between 5 % in logging and forestry and 24 % in paper product manufacturing industry (Korhonen et al., 2024). Racial diversity also remains limited. In 2021, White employees comprised 77.5% of the overall U.S. civilian workforce, yet representation was higher in the forest sector industries: 93.9% in logging, 85.9% in wood products manufacturing, and 83.1% in paper manufacturing (Korhonen et al., 2024).

For over five decades, U.S. federal legislation has promoted the creation of more diverse and inclusive workplaces, beginning with the Title VII of the Civil Rights Act of 1964, to prohibit employment discrimination based on race, color, religion, sex (including sexual orientation, gender identity, and pregnancy), and national origin. Subsequent laws, such as the Age Discrimination in Employment Act of 1967 and the Americans with Disability Act of 1990, further strengthen protections for workers.

The USDA Forest Service aligns with these legislative efforts. Other entities including nonprofit and private organizations in FWP sector have also expressed their commitment to diversity, equity, and inclusion (DEI).

DEI is defined as:

- Diversity means “the practice of including the many communities, identities, races, ethnicities, backgrounds, abilities, cultures, and beliefs of the American people, including underserved communities,” Equity means
- “the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment,” and Inclusion means
- “the recognition, appreciation, and use of the talents and skills of employees of all backgrounds” (The White House, 2021).

Many organizations recognize that the growth and resilience of the forest sector relies on a diverse and inclusive workforce. One example is the U.S. Forest and Wood Products Sector Inclusion Council (Inclusion Council), a collective of both private and public entities, whose mission is to build sector-wide capacity for meeting workplace and workforce needs with strategies that support growth, sustainability, and belonging through activities aligned with their pillars of Knowledge, Mobilization, Workforce, and Impact. Their vision is for the U.S. forest and wood products sector to have sector-wide capacity to provide welcoming workplaces, support a successful existing and prospective workforce, and ensure everyone feels valued, safe, and empowered to contribute to sustainable forestry practices.

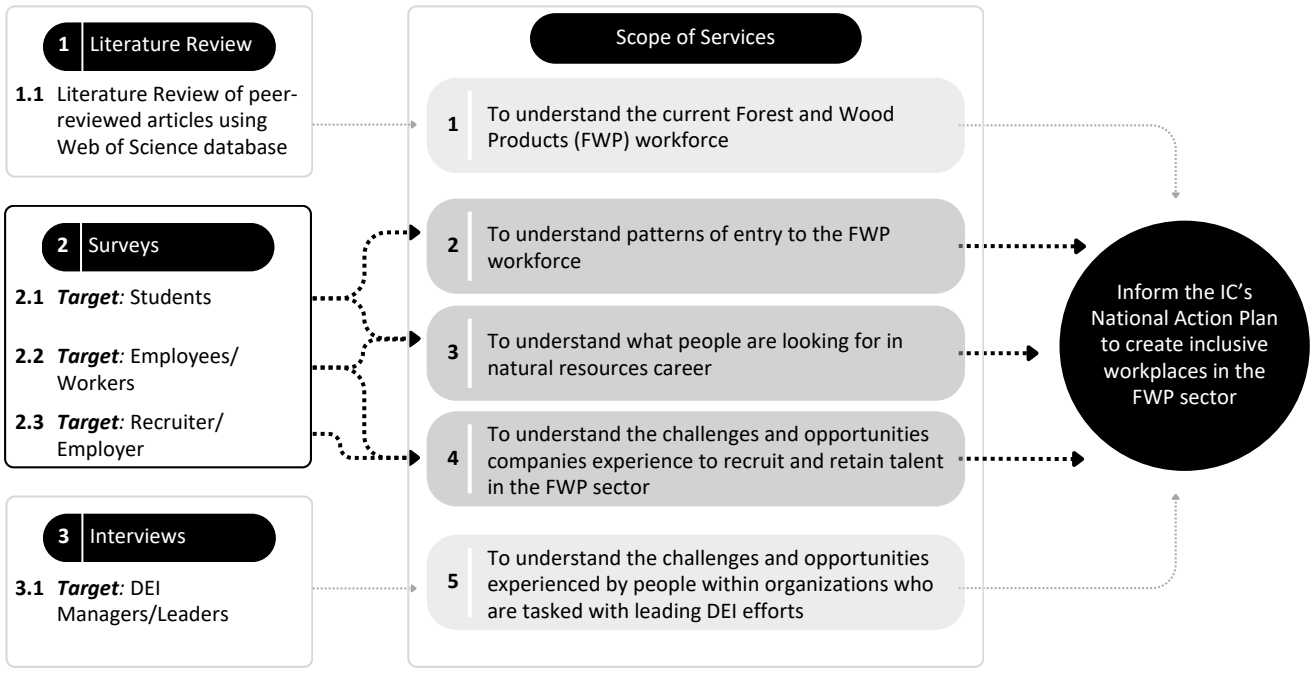
PROJECT BACKGROUND

The objective of this study is to establish a baseline assessment of the FWP sector workforce, with a focus on DEI, to inform the Inclusion Council's National Action Plan for creating diverse and inclusive workplaces. This study aims to achieve five scopes of services, such as to better understand:

1. the current FWP workforce,
2. patterns of entry to the FWP workforce,
3. what people are looking for in natural resources career,
4. the challenges and opportunities companies experience to recruit and retain talent, and
5. the challenges and opportunities experienced by people within organizations who are tasked with leading DEI efforts.

To achieve these, three research methods were employed: systematic literature review of peer-reviewed articles, surveys targeting students, employees, and recruiters, and interviews with DEI leaders in the in the FWP sector (Figure 1).

Figure 1. Project Workflow



Surveys

SURVEY METHODOLOGY

The Arkansas Center for Forest Business conducted an online survey to understand the current and future forest sector workforce and gather perspectives on diversity, equity, and inclusion. The survey targeted professionals and students in the forest and wood products sector.

Sampling Approach: This study employed a purposive (non-probability) sampling approach, deliberately selecting organizations with characteristics relevant to the study (Champ, Boyle, & Brown, 2017), consisting of organizations representing the full FWP sector supply chain and universities with forestry and related natural resources programs. That is, not all organizations in the FWP sector had an equal chance to participate, as only selected organizations were included in the sample (Dillman, Smyth, & Christian et al., 2014). The sample included 58 universities from the National Association of University Forest Resource Programs (NAUFRP) (adapted from Sharik, Lilieholm, Lindquist, & Richardson, 2015) and employees and recruiters from 59 forest-related associations across the U.S. A comprehensive list of participating organizations and universities is provided in the Appendix.

Survey Implementation: To maximize participation, six emails were sent in two phases:

Phase 1. Survey Recruitment Contacts (December 2023 – January 2024): An initial email invitation was sent to all associations and universities listed in the Appendix. A follow-up email was sent on January 4, 2024, to non-respondents. A final invitation email was sent on January 17, 2024, to those who had not replied to the invitation.

Phase 2. Survey Distribution (February – April 2024): Once participation was confirmed, an email sent on February 14, 2024 provided the "survey package" containing all necessary materials and instructions to help associations and universities in distributing the survey to their personnel and students. The package included a project description, survey link, FAQ page, and an invitation flyer with a survey QR code. Associations/universities were instructed to email the survey package to their personnel/students and/or to post the flyer around their facilities and social media to increase visibility and participation. Two reminder emails were sent in March and April 2024, with data collection concluding on May 10, 2024.

Survey Participation and Limitations: A total of 29 associations and eight universities agreed to distribute the survey. The survey received 583 responses, comprising 111 students, 397 employees, and 75 recruiters. These numbers might represent only a small fraction of the total undergraduate and graduate enrollment in forestry and related natural resources programs, as well as the broader workforce in the sector[1] . Also, while only having eight participating universities, student responses represented 21 different states, likely due to additional survey promotion efforts, such as academic conference s and social media outreach (e.g., LinkedIn).

[1]In 2017, U.S. academic institutions affiliated with the National Association of University Forest Resources Programs (NAUFRP) enrolled 28,707 undergraduate and 5,521 graduate students (Sharik et al., 2019). Additionally, in 2021, the U.S. forest sector (NAICS 113, 321, 322) employed approximately 865,000 workers (Korhonen et al., 2024).

Although the research team provided survey distribution materials, instructions, and reminders, they had no control over when or how the survey reached the target audience. Also, response rates could not be calculated, as the total number of students, employees, and recruiters studying/working in the participating institutions was not known. While the purposive sampling approach provided valuable insights into the FWP sector, its limitations should be considered when interpreting and generalizing the findings (Champ, Boyle, & Brown, 2017).

RESPONDENT PROFILE

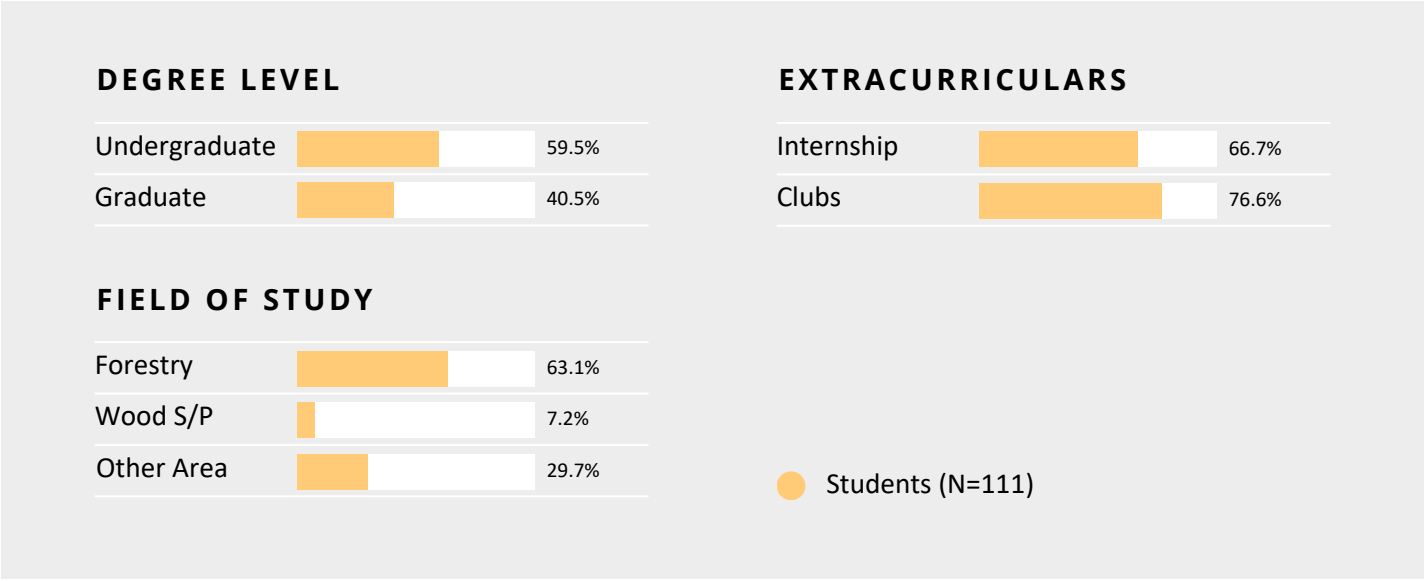
The findings are based on responses from 583 individuals encompassing the three different roles surveyed: 111 students, 397 employees, and 75 recruiters.

STUDENTS

Among the participating students, 59.5% are enrolled in undergraduate programs, while 40.5% are pursuing a graduate degree. Regarding their field of study, 63.1% focus on forestry, 7.2% on wood science or wood products, and 29.7% in other areas, such as fisheries and wildlife, range science or management, and natural resources or environmental management.

Most students are engaged in extracurricular activities, with 66.7% participating in internships and 76.6% involved in student clubs or organizations. Unless otherwise specified, the information presented in the following sections will contain insights from all forest and related natural resources students, not just forestry and wood science/products.

Figure 2. Students' profile.



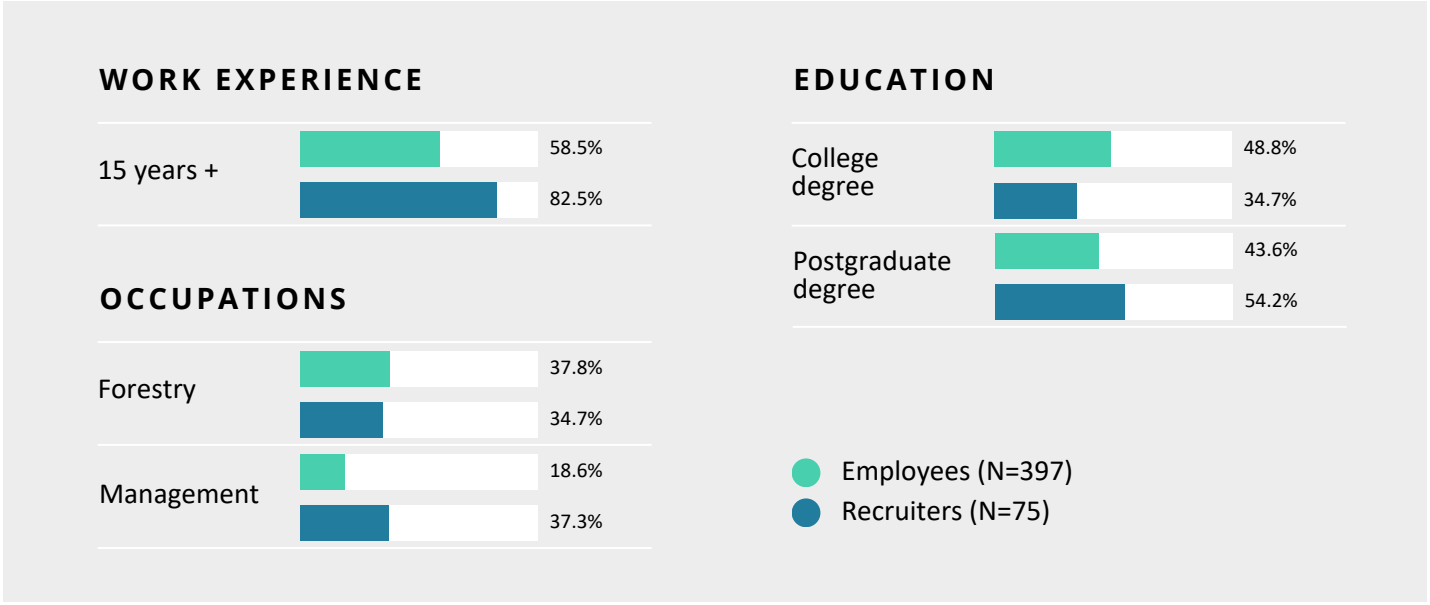
EMPLOYEES

In the survey, 58.5% of employees report having 15 or more years of work experience in the sector. Their roles include forestry (37.8%), management (18.6%), and research and development (13.4%). The remaining 30.2% work in various occupations, such as business, outreach and communication, academia and education, sales and marketing, and other areas. The educational attainment among employees was 48.8% with a college degree, 43.6% with a postgraduate degree, and the reminder had less than a college degree.

