CALIFORNIA WILDFIRE & FOREST RESILIENCE TASK FORCE

NORTH STATE PLANNING AND DEVELOPMENT COLLECTIVE

FOREST SECTOR WORKFORCE STUDY REPORT

FALL 2021

Contents

Credits

NORTH STATE PLANNING & DEVELOPMENT COLLECTIVE

AGRICULTURE/WATER/ENVIRONMENT TECHNOLOGY SECTOR

Funded through the Workforce & Economic Development Division of the California Community Colleges Chancellor's Office

Executive Summary

In the fall of 2020, the Center for Economic Development (CED) was contracted by Reedley College to perform a workforce study of California's forest sector. This document reports the findings of that study and may be used to help shape policy and guide industry leaders and stakeholders in addressing forest sector workforce challenges. The study consists of five parts: an Industry Outlook section that examines historical and projected industry data, a survey administered by the CED to forest sector representatives, an analysis of critical positions within California's forest sector identified during the survey process, workforce projections for the identified critical forest sector positions, and a literature review.

The Industry Outlook section includes historical and projected data that illustrate recent and expected trends in California's forest sector and its workforce. The existing data reveals a decline in several forest sector occupations and serious staffing shortages. The Industry Outlook section includes historical jobs by industry, the workforce landscape, major industry trends, and the largest employers in the State. The data were sourced both from the Bureau of Labor Statistics (BLS), Economic Modeling Specialists Inc. (Emsi) a private economic data analytics advisory firm, and a report from Camoin Associates Economic Development.

The second section of this report contains the results of a survey administered by CED staff to California forest sector industry leaders and stakeholders. The survey questions were designed in collaboration with the California Wildfire and Forest Resilience Task Force. The list of entities to be surveyed was created using Dun & Bradstreet and was administered over a five-month period. Dun & Bradstreet is a private firm that provides commercial data and analytics. The survey was administered and distributed by various means to 1,260 entities in California. The questions included in the survey were designed to illicit honest responses and opinions regarding the condition of California's forest sector and its workforce needs. The development and publication of this study accomplishes goals 1.26 and 3.11 of the California Wildfire and Forest Resilience Action Plan assigned to the Workforce Development Work Group by assessing the current and future workforce needs of California's forest and wood products sectors and providing guidance for investments in training and vocational programs to help meet the sector's unmet workforce needs.

In the Critical Positions by Region section of the report, CED staff connected the regional critical positions identified in the survey with occupational and program data from Emsi. The analysis includes current and projected job numbers, median salary, top schools, educational program

completions, and job posting activity. Employers and industry stakeholders can use this information to identify critical position needs and gaps in the region's educational programs.

The Economic Impact Summary then examines how the expected change in the identified critical positions will impact the forest sector in each region. Using the impact analysis software IMPLAN, CED staff produced economic impact projections based on the Emsi projected critical position job growth within the forest sector. These projections present the economic impacts resulting from the expected critical position job growth within California's forest sector, including impacts on the wood industry in each region.

Lastly, the literature review examines recent literature and research on the workforce challenges facing California's forest sector. A wide variety of sources were examined but only recent literature with relevant data was included in this report. The literature review discusses the workforce challenges facing California's forest sector, forestry practices and how they influence the sector's workforce, policies and funding affecting the forestry workforce, and possible avenues for workforce recovery.

This study found that the forest sector is facing significant workforce challenges. The overall findings of this study include:

- The sector is smaller now than it has been historically
- The sector's need for qualified personnel is growing faster than the available talent pool
- Personnel needs within the sector vary regionally
- The lack of qualified candidates for critical positions is projected to have significantly negative economic impacts on the forest sector.
- The forest sector has difficulty filling many critical positions due to the small pool of qualified candidates. Contributing factors to the small talent pool include:
    - Lack of available housing near forest sector businesses
    - High cost of living in California
    - Negative perceptions of the industry among young people
    - Lack of on-the-job training
    - A disproportionately large amount of personnel within the sector are reaching retirement age

Industry Outlook

To identify trends in California's forest sector workforce, the CED gathered currently available metrics on the State's forestry and wood products sector from the Bureau of Labor Statistics, Emsi, and a report from Camoin Associates Economic Development. Included in this section is a list of historical jobs by industry, a summary of California's forest sector's workforce landscape, major industry trends, and data on the largest employers in the sector.

Historical Jobs by Industry

Since 2001, the forestry, fishing, and related activities sector has experienced a trend of gradually increasing job numbers (Figure 1). This trend was interrupted rather significantly during the recession in 2008, when California's forest sector saw a significant loss of approximately 25,000 jobs. The sector has since stabilized and recovered those lost jobs and now employs over 50,000 more individuals than in 2001.

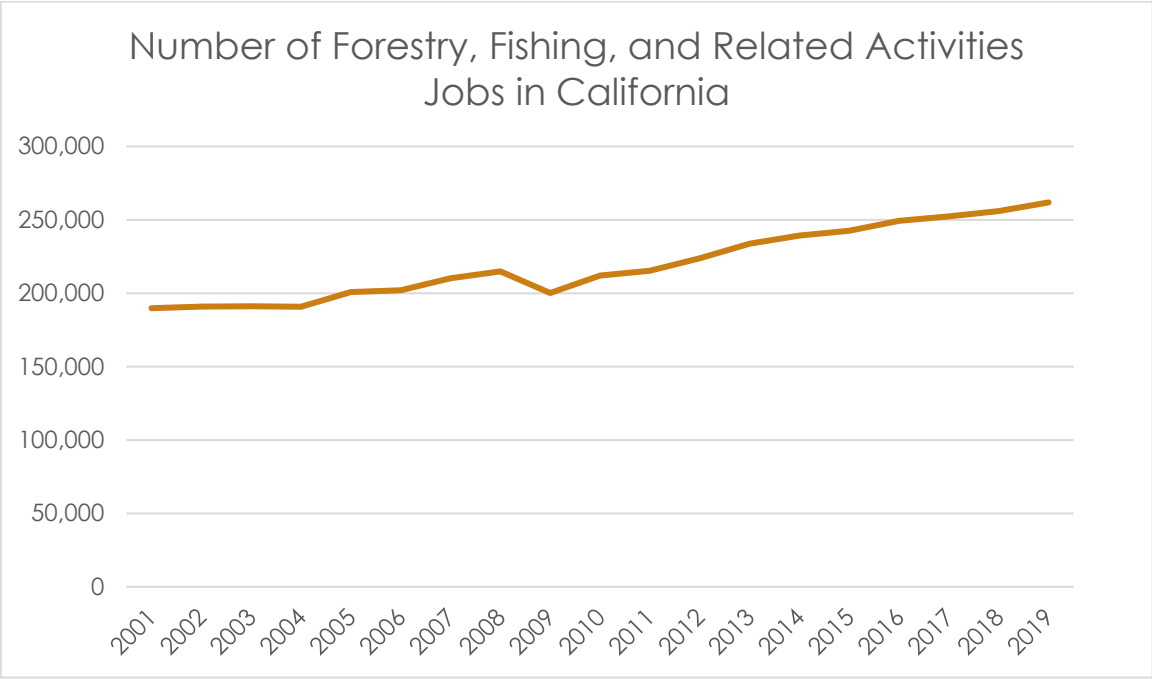

Figure 1. Number of Forestry, Fishing, and Related Activities Jobs in California. Source: Bureau of Economic Analysis, 2019. Includes Forestry, fishing, and related activities

Although there has been overall steady job growth in the forestry, fishing, and related activities sector over the past two decades, the forestry, logging, and wood and paper manufacturing industries within that sector specifically have experienced an opposite trend. Since 2001, these

industries have seen a very significant loss of jobs. Once employing nearly 80,000 Californians in 2001, the State's forestry, logging, and wood and paper manufacturing industries lost nearly half of their workers by 2012. Since 2012, these industries have seen a very mild and gradual increase in employment but remained below 50,000 total employees by 2019.

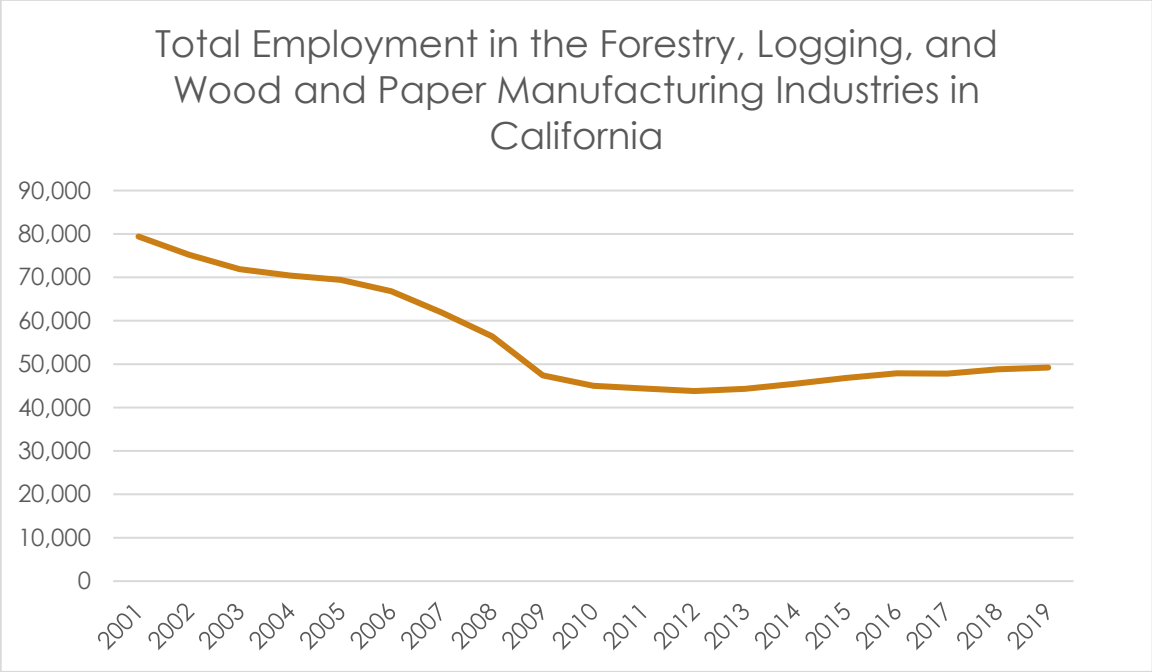

Figure 2. Total Employment in the Forestry, Logging, and Wood and Paper Manufacturing Industries in California, includes Wood product manufacturing (NAICS 321), Forestry and logging (NAICS 113), and Paper manufacturing (NAICS 322). Source: Bureau of Labor Statistics, 2019.

Workforce Landscape

Table 1 displays the projected shift in California's forest sector workforce from 2018 to 2028. The projections show a 10.7% decline in forest and conservation workers by 2028 (Long-Term 2018), along with smaller declines among logging equipment operators and woodworking machine setters, operators, and tenders.

Table 1. Long-Term Occupational Projections (2018-2028) in California, 2018.

Occupation	Base	Projected	Change	% Change	Avg. Annl. Openings
Conservation Scientists	2,000	2,300	300	15	240
Environmental Science and Protection Technicians, Including Health	3,700	4,100	400	10.8	510
Environmental Scientists and Specialists, Including Health	15,000	16,600	1,600	10.7	1,860
Firefighters	33,800	35,100	1,300	3.8	2,470
First-Line Supervisors of Fire Fighting and Prevention Workers	3,000	3,100	100	3.3	200
Forest and Conservation Technicians	6,800	7,100	300	4.4	860
Forest and Conservation Workers	2,800	2,500	-300	-10.7	440
Logging Equipment Operators	1,800	1,700	-100	-5.6	270
Soil and Plant Scientists	3,300	3,800	500	15.2	440
Surveyors	4,600	4,900	300	6.5	370
Woodworkers, All Other	2,500	2,600	100	4	330
Woodworking Machine Setters, Operators, and Tenders, Except Sawing	4,600	4,500	-100	-2.2	620

Major Industry Trends

Table 2 was compiled using data provided by Jim Damicis in his article "Recent and Emerging Trends in Forestry and Lumber," it shows a steady decline in the annual growth rate of most of the industries within the forest sector at the national level. Damicis cites decreasing demand from papermills, the slowing of residential construction, high interest rates for loans that stifle new construction, and rising foreign competition as the primary drivers behind this decrease in the US forest sectors good and services.

Table 2. Summary Chart of National Growth Rate Changes in the Forest Sector, (Damicis)

Industry	Year	Number of Businesses	Number of Employees	Revenue	Exports	5-Year Annual Growth Rate	Projected 5-year Annual Growth Rate	Reason for Growth Rate Change
Timber Services	2018	3,125	7,134	$1.4 billion	No exports	5.2%	1.9%	Import Competition; Technological Advances
Logging	2019	50,374	92,347	$15.9 billion	$2.3 billion	0.7%	0.4%	Slowing of Residential Construction; Weakening Demand from Paper Mills
Forest Support Services	2018	14,743	25,193	$2.25 billion	No exports	1.5%	0.4%	Reduction in Outsourced Services
Sawmills and Wood Production	2019	3,229	88,029	$35.2 billion	$4.7 billion	2.8%	1.1%	Projected increase in interest rates
Wood Paneling Manufacturing	2019	2,715	81,424	$27.6 billion	$1.3 billion	4.1%	1.6%	Slowing of Residential Construction
Prefabricated Home Manufacturing	2018	905	40,877	$10.5 billion	$389 million	8.6%	2.2%	Market Preferences; Traditional Housing Competition
Miscellaneous Wood Product Manufacturing	2018	7,325	38,222	$7.7 billion	$1.0 billion	4.5%	0.8%	Import Competition; Substitute Material Competition

Table 3 displays projected change in the U.S. forest sector over the next ten years (BLS 2019). The projections show an overall rise in forestry jobs, but a decline in logging occupations by 2029.

