

Putting California on the High Road: A Jobs and Climate Action Plan for 2030

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Chapter 11: Natural and Working Lands

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Contents

I. Overview of Sector and Key Climate Policies	442
II. Industries and Occupations Affected	446
III. Workforce Issues in Key Subsectors and Policies	447
A. Forest and Wildlands Management	447
1. <i>Industries and Occupations Affected</i>	449
2. <i>Workforce Outcomes to Date</i>	450
3. <i>Workforce Recommendations</i>	455
B. Biomass Energy and Wood Products Manufacturing	457
1. <i>Industries and Occupations Affected</i>	458
2. <i>Workforce Outcomes to Date</i>	459
3. <i>Workforce Recommendations</i>	459
C. Urban Forests, Wetlands, and Coastal Carbon Sinks	460
1. <i>Industries and Occupations Affected</i>	461
2. <i>Workforce Outcomes to Date</i>	461
3. <i>Workforce Recommendations</i>	462
D. Agriculture	463
D1. Methane Capture from Animal Husbandry	463
1. <i>Industries and Occupations Affected</i>	464
2. <i>Workforce Outcomes to Date</i>	465
3. <i>Workforce Recommendations</i>	465
D2. Agricultural Water Management and Other Programs	466
1. <i>Workforce Outcomes to Date</i>	468
III. Key Recommendations for the Natural and Working Lands Sector	469
Endnotes	471



I. Overview of Sector and Key Climate Policies

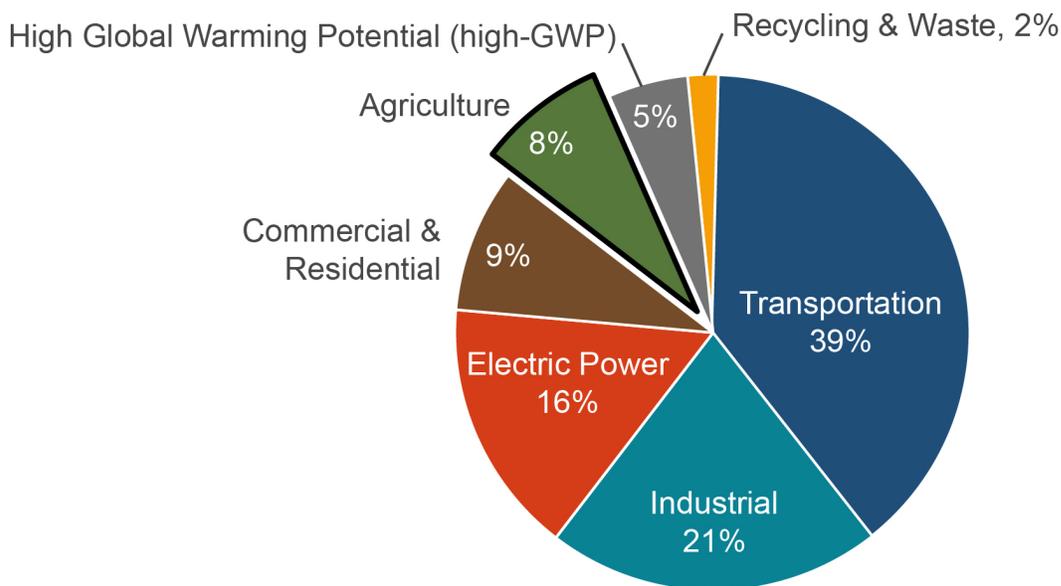
The sector of natural and working lands (NWL), which includes wildlands firefighting, forest and wildlands vegetation management, biomass, wetlands, green urban spaces, and agriculture, is a critical area for state climate policy, but its impact on greenhouse gas emissions is still unpredictable. The sector could have divergent impacts over the coming years, serving either as a carbon sink for absorbing emissions or as a major source of short-lived climate pollutants (SLCPs), especially black carbon from wildfires and methane from livestock.

The California Air Resources Board (CARB) Scoping Plan contains only general analysis and policy framing for the NWL sector, and its greenhouse gas inventory lacks full quantitative estimates of NWL emissions because of methodological challenges throughout the sector.¹ CARB, together with the California Natural Resources Agency (CNRA), the California Department of Food and Agriculture (CDFA), and California Environmental Protection Agency (CalEPA), are currently developing a NWL greenhouse gas emissions inventory as called for in Senate Bill 859 (Committee on Budget and Fiscal Review, Chapter 368, Statutes of 2016).² Also developed alongside this inventory will be an implementation plan to set goals and strategies for NWL emissions reduction.³ The Scoping Plan proposes a general reduction goal from NWL of at least 15-20 million metric tons by 2030, and this goal will be reevaluated in the sector-specific implementation plan.