RECRUITERS

A majority of recruiters, 82.5%, have over 15 years of experience in the sector. Their positions include management (37.3%) and forestry (34.7%), while the remaining 28% occupy roles in research and development, land ownership, academia or education, and other areas. With respect to educational attainment, 34.7% of recruiters hold a college degree, 54.2% a postgraduate degree, and the reminder had less than a college degree.

Figure 3. Employees and recruiters' profile.



DEMOGRAPHIC PROFILE

Description of the demographic characteristics of the sample and comparisons with overall U.S. labor force are presented below.

AGE

The combined median age of undergraduate and graduate students responding to the survey is 24 years, which is consistent with the national average (National Center for Education Statistics, 2023). In contrast, the median ages of employees and recruiters are 48 and 58, respectively, significantly exceeding the median age of the U.S. labor force, which was 41.6 years in 2023 and projected to be 42.4 years in 2033 (U.S. Bureau of Labor Statistics, 2024).

The survey participants further corroborate the trend of an aging workforce in this sector, as mentioned in the previous section: Forest Sector Outlook (Korhonen, et al., 2024). The age distribution of the forest workforce highlights potential challenges due to future retirement patterns and the sector's capacity to attract and retain younger talent.

RACE AND ETHNICITY

The FWP workforce is less diverse when compared to the overall racial composition of the U.S. labor force. In 2021, White workers made up 77% of the U.S. labor force, but in our sample, the representation of White workers is higher, with 87.7% of employees and 81.0% recruiters identifying as White. The employee sample shows the largest discrepancy, with about 10% more White workers than the national average. The representation of Black and African American, Asian, and Hispanic/Latino workers is lower than in the general U.S. labor force (Table 1).

While direct comparisons between our student sample and national college enrollment trends are not possible due to different reporting methods, students are generally more diverse than the current workforce surveyed in this study. Specifically, the proportions of Black or African American, Asian, Two or more races, and Latino/Hispanics exceed those found among the employees and recruiters responding to the survey.

Figure 4. Survey respondents' demographic profile.

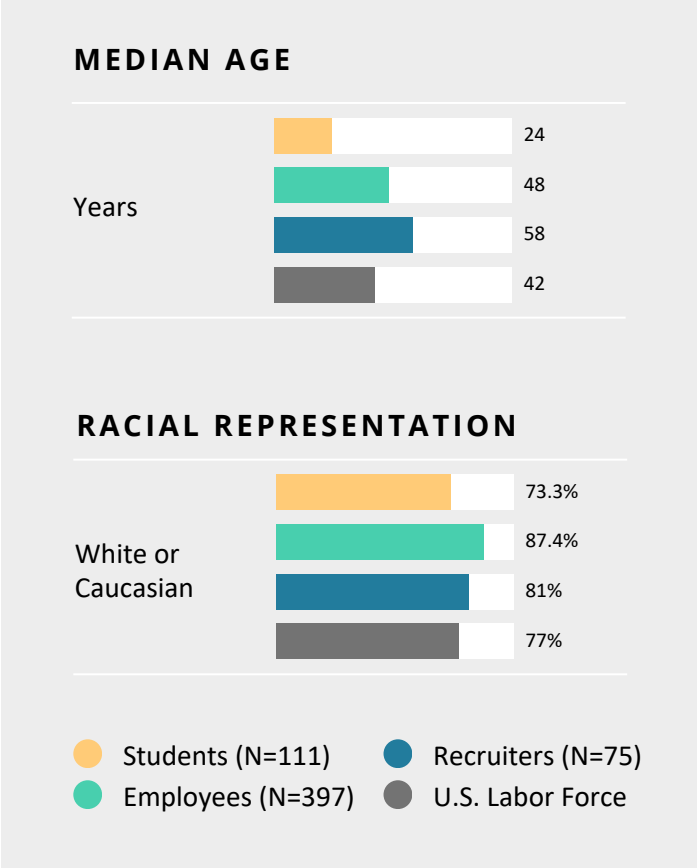


Table 1. Comparison of the racial and ethnical composition of the survey samples with the general U.S. student college enrollment and labor force.

	U.S. Student Enrollment (2021) a	NR Student Enrollment (2023) b	Student survey sample	U.S. Labor Force (2021) c	U.S. Forest Workforce (2022) d	Employee survey sample	Recruiter survey sample
White or Caucasian	52%	68.7%	73.3%	77%	64%	87.4%	81.0%
Black or African American	13%	2.7%	4.0%	13%	14%	2.0%	1.6%
Asian	7%	4.0%	10.9%	7%	2%	2.6%	3.2%
American Indian/Native American or Alaska Native	1%	0.9%	0.0%	1%	1%	2.6%	0.0%
Native Hawaiians and Other Pacific Islanders	<1%	0.1%	0.0%	<0.5%	0%	0.0%	1.6%
Two or More Races	4%	5.4%	9.9%	2%	1%	3.2%	9.5%
Other	-	8.1%	2.0%	-	-	2.3%	3.2%
Hispanic/Latino	22%	10.1%	7.8%	18%	18%	4.3%	0.0%

Source: (a) National Center for Education Statistics (NCES) (b) Food and Agricultural Education Information System (FAEIS), (c) U.S. Bureau of Labor Statistics (BLS), (d) U.S. Equal Employment Opportunity Commission (EEOC).

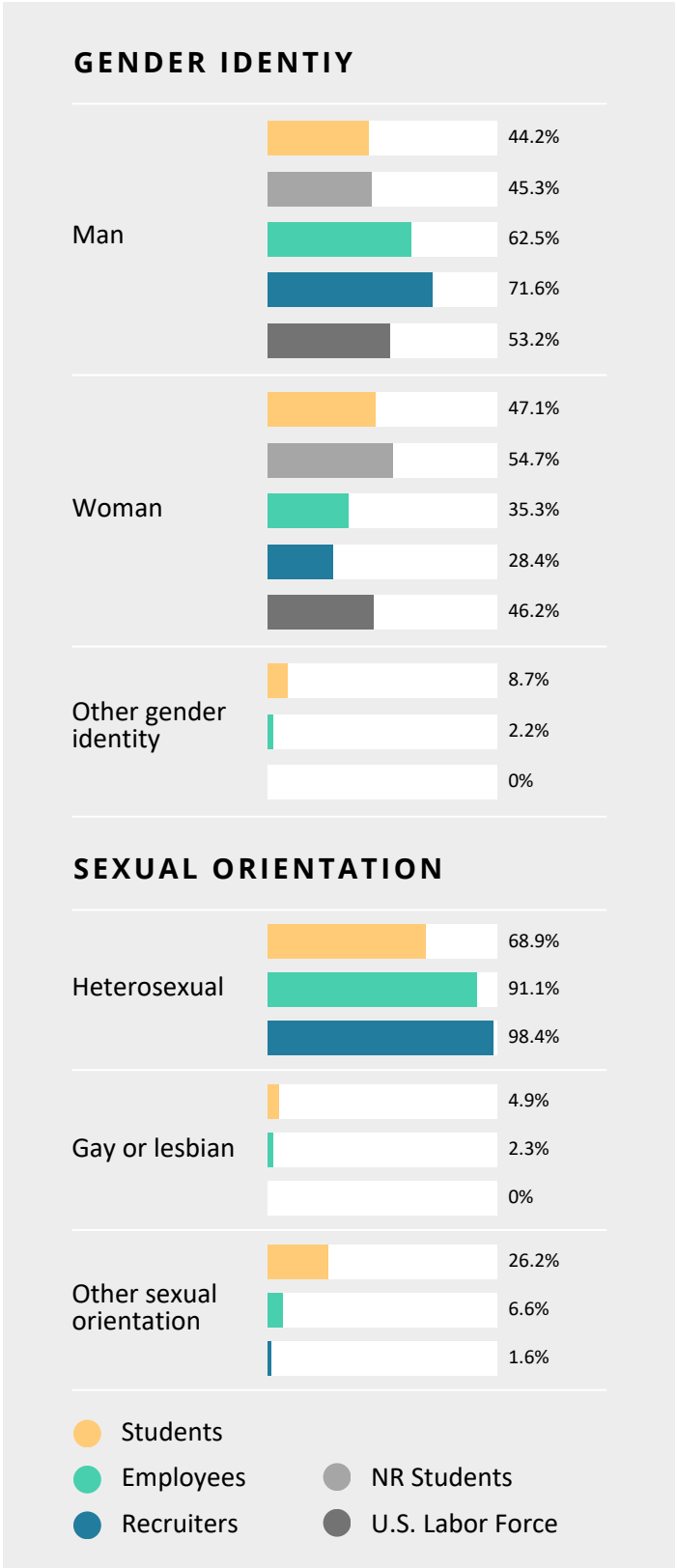
Of note when interpreting Table 1, the U.S. Bureau of Labor Statistics (BLS) provides separate percentages for Hispanic/Latino individuals, recognizing that they can belong to any race. In our analysis, we followed the BLS methodology, while including additional college enrollment and forest workforce statistics for context, such as those reported by the National Center for Education Statistics (NCES), Food and Agricultural Education Information System (FAEIS), and U.S. Equal Employment Opportunity Commission (EEOC). The NCES, FAEIS, and EEOC include Hispanic/Latino individuals in the overall total, possibly understating the percentages of the other racial groups. This limits a direct comparison of the racial distribution with the survey sample.

GENDER IDENTITY AND SEXUAL ORIENTATION

The survey questionnaire included more options for gender identity beyond binary categories of man and woman, and for sexual orientation. Since the FAEIS and the BLS do not report statistics on non-binary gender identity and sexual orientation (Holzberg, et al., 2017), comparisons are limited.

The student sample includes 44.2% identifying as men, 47.1% as women, and 8.7% as other gender identity. Women's participation in this study aligns with the enrollment demographics reported by the FAEIS since 2019. For instance, in 2023, the FAEIS indicated that women's enrollment in

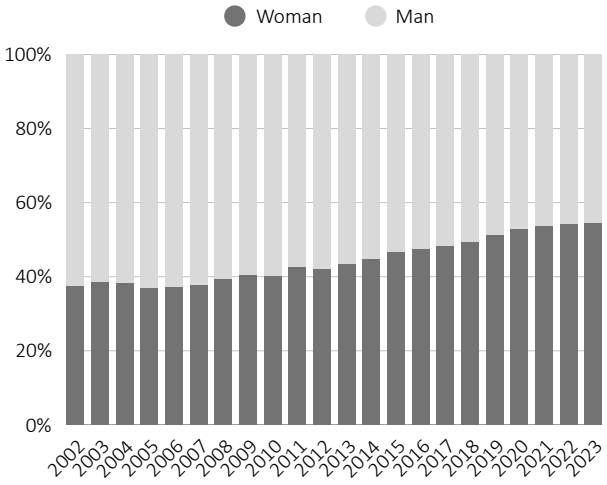
Figure 5. Comparison of the gender identity and sexual orientation distribution of the survey samples with the U.S. natural resources student's college enrollment and labor force.



natural resources programs was 54.7%, compared to 45.3% for men (Figure 6). Specific to the forest and wood science/products areas, women's enrollment continues to be lower than men; however, it has steadily increased from 22.3% in 2002 to 34.9% in 2023, reflecting a 142% growth over the past two decades (Figure 7). In terms of sexual orientation, 68.9% of students are heterosexual, 4.9% are gay or lesbian, and 26.2% identify with other sexual orientation.

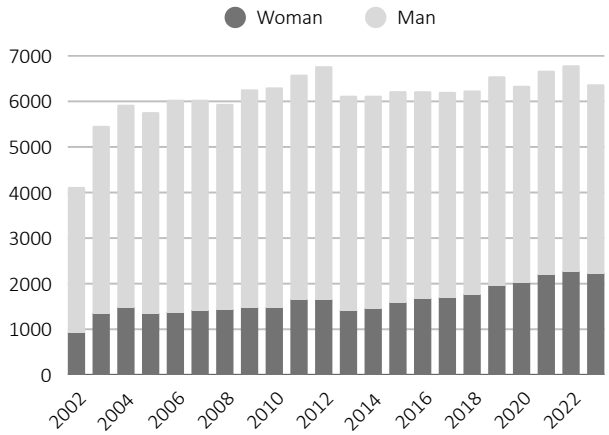
In this study, 62.5% of employees are men, compared to 35.3% who are women and 2.2% who identify as another gender. The majority of recruiters are also men, making up 71.6% of the total, while women make up 28.4%. These figures follow the broader trends in the forest and logging (NAICS 113), wood product manufacturing (NAICS 321), and paper manufacturing (NAICS 322) sectors, where the overall women's representation was 22.5% in 2022 (U.S. Equal Employment Opportunity Commission, 2024). The women's representation of the forest industry lags behind the national average, where in 2023, men accounted for 53.2% and women 46.2% of the total labor force (U.S. Bureau of Labor Statistics, 2024). In addition, the survey results reveal that 91.1% of employees and 98.4% recruiters identify as heterosexual.