Table 3. National Employment Matrix, BLS 2019, Data link

	Total Agriculture, forestry, fishing, and hunting	Support activities for agriculture and forestry	Total Forestry and logging	Forestry	Logging
2019 Employment	2000	300	1700	600	1100
Projected 2029 Employment	2200	400	1800	900	1000
2019 Percent of Occupation	17.5	3.0	14.6	5.1	9.4
Projected 2029 Percent of Occupation	18.3	3.1	15.2	7.3	7.9
2019 Percent of Industry	0.1	0.3	2.9	7.5	2.2
Projected 2029 Percent of Industry	0.1	0.3	3.3	7.7	2.1
Employment Change, 2019-2029	200	0	100	300	-100
Employment Percent Change, 2019-2029	8.2	8.2	8.2	47.5	-13.1

Largest Employers

Table 4 displays the forest sector companies with the highest number of job postings in California. The Davey Tree Expert Company has the greatest number of unique job postings with 284, followed by the US Forest Service with 211.

Table 4. California forestry employers with the highest number of job postings. Source: Emsi Q3 2021 Data Set

Top Companies	Unique Postings
The Davey Tree Expert Company	284
US Forest Service	211
Bartlett	178
ACRT Pacific	113
US Department of Agriculture	95
CN Utility Consulting	68
National Park Service	67
Bureau of Land Management	53
Edison International	51
Asplundh Tree Expert Co.	26

Table 5 identifies the job titles with the highest number of job postings within the forestry sector in California. This data can be used to target educational programs to meet industry demands. The highest number of openings is for consulting utility foresters (466), followed by forestry technicians (188), and arborists (155).

Table 5. Most frequent job titles appearing in California forestry job postings. Source: Emsi Q3 2021 Data Set

Top Job Titles	Unique Postings
Consulting Utility Foresters (RPF)	466
Forestry Technicians	188
Arborists	155
Utility Foresters	82
Foresters	58
Fire Engineers	48
Land Use Planners	35
Supervisory Forestry Technicians	29
Timber Sale Preparation Forestry Technicians	29
Growth Marketing Mangers	28

Survey Results

Methodology

To obtain data from primary sources, CED staff composed a 26-question survey in Constant Contact and administered it to forest sector entity representatives. The list of forest sector entities used in the survey were obtained from Dun & Bradstreet. The survey was open for almost five months between June 2, 2021, and October 22, 2021. The CED collected 113 total survey responses with a response rate of 8.97 percent.

The CED contacted 1,260 entities by the following methods:

- 546 calls from the Dun & Bradstreet call list
- 185 emails from the Dun & Bradstreet call list
- 180 emails from the forest seminar contacts list
- 349 emails provided by Travis Sanchez at Butte County Office of Education

Our partners at the Statewide Wildfire and Forest Resiliency Task Force sent the survey link to the CalFire grant recipients, which is an estimated reach of 105 people. The survey link was also sent out through the CED newsletter with an estimated reach of 453 people. The response rate above does not include the outreach by our partners and newsletter. In this section we have included the results of that survey.

Entity Characteristics

Question 1 asked respondents to identify the California county in which their entity is located. Counties with the most respondents/representation: Butte (18, 16.07 percent), Shasta (13, 11.61 percent), and Placer (11, 9.82 percent). Many of the respondents noted that hiring takes place throughout all of California (14, 12.50 percent). All regions in California are represented.

- Northern 19.35%
- Sierra and East Side 55.30%
- Coastal 18.89%
- Southern 6.45%

Regional Distribution of Survey Responses

Most of the survey responses came from the forested regions of California. Just over half of the respondents were located in the Sierra and East Side region and almost 20 percent of the respondents were located in the Northern region.

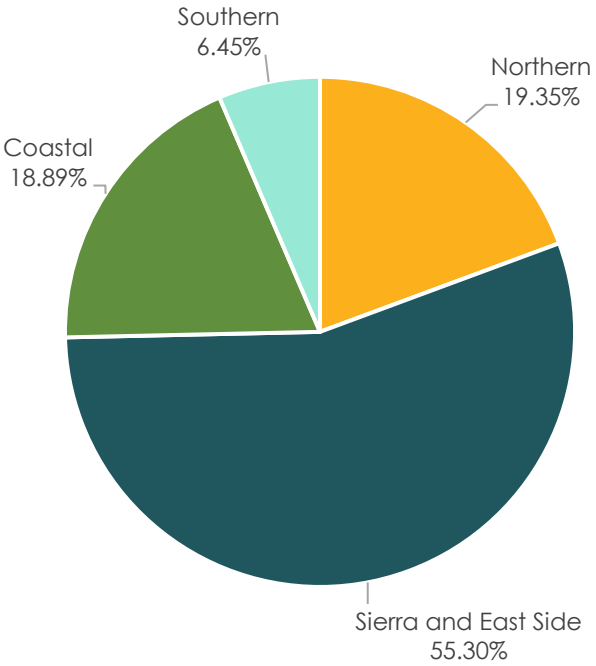

Figure 3. Regional distribution of survey responses.

Figure 4. Region map.

Ownership Type

Question 2 asked respondents to identify their entity's ownership type. 37.17 percent of respondents represented privately owned businesses. Together, government entities (Federal, State, and Local) accounted for 32.74 percent of respondents. Nonprofit entities also made up a sizable 23.89 percent of respondents.

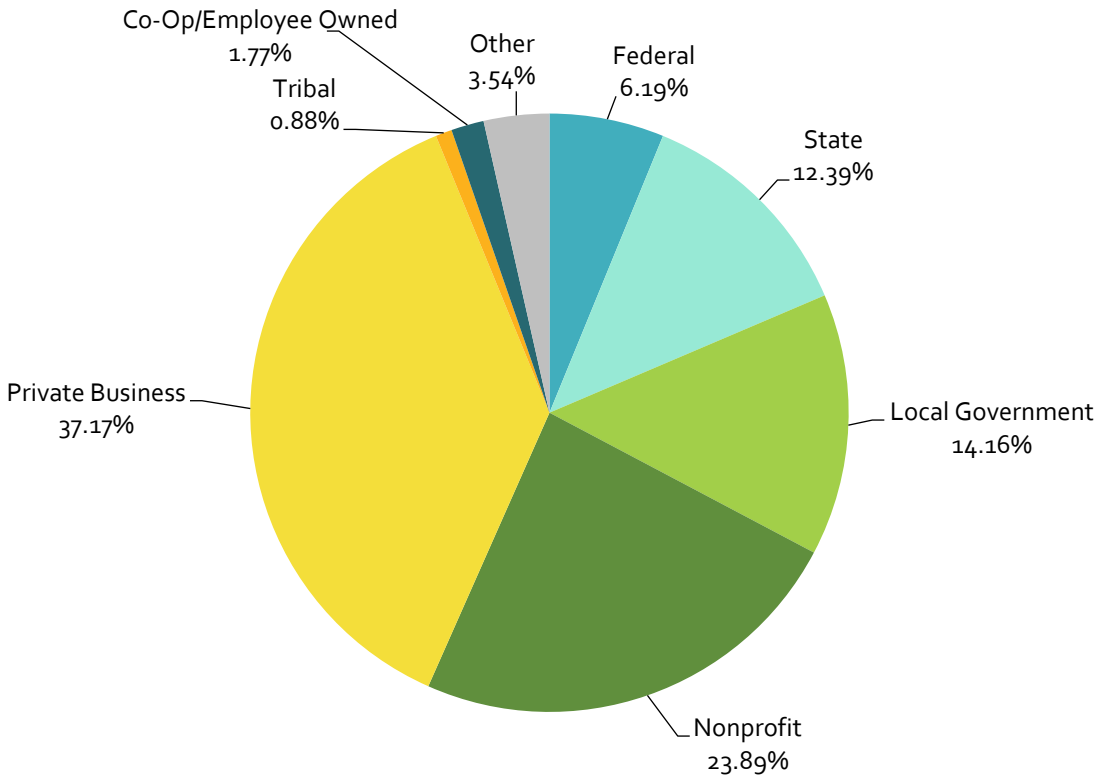

Figure 5. Question 2 responses. Respondents by type of ownership. n=133

Entity Categorization

Question 3 asked respondents to identify the type of entity they represented. The top three responses were land management (21, 18.58 percent), fuels management (15, 13.27 percent), and community outreach education NGOs (9, 7.96 percent).

Table 6. Question 3 results. Survey respondent self-categorization. n=113

Entity Categorization	
Land Management	18.58%
Fuels Management	13.27%
Community Outreach and Education (NGOs)	7.96%
Implementation Agency	7.08%
Forestry Consultant (Licensed Foresters)	6.19%
Firefighting	4.42%
Logging	4.42%
Regulatory Agency	4.42%
Environmental Consulting (Biological Assessments, CEQA, NEPA)	2.65%
Tree Trimming/Care	2.65%
Value Added Products: Biomass (Animal Bedding, Firewood)	2.65%
Biomass Energy Facility	0.88%
Heavy Equipment Operators/Trucking	0.88%
Value Added Wood Products: Other	0.88%
Other	23.01%

Number of Current Employees

Questions 4, 7, and 10 asked respondents about the size of their current full-time, part-time, and seasonal staff, respectively. The majority of respondents were either small firms that employed five or fewer of each type of employee, or large firms that employed fifty-one or more of each type of employee.

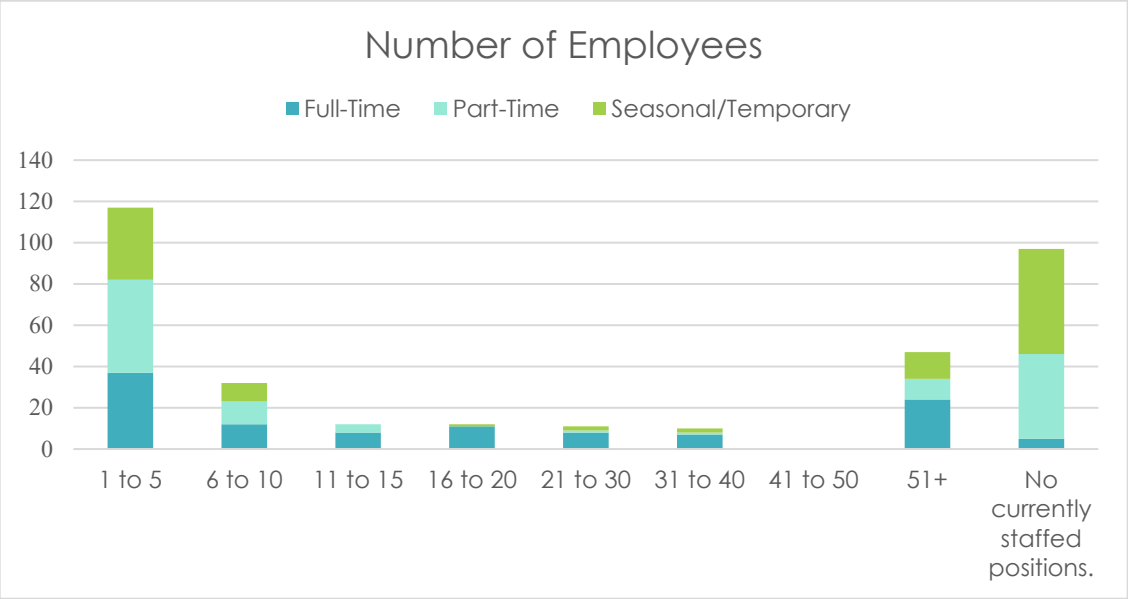

Figure 6. Aggregated question 4, 7, and 10 responses. Respondents by number of employees. Question 4 n=113, Question 7 n=113, Question 10 n=113.

Full-time Employees

Figure 7 displays the responses to question 4. 33.04 percent of respondents currently employed one to five full-time staff, while 21.43 percent employed fifty-one or more full-time staff.

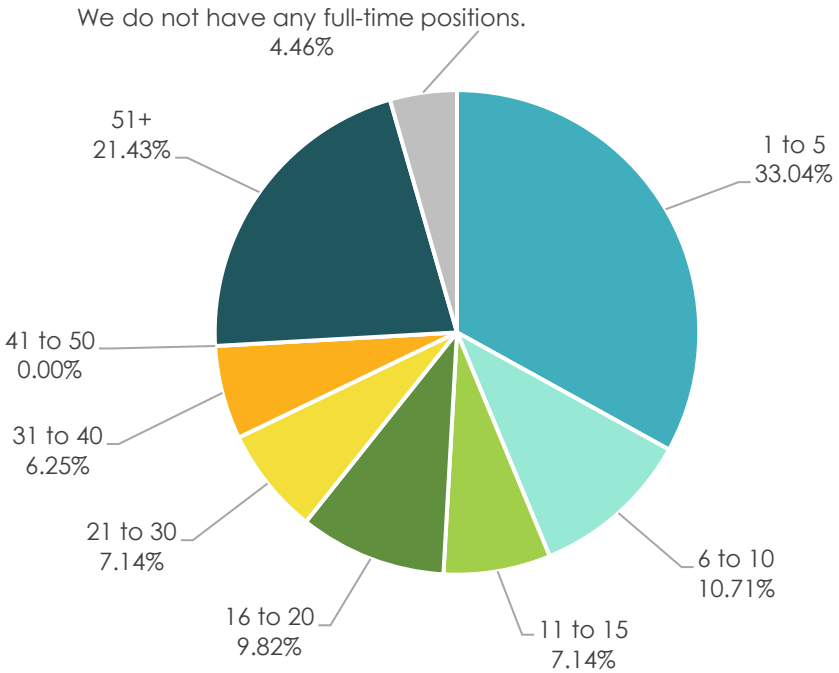

Figure 7. Question 4 results. Respondents by number of full-time employees. n=113

Expected Ownership Change

Question 18 asked respondents whether or not they anticipated their entity's ownership to retire or sell or transfer ownership of their entity in the next one to two years. Question 19 asked respondents to provide an explanation for their answer to question 18. Only 3 of the 113 (2.65 percent) respondents anticipated a change in ownership for their entity in the next 1-2 years.

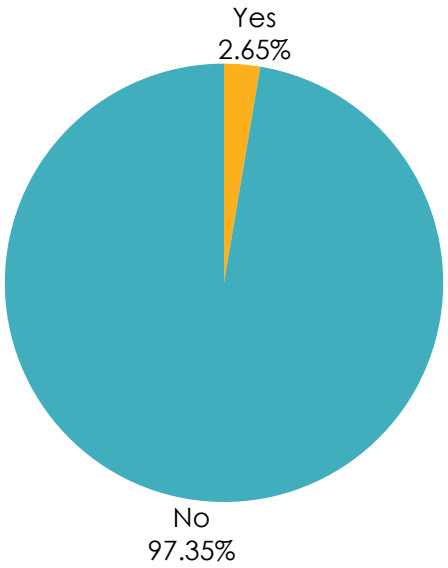

Figure 8. Question 18 and 19 responses. Anticipated change in ownership. n=113

Number of Openings and Hiring Timeline

Openings

Questions 5, 8, and 11 asked respondents about the number of full-time, part-time, and seasonal staff positions they are currently trying to fill, respectively. The majority of respondents either had no open positions or one to five open positions.