As seen in **Exhibit 11.1**, the agriculture sector accounts for 8 percent of total emissions in the statewide greenhouse gas inventory. About three-fifths of agricultural emissions are from methane in dairy and livestock, with the rest from energy use and fertilizer use. **Exhibit 11.2** shows emissions from the agricultural sector in 1990 and 2017 and finally, the estimated range of emissions in 2030 from implementing the measures identified in the Scoping Plan.

Perhaps the most pressing challenge of California's NWL sector is wildfire. Because of climate change and related factors, wildfires have become more frequent and intense in recent years, and this trend is expected to increase. The methodology of calculating wildfire greenhouse gas emissions is uncertain, and for that reason CARB has not yet included wildfires in its statewide greenhouse gas emissions inventory.⁴ However, the U.S. Geological Survey estimated that California's record-breaking wildfire season of 2018 emitted 68 MMTCO₂e, roughly 15 percent of the total annual emissions statewide and almost exactly the same as the entire electric power sector.⁵ The Forest Carbon Plan, published in May 2018, estimated that under a business-as-usual scenario, statewide wildfire emissions could increase by 56 percent by 2100.⁶

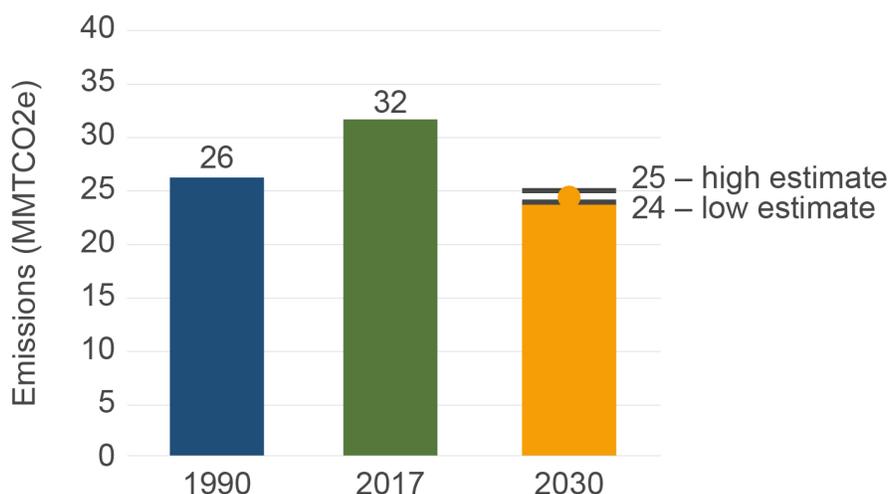


Exhibit 11.1. Agriculture Sector Emissions (MMTCO₂E) as of 2017

Source: California Air Resources Board, “California Greenhouse Gas Emissions for 2000 to 2017: Trends of Emissions and Other Indicators,” 2019, https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf.

California’s programs to address the NWL sector are slated for expansion in the coming years following passage of Senate Bill 901 (Dodd, Chapter 626, Statutes of 2018),⁷ which authorized \$200 million per year through FY 2023-24 from the Greenhouse Gas Reduction Fund (GGRF) for work on fire prevention and vegetation management. This much-needed expansion will have the unintended effect of highlighting the dichotomy between high-road and low-road approaches within the fire- and vegetation management segments of this Scoping Plan sector. Some workers in these fields—primarily the full-time employees of Cal Fire and other public firefighting agencies—have generally high wages, full benefits packages, and collective-bargaining contracts. Much of the rest of the sector, however, demonstrates characteristics of a low-road economic path, with poor job quality and extreme social marginalization, as described later in this chapter. As a result, state investment in the NWL sector could run the risk of simply increasing the number of poverty-level jobs, and the impact of public investment in training in some segments of this sector could be diminished by high worker turnover and low-wage economic competition.



Exhibit 11.2. Agriculture Sector Emissions and 2030 Target

Sources: 1990 levels and 2030 GHG emissions targets: California Air Resources Board, “California’s 2017 Climate Change Scoping Plan,” page 31, table 3, November 2017, https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf; 2017 levels from: California Air Resources Board, “California Greenhouse Gas Inventory for 2000-2017—by Category as Defined in the 2008 Scoping Plan,” August 12, 2019, https://ww3.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_sum_2000-17.pdf.

This chapter addresses the following key measures affecting the various subsectors of the natural and working lands sector:

❖ Forest and Wildlands Management

- Increased fire suppression work to reduce the spread of wildfires once they start.
- Intensive management of forests and other wildlands to increase their resiliency to wildfires, decrease the likelihood of catastrophic fires, reduce greenhouse gas emissions from wildfires, and increase the carbon sink capacity of forests and wildlands. In May 2018, Governor Jerry Brown issued an executive order requiring a significant acceleration of climate-related forest restoration and fuels treatment.⁸

❖ Biomass Energy and Wood Products Manufacturing

- Expansion of the use of forest by-products for bioenergy generation.
- Expansion of the market for timber for manufactured wood products, such as pre-engineered wood.