Figure 6. Student enrollment ratios in natural resources programs by binary gender categorization.



Source: Food and Agricultural Education Information System (FAEIS)

Figure 7. Total student enrollment in forestry and wood science/products programs by binary gender categorization.



Source: Food and Agricultural Education Information System (FAEIS)

PATTERNS OF ENTRY

CAREER CHOICE

The survey included questions aimed at exploring patterns of entry for FWP sector and asked students about their reasons for choosing a career in forestry. In response, three emerging themes arose: (1) intrinsic motivations (something that makes someone want to do something because they enjoy it rather than because they think they might get something out of it), (2) career versatility (providing many career opportunities), and (3) familial influence (the impact that family members have on an individual's beliefs, behaviors, and identity development throughout their life). These themes were qualitatively analyzed from the open-ended responses of those who major in forestry and wood science/products.

Intrinsic motivation:
More than half of the student respondents were motivated by intrinsic factors exhibiting their passion for forests and woodlands. They love and enjoy working outdoors in nature and therefore would like to have a career in the sector. The students' connection to nature drives their commitment to enhancing sustainable forestry and land-based environmental management practices. These individuals state a keen interest in managing forests for their social, economic, and environmentally significant values. One survey respondent explained that they "have a deep admiration for our natural world [and were] fed up with people mistreating Earth, so [they] decided to be the change [they] hoped to see."

Career versality:
Nine percent of student respondents chose their major because they believe forestry is a versatile degree providing many career opportunities. A respondent mentioned that the "degree [can] take [me] a lot of places in case [I] do not get a job in forestry." Another respondent praised the degree to be the "most versatile science degree, [and] useful for being able to do many jobs."

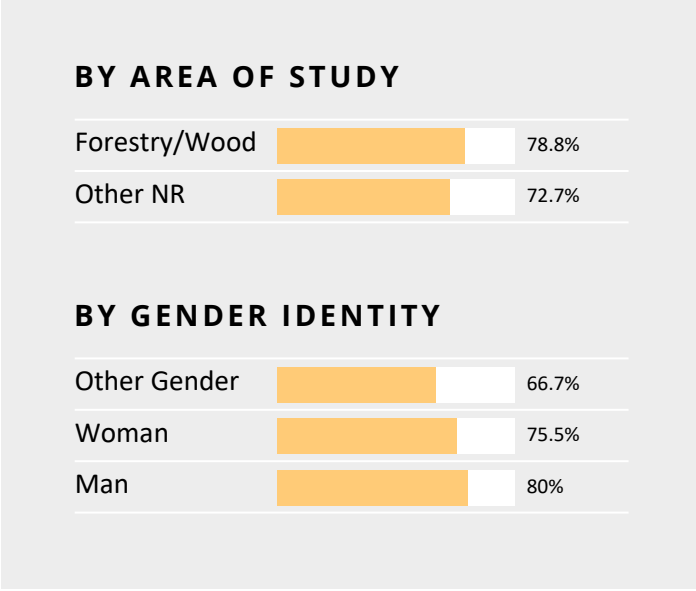
Familial influence:
Eight percent of our student respondents were interested in forestry due to familial influences. Having family members who are forest owners, industry employees, or have been involved in the sector inspires a sense of familiarity and comfort with the field. These family connections often provide early exposure to the sector, fostering an appreciation for the work and its importance. Additionally, the support and guidance from family members already established in the sector can be invaluable in navigating career paths and making informed decisions about education and employment opportunities. For instance, a respondent writes: "I had family in the field and grew up around it, so I know the craft and love it."

CAREER TRANSITION READINESS

Results on students' confidence in their educational background are a self-assessment measured with a five-point Likert scale ranging from 1 (not at all confident) to 5 (extremely confident). An "I don't know" option was provided but excluded from the results. Students were asked "how confident are you that your education will allow you to successfully enter the labor market?"

The findings reveal that a majority of students (74.5%) felt extremely or very confident in their educational qualifications for successfully entering the labor market. Confidence levels varied slightly among different groups (Figure 8). Specifically, forestry and wood science/products students reported a confidence level 6.1% lower than that of their peers in natural resources programs. Also, women and other gender students exhibited lower confidence levels, being 4.5% and 13.3% less confident, respectively, compared to men.

Figure 8. The percentage of students who are extremely or very confident in their educational background to enter the labor market by area of study and gender identity.



PROFESSIONAL COMPETENCIES

We evaluated students' development of key competencies for employability using a framework proposed by Martínez-Clares & González-Lorente (2019). This framework measures 19 elements grouped into five interpersonal and personal competencies: Lifelong learning, Adapting to change, Ethical social commitment, Personal identity, and Initiative (Table 2).

We assessed these competencies for both students and recruiters to evaluate students' preparedness (supply side) against recruiters' expectations (demand side). Recruiters were asked "Do you agree or disagree that your potential employees need to possess these skills?" and students were asked "Does the educational training you are receiving help you develop the following skills?". Responses were collected using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). An "I don't know" option was also provided but was excluded from the analysis.

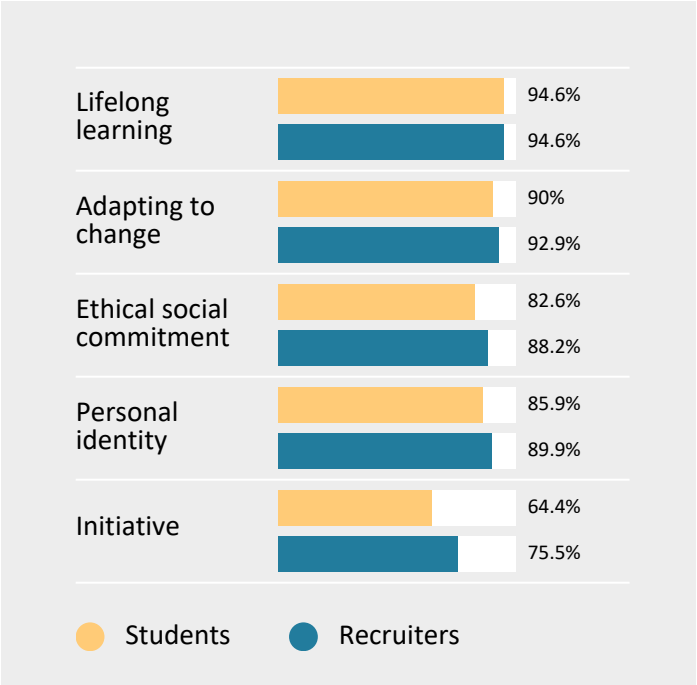
The results indicate a general alignment between the recruiters' need for skills and the training students are receiving, with over 80% of students/recruiters agreeing in the development/need of such skills (Figure 9). Recruiters tend to rate the importance of professional competencies slightly higher than the level of skill development reported by students. The largest gap is observed in the personal skill of "Initiative", suggesting that educational programs could improve their focus on areas such as innovation, entrepreneurship, leadership, and conflict resolution. On the other hand, both students and recruiters rate highly the development (students)/need (recruiters) of "Lifelong learning" skills.

Table 2. Professional competencies when entering the workforce.

Interpersonal Skills			Personal Skills	
Adapting to change	Lifelong learning	Ethical Social Commitment	Personal Identity	Initiative
-Flexibility and orientation to change -Decision making -Motivation for achievement -Organization and planning	-Ability to learn and adapt -Responsibility and perseverance -Analysis, synthesis, and criticism	-Teamwork -Commitment to the organization -People-oriented	-Search for excellence -Resilience and frustration tolerance -Ability to work under pressure -Communication skills -Self-awareness	-Innovation -Entrepreneurship -Leadership -Conflict resolution and negotiation techniques

Source: Martínez-Clares & González-Lorente (2019)

Figure 9. The percentage of students who said they strongly or somewhat agree that their educational training help them develop each of these competencies compared to the percentage of recruiters who said they strongly or somewhat agree that employees need to possess these competencies.



CAREER VALUES

To explore the career values that the future workforce (students) and current employees prioritize, we applied a framework developed by Abessolo, Hirschi, & Rossier (2021). This framework integrates work values (e.g., desirable work settings), career orientations (e.g., career opportunities and circumstances), and career anchors (motives guiding individuals toward specific career choices). The original framework consists of 36 items grouped into 8 values: social, management, specialization, mobility, independence, salary, work-life balance, and variety. For the purposes of this study, we added two additional items to convey Diversity values (Table 3).

The question was phrased as “In your career, how important is it for you to…” followed by the list of 38 value items. The response option was a five-point Likert scale ranging from 1 (not at all important) to 5 (extremely important). The option “I don’t know” was also provided but was excluded from the results.

Over 80% of students and employees identified career values like work-life balance, social impact, and specialization as very or extremely important (Figure 10). For students, work-life balance and social impact are the top priority, while employees place the highest value on specialization. Additionally, employees rank independence and management values higher than students do, suggesting that as individuals transition from school to the workplace, their career goals and aspirations align with factors that promote career advancement.

The values of Diversity, Mobility, and Management rank among the lowest in importance. Specific to Diversity, employees valued it 17.5% lower than students. Further analysis indicates that men and white individuals in the study are less inclined to prioritize working with individuals from diverse gender identities and racial backgrounds (Figure 11).

Figure 10. The percentage of students and employees that rank each of these career values as extremely or very important.

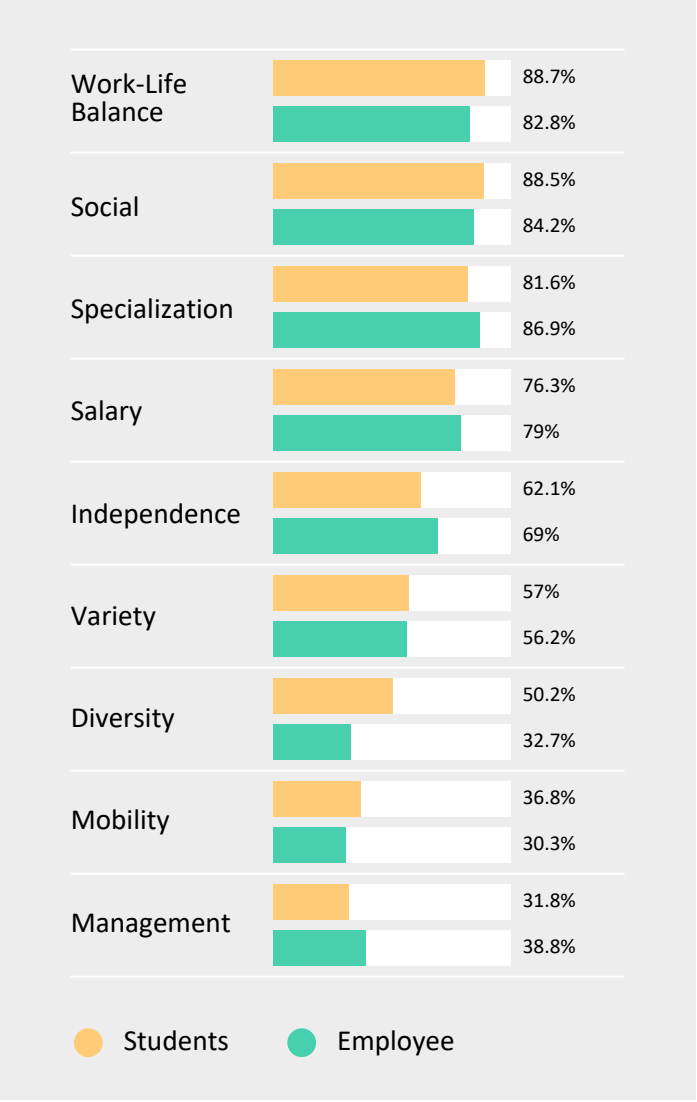


Figure 11. The percentage of respondents who rank a Diversity as an extremely or very important career value.