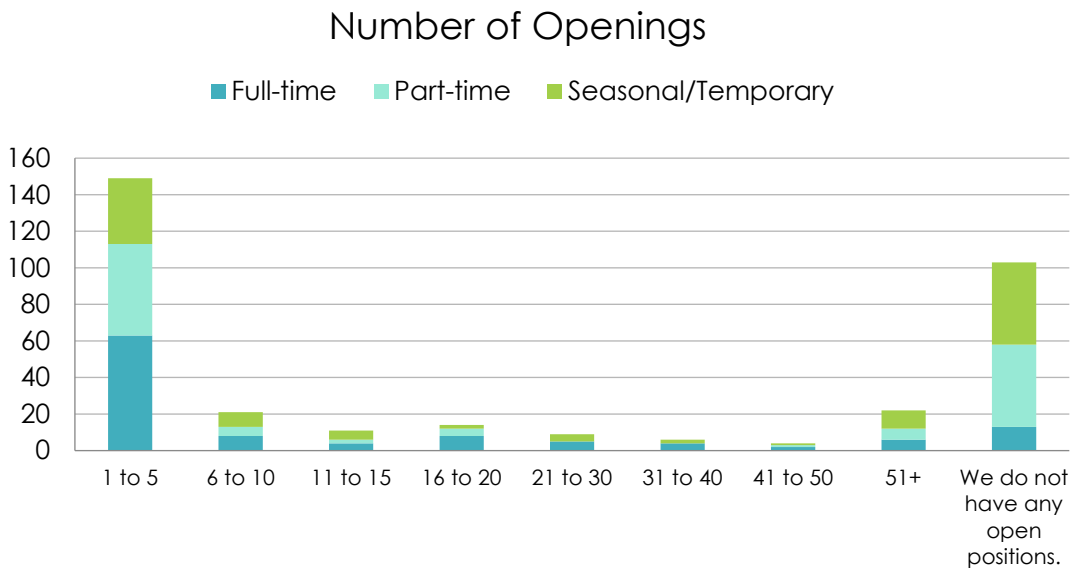

Figure 9. Aggregated responses for questions 5, 8, and 11. Respondents by number of open staffing positions. Question 5 n=113, Question 8 n=113, Question 11 n=113.

Openings for Full-time Positions

Figure 10 displays the responses to question 5. 55.75 percent of respondents were looking to fill one to five full-time staff positions, while 11.5 percent were not looking to hire any new full-time staff.

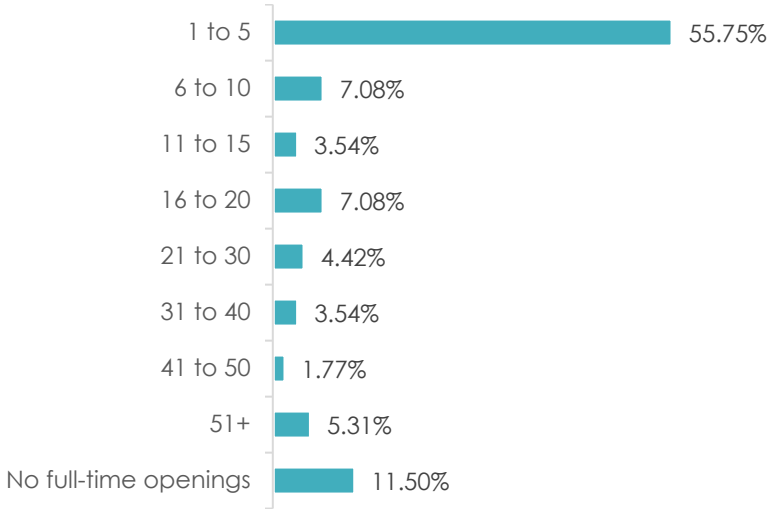

Figure 10. Question 5 responses. Respondents by number of open full-time positions. n=113

Hiring Timeline

Questions 6, 9, and 12 asked respondents when they were looking to fill their open full-time, part-time, and seasonal staff positions, respectively. Question 13 asked when respondents expected to lay off their seasonal staff. The majority of the entities are looking to fill their full-time, part-time, and

seasonal positions openings either immediately or in the next 12 months. Seasonal employment layoffs varied greatly between respondents; however, late fall and winter months represented the greatest number of responses.

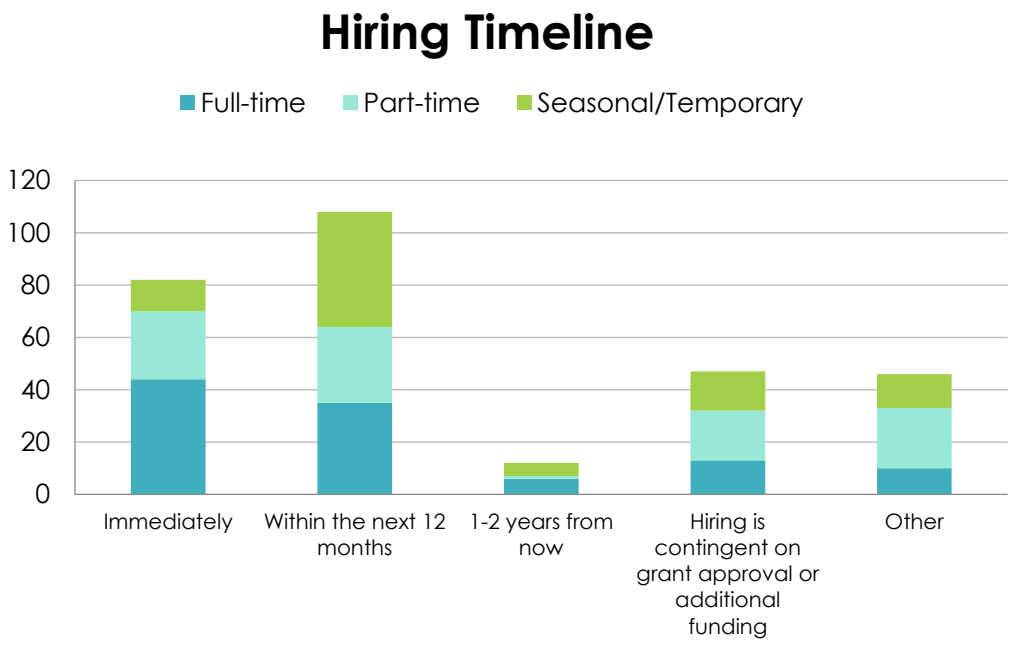

Figure 11. Aggregated responses for questions 6, 9, and 12. Respondents by anticipated hiring timeline. Question 6 n=108, Question 9 n=98, Question 12 n=89

Full-Time Hiring Timeline:

Figure 12 displays the responses to question 6. 40.74 percent of respondents were looking to fill their open full-time staff positions immediately, while 32.41 percent were looking to fill their open full-time staff positions within the next twelve months.

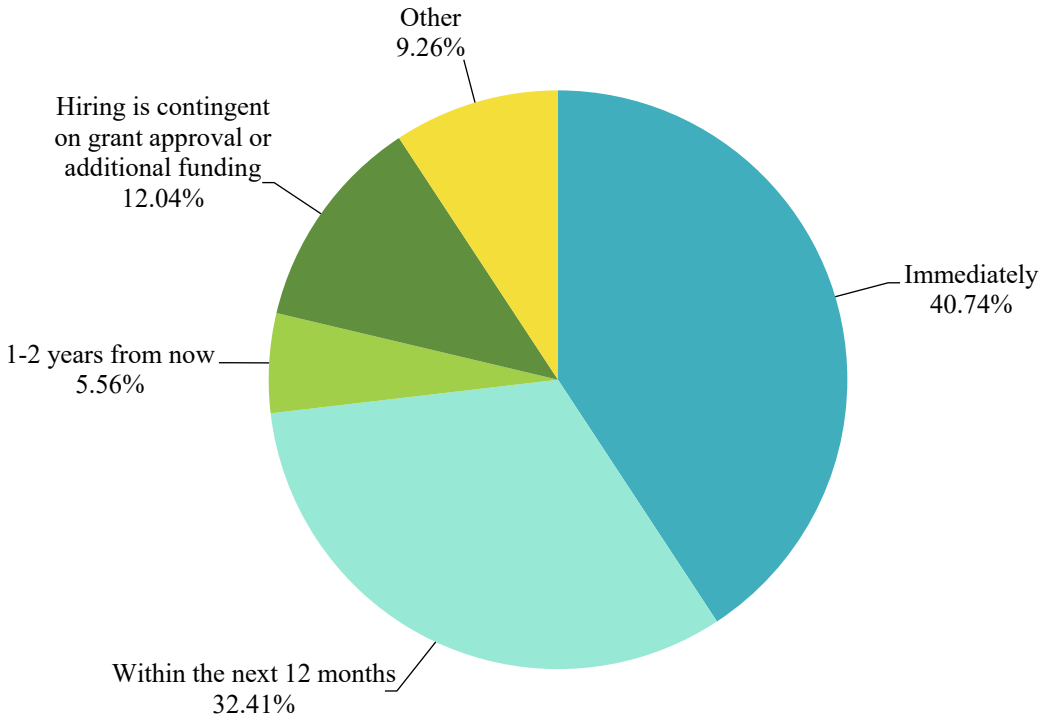

Figure 12. Question 6 responses. Respondents by anticipated hiring timeline for full-time positions. n=108

Methods of Recruitment

Question 20 asked respondents the methods used by their entity to recruit new employees. The most common responses were recommendations/word of mouth (91, 25.71 percent), online job sites (75, 21.19 percent), and internal recruitment (68, 19.21 percent).

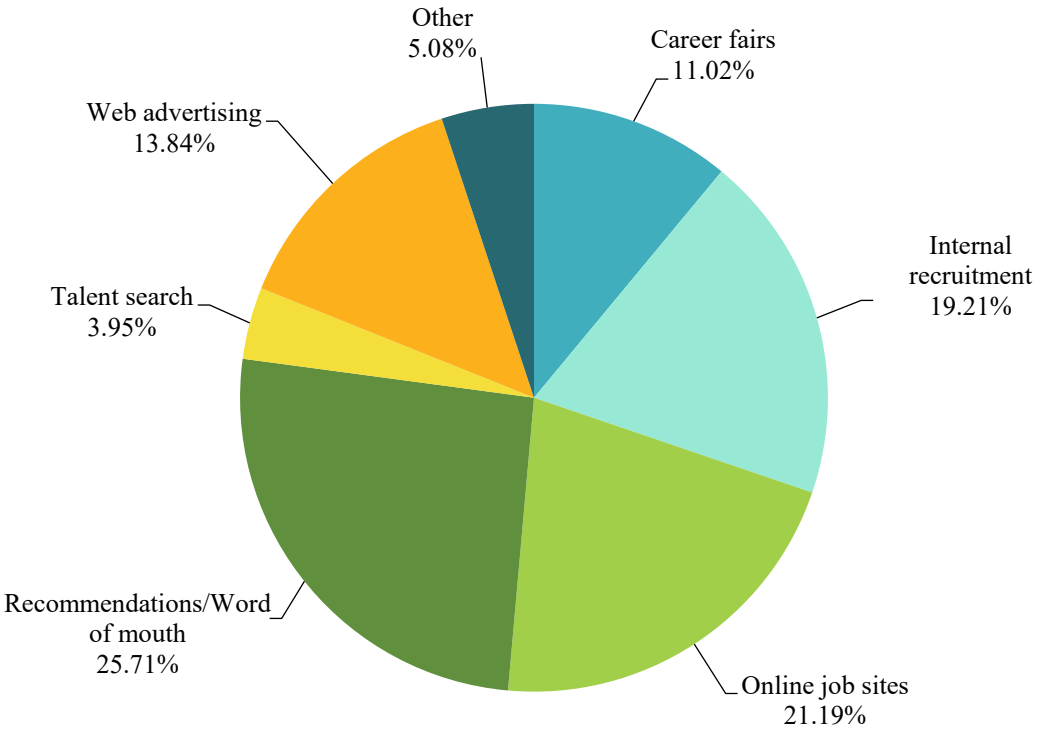

Figure 13. Question 20 responses. Respondents by recruitment methods. n=113

Training

Internship and Shadowing Programs

Questions 14 through 17 asked respondents what internship, mentoring, and/or shadowing programs they offer or plan to offer in the future, if any. Figure 14 displays the number of respondents that currently offer internship, mentoring, and/or shadowing programs. Of the respondents that do not currently have a program in place, 53 percent plan to offer one in the near future.

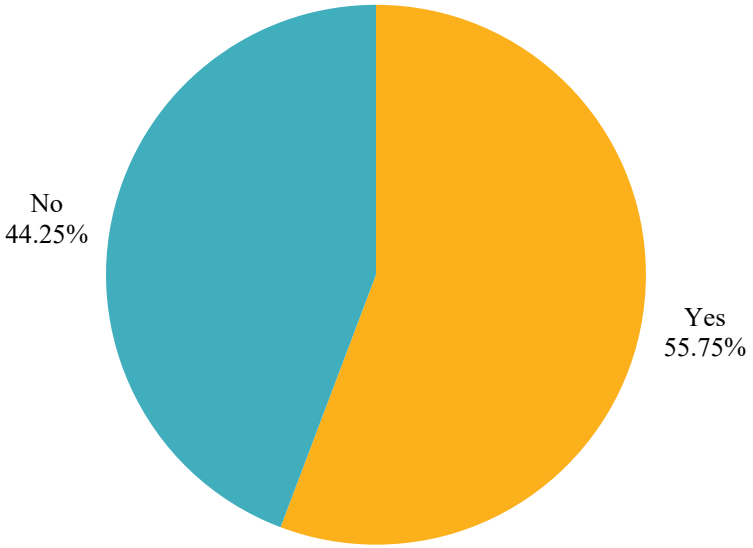

Figure 14. Responses for question 14. Respondents by presence of internship, mentoring, and/or shadowing programs. n=113

Where Training is Provided

Question 21 asked respondents where training for newly hired employees is provided. By a large margin, the majority (70, 61.95 percent) of respondents indicated that newly hired employees receive training within the company through on-the-job training programs.