❖ Urban Forests, Wetlands, and Coastal Carbon Sinks

- Expansion of Cal Fire's Urban and Community Forestry Program to increase the carbon sink effect of street trees. Most of this program consists of grant programs for community street tree-planting groups.
- GGRF funding for the Natural Resources Agency's Urban Greening Grant Program, which provides grants for tree planting (to sequester or store carbon and/or for shade to reduce energy consumption) and active transportation infrastructure.
- GGRF funding for other state grant programs to plan and execute projects to increase the carbon sink effect of wetlands and coastal areas. These programs include the Coastal Conservancy's Climate Ready Program, the Department of Fish and Wildlife's Wetland Restoration for Greenhouse Gas Reduction Program, and the Wildlife Conservation Board's Climate Adaptation Program.

❖ Agriculture

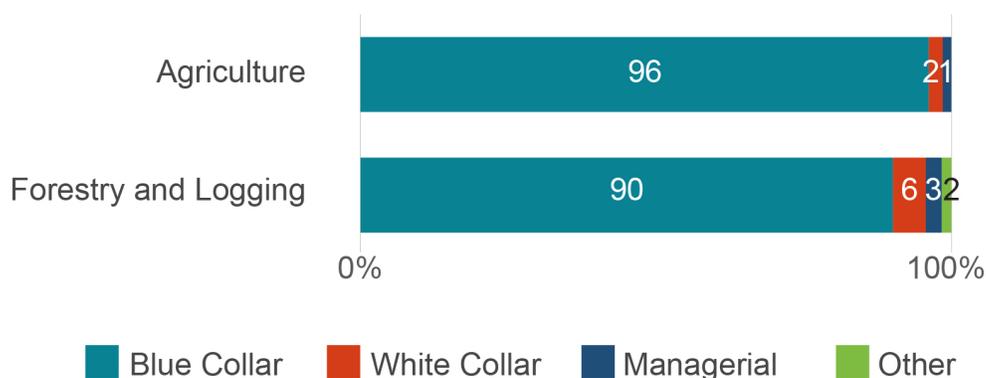
- Subsidies to farmers to install systems to increase the capture of methane emissions from livestock through the California Department of Food and Agriculture (CDFA) Dairy Digester Research and Development Program and Alternative Manure Management Program.
- Grants to farmers to improve local air quality by replacing high-polluting farm vehicles and equipment through the Funding Agricultural Replacement Measures for Emission Reductions (FARMER) Program.
- Grants to farmers to purchase and install water-efficient irrigation systems. State Water Efficiency and Enhancement Program (SWEEP), administered by CDFA, which provides grants to implement water-efficient irrigation systems.
- The Healthy Soils Program, which helps farmers adopt energy-efficient irrigation systems and other conservation measures to increase the carbon sink effect of farmland.
- Partial exemptions on sales and use taxes for the installation of renewable energy generation and energy storage equipment on farms.
- Funding from the Sustainable Groundwater Planning Grant Program of the Department of Water Resources to develop and implement sustainable groundwater planning and projects.



II. Industries and Occupations Affected

A wide variety of industries are included in the NWL sector: firefighting (state and local fire agencies, and private firefighting contractors); logging (timber extraction, trucking and lumber milling); forestry services (thinning, tree planting and other vegetation management); biomass power plants; wood products manufacturing; and agriculture (farming, livestock, and companies providing services for irrigation, methane capture, and rural electricity). Occupations include a wide variety of skilled and unskilled manual laborers, power plant and manufacturing workers, and professional services. As shown in **Exhibit 11.3**, the vast majority of jobs are blue-collar—90 percent in forestry and logging, and 96 percent in agriculture. Bureau of Labor Statistics occupation data do not provide information at the more detailed levels of disaggregation for the subsectors described in this chapter.

Exhibit 11.3. Occupations by Industry in the Natural and Working Lands Sector



Source: May 2016 OES Research Estimates by State and Industry [https://www.bls.gov/oes/current/oes_research_estimates.htm]

Exhibit 11. 3. Shows the broad occupational distribution of the two main industries, agriculture and forestry and logging. More detail on industries and occupations is provided in the sections below.



III. Workforce Issues in Key Subsectors and Policies

The following sections address the workforce issues stemming from major climate policies in the various subsectors of the natural and working lands sector. Each section first examines available evidence on labor conditions in each subsector and the workforce outcomes from the main climate policies thus far. It then identifies where and how workforce policy can be aligned with these climate policies. Specifically, it identifies complementary demand-side workforce policy levers, described in Chapter 2, that the agencies responsible for implementing the climate policies can use to create good jobs and support the demand for skilled labor. It also highlights opportunities to develop, utilize, and leverage the state’s workforce development, training, and education infrastructure to prepare workers for the labor market changes that will occur due to the climate policies in this sector, using the recommendations described in Chapter 3.