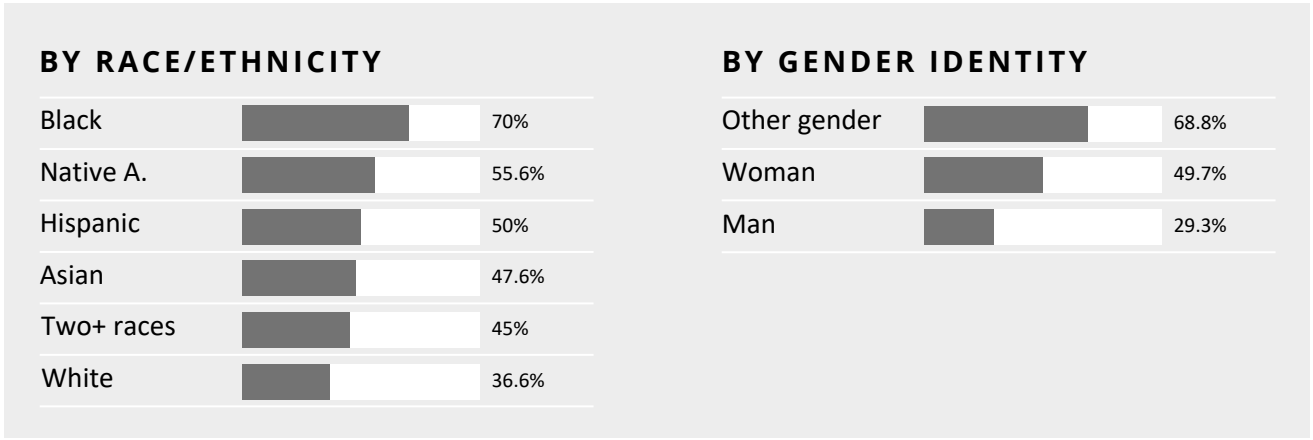


Table 3. Career Values Items

Career Value	Items
Social	1. To improve others' well-being 2. To help colleagues 3. To use one's talents to help others 4. To have a work that is useful to society 5. To be helpful at work 6. To work towards preserving collective interests
Management	7. To be responsible for others' work 8. To able to organize/plan others' work 9. To supervise others' work 10.To assume a management position
Specialization	11. To have sharp/highly intellectual challenges 12. To use one's intellectual skills 13. To exercise advanced expertise 14. To face complex situations/challenges 15. To become an expert in one's domain
Mobility	16. To have professional missions/tasks abroad 17. To work in an international environment 18. To have professional missions/tasks outside of one's company/organization 19. To have a job that allows travel
Independence	20. To make decisions independently/autonomously 21. To follow one's own rules/courses of action 22. To choose one's career trajectory autonomously and freely 23. To work independently 24. To be able to freely organize/plan one's own work
Salary	25. To have a very good salary 26. To have a salary that is comparable to others' salary 27. To be able to have salary or advantages that are deserved/merited 28. To have a stable job in economic terms
Work-life balance	29. To have a balance between one's professional and family life 30. To work in a company/organization that applies a family-friendly policy 31. To reconcile one's personal, social, and professional needs 32. To work for a company/organization that has a fair and balanced policy
Variety	33. To have varied professional activities 34. To have a changing and varied work environment 35. To do something different every day 36. To be constantly occupied/active
Diversity*	37. To work with people of different gender identity than your own 38. To work with people of different racial diversity or ethnic background than your own

Source: Abessolo, Hirschi, & Rossier (2021)
** Diversity career value items were not included in the original framework proposed by Abessolo, Hirschi, & Rossier (2021).*

RECRUITMENT AND RETENTION

To understand hiring trends and challenges in the sector, recruiters were asked to identify the types of jobs they typically hire for and describe the challenges they encounter. The occupations listed in the questionnaire were based on the Standard Occupational Classification System by the U.S. Bureau of Labor Statistics.

In this study, 69.3% of participating recruiters indicated that they typically hire for forestry-related jobs, such as forest management, logging, and other field positions. Other common occupations included management (37.3%), research and development (30.7%), and business and financial operations (29.3%) (Figure 12).

Figure 12. The percentage of recruiters who hire for each of these occupations.

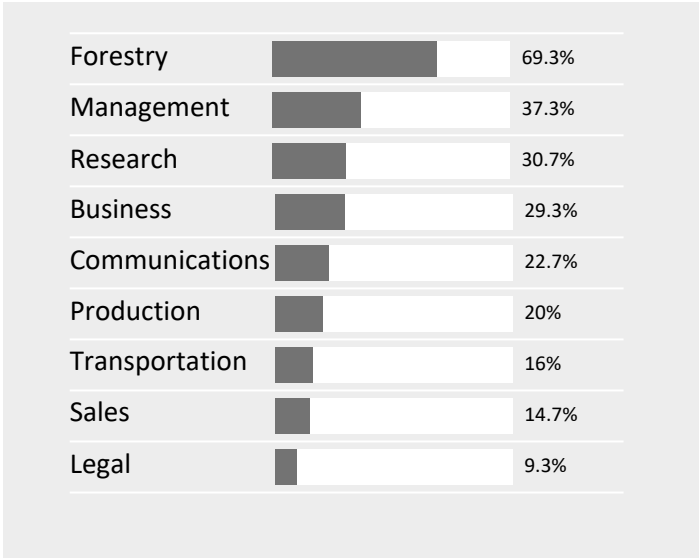


Figure 13. The percentage of recruiters who face hiring challenges for each of these occupations

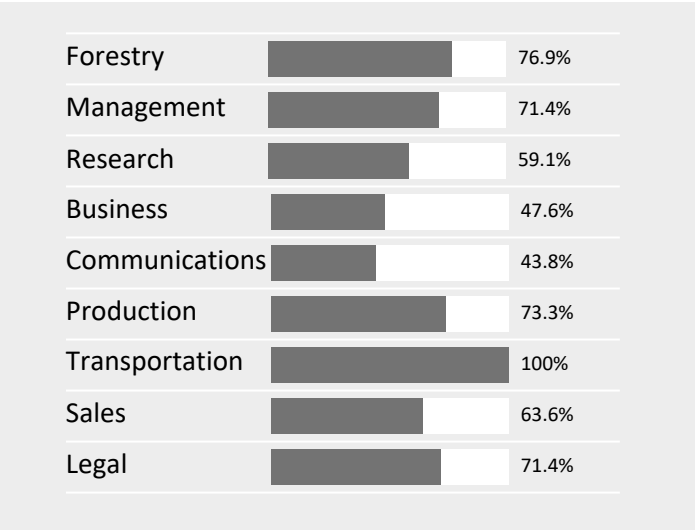


Figure 13 shows the percentage of recruiters facing hiring challenges within each job-specific subgroup, not of the total population. For example, all recruiters (100%) who hire for transportation and trucking roles, which account for 16% of all participating recruiters, reported experiencing hiring challenges.

RECRUITMENT CHALLENGES

Based on the recruiters' responses to an open-ended question, the recruitment challenges were qualitatively analyzed. Four main themes were identified: (1) lack of qualified candidates, (2) limited talent pool, (3) uncompetitive benefits, and (4) diversity challenges.

Lack of qualified candidates:
Most of the recruiters expressed concerns about the shortage of individuals with the necessary skills and experience to meet the diverse demands of working in the forestry sector. One respondent emphasizes that "there are so few people that understand forestry management, forestry banking, transportation, forestry production, milling, drying, and marketing ... it makes business a challenge." Similarly, another indicates the difficulty of "finding the skill set suitable for the diverse tasks in the position." Challenges range from finding talent in more conventional roles, such as foresters and timber production specialists, to those needed in emerging roles, such as modern mill operation or carbon science.

The lack of qualified candidates extends across all experience levels from entry to high level positions. A recruiter respondent mentions that there is "a lack of candidates or experience for lower to middle wage positions and heavy field or labor-intensive positions." While another recruiter expresses that "with higher level positions, it has been challenging to find candidates with higher level skills that are interested in working for a production-focused company."

Limited Talent Pool:
More than 70% of recruiters agree that the forest sector's talent pool is limited. There are a small number of professionals with the required expertise, and the sector often competes with other industries for the same talent. Geographic constraints also play a role, as many forestry jobs are located in remote areas, making them less attractive to potential candidates.

Some respondents also highlight the lack of people's interest in entering the sector. A recruiter explains that the "retention of experienced contractors has not been a problem, but they are "aging out" without a younger generation to take over the business." Another respondent believes that the "forestry and wood products sector are not attractive for the younger generations."

Uncompetitive Benefits:
Thirty percent of recruiters feel that the benefits packages offered in the FWP sector are often less attractive compared to other industries. This includes competitive salaries, better health plans, and retirement packages. Also, since working in the sector is sometimes associated with moving to rural areas, four respondents specifically mention a factor of less affordable housing due to some reasons including a need to move to a small town in remote areas with lower supplies of affordable housing.

Diversity Challenges:
Twelve percent of recruiters stress the challenges of diversifying the workforce. As the forest sector has historically lacked diversity in its workforce, there is underrepresentation of women, minorities, and other marginalized groups. Recognizing this, recruiters have worked to diversify the talent pool. However, it is a big challenge, especially because the pool has been limited.

POSITIVE RECRUITMENT EXPERIENCES

Through qualitative analysis of open-ended responses provided by recruiters, we identify four factors that contribute to a successful recruitment process: (1) internship programs, (2) local networks, (3) competitive benefits, and (4) candidate-centric recruitment.

Internship programs:
More than one third of recruiters use internship programs as a strategy to identify qualified candidates for future full-time roles. A recruiter notes that the "internship program is foundational to identifying the best full-time employees from a competencies, values, and retention perspective." Moreover, respondents believe that outreach activities and early exposure to the sector also contribute to the recruitment efforts.

Local networks:
For having a wider pool, a lot of recruiters suggest connecting to different platforms. Locally, they use Career Centers and local papers. Regionally, they tap into associations and colleges/universities. To access widely, respondents also suggest LinkedIn and online job boards. Some recruiters also utilize their personal contacts to get referrals.

Competitive benefits:
Fifteen percent of recruiters state an offer with competitive benefits is an effective way to recruit candidates. A benefit can be also translated as workplace flexibility. A respondent specifically explains that "people don't want to live in rural America anymore. [So, the company has] loosened up requirements for foresters, allowed them to commute, have more flexible schedules."

Candidate-Centric Recruitment:
Some employers are turning to candidate-centric recruiting techniques to encourage candidates to apply for their job vacancies. The respondents recruit more actively, using open announcements, thoughtful job descriptions, and fluid interviews. Open announcements mean that the invitation is widely shared through different platforms to reach a broader audience. Thoughtful job descriptions refer to an effort to meticulously choose words to be used in the job announcement, with an intention to invite applicants with diverse backgrounds. The fluid interviews can appear to be more like a conversation, which provides the applicants with the opportunity to share additional valuable experience that may not have been brought up in the traditional job interviews.

EMPLOYEE ENGAGEMENT AND RETENTION

Employee engagement involves the physical, cognitive, and emotional expressions that employees bring to their job performance. It reflects their beliefs, feelings, and energy towards an organization, shaping their job performance and passion for their work (Kular, Gatenby, Rees, Soane, & Truss, 2008). Employee retention refers to the various strategies used by organizations to encourage their employees to stay with the company for a longer period (Singh, 2019).

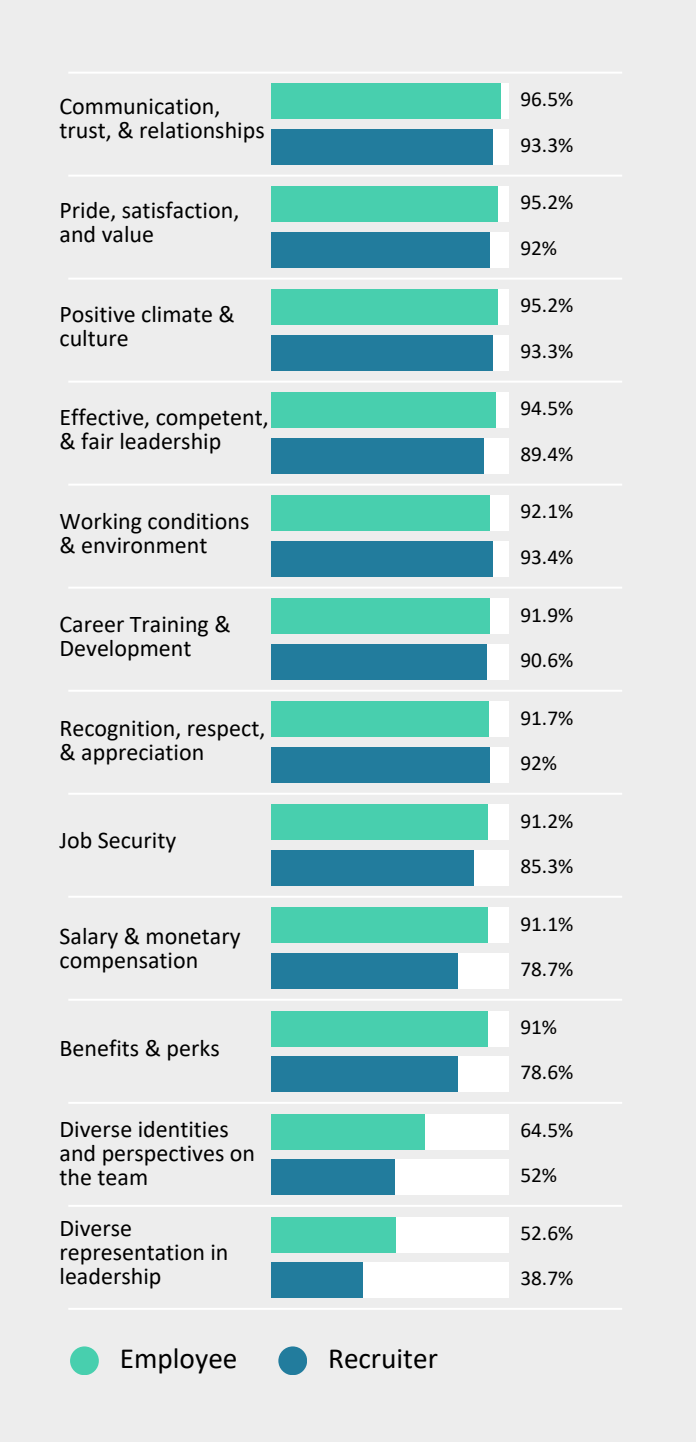
Key Factors for Employee Engagement and Retention:

To understand the factors influencing employee engagement and retention, we employed the criteria proposed by Kennedy & Daim (2010), aiming to align employees' needs and goals with the responsibilities and goals of employers and organizations. While the original criteria consist of ten elements, we also incorporated two additional factors focused on diversity (items 11 and 12):

1. Communication, trust, and relationships
2. Pride, satisfaction, and value
3. Positive climate and culture
4. Effective, competent, and fair leadership
5. Working conditions and environment
6. Career training and development
7. Recognition, respect, and appreciation
8. Job security
9. Salary and monetary compensation
10. Benefits and perks
11. Diverse identities and perspectives on the team
12. Diverse representation in leadership

To assess the alignment in agreement between employees and recruiters on these 12 elements, we presented both groups with a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) (Figure 14).