Table 7. Question 21 responses. Respondents by job training location. n=113

Where training is provided	
We train within the company through on-the-job training programs.	61.95%
We do not provide training at this time.	11.50%
We have a job rotation/mentoring program employees partake in.	4.42%
Training is provided at four-year colleges and universities.	3.54%
Training is provided through courses at community colleges.	2.65%
Training is offered at another local training agency.	0.88%
Training is provided through courses at technical schools.	0.00%
Other	15.04%

Critical and Hard-to-Fill Positions

In the survey, the questions regarding critical and hard to fill positions were open-ended, so the responses were heavily varied. CED staff coded the responses and fit each position into one of

seven occupation categories: management, laborers, forest and conservation scientists, administration workers, firefighters and wildfire prevention, arborists, and transportation and equipment operators. Below is a table that describes the categories.

Table 8. Coded response categories and associated SOC Codes.

Category	Description	SOC Codes
Management Roles	Upper and middle management	45-1011, 11-1021
Laborers	Support workers, electricians, mechanics, maintenance, and entry level	45-4011, 47-2111, 49-9041
Forest and Conservation Scientists	Certified foresters, biologists, conservationists, and scientists	19-1030, 19-4070, 19-1020
Administration Workers	Office workers, bookkeepers, planners, and sales	43-9060, 43-3030
Firefighters and Wildfire Prevention Roles	Firefighting and prevention workers	33-2000
Arborists	Certified arborist, fallers, and tree trimmers	37-3013, 45-4021
Transportation and Equipment Operators	Tracker operators, truck drivers, and equipment operators	53-7051, 45-4022, 53-3032

Critical Positions

Question 22 asked respondents to identify the critical positions within their entity and the average hourly wage and number of vacancies for each of those positions. The greatest number of critical positions identified by respondents were those coded as forest and conservation scientists (25.51 percent), followed by management roles (21.43 percent), and laborers (13.78 percent). Forest and conservation scientists were also identified as the critical position with the greatest number of vacancies (106), followed by laborers (64), and arborists (43). Of the critical positions identified by respondents, those coded as administrative workers were reported by those respondents to have the highest average hourly wage ($29.53), followed by management roles ($29.03), and forest and conservation scientist ($27.23). The method by which responses were categorized is described in the following section of this report.

Table 9. Question 22 responses. Critical forestry position distribution, average hourly wage, and vacancies. n=113

Occupation Categories	Distribution of Positions	Average Hourly Wage	Number of Vacancies
Management Roles	21.43%	$29.03	24
Laborers	13.78%	$16.64	64
Forest and Conservation Scientists	**25.51%**	$27.23	**106**
Administration Workers	8.67%	**$29.53**	8
Firefighters and Wildfire Prevention Roles	9.69%	$22.42	33
Arborists	8.67%	$25.43	43
Transportation and Equipment Operators	12.24%	$22.83	8

Hard-to-Fill Positions

Question 23 asked respondents to identify the hard-to-fill positions within their entity and the average hourly wage and number of vacancies for each of those positions. The greatest number of hard-to-fill positions identified by respondents were those coded as forest and conservation scientists (25.93 percent), followed by management roles (22.22 percent), and laborers (17.28 percent).

Table 10. Question 23 responses. Hard-to-fill forestry position distribution, average hourly wage, and vacancies. n=113

Occupation Categories	Distribution of Positions	Average Hourly Wage	Number of Vacancies
Management Roles	22.22%	$26.40	26
Laborers	17.28%	$17.63	**73**
Forest and Conservation Scientists	**25.93%**	**$29.64**	39
Administration Workers	7.41%	$21.76	6
Firefighters and Wildfire Prevention Roles	9.26%	$25.68	5
Arborists	6.17%	$26.00	0
Transportation and Equipment Operators	11.73%	$26.46	12

Reason for Hard-to-Fill Position

Question 24 asked respondents why they believe the positions identified in question 23 are hard to fill. The most frequent response (24.56 percent) cited the small pool of candidates in the area

as the primary barrier to filling these positions, followed by high cost of living (14.59 percent), and lack of available housing (12.81 percent).

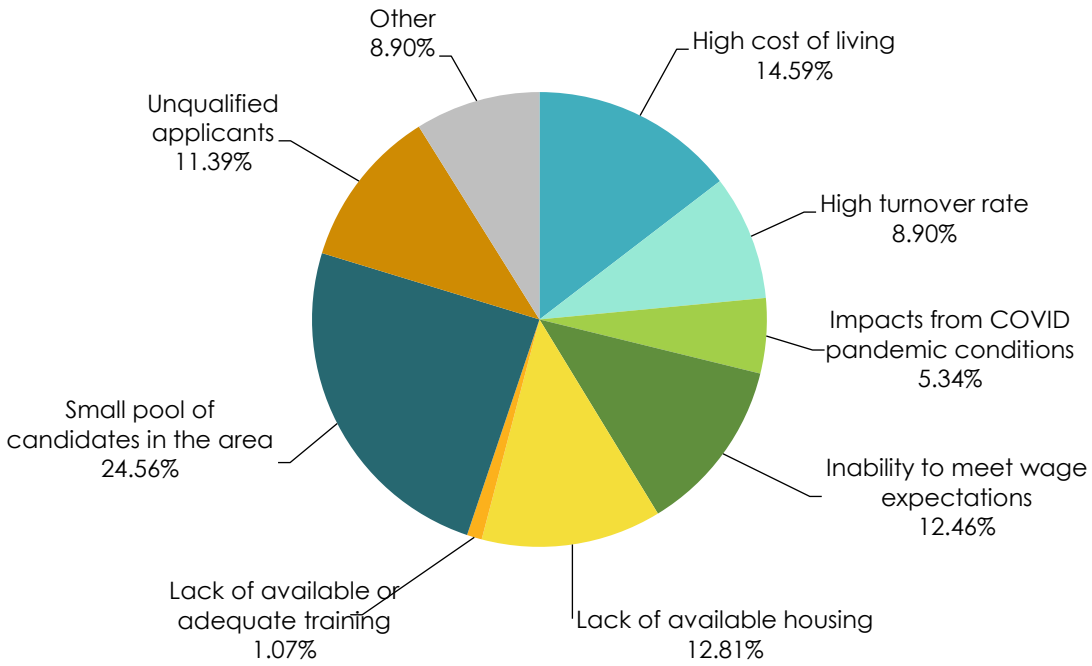

Figure 15. Question 24 responses. Barriers to recruiting for hard-to-fill forestry positions. n=113

Skills

Hard and Technical Skills

Question 25 asked respondents to identify the hard and/or technical skills possessed by their most beneficial and useful employees. The top three hard or technical skills identified by survey respondents were forestry (28.62%), wildfire suppression (14.47%), and map creation software (13.52%).

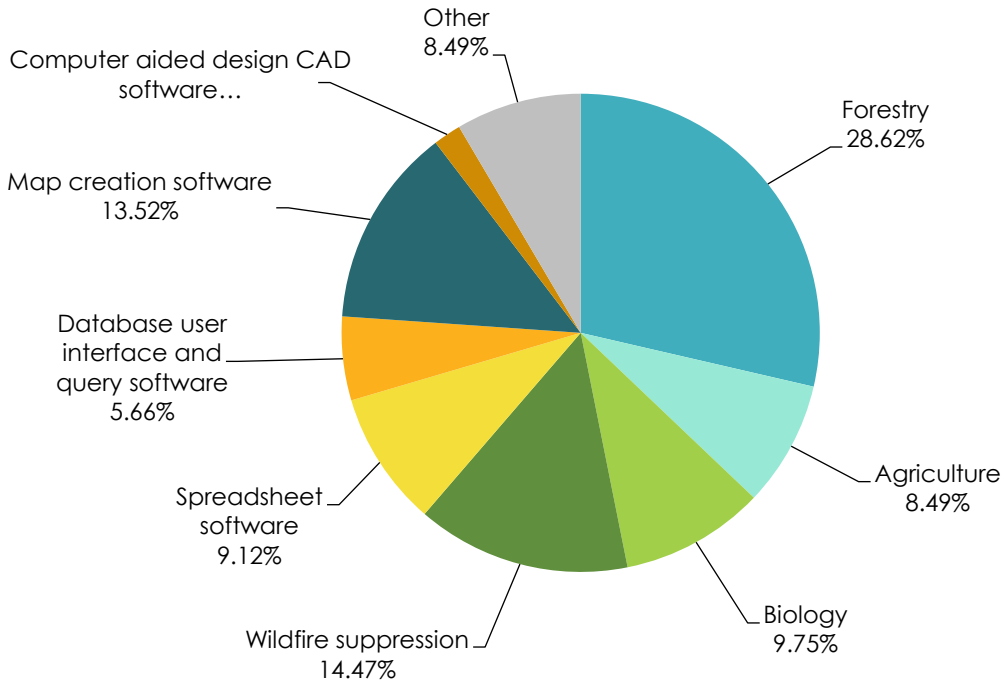

Figure 16. Question 25 responses. Most needed hard/tech skills as reported by survey respondents. n=113

Soft and Common Skills

Question 26 asked respondents to identify the soft and common skills possessed by their most beneficial and useful employees. The top three soft or common skills identified by survey respondents are possession of a valid driver's license (17.46%), management (15.49%), and operations (14.08%).

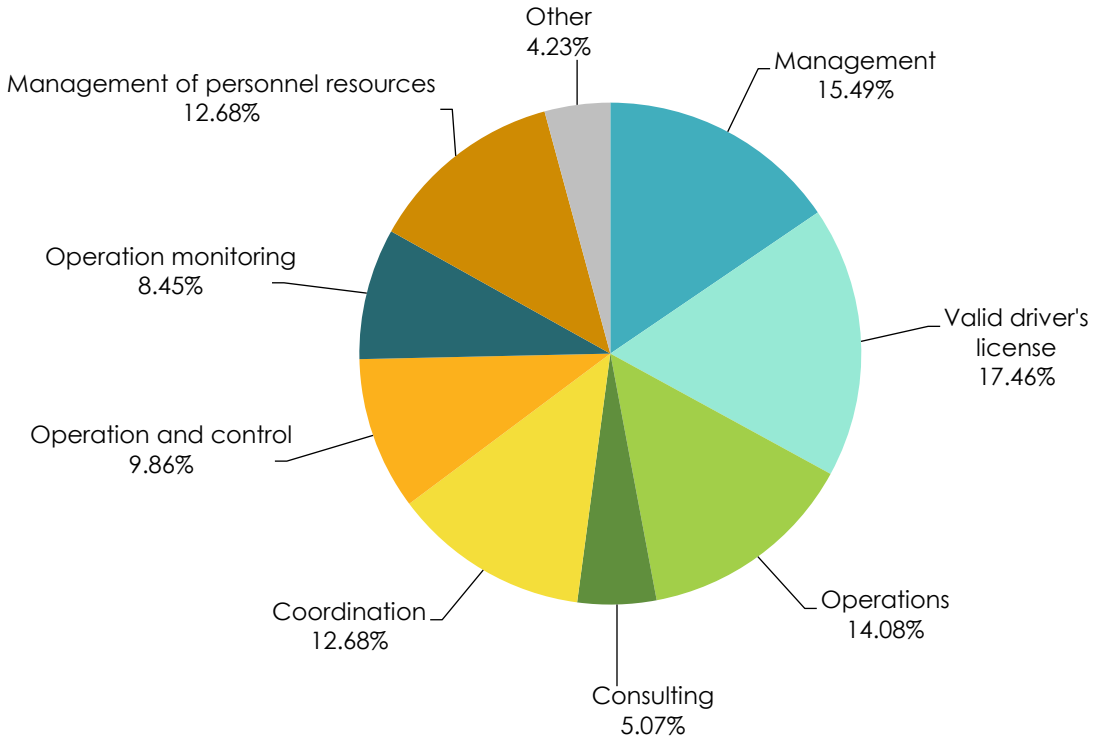

Figure 17. Question 26 responses. Most needed soft/common skills as reported by survey respondents.

How Skills are Obtained

Question 27 asked respondents how the skills identified in questions 25 and 26 were obtained. Prior work experience (36.28 percent) and on the job training (34.51 percent) were the most common responses by a significant margin.

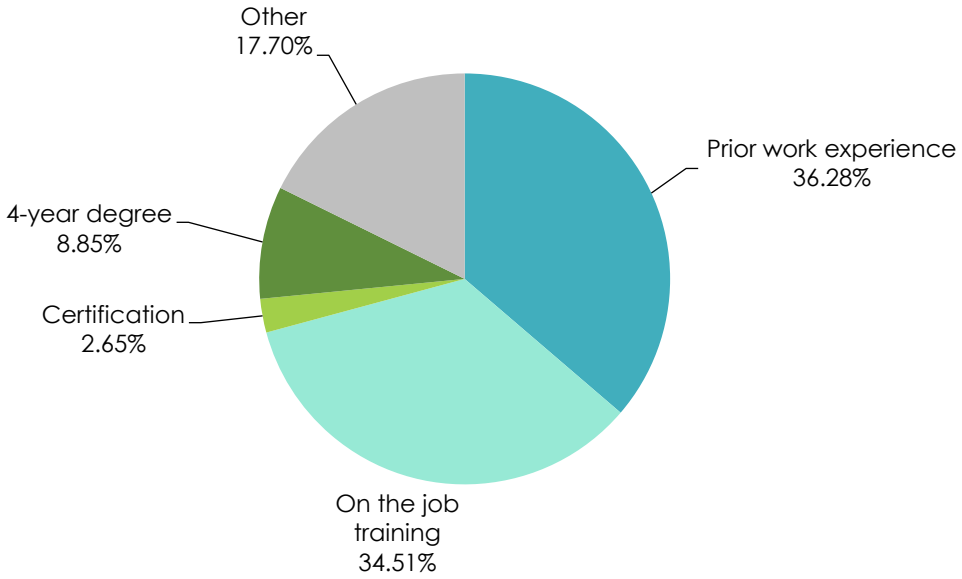

Figure 18. Question 27 responses. Method of obtaining most needed skills as reported by survey respondents.