A. Forest and Wildlands Management

The Scoping Plan designates the Forest Carbon Plan (FCP), finalized in May 2018, as the detailed implementation plan for wildlands greenhouse gas emission reduction targets.⁹ The FCP was produced by the multi-agency Forest Climate Action Team, co-led by the state’s Department of Forestry and Fire Protection (Cal Fire), the Natural Resources Agency, and CalEPA.¹⁰ The FCP is also designated by CARB’s Proposed Short-Lived Climate Pollutant Reduction Strategy as the mechanism for addressing black carbon emissions from wildfire.

California forests comprise three main categories:

- Federal lands: 19 million acres, 57 percent of total
- State lands: 1 million acres, 3 percent of total
- Private lands: 13.3 million acres, 40 percent of total

The FCP states that a dramatically increased amount of fuels treatment—primarily commercial and pre-commercial thinning—is required in order to maintain forests’ role as a carbon sink while increasing forest health and decreasing wildfire danger. Much of this need is caused by California’s fast-escalating tree die-off from bark beetles and drought, comprising an estimated 129 million dead trees in forests statewide.¹¹ The FCP recommends the following:

- “By 2020, increase the rate of fuels treatment from the recent average of 17,500 acre/years to 35,000 acres/year.”



- “By 2030, further increase the rate of fuels treatment to 60,000 acres/year. By 2030, increase the area reforested annually by 25 percent above the current level.”
- By a non-specified date after 2030, “increase rate of treatment to approximately 500,000 acres per year on non-federal lands to make an ecologically meaningful difference at a landscape scale. This estimate provided by Cal Fire is an aspirational goal based on consideration of ecological need and predictions of capacity to implement treatments. This acreage is currently more than what Cal Fire considers operationally feasible. It should be considered a target to work toward and is achievable pending increased resources.”

The FCP notes that the state is increasing its programs for forest health and fire prevention programs. The FY 2018-19 Budget Act included \$99 million from the General Fund for state and local fire agencies for fire prevention and suppression, and \$223 million from the GGRF for state and local agencies for fire prevention, forest health, and vegetation management.¹² In addition, SB 901, enacted in September 2018, directed that \$200 million from the GGRF shall be appropriated annually through FY 2023-24 in grants to local governments, tribal agencies, and nonprofits for this work. These programs, as summarized in Cal Fire’s 2018 Strategic Fire Plan, are carried out on state and private lands by a wide mix of entities, including Cal Fire, county and municipal government agencies, and Fire Safe Councils, which are local nonprofits that carry out fire prevention work.¹³ These funding appropriations do not specify the acreage that can be treated with the added expenditures and do not make clear whether the funds will put the state on track to achieve its 2020 treatment goals. However, the goals for 2030 and beyond seem so ambitious that they will require continued major growth in funding and the associated workforce.

The FCP does not include any detailed policy tools for federal lands, where the state has limited jurisdiction. However, the U.S. Forest Service has set a 2020 goal of increasing forest and fuel reduction treatment on its lands from the current level of approximately 250,000 acres per year to 500,000 acres per year, and the U.S. Bureau of Land Management has a goal of increasing treatment on its California lands from the current 9,000 acres per year to 10-15,000 acres per year by 2020. Relevant federal programs include the Forest Service’s Good Neighbor Authority (which involves cooperation with state authorities) and the U.S. Department of the Interior’s Wildland Fire Resilient Landscapes Program.¹⁴ It is unclear whether sufficient federal funding has been appropriated to attain these expanded forest treatment goals.

Another limitation of the FCP is related to workforce development. The FCP describes a “limited appropriately trained or licensed supporting workforce” as one of the key “major impediments to forest restoration and ongoing forest management.” However, the FCP does not propose any specific training programs to increase workforce skills and availability, nor does it identify or incorporate standards for skills or occupational safety



and health as program requirements. Clear skill and safety standards are necessary to address the need for, and ensure demand for, trained workers and to provide signals to training institutions about what skills are needed.

The FCP does not propose detailed policy tools for mandates or other regulations to ensure that private timberland—ranging from small owners to large firms such as Sierra Pacific (the second-largest lumber producer in the United States)—meets the state’s goals for more intensive forest management. Some funding and technical assistance for forest landowners is provided by the U.S. Department of Agriculture through its Natural Resources Conservation Service.¹⁵

1. Industries and Occupations Affected

The two leading industries involved in the forest and wildlands management subsector are firefighting and vegetation management.¹⁶ Firefighting or fire suppression is a well-understood occupation and is discussed in the next section on workforce outcomes. The category of vegetation management encompasses a range of forestry services work, including tree planting, commercial and pre-commercial thinning, brush clearing, and other forms of vegetation reduction to decrease the intensity of fires in forests and scrublands, increase forest resiliency, and increase the carbon sink effect of forests. Vegetation management overlaps with the logging industry, because logging includes commercial thinning, with large trees removed for timber production and other debris sold to the forest products industry. This category also includes pre-commercial thinning,¹⁷ which is a form of vegetation management that involves leaving the larger trees while cutting smaller trees and brush, most or all of which is left on site. Industries involving the products and byproducts of forestry services work include biomass power generation and wood products manufacturing, which are detailed in Part 2 of this chapter.