Figure 14. The percentage of employees and recruiters that said they strongly or somewhat agree that each of these factors are important for work engagement and retention.

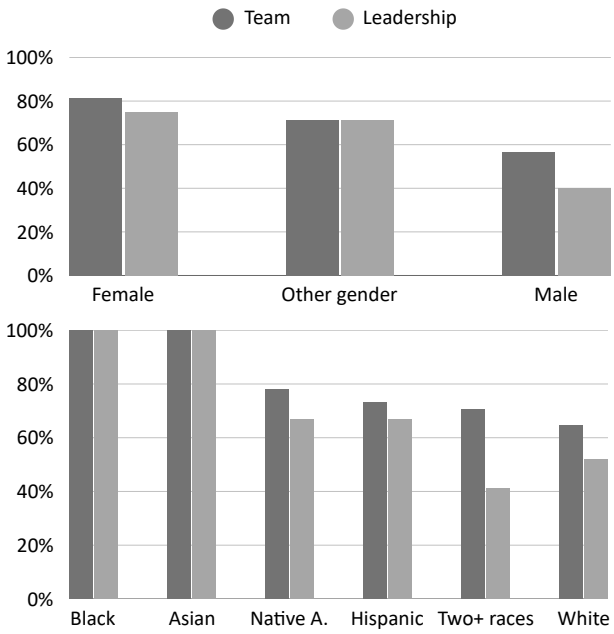


Approximately 90% or more of both employees and recruiters agree on seven of the 12 factors that impact engagement and retention: communication, trust, and relationships; pride, satisfaction, and value; positive climate and culture; effective, competent, and fair leadership; working conditions and environment; career training and development; and recognition, respect and appreciation.

Despite the generally high level of agreement among the two groups, employees typically rate their agreement a few percentage points higher than recruiters. This discrepancy is particularly more pronounced in areas such as job security, salary and monetary compensation, and benefits and perks.

The two diversity-related factors obtained the lowest ratings overall. To further understand the diversity ratings, we compared responses across different demographic groups (Figure 15). The findings indicate that male, multiracial, and white respondents are more likely to rate lower importance of diversity factors, especially in relation to diverse leadership, when it comes to feeling engaged and retained in their workplace.

Figure 15. The percentage of employees and recruiters who strongly or somewhat agree on diversity team and leadership as important work engagement and retention factors.



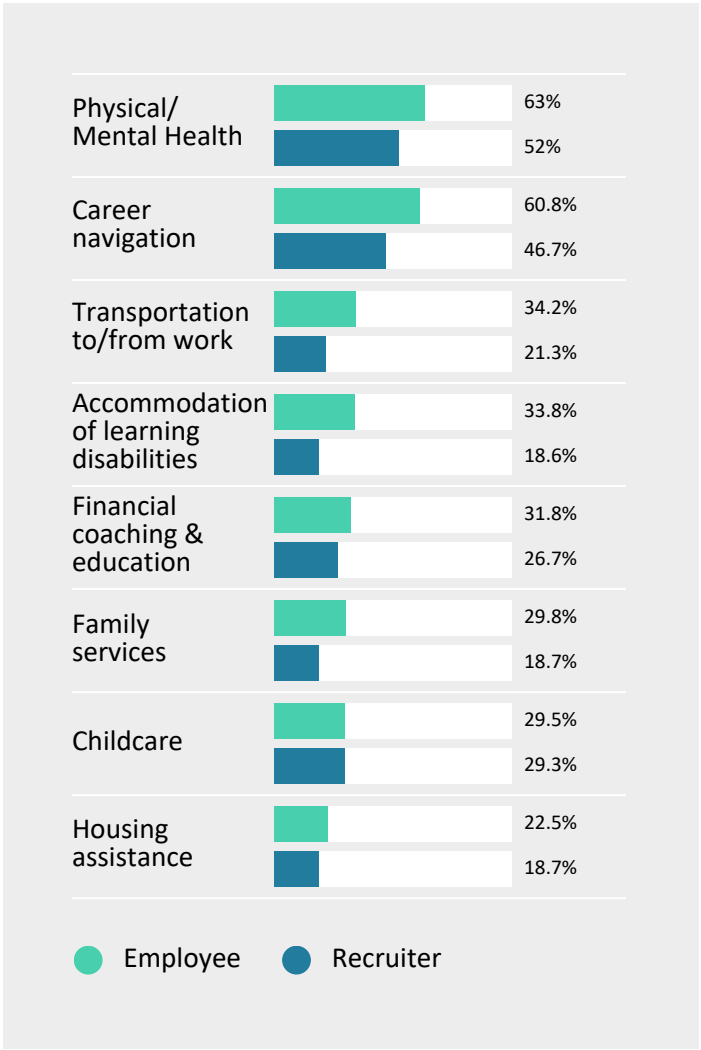
Key Services for Employee Engagement and Retention:

In this section, we explore questions regarding access to integrated services designed to address individuals' complex needs, such as training and social support, which are important for improving recruitment and retention outcomes (Center for Law and Social Policy, 2017). These stabilization and supportive services include:

- Physical and mental health services
- Career navigation
- Transportation to/from work
- Accommodation of learning disabilities
- Financial coaching and education
- Family services (e.g., abuse, children's health)
- Childcare
- Housing assistance

Similar to the previous section, we examine the perspectives of both employees and recruiters regarding the importance of these services for engagement and retention (Figure 16). Overall, access to physical and mental health services and career navigation are considered the most important. Consistent with the findings in the previous section, employees tend to rate most services higher than recruiters do. The only exception is "childcare", in which both groups view it as equally important.

Figure 16. The percentage of employees and recruiters who strongly or somewhat agree on the importance of accessing each of these services for employee engagement and retention.



HARASSMENT AND MICROAGGRESSION

To assess the prevalence of harassment, discriminatory behaviors, and racial microaggressions in the forest sector, this study adopted the IDEAL Diversity, Equity, and Inclusion Survey developed by Stanford University (2021).

- Harassment is defined as "unwelcome conduct that is based on race, color, religion, sex (including sexual orientation, gender identity, or pregnancy), national origin, older age (beginning at age 40), disability, or genetic information (including family medical history)" (U.S. Equal Employment Opportunity Commission, n.d.a).
- Discrimination refers to "treating a person differently, or less favorably," due to any of the characteristics listed above (U.S. Equal Employment Opportunity Commission, n.d.b).
- Racial microaggressions are "brief and commonplace daily verbal, behavioral, and environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults to target a person or group" (Sue et al., 2007).

All participants, including students, employees, and recruiters, were asked three questions about their experiences with verbal, written, or online harassing behaviors, physical harassing behaviors, or discriminatory behaviors. Examples of interactions presented in each question include:

1. Verbal, written, or online harassment:

- Someone made a derogatory remark or gesture in person or online
- I was embarrassed, humiliated, or threatened by someone in person or online

2. Physical harassment:

- I was threatened with physical violence
- Someone tried to touch me without my consent

3. Discriminatory behaviors:

Employees and Recruiters

- Denied or overlooked for a promotion
- Unfair or unjust hiring practice

Students

- Graded unfairly by professor/instructor
- Discouraged from pursuing a particular major

In addition, respondents were asked if they had experienced any of these four related to racial microaggressions. Examples of interactions presented in each question include:

1. Invalidated lived experience:

- Someone told me that they "don't see color" or we should not think about race anymore
- Others assume that people of my racial background would succeed if they simply worked harder

2. Assumed inferiority:
- Someone acted surprised at my scholastic or professional success
- Someone assumed I come from a disadvantaged background

3. Othered or exoticized:
- Someone did not believe me when I told them I was born in the U.S.
- Someone suggested I was "exotic"

4. Acted afraid or wary
- Someone avoided walking near me
- Someone clenched her/his/their purse or wallet upon seeing me

More than 50% of the respondents reported experiencing at least one form of harassment, discrimination, or racial microaggression in their school or workplace. Specifically, 37.3% encountered verbal, written, or online harassment, 8.0% physical harassment, and 28.6% discrimination. Gender identity was the most common harassment or discrimination factor, followed by age. Compared to Man, individuals identifying with Other gender and Woman were more likely to encounter harassment or discrimination (Figure 17). In addition, respondents between the ages of 35 and 74 were more likely to experience harassment or discrimination.

Regarding racial microaggression, 18.9% of respondents reported their lived experiences being invalidated, 22.6% felt that they were perceived as inferior, 9.3% sensed that others acted afraid or wary of them, and 14.6% felt othered or exoticized. Black/African American, multiracial, and Hispanic/Latino respondents reported the highest prevalence of racial microaggressions (Figure 18).

Figure 17. The percentage of respondents saying they have experienced harassment and discrimination at school or work.

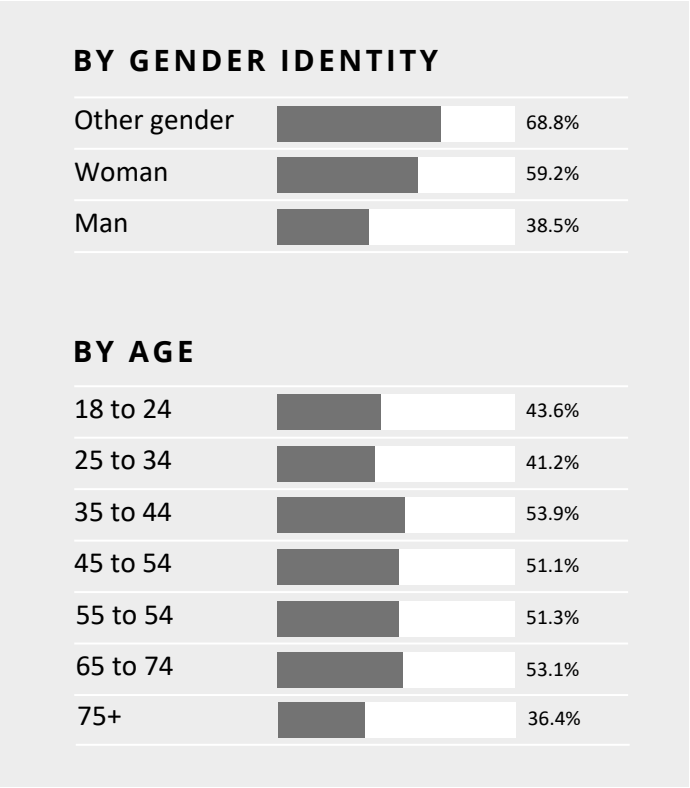
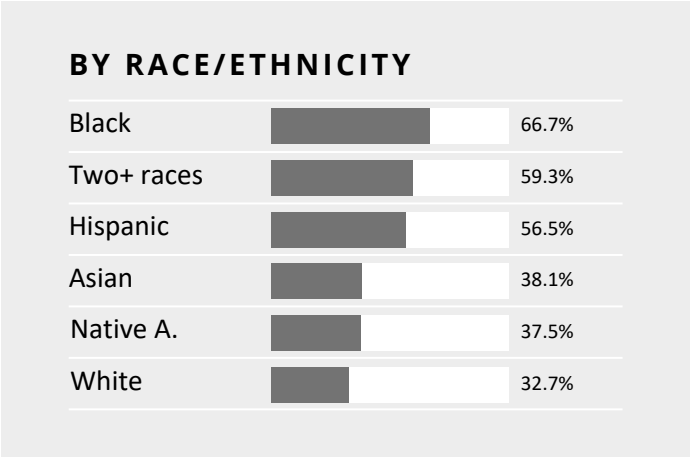


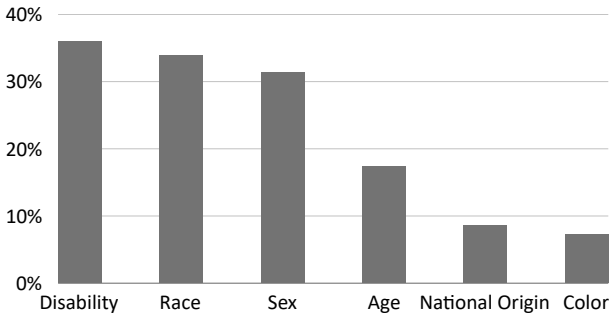
Figure 18. The percentage of respondents saying they have experienced racial microaggressions at school or work.



These reported experiences are not unique to the forest sector. In 2023, the U.S. Equal Employment Opportunity Commission recorded 81,000 employment discrimination charges. Of these charges, 33.9% were race based, 31.4% sex (gender) based, and 17.4% age based (Figure 19).

Specific to gender, 42% of working women in the U.S. report facing discrimination in the workplace, compared with 22% of men (Pew Research Center, 2017). Regarding race or ethnicity, 41% of Black workers report facing discrimination or unfair treatment, compared with 8% of White workers, 20% of Hispanic workers and 25% of Asian workers (Pew Research Center, 2023).

Figure 19. Employment discrimination charges filed in 2023 in the U.S.



Source: Equal Employment Opportunity Commission (EEOC)

FUTURE OUTLOOK

The next set of results summarizes the views and opinions about future outlooks for the forest and wood products sector from the three survey samples: students, employees, and recruiters.