Skill and Training Gaps

Question 28 asked respondents to identify the skill and training gaps they have noted when seeking qualified job candidates. The most common response was that candidates lack hands-on experience (29.03 percent), followed by candidates lacking soft skills (25 percent) and technical skills (22.18 percent).

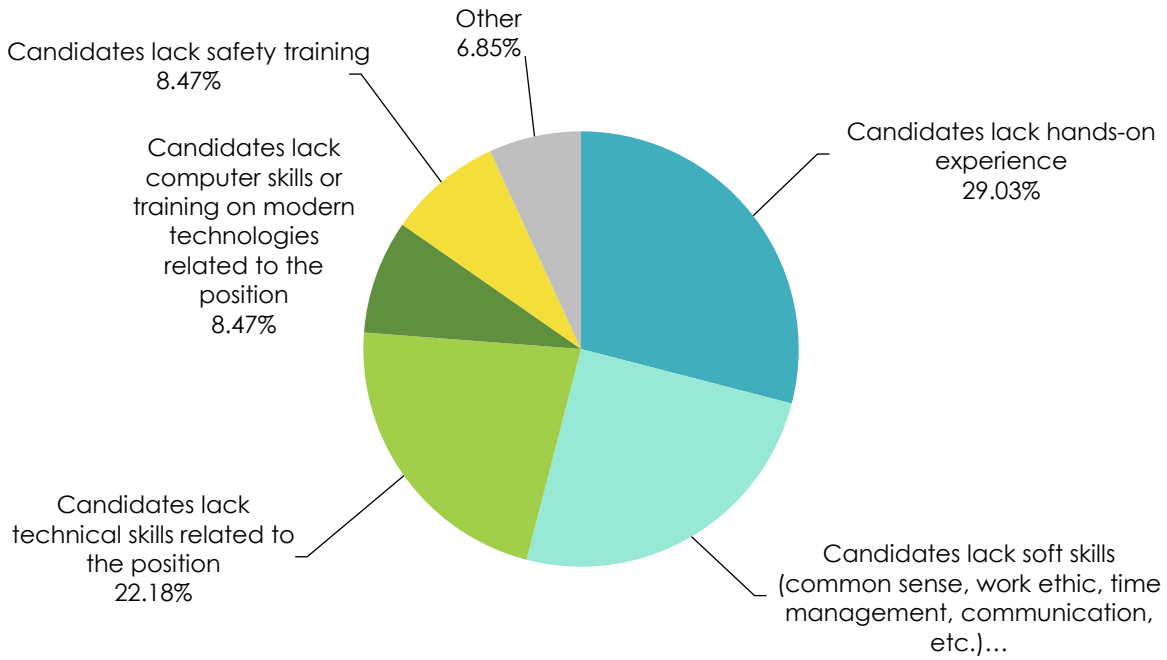

Figure 19. Question 28 responses. Skill gaps identified in job candidates as reported by survey respondents.

Challenges and Needs

Challenges and Barriers

Question 29 asked respondents to identify the challenges and/or barriers their entity faces when trying to expand or stay in business. The majority of respondents (57.52 percent) cited lack of qualified workforce as the primary challenge to their entity expanding and/or staying business.

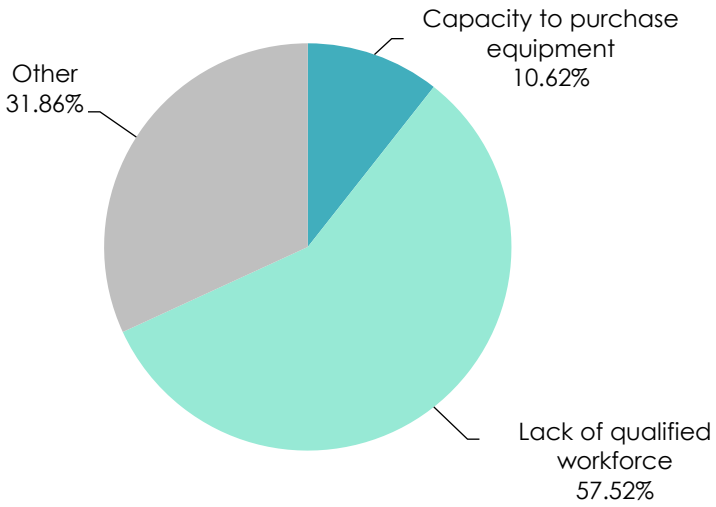

Figure 20. Question 29 responses. Barriers to expansion and stability as reported by survey respondents.

Survey Comments on Workforce Needs

The final survey question asked respondents to provide any additional comments regarding their entity's workforce needs. In total, there were 48 unique responses. The most common trend among the responses was a difficulty finding workers, in terms of both skilled staff and qualified contractors. One response specifically cited the issue of many skilled workers reaching retirement age and that there are few young skilled workers to take their place. Some responses stated that in addition to skilled labor, even entry-level positions are very difficult to fill. Several responses cited a lack of accurate positive education around the timber industry and the forest sector in general as a major contributor to this worker shortage. Other responses cited a lack of housing in rural areas and insufficient training programs as contributors to the worker shortage. Some respondents did acknowledge that the difficult and demanding nature of the work as a barrier to attracting new workers.

Another concern expressed by several respondents regarded competition between the private and public sectors. Multiple respondents representing private firms expressed difficulty in matching the pay offered by government forestry positions, and therefore losing potential qualified staff to those government agencies. One respondent specifically cited how the recent fires in California have created a number of high paying positions addressing the damage of those fires and syphoning away many potential employees from their business.

Lastly, some respondents provided suggestions that might aid the forest sector in their responses to the final survey question. One respondent wrote, "Licensing, expansion/enforcement of labor standards, and centralized advertising of contract opportunities could be helpful for both building private contractor capacity and professionalizing the more labor-intensive segment of the sector."

Critical Position Profiles by Region

The CED recognizes that the needs and characteristics of forest sector employers in California may differ throughout the State. To address this, CED staff analyzed the critical positions identified in the survey by region to present more applicable data to forest sector stakeholders throughout California. To conduct the regional analysis, CED staff sorted survey responses based on California's Forest Management Task Force regions, Northern, Sierra and East Side, Coastal, and Southern.

In order to conduct the analysis, CED staff coded the critical positions identified by survey respondents to seven groups with corresponding Standard Occupational Classification (SOC) codes. These codes were then entered into the Emsi Burning Glass application. Through Emsi, CED staff were able to analyze the critical positions by region and by specific industries. By limiting the region and industry, CED staff were able to gather accurate and relevant data on the critical positions identified. CED staff used the industry NAICS codes from the original Dun & Bradstreet survey call list to capture the job growth specifically in the forest sector industry. Emsi, however, does not provide 6-digit North American Industry Classification System (NAICS) code information for the following government related industries:

- Administration of Conservation Programs (924120)
- Fire Protection (922160)
- Administration of Air and Water Resource and Solid Waste Management Programs (924110),

Emsi also does not include the NAICS code for Nursery and Tree Production (111421). Occupations within these NAICS industries were excluded from the data in this section and the next. The analyzed NAICS codes include:

- 113110 - Timber Tract Operations
- 113210 - Forest Nurseries and Gathering of Forest Products
- 113310 - Logging
- 115310 - Support Activities for Forestry
- 813312 - Environment, Conservation and Wildlife Organizations
- 321113 - Sawmills
- 712190 - Nature Parks and Other Similar Institutions
- 221117 - Biomass electric power generation

Using Emsi labor market information (LMI), CED staff determined the projected job growth over the next 5 years (2021-2026) for the top three critical positions identified for each region by survey respondents.

Top Three Critical Positions in Each Region

Figure 21 displays the four regions determined by the Forest Management Task Force and the three positions most frequently identified as critical by survey respondents in each region.

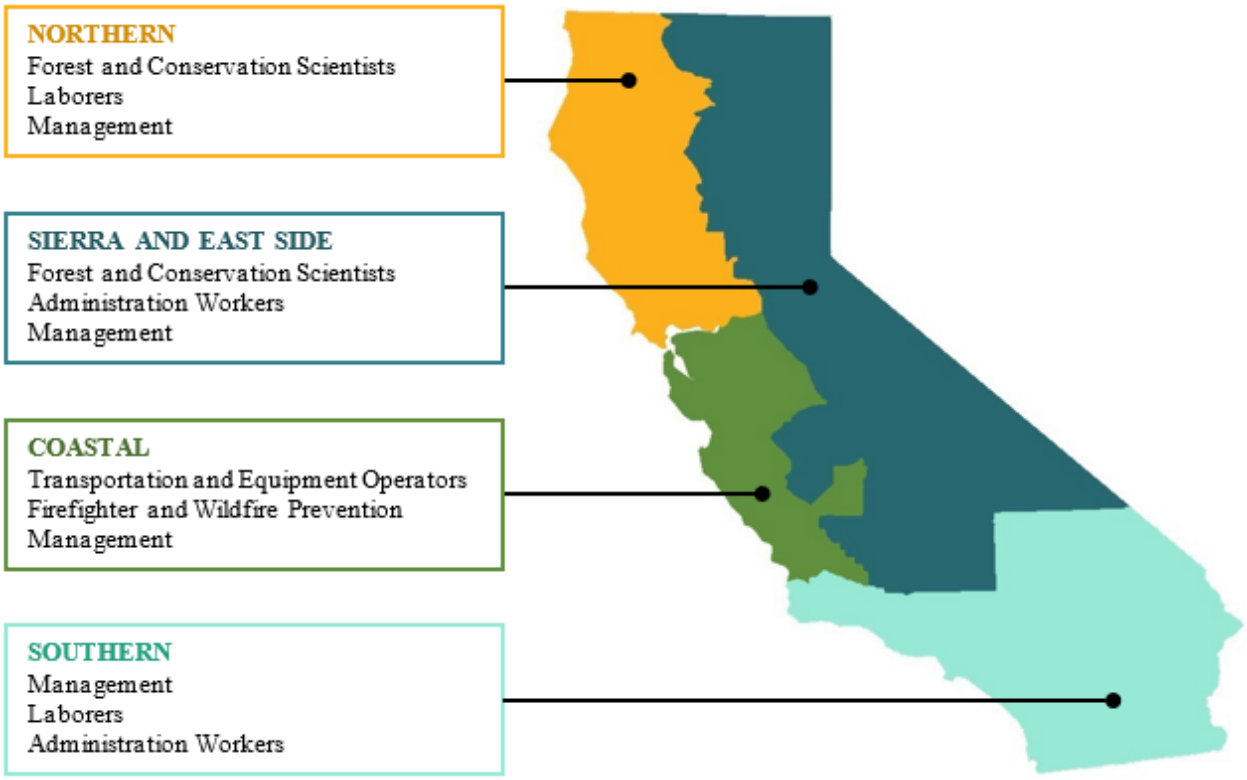

Figure 21. Top three critical positions identified by survey respondents by region

Northern

The Northern region in California encompasses the western half of the North State, from the San Francisco Bay to the Oregon border. Respondents from this area identified Forest and Conservation Scientists, Laborers, and Management as their top three most critical positions. CED staff gathered data to explore the characteristics and needs of these three occupations in the region:

Table 11. Top Three Critical Positions in the Northern Region

Critical Positions in the Northern Region	2021 Jobs	2026 Jobs	2021-2026 Change	2021-2026 % Change	Average Median Hourly Earnings
Forest and Conservation Scientist	472	496	24	5.1%	$27.65
Laborers	57	55	-2	-3.4%	$34.14
Management	350	370	20	5.9%	$37.79

Table 12. Unique critical position job postings and number of competing employers in the Northern Region.

Occupation	Unique Job Postings (Jan 2019 to Oct 2021)	Number of Competing Employers
Forest and Conservation Scientist	355	33
Laborers	49	6
Management	21	9

Table 13. Summary of relevant 2 to 4-year educational training programs for critical forestry positions in the Northern Region.

Occupation	Number of Educational Programs	Number of Program Completions 2020	Number of Program Openings
Forest and Conservation Scientist	472	496	24
Laborers	57	55	-2
Management	350	370	20

Table 14. Top Schools for Forest and Conservation Scientists in the Northern Region. Source: Emsi Q3 2021 Data Set

Top Schools for Forest and Conservation Scientists in the Northern Region	Program Completions (2020)
University of California, Davis	2,413
California State University, Sacramento	480
Humboldt State University	420
American River College	216
Solano Community College	188
Sonoma State University	153
Napa Valley College	106
Sacramento City College	97
Cosumnes River College	75
Santa Rosa Junior College	72

Table 15. Top Schools for Laborers in the Northern Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Laborers in the Northern Region	Program Completions (2020)
National Career Education	154
Humboldt State University	89
Independent Training & Apprenticeship Program	71
InterCoast Colleges, Rancho Cordova	55
Santa Rosa Junior College	40
American River College	39
InterCoast Colleges, Fairfield	34
University of California, Davis	30
College of the Redwoods	15
Shasta College	12

Table 16. Top Schools for Management in the Northern Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Management in the Northern Region	Program Completions (2020)
Santa Rosa Junior College	3,046
University of California, Davis	1,596
California State University, Sacramento	1,442
American River College	1,126
Sacramento City College	697
Sonoma State University	697
Folsom Lake College	637
Shasta College	599
Humboldt State University	586
Solano Community College	554

Sierra and East Side

The Sierra and East Side region in California encompasses the eastern half of the North State, the Sierra Nevada Mountain Range and most of the Central Valley. Respondents from this area identified Forest and Conservation Scientists, Administration Workers, and Management as their top three most critical positions. CED staff gathered data to explore the characteristics and needs of these three occupations in the region:

Table 17. Top Three Critical Positions in the Sierra and East Side Region

Critical Positions in the Sierra and East Side Region	2021 Jobs	2026 Jobs	2021- 2026 Change	2021-2026 % Change	Average Median Hourly Earnings
Forest and Conservation Scientist	160	185	25	15.6%	$30.28
Administration Workers	195	204	9	4.7%	$33.13
Management	405	433	28	6.9%	$18.93

Table 18. Unique critical position job postings and number of competing employers in the Sierra and East Side Region.