Professional occupations in firefighting and vegetation management include fire engineers, foresters, ecological restoration scientists, while the blue-collar occupations include wildland firefighters, loggers, tree planters, thinners, brush-pilers, ecological restoration workers, and *equipment operators*.

At the peak of each year’s fire season, roughly 13,000 firefighters are working on wildfires statewide. Cal Fire’s 6,100 year-round employees comprise almost one-half of this total.¹⁸ State prison inmates enrolled in a joint Cal Fire and state Department of Corrections and Rehabilitation (CDCR) program account for up to forty percent of the wildland firefighters in California.¹⁹

Full-time Cal Fire employees do a considerable amount of fire prevention and vegetation management work as well, primarily during the winter-spring fire offseason; some of Cal Fire’s work lies outside the NWL sector as the agency serves as the local fire department in towns and small cities, under contract to many counties and rural municipalities. A



large share of vegetation management and forestry services work is carried out by independent contractors that work on federal, state, and private lands;²⁰ this contracted workforce is described in greater detail below. A small share of this work in the state is carried out under the California Conservation Corps (CCC), an entry-level, one-year program for roughly 1,400 young adults (18- to 25-year-olds).

2. Workforce Outcomes to Date

a. Job Growth

In recent years, employment in these sectors has been stagnant or declining, at least by U.S. Census data—although as described below, the data may be partially underreported.

i. Fire Suppression

Some wildlands firefighting and vegetation management work is carried out by state, city and county fire agencies that are primarily dedicated to urban and suburban firefighting. There is no industry classification (NAICS category) in government data specifically for wildlands firefighting, thus no current or projected job numbers are available.

ii. Fire Prevention, Management and other Forestry Services

Data for employment in this subsector vary by source, possibly because the category definitions are slightly different. According to U.S. Census County Business Patterns, employment in logging decreased 12 percent during 2005-2016 to 1,668 people, while workers in “Support Activities for Forestry” (including vegetation management and other jobs) shrank 29 percent to 601 people during the same period.²¹ These numbers are slightly different from those of the U.S. Bureau of Labor Statistics, whose data for May 2017 show 1,810 logging jobs and 1,780 “Forest and Conservation” jobs.²² In any case, the number of forestry services workers may be significantly undercounted.²³ Some researchers and advocacy groups assert that forestry services workers are especially difficult to count because many of their employers are small contractors, some of which are domiciled out of state and whose crews migrate from one remote job site to the next as often as every few weeks.²⁴

b. Job Quality

Wildlands firefighting, fire prevention, and vegetation management jobs inherently involve grueling, dangerous work, often including long hours in remote locations. In 2015, the agriculture and forestry sector (including firefighting, forestry services, and



logging) had the highest fatality rate of any major industry in the state, with 17.1 fatalities per 100,000 full-time workers, according to Cal-OSHA data.²⁵ The next-highest industry (construction) had 6.8 fatalities per 100,000 workers.

As described below, wages and conditions in the sector are generally low, except for Cal Fire employees, and available data are thin.

i. Fire Suppression

Wages and working conditions for year-round Cal Fire firefighters provide middle-class livelihoods. These workers are represented by Cal Fire Local 2881, and while their starting pay is only the state's minimum wage of \$11.00 per hour, there is a clear career path with pay rates that rise rapidly—for example, mid-level paramedic firefighters average about \$11,000 a month in total compensation.²⁶ Nevertheless, a 2014 study by the state Department of Human Resources showed that Cal Fire firefighters earn an average 33 percent less in total compensation (wages and benefits) and work more hours than their full-time counterparts at local fire agencies.²⁷

A much lower-paid component of the firefighting workforce is prison labor, which can comprise up to forty percent of California's wildlands firefighting workforce in a given year. Their pay is \$2 per day, plus \$1 an hour while fighting an active fire; they also earn credits toward reducing their sentences. This work does not count as job training for post-release employment, however.²⁸ Cal Fire and most other firefighting agencies do not hire workers with felony records, in part because such individuals are barred from obtaining Emergency Medical Technician and Paramedic certifications, which are required by most local fire departments.²⁹

ii. Fire Prevention and Forestry

Much forestry services and vegetation management work in California (and other Western states) is seasonal and irregular, with periods of unemployment or unpaid downtime because of weather or gaps between contracts. This work is also often migratory and occurs in remote locations.