SECTOR ATTRACTIVENESS

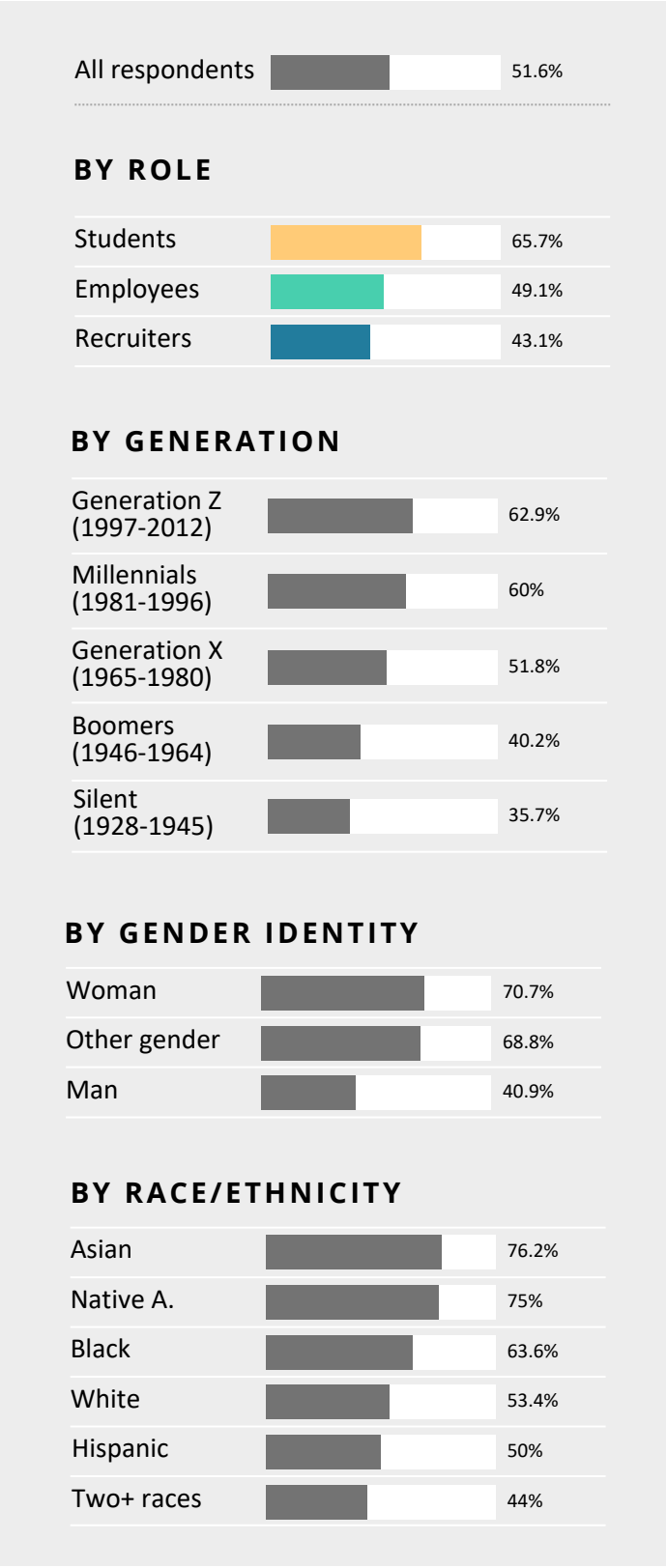
To attract people to the FWP sector, enhancing its appeal is crucial. Currently, 63.3% of survey respondents who study or work in the FWP sector believe that its attractiveness is likely to increase in the next 5 to 10 years. A breakdown of this percentage reveals that students are the most optimistic as 72% of them anticipate an increase in attractiveness, compared to 61.6% of employees, and 59.2% of recruiters.

IMPORTANCE OF DEI FOR THE INDUSTRY

Half of all respondents believed that diversity, equity, and inclusion will be extremely or very important for the FWP sector in the next 5 to 10 years (Figure 20).

This view is more common among students than employees or recruiters, likely reflecting a generational shift. Younger generations, particularly Generation Z (1997-2012) and Millennials (1981-1996), are more likely to say DEI will be extremely or very important for the FWP sector compared to older generations.

Figure 20. The percentage of respondents who said diversity, equity, and inclusion will be extremely or very important for the FWP sector in the next 5-10 years.



Our results also show that gender-based differences in perceptions of DEI, as 70.7% of women said it will be extremely or very important, compared to just 40.9% of men. There are also differences based on race, with Asian and American Indian/Native American or Alaska Native respondents being more likely than other racial groups to say that DEI will be extremely or very important for the FWP sector.

PERCEPTIONS OF EMPLOYMENT OPPORTUNITIES

The majority of respondents (students, employees, and recruiters combined) said both men (85.6%) and women (83.0%) are extremely or somewhat likely to find employment in the FWP sector over the next 5 to 10 years. In contrast, just 39.5% said other gender identity individuals are likely to find job in this field (Figure 21).

Perceptions regarding employment for individuals with Other gender identities varied slightly by role: 46.0% of students and 45.2% of recruiters believed they were likely to find a job, compared to just 36.6% of employees. Of note, nearly a quarter of employees and recruiters, along with 18.9% of students, selected "I don't know" when asked about employment opportunities for individuals with other gender identities. This may suggest a lack of awareness and/or familiarity with the challenges these individuals face in securing jobs in the sector.

Employment perceptions also differ both between and within gender. While the overall view of men and women securing jobs in the FWP sector is similar (85.6% and 83%, respectively), men tend to believe women have better employment chances than women themselves do (Figure 22). For instance, 53.4% of men believe women are extremely likely to find jobs in the sector, compared to only 36% of women who share this view. Similarly, women view men's chances of finding jobs more favorably than men do (Figure 23). While 86.3% of women indicated men are extremely likely to find a job in the sector, only 60.6% of men express the same confidence in their own job opportunities.

Figure 21. The percentage of respondents saying each of these gender identities are extremely or somewhat likely to find a job in the FWP Sector.

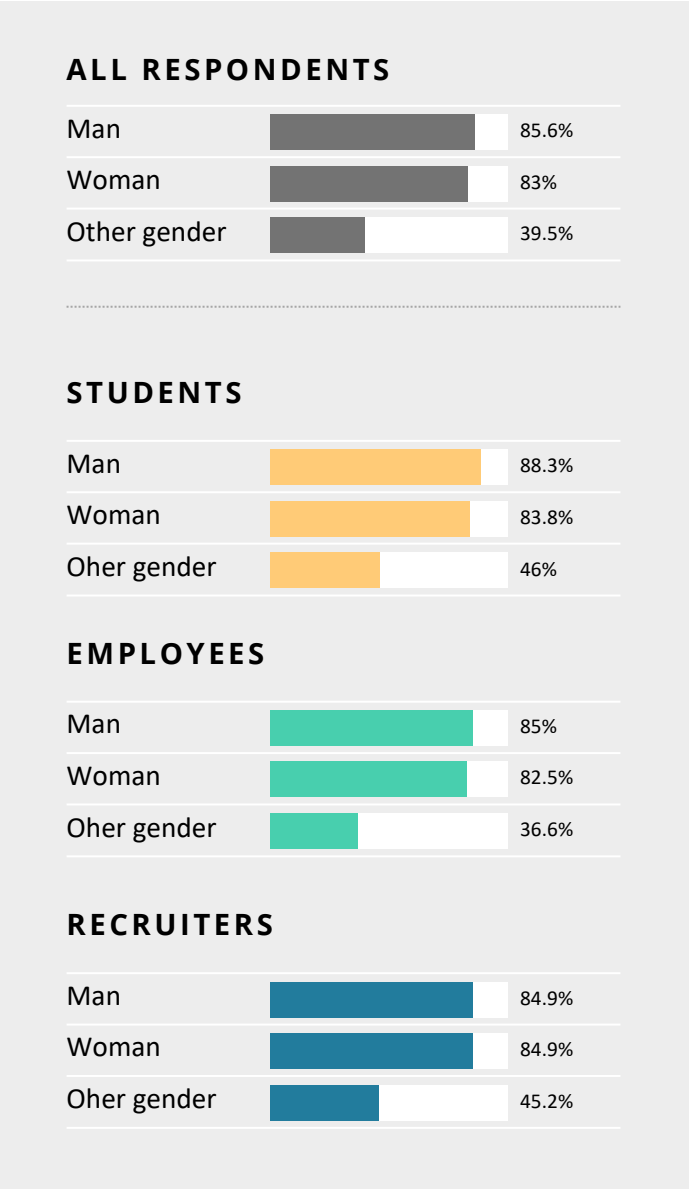


Figure 22. Perspectives on Women's likelihood to secure employment in the FWP sector.

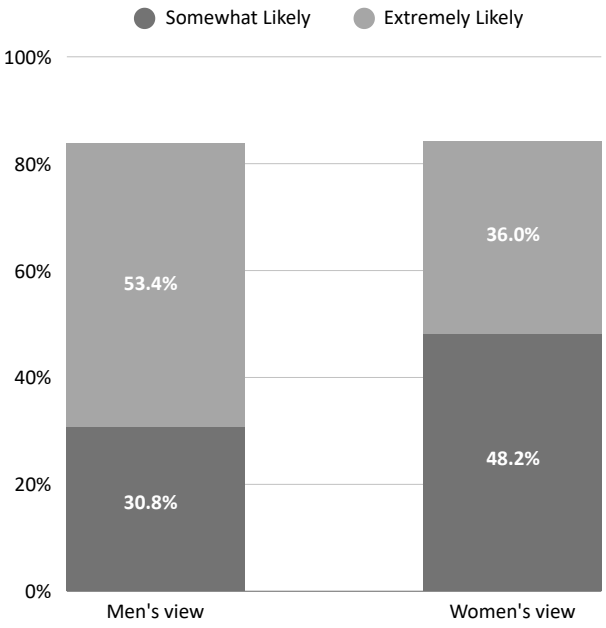
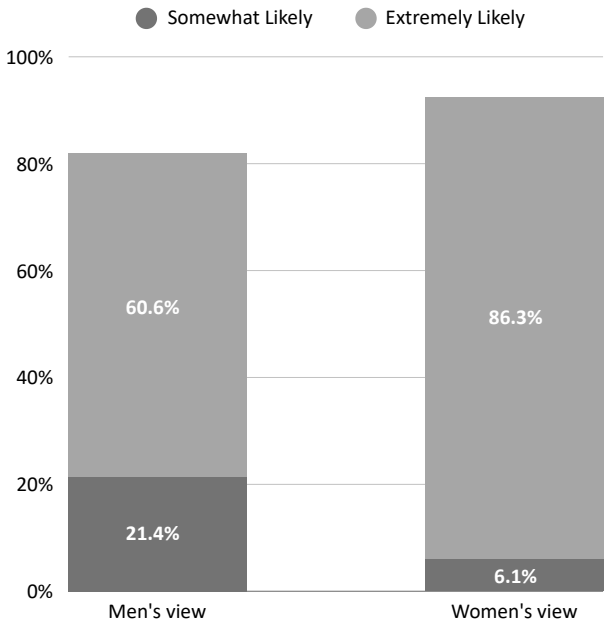


Figure 23. Perspectives on Men's likelihood to secure employment in the FWP sector.



Systematic Literature Review (SLR)

SLR METHODOLOGY

We utilized a systematic literature review (SLR), a scientific investigation methodology characterized by the use of predetermined procedures and a focus on main research publications (Cook et al., 1997). A SLR differs from typical narrative reviews by employing a replicable, rigorous, and transparent process that aims to minimize bias (Tranfield et al., 2003). The SLR conducts comprehensive literature searches of published research to summarize extensive bodies of evidence and analyze the data synthesis (Cook et al., 1997). Figure 24 presents three phases of our SLR.

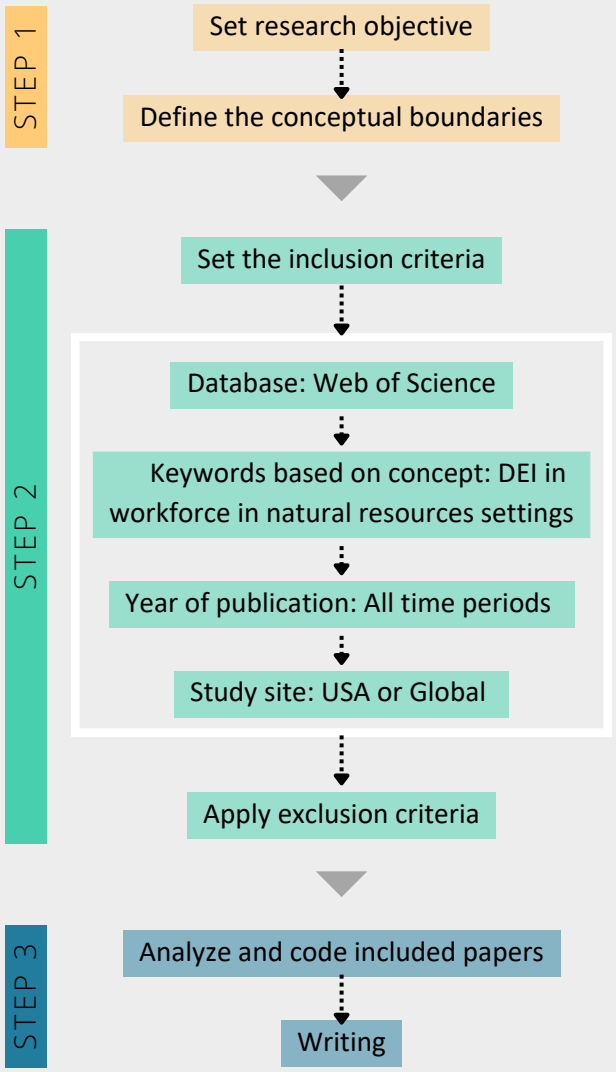
Step 1: research objective and conceptual boundaries

We conducted a qualitative, concept-driven systematic review approach proposed by Webster and Watson (2002). The technique involves conducting a thorough examination of literature from a conceptual perspective, taking into account the viewpoints presented by all authors. We chose this approach because it provides a clear and comprehensive overview of the available evidence on a given topic.