Occupation	Unique Job Postings (Jan 2019 to Oct 2021)	Number of Competing Employers
Forest and Conservation Scientist	612	23
Administration Workers	65	11
Management	26	9

Table 19. Summary of relevant 2 to 4-year educational training programs for critical forestry positions in the Sierra and East Side Region.

Occupation	Number of Educational Programs	Number of Program Completions 2020	Number of Program Openings
Forest and Conservation Scientist	19	2,698	479
Administration Workers	15	1,402	5,377
Management	34	14,569	2,277

Table 20. Top Schools for Forest and Conservation Scientists in the Sierra and East Side Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Forest and Conservation Scientists in the Sierra and East Side Region	Program Completions (2020)
California State University, Chico	412
California State University, Fresno	403
Bakersfield College	354
Reedley College	252
Fresno City College	247
California State University, Bakersfield	221

Clovis Community College	217
Sierra College	204
Yuba College	70
College of the Sequoias	60

Table 21. Top Schools for Administration Workers in the Sierra and East Side Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Administration Workers in the Sierra and East Side Region	Program Completions (2020)
Sierra College	223
Butte College	145
Reedley College	141
Fresno City College	133
San Joaquin Valley College, Visalia	79
Santa Barbara Business College, Bakersfield	57
Shasta College	55
Bakersfield College	46
Milan Institute, Visalia	44
Yuba College	43

Table 22. Top Schools for Management in the Sierra and East Side Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Management in the Sierra and East Side Region	Program Completions (2020)
Bakersfield College	3,586
California State University, Fresno	1,685
Reedley College	1,495
California State University, Chico	1,068
Clovis Community College	1,066
College of the Sequoias	1,043
California State University, Bakersfield	758
Sierra College	630
Shasta College	599
Fresno City College	351

Coastal

The Coastal region in California encompasses the Central Coast from San Luis Obispo north to San Francisco, and some of the Central Valley. Respondents from this area identified transportation and equipment operators, firefighter and wildfire prevention, and management as their top three most critical positions. CED staff gathered data to explore the characteristics and needs of these three occupations in the region:

Table 23. Top Three Critical Positions in the Coastal Region

Critical Positions in the Coastal Region	2021 Jobs	2026 Jobs	2021-2026 Change	2021-2026 % Change	Average Median Hourly Earnings
Transportation and Equipment Operators	95	107	12	12.7%	$22.99
Firefighters and Wildfire Prevention	<10	<10	3	~30%	$50.48
Management	246	288	42	16.9%	$43.72

Table 24. Unique critical position job postings and number of competing employers in the Coastal Region.

Occupation	Unique Job Postings (Jan 2019 to Oct 2021)	Number of Competing Employers
Transportation and Equipment Operators	331	8
Firefighters and Wildfire Prevention	2	0
Management	37	3

Table 25. Summary of relevant 2 to 4-year educational training programs for critical forestry positions in the Coastal Region.

Occupation	Number of Educational Programs	Number of Program Completions 2020	Number of Program Openings
Transportation and Equipment Operators	2	81	6,951
Firefighters and Wildfire Prevention	9	1,706	595
Management	49	31,343	6,957

Table 26. Top Schools for Transportation and Equipment Operators in the Coastal Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Transportation and Equipment Operators in the Coastal Region	Program Completions (2020)
Center for Employment Training, Soledad	45
California Polytechnic State University, San Luis Obispo	33
University of California, Berkeley	3

Table 27. Top Schools for Firefighter and Wildfire Prevention in the Coastal Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Firefighter and Wildfire Prevention in the Coastal Region	Program Completions (2020)
San Francisco State University	253
California State University, Stanislaus	226
San Jose State University	206
California State University, East Bay	204
Las Positas College	137
City College of San Francisco	120
Los Medanos College	120
Modesto Junior College	71
Skyline College	70
Monterey Peninsula College	48

Table 28. Top Schools for Management in the Coastal Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Management in the Coastal Region	Program Completions (2020)
San Jose State University	1,841
San Francisco State University	1,785
University of California, Berkeley	1,759
Hartnell College	1,559
California Polytechnic State University, San Luis Obispo	1,225
Cuesta College	1,200
Merced College	1,144
California State University, East Bay	1,068
Chabot College	1,007
Los Medanos College	1,003

Southern

The Southern region in California encompasses the southern part state, from the Inland Empire to the Mexico border. Respondents from this area identified Management, Laborers, and Administration Workers as their top three most critical positions. CED staff gathered data to explore the characteristics and needs of these three occupations in the region:

Table 29. Top Three Critical Positions in the Southern Region.

Critical Positions in the Southern Region	2021 Jobs	2026 Jobs	2021- 2026 Change	2021-2026 % Change	Average Median Hourly Earnings
Management	270	316	46	17.0%	$38.60
Laborers	174	201	27	15.6%	$24.24
Administration Workers	223	251	28	12.8%	$20.61

Table 30. Unique critical position job postings and number of competing employers in the Southern Region.

Occupation	Unique Job Postings (Jan 2019 to Oct 2021)	Number of Competing Employers
Management	22	15
Laborers	14	5
Administration Workers	21	10

Table 31. Summary of relevant 2 to 4-year educational training programs for critical forestry positions in the Southern Region.

Occupation	Number of Educational Programs	Number of Program Completions 2020	Number of Program Openings
Management	46	123,251	11,945
Laborers	14	2,279	6,956
Administration Workers	22	9,756	33,295

Table 32. Top Schools for Management in the Southern Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Management in the Southern Region	Program Completions (2020)
Santa Monica College	5,058
Irvine Valley College	3,783
Fullerton College	3,700
Saddleback College	3,593
Golden West College	3,390
Ashford University	3,268
Orange Coast College	2,919
Los Angeles Pierce College	2,856
Pasadena City College	2,810
California State University, Fullerton	2,782

Table 33. Top Schools for Laborers in the Southern Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Laborers in the Southern Region	Program Completions (2020)
Summit College	241
Los Angeles Trade Technical College	212
Southern California Institute of Technology	190
San Joaquin Valley College, Ontario	169
NTMA Training Centers of Southern California	139
Chaffey College	125
Santa Ana College	104
Santiago Canyon College	102
InterCoast College, West Covina	86
Palomar College	79

Table 34. Top Schools for Administration Workers in the Southern Region. Source: (Emsi Q3 2021 Data Set)

Top Schools for Administration Workers in the Southern Region	Program Completions (2020)
University of Southern California	936
East Los Angeles College	617
Irvine Valley College	373
California Technical Academy	357
College of the Canyons	351
California State University, Northridge	334
Santa Monica College	314
Coastline Community College	304
Chaffey College	250
Santa Ana College	238

Economic Impact Summary

Using IMPLAN Economic Modeling software, CED staff entered the projected employment growth data acquired from Emsi to determine the economic impact for each region over the same 5-year period. The economic impact results include direct and indirect employment growth (number of employees), projected labor income, projected value-added for the region, and projected dollar output. CED staff determined the top five most positively impacted and top 5 most negatively impacted industries in each region based on projected growth among the identified critical positions. Also included is an assessment of the impact on wood related industries. The dollar values account for yearly inflation and show a total impact over the entire 5-year projected period. Some industries report positive impacts in employment alongside negative impacts to outputs. This can be explained by net leakages of economic activity that do not generate effects within the defined regions. Such leakages can be caused by taxes, savings, profits, imports or commuting outside of the region.

Tables 39, 43, 46, and 50 display the aggregate impact of the projected growth of critical positions in the forest sector on wood related industries. Table 35 displays the wood related industries included in the aggregated results.

Table 35. Wood related industries included in aggregated results in tables

Industry
Wood windows and door manufacturing
Wood container and pallet manufacturing
Wood kitchen cabinet and countertop manufacturing
Nonupholstered wood household furniture manufacturing
All other miscellaneous wood product manufacturing
Prefabricated wood building manufacturing
Reconstituted wood product manufacturing
Engineered wood member and truss manufacturing
Office furniture, except wood, manufacturing
Custom architectural woodwork and millwork
Sawmill, woodworking, and paper machinery
Wood office furniture manufacturing
Wood preservation
Veneer and plywood manufacturing

Northern

Table 36 displays a summary of economic impacts to the region based on projected 5-year change for each of the top three critical positions identified in the Northern region. Employment represents the total projected change in the number of top three critical positions within the region's forest sector between 2021 and 2026. Labor Income displays the total increase in employee compensation and proprietor income during the 5-year period, while Value Added includes

employee compensation, proprietor income, taxes on production and imports, and other property income, and Output includes employee compensation, proprietor income, taxes on production and imports, other property income, and intermediate inputs.

Table 36. Northern region economic impact summary

Impact	Employment	Labor Income	Output
Direct	41	$3,001,112.38	$3,065,038.17
Indirect	6.09	$160,670.85	-$365,712.04
Totals	47.09	$3,161,783.23	$2,699,326.13

Tables 37 and 38 display the 5 most positively and negatively impacted industries in the region respectively. Direct Output displays the output increased or decreased by the projected change of employees within the industry listed. Indirect Output displays the output increased or decreased by the projected change of employees within the other industries.

Table 37. Top 5 most positively impacted industries in the Northern region.

Industry	Direct Output	Indirect Output	Total Output
522 - Grantmaking, giving, and social advocacy organizations	$5,555,550.48	$20,372.22	$5,575,922.70
15 - Forestry, forest products, and timber tract production	$3,160,256.07	-$16,450.81	$3,143,805.26
19 - Support activities for agriculture and forestry	$120,997.22	$313,514.33	$434,511.55
447 - Other real estate	$0.00	$225,047.36	$225,047.36
501 - Museums, historical sites, zoos, and parks	$180,019.34	$0.16	$180,019.50

Table 38. Top 5 most negatively impacted industries in the Northern region.

Industry	Direct Output	Indirect Output	Total Output
45 - Electric power generation - Biomass	-$3,844,076.60	-$38,426.67	-$3,882,503.27
132 - Sawmills	-$1,931,375.07	-$161,262.59	-$2,092,637.66
16 - Commercial logging	-$176,333.28	-$307,284.80	-$483,618.08
47 - Electric power transmission and distribution	$0.00	-$354,480.45	-$354,480.45
396 - Wholesale - Other durable goods merchant wholesalers	$0.00	-$292,196.16	-$292,196.16

Table 39 displays the impact of the projected change in critical positions over the next five years (2021-2026) on major industry sectors in the Northern region. Total Output displays the amount of output for the industries in the region for a given year. Impact Output displays the projected change to output based on the modeled impact (change in critical positions). Estimated growth percentage displays the estimated percent change based on the modeled impact.

Table 39. Estimated growth to wood related industries for Northern region.

Industry	Total Output	Impact Output	Estimated Growth
Wood Related Industries	$1,387,944,214.17	-$1,073.69	-0.0000774%
Agriculture, Forestry, Fishing and Hunting	$7,493,864,877.64	$3,564,276.94	0.0475626%
Mining	$2,045,491,216.77	$1,801.83	0.0000881%
Utilities	$5,511,092,551.84	$30,304.89	0.0005499%
Construction	$25,323,260,839.25	$21,764.00	0.0000859%
Manufacturing [except wood manufacturing]	$57,091,329,800.36	$42,409.72	0.0000743%
Wholesale Trade	$20,232,687,017.15	$96,309.96	0.0004760%
Retail Trade	$19,429,536,104.51	$167,113.65	0.0008601%
Transportation and Warehousing	$10,743,344,634.59	$54,816.29	0.0005102%
Information	$12,353,504,404.27	$64,404.96	0.0005213%
Finance and Insurance	$24,928,904,897.75	$181,783.27	0.0007292%
Real Estate Rental and Leasing	$52,069,223,972.14	$415,693.22	0.0007983%
Professional, Scientific, and Technical Services	$27,638,415,222.28	$76,532.95	0.0002769%
Management of companies and enterprises	$4,738,716,427.65	$21,677.06	0.0000000%
Administrative and Support and Waste Management and Remediation Services	$12,307,365,462.22	$49,943.03	0.0004058%
Educational Services	$2,303,473,974.03	$20,421.10	0.0008865%
Health Care and Social Assistance	$31,841,282,389.20	$254,072.82	0.0007979%
Arts, Entertainment, and Recreation	$3,435,614,483.63	$23,860.22	0.0006945%
Accommodation and Food Services	$14,397,287,311.79	$113,165.87	0.0007860%
Other Services (except Public Administration)	$12,569,400,539.24	$107,795.16	0.0008576%
Public Administration	$45,888,758,807.22	$34,159.48	0.0000744%

Sierra and East Side

Table 40 displays a summary of economic impacts to the region based on projected 5-year change for each of the top three critical positions identified in the Sierra and East Side region. Employment represents the total change in the number of critical positions within the region's forest sector between 2021 and 2026. Labor Income displays the total increase in employee compensation and proprietor income during the 5-year period, while Value Added includes employee compensation, proprietor income, taxes on production and imports, and other property income, and Output includes employee compensation, proprietor income, taxes on production and imports, other property income, and intermediate inputs.

Table 40. Sierra and East Side region economic impact summary

Impact	Employment	Labor Income	Output
Direct	69	$3,578,872.56	$7,011,244.74
Indirect	13.72	$614,035.01	$1,466,848.75
Totals	82.72	$4,192,907.57	$8,478,093.49

Tables 41 and 42 display the 5 most positively and negatively impacted industries in the region respectively. Direct Output displays the output increased or decreased by the projected change of

employees within the industry listed. Indirect Output displays the output increased or decreased by the projected change of employees within the other industries.

Table 41. Top 5 most positively impacted industries in the Sierra and East Side region.

Industry	Direct Output	Indirect Output	Total Output
522 - Grantmaking, giving, and social advocacy organizations	$3,943,858.15	$13,991.77	$3,957,849.92
19 - Support activities for agriculture and forestry	$1,764,072.87	$293,695.62	$2,057,768.49
15 - Forestry, forest products, and timber tract production	$1,764,619.58	$320.26	$1,764,939.84
447 - Other real estate	$0.00	$203,129.22	$203,129.22
472 - Employment services	$0.00	$93,713.99	$93,713.99

Table 42. Top 5 most negatively impacted industries in the Sierra and East Side region.