Workers in the Forest and Conservation category (which includes thinners, tree planters, and other vegetation management workers) had a median hourly wage of \$10.66, the lowest of all 747 occupations statewide, according to U.S. Bureau of Labor Statistics' occupational data for 2018.³⁰ Workers in the Logging category were better paid, with a median hourly wage ranging from \$19.77 to \$24.43 depending on job description.³¹

Wages on U.S. Forest Service and Bureau of Land Management (BLM) land should be markedly higher than wages on state and private land, because forestry services contractors with a federal contract of more than \$2,500 must pay the local prevailing



wage under the Service Contract Act.³² In California, the 2018 prevailing wage levels for forest workers on U.S. Forest Service and BLM contracts ranged from \$14.13 per hour for tree planters to \$15.88 for thinners and slash pilers, up to \$35.51 for (logging) fallers, plus benefits.³³ Federal enforcement of prevailing wage standards (and other important labor laws and regulations), however, is lacking which means workers may not experience a real wage premium when carrying out contracted work on federal versus state or private forest lands; enforcement challenges are detailed below.

A relatively small share of the workforce in forestry services and vegetation management in the state is employed by the California Conservation Corps (CCC), an entry-level, one-year program for roughly 1,400 young adults (18- to 25-year-olds). Corps members work on fire prevention, tree-planting and vegetation management, as well as parks restoration, fish habitat, backcountry trails work, and energy conservation. The CCC pays the state minimum wage, plus benefits, and is intended to prepare youth for further career steps.³⁴

A more significant share of the forestry services workforce is hired by private contractors. These employers have contracts predominantly on national forest lands, although they also have contracts on private lands (commercial and residential), and to a lesser extent on state forest land. These private contractors rely in part on foreign guest workers with temporary work authorization under the federal H2-B visa program. Industry and labor experts estimate that H-2B workers account for 10 to 15 percent of the contracted forestry services workforce, which has grown over the past decade. Some portion of the privately-contracted forestry services workforce is comprised of undocumented immigrants, although it is difficult to estimate the extent.³⁵ Much of the contracted forestry services work takes place in remote locations, which is one challenge to enforcement of labor and employment laws in this sector—and workers not on federal lands are not covered by wage requirements other than minimum wage.³⁶

As noted above, the federal government has not consistently enforced labor laws—including prevailing wage requirements—in California’s forestry sector due to the nature of the contracted work and negligence or malpractice on the part of forestry services contractors. Victoria Lipnic, former U.S. Assistant Secretary of Labor for Employment Standards, admitted to inadequate enforcement in her 2006 testimony to the U.S. Senate regarding foreign guest workers (viz., H-2B visa-holders) employed on tree-planting and other service contracts on national forest land citing particular challenges such as “the short duration of the contracts; the remote, constantly changing work sites; the temporary residence of the workers in this country; the typically poor or nonexistent recordkeeping practices of the contractors; and the need to personally inspect and document safety, housing, and transportation violations when they occur... [and] significant trust, language, and literacy barriers.”³⁷ Subsequent research, news articles, and court cases have shown continued allegations of employer mistreatment of forest workers, including wage theft, and suggest that workers may sometimes have little recourse to



effective enforcement of labor laws.³⁸ U.S. Department of Labor (DOL) data show that from 2005-2017, 22 forestry employers on National Forest and BLM lands were fined \$789,145 by the DOL's Wage and Hour Division for a total of 1,570 violations. The state Division of Labor Standards Enforcement does not track this information.³⁹

The U.S. Forest Service and BLM require contractors to use the E-Verify system to check their employees' immigration status—although as mentioned above, enforcement appears to be uneven and/or irregular. Contractors on federal lands in California that comply with E-Verify often use foreign citizens working on temporary H-2B visas.⁴⁰ DOL's Office of Foreign Labor Certification does not provide disaggregated data for H-2B visa holders by sector per state, but DOL data on companies employing workers on these visas show that in 2017, four forestry services contractors in California were certified to bring in 329 workers on H-2B visas.⁴¹

The H-2B visa program, which grants temporary non-agricultural work authorization to foreign nationals, has significant weaknesses in terms of safeguarding labor rights. Under the program, each worker's visa is sponsored by their original employer, and the visa is valid only as long as the worker remains with that employer. Once the worker loses that job, they must leave the United States within 10 days. This restriction reduces workers' ability to organize for better pay and conditions. A 2013 report by the Southern Poverty Law Center about H-2B visa programs stated: "The most fundamental problem with guest worker programs, both historically and currently, is that the employer—not the worker—decides whether a worker can come to the United States and whether [they] can stay. Because of this arrangement, the balance of power between employer and worker is skewed so disproportionately in favor of the employer that, for all practical purposes, the worker's rights are nullified. At any moment, the employer can fire the worker, call the government, and declare the worker to be 'illegal.'"⁴²

c. Job Access and Workforce Training

i. Fire Suppression

Rigorous training is required through the California Firefighter Joint Apprenticeship Committee (Cal-JAC) for the roughly one-third of California wildland firefighters who are year-round Cal Fire employees. Cal-JAC is co-sponsored by California Professional Firefighters (CPF) and the California State Fire Marshal, and is a best-practice model for the NWL sector, as described in **Promising Practice #11.1**.⁴³

ii. Fire Prevention and Forestry

The state does not require any skill standards for workers in fire prevention, forestry services, vegetation management, or related fields.⁴⁴ The only training program identified in this report for blue-collar work in these activities is the California Conservation Corps