Step 2: inclusion and exclusion criteria

During the 2-month time period of December 2023 through January 2024, we conducted searches and identified articles to support completion of Step 2 of the SLR method. Relevant articles were identified from the Web of Science

Figure 24. Systematic Literature Review Phases



database by Thomson Reuters using predetermined keywords:

> *Diversity OR equity OR equality OR inclusion OR justice OR accessibility OR "affirmative action" (Topic) AND forest OR "wood product" (Topic) AND workforce or workplace or employment OR labor OR labour (Topic).*

Methodologically, "affirmative action" and "wood product" are in quotation marks to significantly improve the accuracy and relevance of the search results.

In total, we identified 1,047 potential articles from the Web of Science database. The researchers read the articles to identify those that have a scientific contribution (i.e., having research methods to meet their objectives). We excluded articles that did not directly address DEI concepts in workforce study in natural resource settings.

We also only included papers that cover United States and/or global perspectives. For example, 381 from 1,047 articles applied to a single country other than United States. We finalized 28 articles as our population (Table 4).

Step 3: content analysis

Each paper was again read by the researchers, and the following information was placed in a database: author, article title, published year, journal name, publisher, and research methods (Table 4). We followed a qualitative content analysis approach and thematically analyzed the final selection of articles based on criteria developed from the literature analysis (Schreier, 2012).

Table 4. Papers included in the systematic literature review

Aurthor	Year	Title	Journal	Publisher	Method
Davis, E.J., Wilmsen, C., Machado, M.A. and Alessi, G.M.	2023	Multiple Stories, Multiple Marginalities: The Labor-Intensive Forest and Fire Stewardship Workforce in Oregon	Fire	MDPI	Mixed: Literature review and based on professional and personal experiences
Sachdeva, S.S., Westphal, L.M., Kenefic, L.S., Dockry, M.J., Locke, D.H. and Fisher, C.L.	2023	Despite Workforce Diversity Efforts, Career Metrics Differ for Some Demographic Groups in the USDA Forest Service	Society & Natural Resources: An International Journal	Routledge	Government data analysis
Westphal, L.M., Dockry, M.J., Kenefic, L.S., Sachdeva, S.S., Rhodeland, A., Locke, D.H., Kern, C.C., Huber-Stearns, H.R. and Coughlan, M.R.	2022	USDA Forest Service Employee Diversity During a Period of Workforce Contraction	Journal of Forestry	Oxford	Government data analysis
Bailey, C., Sinclair, P., Bliss, J. and Perez, K	1996	Segmented labor markets in Alabama's pulp and paper industry	Rural Sociology	Wiley	Secondary data analysis and interviews
Locke, D.H., Sachdeva, S.S., Westphal, L.M., Kenefic, L.S., Dockry, M.J. and Fisher, C.L.	2023	Spatially Explicit Assessment of the USDA Forest Service as a Representative Bureaucracy	Forest Science	Oxford	Government data analysis

Aurthor	Year	Title	Journal	Publisher	Method
Macinnis-Ng, C. and Zhao, X.	2022	Addressing Gender Inequities in Forest Science and Research	Forests	MDPI	Literature review
Bardekjian, A.C., Nesbitt, L., Konijnendijk, C.C. and Lötter, B.T.	2019	Women in urban forestry and arboriculture: Experiences, barriers and strategies for leadership	Urban Forestry & Urban Greening	Elsevier	Survey
Heynen, N., Perkins, H.A. and Roy, P.	2007	Failing to grow "their" own justice? The co-production of racial/gendered labor and Milwaukee's urban forest	Urban Geography	Routledge	Mixed - Interviews, archival materials
Dockry, M.J., Sachdeva, S.S., Fisher, C.L., Kenefic, L.S., Locke, D.H. and Westphal, L.M.	2022	Student trainee and paid internship programs have positive results but do little to influence long-term employee diversity in the USDA forest service	PLOS One	PLOS	Government data analysis
Hartshorn, J.A., Brockerhoff, E.G., Klapwijk, M.J., Marzano, M., Ganley, R.J. and Darr, M.N	2023	Attracting and retaining women in forest entomology and forest pathology	Forest Policy & Economics	Elsevier	Survey
Larasatie, P., Barnett, T. and Hansen, E.	2020	Leading with the heart and/or the head Experiences of women student leaders in top world forestry universities	Scandinavian Journal of Forest Research	Taylor & Francis	Interviews
Kern, C.C., Kenefic, L.S., Dockry, M.J. and Cobo-Lewis, A.	2020	Discrimination and career satisfaction: perceptions from US Forest Service Scientists	Journal of Forestry	Oxford	Survey
Charnley, S., Davis, E.J. and Schelhas, J.	2023	The Bipartisan Infrastructure Law and the Forest Service: Insight for Local Job creation and equity from the American recovery and reinvestment act	Journal of Forestry	Oxford	Case studies
Hansen, E., Conroy, K., Toppinen, A., Bull, L., Kutnar, A. and Panwar, R.	2016	Does gender diversity in forest sector companies matter?	Canadian Journal of Forest Research	NRC	Secondary data analysis
Bal, T.L. and Sharik, T.L.	2019	Web content analysis of university forestry and related natural resources landing webpages in the united states in relation to student and faculty diversity	Journal of Forestry	Oxford	Web content analysis
Brown, G., Harris, C. and Squirrell, T.	2010	Gender Diversification in the U.S. Forest Service: Does It Still Matter?	Review of Public Personnel Administration	Sage	Survey

Aurthor	Year	Title	Journal	Publisher	Method
Kern, C.C., Kenefic, L.S. and Stout, S.L.	2015	Bridging the Gender Gap: The Demographics of Scientists in the USDA Forest Service and Academia	BioScience	Oxford	Secondary data analysis
Brown, G. and Harris, C.C.	2001	A longitudinal study of environmental attitudes of women and gender diversification in the US forest service 1990-1996	Forest Science	Oxford	Survey
Ashton, P.G. and Pickens, J.B.	1995	Employment diversity and economic performance in small, resource-dependent communities near western national forests	Society & Natural Resources: An International Journal	Routledge	Mixed: Government data analysis and interviews
Larasatie, P., Baublyte, G., Conroy, K., Hansen, E. and Toppinen, A.	2019	From nude calendars to tractor calendars: the perspectives of female executives on gender aspects in the North American and Nordic forest industries	Canadian Journal of Forest Research	NRC	Interviews
Rustad, L., Adams, M.B., Dymond, S.F., Gregory, M. and Miniat, C.F.	2023	Perspectives on the contributions of women to the hydrologic sciences and their changing demographics at USDA Forest Service Experimental Forests and Ranges	Journal of Hydrology	Elsevier	Mixed: Secondary data analysis, literature reviews, and survey
Halvorsen, K.E.	2000	Relationships between national forest system employee diversity and beliefs regarding external interest groups	Forest Science	Oxford	Survey
Thomas, J.C. and Mohai, P.	1995	Racial, gender, and professional diversification in the Forest Service from 1983 to 1992	Policy Studies Journal	Wiley	Secondary data analysis
Bettinger, P., Merry, K.L. and Cieszewski, C.J.	2016	The importance of mapping technology knowledge and skills for students seeking entry-level forestry positions: evidence from job advertisements	Mathematical and Computational Forestry & Natural-Resource Sciences	MCFNS	Secondary data analysis
Crandall, M.S., Costanza, K.K., Zukswert, J.M., Kenefic, L.S. and Leahy, J.E.	2020	An Adaptive and Evidence-Based Approach to Building and Retaining Gender Diversity within a University Forestry Education Program: A Case Study of SWIFT	Journal of Forestry	Oxford	Case study through observation and survey

Aurthor	Year	Title	Journal	Publisher	Method
Sample, V.A., Bixler, R.P., McDonough, M.H., Bullard, S.H. and Snieckus, M.M.	2015	The Promise and Performance of Forestry Education in the United States: Results of a Survey of Forestry Employers, Graduates, and Educators	Journal of Forestry	Oxford	Survey
O'Herrin, K., Day, S.D., Wiseman, P.E., Friedel, C.R. and Munsell, J.F.	2018	University student perceptions of urban forestry as a career path	Urban Forestry & Urban Greening	Elsevier	Survey
Arenas, A.A., Spence, P.L., Nilon, C.H. and Leggett, Z.H.	2023	Diversifying the Field of Forestry Through a Graduate Fellowship Program: A Pilot Study on the Expectations of Students of Color	Journal of Forestry	Oxford	Survey

SLR RESULTS

Based on the content analysis of our population articles (Table 4), we found three themes: (1) the USDA Forest Service (USFS) has been a lead agency in developing the research in FWP sector; (2) Discussion on diversity, equality, and inclusion largely focuses on gender and race/ethnicity; and (3) The concepts of equity and justice are investigated concomitantly.

1 USDA FOREST SERVICE (USFS)

Following a court consent decree in 1973, the agency initiated a workforce diversification program aimed at enhancing opportunities for women and minorities (Brown et al., 2010). This initiative was designed to create a workforce that reflects the diverse communities served by the USFS. Despite these efforts, there remains a perception among some male employees that diversification has not improved workforce competency or broadened agency values (Brown & Harris, 2001).

Research indicates that the USFS operates within a "discrimination-and-fairness" framework rather than a "valuing-and-integrating" approach, which may limit the benefits of diversification (Brown et al., 2010). Women continue to be underrepresented in higher management levels, with only 21% and 17% of positions in the GS13–15 and Senior Executive Service levels occupied by women, respectively (Brown & Harris, 2001). However, recent studies show a positive trend, with an increase in the proportion of women in higher-grade positions and managerial roles within the agency (Rustad et al., 2023). This growth is attributed to women leaders serving as role models and advocating for gender-related issues, thereby enhancing awareness and contributing unique perspectives to the agency's mission (Rustad et al., 2023).

The USFS has the potential to serve as a model for other land management agencies facing similar diversity challenges (Sachdeva et al., 2023). In alignment with President Biden’s executive orders, the agency developed an Equity Action Plan to address barriers to equitable participation in its programs, particularly for underserved communities (Charnley et al., 2023). Underserved communities “specified include racial and ethnic minorities, people who live in rural areas, and people adversely affected by persistent poverty or inequality, among several others” (Charnley et al., 2023 p.284). Moreover, evidence suggests that communities with higher employment diversity are better equipped to adapt to economic changes, exhibiting lower and more stable unemployment rates (Ashton & Pickens, 1995). In this paper, employment diversity is defined as balanced employment across industry sectors. The evidence underscores the importance of promoting workforce diversification not only within the USFS but also in the communities it serves.

2 DIVERSITY, EQUALITY, AND INCLUSION

The landscape of forest-related higher education is witnessing a gradual shift toward gender diversity and equality, primarily initiated at the leadership level by university presidents, deans, and department heads (Larasatie et al., 2020). However, a distinction exists between the academic levels. Research indicates that the graduate level of forest-related education is more inclusive than the undergraduate level, suggesting that targeted efforts at higher academic tiers may yield better outcomes for gender equality (Larasatie et al., 2020). Also, despite increased enrollment of female students, particularly from minority racial groups, there remains a significant gap in the representation of female faculty members, indicating systemic barriers that persist in the academic workforce (Bal & Sharik, 2019).

Nevertheless, in the workforce, particularly for African-Americans, employees continue to grapple with the long-lasting effects of historical discrimination, which hampers equal opportunities in both education and employment (Bailey et al., 1996). In the arboricultural sector, for example, addressing labor market inequalities presents a complex challenge that necessitates efforts beyond a mere public relations campaign aimed at promoting the concept of minority forestry employees (Heynen et al., 2007).

The slow pace of advancements in workplace equality is evident (Larasatie et al., 2020), as many professionals report experiencing gender-based discrimination and harassment, highlighting the unique challenges faced by women in the industry (Bardekjian et al., 2019). Despite these challenges, there are positive developments towards fostering a more diverse and inclusive workforce within the forest industry (Larasatie et al., 2019). The increasing participation of women is contributing to a more welcoming work environment, encouraging them to pursue their interests alongside their careers (Bardekjian et al., 2019). For example, in addition to their forestry careers, women today have numerous options to explore interests in tree care, arboriculture, and urban forestry. This evolution towards inclusivity is recognized as a gradual process, especially due to bias, microaggressions, discrimination, isolation, lack of support, and networking struggles (Crandall et al., 2020). Therefore, the need for sustained efforts to achieve meaningful change is emphasized (Crandall et al., 2020).

3 EQUITY AND JUSTICE

The literature on environmental justice has offered valuable insights into the creation of uneven urban environments, particularly in terms of procedural justice, as well as the disparities in individuals' capacities to engage with these environments, reflecting distributional justice (Heynen et al., 2007). A study examining the evolving dynamics between Milwaukee’s Bureau of Forestry and its African American and female employees indicates that procedural injustices within the Bureau have significant implications for distributional injustices related to salary and benefits for its marginalized workforce. While in wildfire literature, the scholars often focus on distributional equity, recognizing the influence of structural and institutional factors on the allocation of benefits, outcomes, and costs (Davis et al., 2023). Those factors include access to resources for fire readiness and mitigation: information, expertise, financial resources for structural and vegetation preparation,

responsibility for protection and preparation expenses, financial or capacity assistance such as grants, and the locations of fuel treatments (Adams & Charnley, 2020; Auer 2021). However, quantifying procedural equity (who is represented in deliberation, dialogue, and decision-making processes) and recognitional equity (acknowledgement of and respect for identity, values, and associated rights) in wildfires presents challenges. The narrative surrounding wildfire governance is evolving, incorporating new perspectives and complexities related to equity and environmental justice (Davis et al., 2023).