Industry	Direct Output	Indirect Output	Total Output
132 - Sawmills	-$647,634.98	-$52,366.77	-$700,001.75
396 - Wholesale - Other durable goods merchant wholesalers	$0.00	-$74,886.97	-$74,886.97
415 - Rail transportation	$0.00	-$1,837.05	-$1,837.05
138 - Cut stock, resawing lumber, and planing	$0.00	-$516.83	-$516.83
134 - Veneer and plywood manufacturing	$0.00	-$383.17	-$383.17

Table 43 displays the aggregated impact of the projected change in critical positions over the next five years (2021-2026) on major industry sectors in the Sierra and East Side region. Total Output displays the amount of output for the industries in the region for a given year. Impact Output displays the projected change to output based on the modeled impact (change in critical positions). Estimated growth percentage displays the estimated percent change based on the modeled impact.

Table 43. Estimated growth to wood related industries for Sierra and East Side region.

Industry	Total Output	Impact Output	Estimated Growth
Wood Related Industries	$820,749,776.87	$1,296.56	0.0001580%
Agriculture, Forestry, Fishing and Hunting	$25,071,794,583.38	$3,858,710.63	0.0153906%
Mining	$7,745,964,426.02	$8,176.64	0.0001056%
Utilities	$9,437,731,804.77	$44,756.74	0.0004742%
Construction	$19,752,107,699.38	$44,300.47	0.0002243%
Manufacturing [except wood manufacturing]	$44,257,584,323.53	-$575,286.02	-0.0012999%
Wholesale Trade	$17,708,966,159.50	$132,936.50	0.0007507%
Retail Trade	$17,720,603,422.83	$287,306.28	0.0016213%
Transportation and Warehousing	$9,823,931,947.49	$139,722.34	0.0014223%
Information	$7,347,394,431.84	$204,404.49	0.0027820%
Finance and Insurance	$16,880,882,379.08	$378,143.03	0.0022401%
Real Estate Rental and Leasing	$43,128,368,447.42	$857,483.94	0.0019882%
Professional, Scientific, and Technical Services	$14,119,061,440.24	$298,056.93	0.0021110%
Management of companies and enterprises	$2,612,278,824.88	$32,286.78	0.0012360%
Administrative and Support and Waste Management and Remediation Services	$9,641,510,188.79	$280,672.43	0.0029111%
Educational Services	$1,019,540,096.92	$85,071.56	0.0083441%
Health Care and Social Assistance	$27,272,973,835.06	$434,870.82	0.0015945%
Arts, Entertainment, and Recreation	$2,083,981,364.26	$116,325.48	0.0055819%
Accommodation and Food Services	$12,199,680,318.66	$217,506.95	0.0017829%
Other Services (except Public Administration)	$10,128,410,709.83	$4,136,182.77	0.0408374%
Public Administration	$35,459,396,275.00	$73,678.38	0.0002078%

Coastal

Table 44 displays a summary of economic impacts to the region based on projected 5-year change for each of the top three critical positions identified in the Coastal region. Employment represents the total change in the number of critical positions within the region's forest sector between 2021 and 2026. Labor Income displays the total increase in employee compensation and proprietor income during the 5-year period, while Value Added includes employee compensation, proprietor income, taxes on production and imports, and other property income, and Output includes employee compensation, proprietor income, taxes on production and imports, other property income, and intermediate inputs.

Table 44. Coastal region economic impact summary

Impact	Employment	Labor Income	Output
Direct	57	$4,593,795.47	$13,308,951.43
Indirect	22.36	$2,085,248.28	$4,702,995.61
Totals	79.36	$6,679,043.75	$18,011,947.04

Table 45 displays the 5 most positively impacted industries in the region. The Coastal region had no projected negative impacts. Direct Output displays the output increased or decreased by the projected change of employees within the industry listed. Indirect Output displays the output increased or decreased by the projected change of employees within the other industries.

Table 45. Top 5 most positively impacted industries in the Coastal region.

Industry	Direct Output	Indirect Output	Total Output
522 - Grantmaking, giving, and social advocacy organizations	$8,888,938.17	$25,975.88	$8,914,914.05
132 - Sawmills	$1,983,861.61	$30,631.71	$2,014,493.32
16 - Commercial logging	$615,664.35	$292,029.14	$907,693.49
19 - Support activities for agriculture and forestry	$740,841.71	$126,688.42	$867,530.13
501 - Museums, historical sites, zoos, and parks	$670,440.71	$0.62	$670,441.33

Table 46 displays the aggregated impact of the projected change in critical positions over the next five years (2021-2026) on major industry sectors in the Coastal region. Total Output displays the amount of output for the industries in the region for a given year. Impact Output displays the projected change to output based on the modeled impact (change in critical positions). Estimated growth percentage displays the estimated percent change based on the modeled impact.

Table 46. Estimated growth to wood related industries for Coastal region.

Industry	Total Output	Impact Output	Estimated Growth
Wood Related Industries	$1,921,275,353.66	$8,205.19	0.0004271%
Agriculture, Forestry, Fishing and Hunting	$20,417,363,297.95	$2,242,119.38	0.0109814%
Mining	$2,395,896,034.36	$4,492.12	0.0001875%
Utilities	$21,805,123,270.91	$94,732.38	0.0004345%
Construction	$58,480,868,219.96	$73,088.81	0.0001250%
Manufacturing [Except Wood Manufacturing]	$306,285,272,688.29	$2,356,965.79	0.0007695%
Wholesale Trade	$70,375,883,490.77	$650,267.64	0.0009240%
Retail Trade	$56,434,571,095.00	$398,786.39	0.0007066%
Transportation and Warehousing	$48,771,459,253.84	$446,070.09	0.0009146%
Information	$259,434,351,113.04	$953,966.39	0.0003677%
Finance and Insurance	$30,633,799,131.13	$275,088.79	0.0008980%
Real Estate Rental and Leasing	$181,592,138,227.56	$1,482,451.99	0.0008164%
Professional, Scientific, and Technical Services	$222,371,027,332.11	$811,737.97	0.0003650%
Management of companies and enterprises	$26,773,239,249.65	$124,433.19	0.0004648%
Administrative and Support and Waste Management and Remediation Services	$39,097,288,127.99	$490,766.11	0.0012552%
Educational Services	$12,671,373,555.77	$219,710.20	0.0017339%
Health Care and Social Assistance	$79,862,772,657.84	$530,584.69	0.0006644%
Arts, Entertainment, and Recreation	$11,036,455,541.22	$755,326.13	0.0068439%
Accommodation and Food Services	$47,334,998,365.92	$349,482.69	0.0007383%
Other Services (except Public Administration)	$32,813,935,123.41	$9,181,378.50	0.0279801%
Public Administration	$78,149,084,408.71	$73,974.73	0.0000947%

Southern

Table 47 displays a summary of economic impacts to the region based on projected 5-year change for each of the top three critical positions identified in the Southern region. Employment represents the total change in the number of critical positions within the region's forest sector between 2021 and 2026. Labor Income displays the total increase in employee compensation and proprietor income during the 5-year period, while Value Added includes employee compensation, proprietor income, taxes on production and imports, and other property income, and Output includes employee compensation, proprietor income, taxes on production and imports, other property income, and intermediate inputs.

Table 47. Southern region economic impact summary

Impact	Employment	Labor Income	Output
Direct	100	$6,053,082.59	$22,434,310.73
Indirect	51.35	$3,569,288.06	$9,978,105.43
Totals	151.35	$9,622,370.65	$32,412,416.16

Tables 48 and 49 display the 5 most positively and negatively impacted industries respectively. Direct Output displays the output increased or decreased by the projected change of employees within the industry listed. Indirect Output displays the output increased or decreased by the projected change of employees within the other industries.

Table 48. Top 5 most positively impacted industries in the Southern region.

Industry	Direct Output	Indirect Output	Total Output
522 - Grantmaking, giving, and social advocacy organizations	$15,510,927.51	$55,190.61	$15,566,118.12
45 - Electric power generation - Biomass	$5,412,519.08	$3,169.17	$5,415,688.25
19 - Support activities for agriculture and forestry	$2,147,918.87	-$7,496.77	$2,140,422.10
447 - Other real estate	$0.00	$996,498.89	$996,498.89
472 - Employment services	$0.00	$583,063.50	$583,063.50

Table 49. Top 5 most negatively impacted industries in the Southern region.

Industry	Direct Output	Indirect Output	Total Output
132 - Sawmills	-$929,060.39	-$5,319.76	-$934,380.15
16 - Commercial logging	-$165,154.25	-$147,823.27	-$312,977.52
396 - Wholesale - Other durable goods merchant wholesalers	$0.00	-$109,957.16	-$109,957.16
138 - Cut stock, resawing lumber, and planing	$0.00	-$3,515.83	-$3,515.83
10 - All other crop farming	$0.00	-$3,391.93	-$3,391.93

Table 50 displays the aggregated impact of the projected change in critical positions over the next five years (2021-2026) on major industry sectors in the Southern region. Total Output displays the amount of output for the region for a given year. Impact Output displays the projected change to output based on the modeled impact (change in critical positions). Estimated growth percentage displays the estimated percent change based on the modeled impact.

Table 50. Estimated growth to wood related industries for Southern region.

Industry	Total Output	Impact Output	Estimated Growth
Wood Related Industries	$4,229,426,799.29	$9,417.97	0.0002227%
Agriculture, Forestry, Fishing and Hunting	$9,213,331,090.17	$2,000,797.42	0.0217163%
Mining	$8,111,826,822.16	$43,296.42	0.0005337%
Utilities	$45,596,555,434.94	$6,358,004.22	0.0139440%
Construction	$114,409,109,985.72	$148,944.68	0.0001302%
Manufacturing [Except Wood Manufacturing]	$353,663,077,396.38	$98,623.23	0.0000279%
Wholesale Trade	$169,091,162,233.93	$727,589.08	0.0004303%
Retail Trade	$119,482,605,274.97	$812,486.10	0.0006800%
Transportation and Warehousing	$98,733,031,642.15	$1,010,899.36	0.0010239%
Information	$195,693,427,109.71	$1,727,958.78	0.0008830%
Finance and Insurance	$178,725,356,161.89	$2,057,355.85	0.0011511%
Real Estate Rental and Leasing	$384,474,405,974.00	$2,966,798.72	0.0007717%
Professional, Scientific, and Technical Services	$236,429,260,530.47	$2,163,449.03	0.0009151%
Management of companies and enterprises	$38,313,052,962.65	$240,217.75	0.0006270%
Administrative and Support and Waste Management and Remediation Services	$87,806,222,966.31	$1,413,774.61	0.0016101%
Educational Services	$19,355,754,811.52	$539,103.26	0.0027852%
Health Care and Social Assistance	$166,575,386,618.09	$1,094,185.48	0.0006569%
Arts, Entertainment, and Recreation	$50,987,588,701.64	$502,459.13	0.0009855%
Accommodation and Food Services	$99,920,085,334.73	$791,759.11	0.0007924%
Other Services (except Public Administration)	$73,045,666,975.14	$16,122,707.95	0.0220721%
Public Administration	$204,100,407,442.75	$334,325.62	0.0001638%

Literature Review

The forest industry is facing serious staffing shortages. Based on data from the Bureau of Labor Statistics, the U.S. logging industry will have a shortage of 7,000 workers by 2026 (3 Challenges 2019). According to the 2016 Forest Industries Data Collection System (FIDACS) census, there are 80 active primary wood products facilities in California, an increase from the 77 manufacturers identified in 2012 and 2006. Despite this recent increase in wood products facilities in California, the industry remains significantly smaller than it has been historically, as in 1968 there were 262 operational facilities in the State. Most of these losses have come in the form of lumber-producing facilities, such as sawmills (Marcille, et al.).

Along with the overall decrease in wood products facilities in California, total employment within the forest sector has also experienced recent declines. Between 1998 and 2012, employment in the California forest sector has decreased from over 90,000 employees to less than 60,000 (Marcille, et al.). As stated in a 2014 speech by Tom Tidwell of North American Forest Commission, over a thousand sawmills closed between 2005 to 2009. One fully operational, modern sawmill has the capacity to create over 600 direct jobs, with the ability to add hundreds more additional jobs in the community (Ring). It comes as no surprise then, that the sawmills closures between 2005 to 2009 resulted in the loss of almost 300,000 full-time jobs, over 25 percent of all jobs in the forest products industry (Tidwell). While the Great Recession contributed to these decreases, the forest industry has been very slow to recover with only slight increases in employment in recent years (Marcille, et al.).

The workforce challenges faced by California's forest sector not only present economic difficulties, but safety concerns as well. Over the past decade, California has experienced rapidly escalating wildfires in both frequency and severity. Forest sector workers are, in many cases, the first line of defense against wildfires and a diminished forest sector workforce can greatly impact California's ability to prevent these disasters through methods like brush removal, pruning, thinning treatments, selective harvesting, and controlled burns.

Challenges

The forestry industry is currently facing several workforce challenges, which have resulted in a workforce shortage within the industry. By 2026, the forestry sector will be short 7,000 loggers (3 Challenges Facing the American Forestry Industry). According to a report prepared by the Columbia

Basin Rural Development Institute, the forestry sector faces such workforce challenges as an aging workforce, skill shortages, lack of training, public perception, lack of diversification, and fragmentation (Rural Workforce Development). Many of the sector's most skilled and experienced workers are getting older and nearer to retirement. Small, family-owned companies employ most of the U.S. logging workforce, and the median employee age is 54 years old, as of 2013 (Goergen, et al). The sector's aging workforce will result in not only a shortage of workers, but also a great loss in the overall skill level within the sector. The aging workforce also presents several workforce health and safety concerns (Ackerknecht).

The issue of an aging workforce is also compounded by the few young people pursuing forestry occupations (Ackerknecht). Many forest sector employers find it very difficult to find qualified full-time employees (Kelly). Both training and public perception contribute to the dearth of young forest sector workers. Many traditional forestry jobs are dangerous and take an extreme physical toll on workers, this combined with the public perception of such jobs damaging the environment has dissuaded many young people from entering the industry (3 Challenges Facing the American Forestry Industry). Additionally, wood-based industries have acquired an arguably unfitting reputation as environmentally detrimental. There is also a common misconception that forest jobs do not pay well; however, despite employment in forestry and logging decreased between 2012 and 2016, income for these positions have increased by approximately 30 percent over the same period (Marcille, et al.). Lastly, there is a common perception that the forest industry is a "sunset industry" that may not be around long enough to be worth pursuing a career in forestry (Biles).