(CCC), described above. The central purpose of the CCC is to provide job skills to young workers, especially youth from disadvantaged communities. Although the CCC does recruit at-risk youth of color, only about one-fourth of Corps members complete the one-year program, and there is little data available on job outcomes for graduates.⁴⁵ Like many other workforce training programs, the CCC is challenged by the lack of clear career paths and an insufficient number of good jobs in the graduates’ fields—which in this case includes forestry, vegetation management, fire prevention, and firefighting. A February 2018 report from the Legislative Analyst’s Office concluded that, “the lack of measurable programmatic objectives or collection of outcome data on how the CCC performs in key areas makes it difficult to evaluate the program’s performance.”⁴⁶ The lack of other training programs in fire prevention is not surprising because, as described above, the jobs in this segment of the industry are largely very low wage.

PROMISING PRACTICE #11.1 Firefighter Pre-Apprenticeship Training and Inclusive Hiring Program

The pre-apprenticeship program under Cal-JAC is a best practice in the NWL sector because it provides a hiring pathway for underrepresented communities into family-supporting middle class careers. The program links to certified apprenticeship, a form of training and employment with clearly-defined wage increases as skills are acquired (See Chapter 3 for a description of the advantages of this earn-while-you-learn training model). Like all apprenticeship programs, Cal-JAC has clear skill standards that

are periodically updated and reviewed by the California Division of Apprenticeship Standards (DAS).⁴⁷ Under the mandate of Assembly Bill 579 (Flora, Chapter 344, Statutes of 2017),⁴⁸ Cal Fire and the DAS worked with the Cal-JAC to develop a statewide firefighter pre-apprenticeship program to recruit candidates from underrepresented groups. For the first class of this program, starting in January 2018, substantial diversity has been achieved, as shown in **Exhibit 11.4**, below.⁴⁹

Exhibit 11.4. Diversity of First Class of Firefighter Pre-Apprenticeship Training and Inclusive Hiring Program

People who:	Latinos	African Americans	Asians	Women of All Groups	Total
Applied	27%	22%	4%	17%	228
Admitted	20%	22%	7%	20%	54
Enrolled	17%	17%	8%	29%	24



Pre-apprenticeship graduates are placed on the Firefighter Candidate Testing Center’s Statewide Eligibility List, which applicants must be on to be considered for hire by fire departments throughout California, and are guaranteed an oral interview with the Sacramento Fire Department—both key measures to increase access to these jobs. The robust training infrastructure of certified apprenticeship combined with this pre-appren-

ticeship program sets skill standards, increases wages as skills are acquired, and creates pipelines for inclusion of underrepresented groups. However, it only exists for year-round Cal Fire employees, as apprenticeship programs have not been developed for other segments of the workforce in fire prevention, forestry services, and vegetation management.

3. Workforce Recommendations

a. *Demand-Side Workforce Policy Levers for Job Quality and Job Access*

To achieve the goals of the Forest Carbon Plan and Governor Brown’s May 2018 Executive Order, the state will need an expanded labor force for both fire suppression and prevention: firefighters, thinners, forestry technicians, heavy machine operators, truck drivers, and others. This undertaking could be a major economic boon for rural, economically depressed California communities, if measures are taken to ensure local hiring and good-quality jobs, rather than the low-wage prison labor and contractor work crews. To enable this expansion, increased funding and stronger workforce requirements may be needed for related programs, even beyond the commitments made in the 2018 budget and SB 901.

Our recommendations for demand-side workforce interventions for Forest and Wildlands Management are:

- ❖ **Use inclusive procurement policies for public contracts for work in fire suppression and fire prevention, including vegetation management, tree thinning and planting, and habitat restoration. This includes:**
 - **Verification of compliance with labor and employment laws for all forestry contractors.**
 - **Setting of wage floors, which could be at the same levels as the federally mandated prevailing wages for forestry work on federal lands.**



- **Prioritize in-state firms. Contract bidding should comply with Governor Brown’s May 2018 Executive Order to ensure prioritization of local hiring over out-of-state forestry services contractors.**
- **For all firefighting, including seasonal workers who currently receive much less training, use a skilled and trained workforce standard to employ enrollees and graduates of the Cal-JAC apprenticeship program.**

b. Supply-Side Workforce Development Strategies

The forestry sector’s high fatality rates indicate a need for additional safety and skills training requirements for all forestry workers, including logging, thinning, and wildland firefighting. The governor’s May 2018 Executive Order instructs the Labor and Workforce Development Agency to “work with relevant state agencies and local workforce development boards to develop pilot training programs in forest thinning and biomass processing in areas where there is inadequate labor capacity to support such activities.”⁵⁰

❖ Expand the state-certified apprenticeship program for firefighters.