Two of President Biden's executive orders demonstrated the administration's commitment to prioritizing equity in federal government operations (Charnley et al., 2023). The first focuses on advancing racial equity and providing support for underserved communities. The second establishes the Justice40 Initiative, directing 40% of the advantages of "covered" federal programs towards disadvantaged communities (Charnley et al., 2023).

The ongoing dialogue surrounding gender equity in the forest sector underscores the need to move away from being comfortable with “acceptable” social constructs and start realizing how unacceptable they are for women across various industries (Bardekjian et al., 2019). Social science and psychology offer social constructionist theories positing that sex-differentiated social behavior is shaped by social role assignments and individual self-selection into these roles (Eagly et al., 2012; Wood and Eagly, 2002). The traits necessary for performing gender-typical roles become stereotypical for women and men. The degree to which individuals occupy these roles reinforces related stereotypes and influences social behavior, a process further exacerbated by socialization (Bussey and Bandura, 1999; Wood and Eagly, 2002). To implement impactful changes that promote gender equity in the workplace, it is crucial to understand the unique experiences of women and explore potential strategies to ensure positive and empowering experiences (Bardekjian et al., 2019). The top five strategies suggested in the paper are sponsorship/mentoring, confidence, communication, work-life balance, and career planning.

Latinx (a non-binary inclusive term for “Hispanic” and “Latino”) workers face numerous inequities and injustices, particularly under the H-2B program (Davis et al., 2023). In Oregon, the wildfire workforce comprises a significant portion of Latinx individuals, including multi-generational U.S. residents, business owners, and those holding temporary work (H-2B) visas. These workers encounter challenging working conditions as a result of the segmented labor market, immigration policy, and the influence of the agricultural lobby (Davis et al., 2023). Further, the authors present both ideological and pragmatic recommendations regarding how researchers and practitioners can cultivate this through two interconnected and mutually reinforcing strategies: (1) Reimagine the collaborative dynamics inherent in research and practice; and (2) Allocate resources towards extension and educational initiatives.

In-Depth Interviews

INTERVIEW METHODOLOGY

In total, we interviewed 12 individuals with DEI leadership positions across the United States: three companies, four universities, and five non-profit organizations. Internet searches (investigating potential individual respondents through the organization's website) and snowball sampling (respondents helping to recruit potential respondents) helped us identify the interview population.

We utilized an elite interview (Dexter, 1970), a specialized and focused method, to target the top management team, which is specifically responsible for leading DEI efforts. Before conducting the interviews, the researchers reviewed DEI-related information from each organization to conduct a preliminary analysis. This step is beneficial in preventing the possibility of misunderstanding concepts and excessive personal bias, as the outcome of the interview is the respondents' definition of the situation (Berry, 2002).

We chose the elite interview approach because gatekeeping, a crucial networking practice in leadership recruitment, can significantly impact DEI efforts in various ways (e.g., Van den Brink & Benschop, 2014). Since gatekeeping pertains to the decisions on shortlisting, interviewing, and nominating leader candidates, it implies the power of elites as the absolute decision-makers. The mechanism of these gatekeepers is often associated with homophily (Van den Brink & Benschop, 2014), in which communication and relationships between similar people occur at a higher rate than among dissimilar people (McPherson et al., 2001). Homosociality is a related phenomenon that involves preference relations and the "similar-to-me" effect (Lipman-Blumen, 1976; Rand & Wexley, 1975). For instance, if these elites predominantly consist of white men, women and minorities may face significant challenges in securing leadership positions.

We adapted the interview questionnaire from a few studies on DEI elements in the FWP sector such as Baublyte et al. (2019) and Larasatie et al. (2019). We designed the questions to gain a comprehensive understanding of (1) the leader's background, (2) the DEI leadership, and (3) their future predictions for DEI. We transcribed and analyzed the recorded conversation verbatim using the three criteria, concentrating on content. We interpret respondents’ perspectives, ideas, and subjective viewpoints, although we recognize that current knowledge may influence these. Repeating the same questions over time may result in various patterns.

INTERVIEW RESULTS

1 LEADER'S BACKGROUND

Our interview respondents hold DEI leadership positions in different organization types across United States: three companies, four universities, and five non-profit organizations. Nine of the 12 individuals that were interviewed hold graduate degrees. One respondent has an academic background in forestry, four have backgrounds in natural resources and related sciences, and the remaining seven have a diverse background including higher education administration, business administration, and leadership.

Nine participants hold graduate degrees from reputable U.S. universities including Ivy League universities.

While most of our respondents have served various different leadership roles prior to spearheading DEI initiatives, just three have official DEI training. Others hold varied certificates such as mentorship, professional counselor, and career development. A respondent from a commercial company mentions that they started their career in the supply chain before moving to different roles such as marketing. The respondent also needs to move to different job locations within the same companies.

2 DEI LEADERSHIP

The participants' understanding of DEI reveals a complex, evolving landscape in both institutional and individual contexts. They perceive progress in institutional DEI efforts, especially when it comes to enhancing visibility, forming partnerships, and increasing diversity in hiring. However, challenges remain, especially in a white male-dominated field, where gender and racial equity have been slow to develop. Some respondents highlight systemic thinking as crucial to DEI, comparing it to biodiversity in that inclusion must be holistic and relational. Others underscore that while diversity is addressed, equity is often overlooked or underdeveloped. The intersection of personal experiences with institutional efforts underscores the importance of leadership, intentional hiring practices, and the need for cultural change, particularly in industries where historic exclusion persists.

We discovered that DEI leaders in different organization types have a range of experiences and methods. One participant highlights how their African American ethnicity shapes student-beneficial policies and practices. Others spoke about their participation in grant applications aimed at underserved groups. The leaders consider the value of a variety of advocacy strategies, such as direct action and persuasion. In addition, the leaders attempt to clarify the

importance of creating inclusive methods, promoting equal experiences, and helping people find who they are. All the leaders dedicate themselves to fostering inclusive cultures in both academic and professional settings.

A respondent articulated a sense of personal fulfillment derived from ascending to positions of DEI leadership. The leader experiences profound satisfaction in effecting positive changes for their organization members. It entails creating avenues for individuals from diverse and underrepresented backgrounds within various organizations to access opportunities. The leader further explains it is imperative to identify and address the barriers that hinder the individuals' experience of equitable opportunities with deliberate intent. The actions include asking questions such as what kind of measures can be implemented to guarantee that all perspectives are acknowledged; ensuring individuals encounter equitable experiences in their lives while simultaneously addressing the social injustices that hinder such experiences.

Active leadership is emphasized as essential in promoting change and facilitating the success of DEI. Over time, this assistance has aided in the growth of DEI efforts, enabling teams and programs to target corporate objectives more effectively. In higher education settings, mentorship is cited as a crucial tactic in assisting students in overcoming obstacles in their academic and professional lives. Mentorship provides students with networks and connections that support their continued development, especially for underrepresented groups.

3 FUTURE OF DEI

Leaders identified political dynamics and public perceptions as the most challenging factors for the future of DEI. The field of DEI has become significantly politicized and polarized. For example, some respondents talked about recent political movements that have resulted in changes to how their institution addresses DEI efforts, including rebranding and modifications to positions and titles.

These changes, which were prompted by political decisions, compel them to reorient their DEI activities to align with new national expectations. The politicization of DEI at various levels has had a big effect on how it is used and organized across institutions. For example, rising anti-DEI sentiment makes it unclear whether the respondents' position will be able to last in the long term.

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APPENDIX

Appendix 1. Universities Invited to Participate in the Survey:

1.Abraham Baldwin Agricultural College
2.Alabama A&M University
3.Auburn University
4.California Polytechnic State University
5.Clemson University
6.Colorado State University
7.Cornell University
8.Delaware State University
9.Duke University
10.Florida A&M University
11.Humboldt State University
12.Iowa State University
13.Kansas State University
14.Louisiana State University
15.Louisiana Tech University
16.Michigan State University
17.Michigan Technological University
18.Mississippi State University
19.North Carolina State University
20.Northern Arizona University
21.Ohio State University
22.Oklahoma State University
23.Oregon State University
24.Paul Smith's College
25.Pennsylvania State University
26.Purdue University
27.Southern Illinois University
28.SUNY College of Environmental Science and Forestry
29.Texas A&M University
30.The University of Vermont
31.University of Alaska Fairbanks
32.University of California, Berkeley
33.University of California, Davis
34.University of Connecticut
35.University of Delaware
36.University of Florida
37.University of Georgia
38.University of Idaho
39.University of Illinois at Urbana-Campaign
40.University of Kentucky
41.University of Maine
42.University of Maryland
43.University of Massachusetts Amherst
44.University of Michigan
45.University of Minnesota
46.University of Missouri
47.University of Montana
48.University of New Hampshire
49.University of Tennessee
50.University of Washington
51.University of Wisconsin- Madison
52.University of Wisconsin-Stevens Point
53.Utah State University
54.Virginia Polytechnic Institute
55.Washington State University
56.West Virginia State University
57.West Virginia University
58.Yale University

Appendix 2. Organizations Invited to Participate in the Survey

1.1890 Foundation
2.1994 Tribal Colleges
3.Alabama Forest Owners Association
4.Alabama Forestry Association
5.Alaska Forestry Association
6.American Forest & Paper Association
7.American Logging Council
8.American Wood Council
9.Arkansas Forestry Association
10.Association of Consulting Foresters
11.CalForests
12.Florida Forestry Association
13.Forest Carbon Coalition
14.Forest Landowners Association
15.Forest Products Society
16.Forest Resources Association
17.Forestry Association of South Carolina
18.Georgia Forestry Association
19.Hawaii Forest Industry Association
20.Hispanic Association of Colleges and Universities
21.Idaho Forest Owners Association
22.International Society of Forest Resource Economics
23.Intertribal Timber Council
24.International Association of Arborists
25.Louisiana Forestry Association
26.Maine Forest Products Council
27.Minorities in Agriculture, Natural Resources, and Related Sciences
28.Maryland Forests Association
29.Massachusetts Forestry Alliance
30.Michigan Forest Products Council
31.Minnesota Forest Industries
32.Mississippi Forestry Association
33.Montana Wood Products Association
34.National Alliance of Forest Owners
35.National Association of State Foresters
36.National Association of University Forest Resources Programs
37.National Woodland Owners Association
38.New Hampshire Timber Owners Association
39.North Carolina Forestry Association
40.Ohio Forestry Association
41.Oregon Forest Industries Council
42.Pennsylvania Forest Products Association
43.Society of American Foresters
44.Society of Wood Science and Technology
45.Southeast Lumber Manufacturers Association
46.Sustainable Urban Forest Coalition
47.Technical Association of Pulp and Paper Industry (TAPPI)
48.Tennessee Forestry Association
49.Texas Forestry Association
50.U.S. Forest Service
51.U.S. Industrial Pellet Association (USIPA)
52.Urban and Community Forestry Society
53.Urban Wood Network
54.Vermont Forest Products Association
55.Virginia Forestry Association
56.Washington Forest Protection Association
57.West Virginia Forestry Association
58.Wisconsin Alliance of Forest Owners
59.Women's Forest Congress

Appendix 3. In-depth Interview Questionnaire

We're introducing our research topic and goals briefly at the outset of the interview. The interviewee will be informed of the interview's structure and estimated duration. Additionally, interview consent will be sent out prior to the interview, and all ethical issues will be discussed. All interviewees will remain anonymous.

Individual Background

1.Would you like to start by telling me about your educational background?
-Did you study forest [or a natural resource] related major?
-Have you had any kind leadership training? Any DEI specific?

2.How long have you been working in the forest [or natural resources] sector?
-Can you please describe your career path?

Organizational Background

3.Can you please tell me about your organization?
-How does your organization understand DEI?
-Has your organization's viewpoint on DEI changed over time?

DEI Leadership

4.What does DEI mean to you?
-Why is it important?
-Has your viewpoint on DEI changed over time?
-What personally motivates you to promote DEI in the forest [or natural resources] sector?
-How do you see DEI benefiting your organization and the sector in the long term?

5.How did you get this leadership role in your organization?
-What made you interested to apply/accept the job?
-How long have you been in this position?

6.What are your day-to-day responsibilities in the organization as a DEI leader?

7.Reflecting on your time in leadership, how do the organization members react to your leadership?
-How about your organization's stakeholder's reaction?
-Who are the key stakeholders within the organization that influence your DEI efforts?
-How do external factors (policies, industry standards, etc.) influence your DEI efforts?
-Who are the potential allies for your DEI efforts?

DEI Goals

8.What are your organization's DEI goals?
-How do you handle situations where DEI goals conflict with other organizational priorities?
-What do you believe to be the pressure(s) for DEI actions of your organization?
-What degree of pressure is experienced?

9.Which are the DEI actions/initiatives that work? What are the enablers to make it work?
-Which are the DEI actions that do not work? What are the barriers?

Future

10.How does your organization ensure that DEI efforts are applied and sustained over time, even with changes in leadership?
-Given the current circumstances/context (e.g., political, etc.), do you think DEI leadership can be sustained?
-
11.What advice would you give to other leaders in the forest or natural resources sector who are looking to incorporate DEI initiatives within their organizations?

Closing

Is there something you would like to share or add?

[Back Cover]