Appropriate training for forestry jobs is also difficult for young people to obtain (3 Challenges Facing the American Forestry Industry) and has also seen a substantial loss of interest from students, largely due to the negative perceptions of the industry. Until recently, most forest industry jobs consisted of more traditional activities such as silviculture and timber harvesting. Today, the industry has expanded to include an even wider array of positions related to forest ecosystem functions. While this is beneficial for the industry in many ways, it has also resulted in many students entering into interdisciplinary and ecosystem-based programs rather than receiving the appropriate education for more traditional forest practices like logging (Forest Sector Workforce in the UNECE Region). These circumstances have led to many of the sector's new employees lacking the training possessed by the sector's older retiring workforce, with the issue being exacerbated by the increasing number of careers within the natural resource sector, which has syphoned away many potential forestry sector employees (Rural Workforce Development). Additionally, there are few schools in the United States

that offer degrees in wood science and technology. According to the International Society of Wood Science and Technology, there are only thirty-four schools in the U.S. that offer degrees in wood science and technology and while each of these schools offer master's degrees in wood science and technology, only twenty-six of them offer bachelor's degrees and only thirty-one of them offer doctorate degrees in the same subject ("Directory of North American Schools").

Forestry Practices

As stated earlier, a lack of incoming young and qualified workers is responsible for a large portion of the sector's workforce shortage. Many young, qualified workers are seeking employment as forestry and conservation scientists rather than forestry and conservation workers (Zilberman). While there are many factors influencing this phenomenon, a major contributor is wage disparity. In 2015, the median annual wage for forestry and conservation workers was $26,190, while median annual wages for conservation scientists were $61,110 (Zilberman). This substantial difference in wages coupled with the perception that workers in the sector contribute to environmental damage while scientists contribute to environmental preservation has had a profound impact on the workforce.

As previously stated, the dangerous nature of many forest sector careers also acts as a deterrent to new potential employees (Ackerknecht). Logging in particular can be a very dangerous job and also takes a serious physical toll on workers ("3 Challenges Facing the American Forestry Industry"). While many of the safety risks are inherent to the work being performed, others are "directly related to the way forestry operations are being performed" ("Forest Sector Workforce in the UNECE Region"). Because of this, technological advances will not be enough to fully address the safety concerns within the forest sector and will need to be coupled with behavioral changes as well ("Forest Sector Workforce in the UNECE Region"). Safety is a concern within the forest service as well, as its safety practices rely on a "hierarchical dissemination of safety information, which does not effectively deliver the needed information from academic researchers to the forest workforce" (Adams). Effective safety information delivery is vital to a safe and dynamic work environment.

Alternatively, the U.S. forest sector's practice of reforestation has a positive impact on the industry's workforce ("Restoring America's Forests for Wildfire Resilience in a Changing Climate"). This practice of reforestation attracts a more varied workforce to the industry (Gordon). Additionally,

reforestation efforts are largely impacted by the sector's current workforce shortage as many nurseries required for such efforts are currently without the staff required to keep up with demand ("Ramping up Reforestation . . .").

Policies and Funding

In 2020, the Bureau of Land Management made a recent revision to the National Environmental Policy Act (NEPA) that updated old regulations governing timber sales. The updated NEPA regulations will allow for a streamlined process of pinyon pine and juniper tree removal and authorizes the harvest of dead or dying trees, known as "salvage harvest" (Bureau of Land Management). The salvage harvest authorization is expected to have a positive impact on the workforce in the forest management sector. The Bureau of Land Management anticipates the new regulation will contribute to the economies in rural communities and lower the hazard of dead or dying trees that pose a risk to the forest sector workforce (Bureau of Land Management).

A new joint initiative between California and the U.S. Forest service, the Agreement for Shared Stewardship of California's Forest and Rangelands, is projected to create efficiency in forest management and facilitate forest sector workforce growth (Debel). The state and federal joint agreement will work with timber companies to create an efficient permitting process and remove any unnecessary barriers that impede project approvals. The agreement is backed by funding through the federal Great American Outdoors Act of 2020. One of the goals of this initiative is to find ways to incentivize investment into forest sector equipment, such as chippers and bulldozers, and forest sector facilities, such as mills. To incentivize private investment, both California and the federal government agree to support loan guarantees and revolving loan funds. The agreement also commits to growing the workforce through vocational training development in several forest-related fields, including timber faller, heavy machine operator, vegetation treatment crews, and ecological restorationists (Debel).

The Wildfire and Forest Resilience Action Plan released in January 2021 will positively influence the forest sector workforce through economic and job growth. The Governor's proposed budget will allocate $76 million in funding to support the Plan's initiative to develop forest management job training, incentivize forest sector investment access through Climate Catalyst Fund's low-interest lending program, and expand the California Conservation Corps workforce programs (Lien-Mager and Curtis).

The Loggers Relief Act was introduced to the Senate in July 2020 and passed in December of 2020. The Loggers Relief Act provides aid to the logging industry impacted by Covid-19 by issuing payments equal to 10% of the company's gross revenue between the period of January 1, 2019, and July 31, 2019 (Collins).

Possible Avenues for Workforce Recovery

Having identified many of the workforce challenges faced by the forest sector, CED staff also reviewed related literature offering suggestions as to how the industry can overcome these challenges. The most common suggestion within the literature is for the forest sector to focus on promoting itself as a sustainable and ecologically sound industry (Tidwell). Negative perceptions of the industry are one of the primary drivers behind the forest sector's workforce shortage and addressing these negative perceptions is very important for workforce recovery. Thankfully for the forest sector, these negative perceptions are largely inaccurate, and the industry can combat the perception of the industry being environmentally unfriendly with facts and hard data. Through successful promotion and branding as an environmentally friendly and economically strong industry, the forest sector can shift the narrative and draw in new workers (Biles).

The forest industry should also focus on expanding diversity within its workforce. Historically, the forest industry has attracted a fairly homogenous workforce, which ultimately limits the labor pools from which the industry can draw new workers (Biles). By actively supporting and promoting diversification within its workforce, the industry can take the first steps toward increasing the attractiveness of forest sector work among more varied groups of potential employees. The number of women in the forest sector have been growing in recent years and have brought beneficial skills to the industry; forest industry management should continue to encourage growth in this trend to ensure greater avenues for employment and a more diverse workforce (Ackerknecht).

In October of 2021, the California Wildfire & Forest Resilience Task Force released the California Strategic Plan for Prescribed Fire, Cultural Burning, & Prescribed Natural Fire, which cites lack of human resources as a primary hurdle to performing the necessary work, including prescribed burns, required to safely manage California's forests. The strategic plan also cites one of its goals as, "The state and its partners will grow, train, and diversify the prescribed fire workforce, including people trained in burn planning, burn implementation, public communication, air quality modeling and permitting, data analysis and modeling, and operational support, in order to implement more

beneficial fire projects across all land ownerships" (California Wildfire & Forest Resilience Task Force). Key actions to help achieve this goal are also provided, including establishing a prescribed fire training center, developing sufficient prescribed fire crews, creating incentives for agency staff, increasing cooperative efforts, increasing diversity, and increasing training.

Many positions within the sector come with inherent dangers; however, by continuous review and updating of industry safety practices and employing the use of technological upgrades, these dangers can be greatly reduced. While technological advances and safety equipment help in reducing the dangers inherent to forest sector work, greater behavioral changes will have to be made to fully address the issue. Firms can support the development of a safety culture, as well as risk assessment procedures and monitoring to ensure these new practices are being followed ("Forest Sector Workforce in the UNECE Region"). In 2018, WorkSafe, a government agency in New Zealand, released a Health and Safety at Work Strategy for the Nation's forest sector. The strategy was produced as a response to the high injury rate among forest sector workers making it the most dangerous industry in the Country. The strategy developed by WorkSafe involves cooperation between businesses within the sector to help those most in need of improved safety measures, integration of health and safety measures by sector leaders at all levels, encouraging cooperative efforts to improve safety for those most at risk, improving and increasing worker engagement; participation; and representation in safety procedures and development, improving management of worker physical and mental health, increased and improved trainings to lift overall capability among the sector's workforce, and the development and sharing of data and insights into health and safety to improve decision making throughout the sector. Adopting similar strategies within California's forest sector may increase workplace safety within the sector and, in turn, raise interest in forest sector positions among California's workforce.

References

"3 Challenges Facing the American Forestry Industry." USC Consulting Group. 2019. http://www.usccg.com/blog/3-challenges-facing-american-forestry-industry/

Ackerknecht, Carlos. "Work in the forestry sector: some issues for a changing workforce." *People and Forests in Harmony*. 2010 http://www.fao.org/3/i1507e/i1507e12.pdf

Adams, Theodore, Bret W. Butler, Sara Brown, Vita Wright, and Anne Black. Bridging the divide between fire safety research and fighting fire safely: how do we convey research innovation to contribute more effectively to wildland firefighter safety? International Journal of Wildland Fire, 26, 107–112. 2017. http://dx.doi.org/10.1071/WF16147

Biles, Kara. "Five Ways to Help Attract, Recruit and Retain in the Forest Industry." Canadian Biomass. 2018. https://www.canadianbiomassmagazine.ca/five-ways-to-help-attract-recruit-and-retain-in-the-forest-industry/

BLS. "Forestry and Logging: NAICS 113." US Bureau of Labor Statistics. 2020. https://www.bls.gov/iag/tgs/iag113.htm

Bureau of Land Management. "BLM Proposed Administrative Categorical Exclusions." *BLM National NEPA Register.* 2020. https://eplanning.blm.gov/eplanning-ui/project/1504279/510

California Wildfire & Forest Resilience Task Force, "California's Strategic Plan for Prescribed Fire, Cultural Burning & Prescribed Natural Fire." October, 2021. https://wildfiretaskforce.org/wp-content/uploads/2022/04/californiawildfireandforestresilienceactionplan.pdf

Collins, Susan M. "Loggers Relief Act." Congress.gov, July 21, 2020. https://www.congress.gov/bill/116th-congress/senate-bill/4233

Damicis, Jim. "Recent and Emerging Trends in Forestry and Lumber." Camoin Associates Economic Development. 2019. https://www.expansionsolutionsmagazine.com/recent-and-emerging-trends-in-forestry-and-lumber/

Debel, Danella. "California, U.S. Forest Service Establish Shared Long-Term Strategy to Manage Forests and Rangelands." *Office of Governor Gavin Newsom, Press Release*. 2020. https://www.gov.ca.gov/2020/08/13/california-u-s-forest-service-establish-shared-long-term-strategy-to-manage-forests-and-rangelands/

"Directory of North American Schools." International Society of Wood Science and Technology. 2010. https://www.swst.org/wp/education/directory-north-american-schools/

"Forest Sector Workforce in the UNECE Region." United Nations and the Food and Agriculture Organization of the United Nations, 2019. https://unece.org/fileadmin/DAM/timber/meetings/2019/20190327/Key-Findings-Forest-Sector-Workforce-Study-Draft.pdf

Goergen, Michael, et al. "The State and Future of U.S. Forestry and the Forest Industry." US Endowment for Forestry and Communities. 2013. https://www.usendowment.org/wp-content/uploads/2018/10/forest_sector_report_-_final_9.5.13.pdf

Gordon, John C., et all. Assessment of Indian Forests and Forest Management in the United States. Intertribal Timber Council. 2013. https://www.itcnet.org/file_download/295cc60c-7e21-4947-8ef1-74b3234af5d9

Kelly, Erin C., and Greg Brown. "Who Are We Educating and What Should They Know? An Assessment of Forestry Education in California. "*Journal of Forestry*, Volume 117, Issue 2, March 2019, Pages 95–103. 2019. https://doi.org/10.1093/jofore/fvy079

Lien-Mager, Lisa and Erin Curtis. "Governor's Task Force Outlines Actions to Reduce Wildfire Risk, Improve Health of Forests and Wildlands." California Environmental Protection Agency. 2021. https://calepa.ca.gov/2021/01/08/press-release-governors-task-force-outlines-actions-to-reduce-wildfire-risk-improve-health-of-forests-and-wildlands-1-8-21/

"Long-Term Occupational Projections (2018-2028)." Projections Central. 2018. https://projectionscentral.org/Projections/LongTerm

Marcille, Kate C., Todd A. Morgan, Chelsea P. McIver, and Glenn A. Christensen. "California's Forest Products Industry and Timber Harvest, 2016." United States Department of Agriculture, 2020. https://www.fs.fed.us/pnw/pubs/pnw_gtr994.pdf

"Ramping up Reforestation in the United States: A Guide for Policymakers." American Forests. 2021. https://www.americanforests.org/wp-content/uploads/2021/02/Ramping-Up-Reforestation_FINAL.pdf

"Restoring America's Forests for Wildfire Resilience in a Changing Climate." American Forests. 2021. https://www.americanforests.org/wp-content/uploads/2021/03/FINAL_Wildfire_Resiliency_Strategy_March-2021.pdf

Ring, Edward. "How to Save California's Forests." California Globe. 2020. https://californiaglobe.com/section-2/how-to-save-californias-forests/

"Rural Workforce Development: Challenges and Strategies in the Forestry Sector." Columbia Basin Rural Development Institute. 2018. http://datacat.cbrdi.ca/sites/default/files/attachments/Forestry%20Workforce%20Knowledge%20Brieft-FINAL.pdf

Tidwell, Tom. "The State of Forests and Forestry in the United States." Speech, North American Forest Commission, Madison, WI, October 2014. https://www.fs.usda.gov/speeches/state-forests-and-forestry-united-states-0

Tooke, Tony. "The Challenges Facing the Nation's Forests and the USDA Forest Service." Seminar speech, Mississippi State University, Starkville, MS. February 2018. https://www.fs.usda.gov/speeches/challenges-facing-nations-forests-and-usda-forest-service

WorkSafe. "Health and Safety at Work Strategy 2018-2028" 2018.https://www.mbie.govt.nz/assets/44672a6387/forestry-factsheet-health-and-safety-strategy.pdf

Zilberman, Alan. "Careers in Forestry: Nature's Office Suite." U.S. Bureau of Labor Statistics. 2016. https://www.bls.gov/careeroutlook/2016/article/forestry-careers.htm