The Cal-JAC apprenticeship and pre-apprenticeship programs could be used as models for the training of all firefighters, including seasonal employees and employees of businesses that contract with the state for firefighting activities. If the state expands its fire suppression and prevention programs, this would cause an expansion of the Cal-JAC program. As new apprenticeship slots open up, this is an opportunity to explore using the CCC forestry services workers training program as a feeder program to the CPF pre-apprenticeship program.

❖ Expand high-road industry partnership initiatives to include fire prevention and forestry.

There is an opportunity for workforce intermediaries to convene employers, relevant state agencies, and nonprofit groups (such as worker centers) to explore the creation of a high-road industry training partnership for state contractors that carry out fire prevention (vegetation management, tree thinning and planting, and habitat restoration). This could eventually become a certified apprenticeship program as is the case for firefighting.



❖ **Train workers on Know-Your-Rights for fire prevention and forestry contract work.**

Research has shown that worker centers can serve as intermediaries to improve labor and employment law enforcement in cases of worker marginalization, as in the forestry services.⁵¹ Such an outreach plan is needed in California fire prevention and forestry services because of the extreme conditions of many workers, as described above. This plan could be modeled in part on the Spanish-language program *Si Sé: Salud y Seguridad en el Trabajo* (Yes, I Know: Health and Safety at Work), developed by the Northwest Forest Worker Center, the Labor Occupational Health Program at UC Berkeley, the Pacific Northwest Agricultural Safety and Health Center at University of Washington, and the Lomakatsi Restoration Project.⁵²

❖ **Continue efforts to unblock the prison-to-job pipeline for inmate firefighters.**

Public safety concerns are likely to continue to weigh against allowing the hiring of people with a previous felony conviction for jobs as front-line professional firefighters who interact with members of the public. However, firefighting experience while in prison could serve as part of a more comprehensive post-release, re-entry training program in forestry services and other fire prevention work.

B. Biomass Energy and Wood Products Manufacturing

Because fire prevention and forest restoration work is expensive, development of an associated revenue stream has long been viewed as an important component of policymaking for the sector. The woody biomass removed from forests via thinning is often not of adequate size or quality for lumber production at traditional sawmills. Forest landowners and communities need development of markets for this biomass to help defray the costs associated with forest restoration work.

Several policies have been passed by California Legislature to encourage the utilization of biomass from forests. These policies were modest in scale, and their impact to date has been limited. For example, an initial measure to mandate the expansion of bioenergy production from forest waste was Senate Bill 1122 (Rubio, Chapter 612, Statutes of 2012),⁵³ which called for utilities to procure 50 megawatts (MW) of biomass power. This law was codified in CPUC Resolution E-4770, which required that the three investor-owned utilities solicit 50 MW from bioenergy facilities that use waste from zones designated as high hazard for tree deaths or wildfires.⁵⁴



In 2016, SB 859 called for procurement of 125 MW of biomass power from facilities that source the majority of their feedstock from specific tree mortality high-hazard zones on private, state, and federal lands, as designated by Cal Fire according to the 2015 State of Emergency declaration about dead trees.⁵⁵ More recently, SB 901 required all electricity providers that had bioenergy contracts during 2018 to extend those contracts until at least 2024.

These policies to stimulate the biomass power market do not appear to have had the desired effect. From 2012 to 2017, statewide biomass energy generation declined from 6,031 gigawatt-hours (GWh) to 5,827 GWh, for reasons that are outside the scope of this report.⁵⁶

As with SB 1122, the 125-MW target has not yet been met. In October 2017, the Natural Resources Agency's Wood Products Working Group called for a series of steps to expand wood products manufacturing and biomass energy production.⁵⁷ Among other actions, it recommended:

- Development and promotion of “innovative wood products,” such as pre-engineered wood.
- Creation of a California Wood Innovations Small Grants Program for grants of \$50,000-\$150,000 for “innovative wood products and manufacturing concepts.” However, in the 2018 legislative session, AB 2842 (Bigelow), which would appropriate \$20 million in GGRF funds for this program, died in committee.⁵⁸
- Creation of a Wood Products Corps program under the California Conservation Corps (CCC). Like other CCC programs, this one-year program would be open to 18- to 25-year-olds and pay minimum wage. The Working Group report said this would “create and work with various training partnerships including community colleges and industry apprenticeships to connect graduating Corps members to employment opportunities, related community college associate degree programs, and continuing education.”⁵⁹

1. Industries and Occupations Affected

The main industries involved are the operation of biomass power plants, truck transportation of forest products, and manufacture of wood products. White-collar occupations in this sector are engineers and other technicians, while blue-collar occupations are power plant operators, electricians, boilermakers, carpenters, and assembly-line manufacturing workers.⁶⁰ However, the vast majority of the logging and wood products manufacturing industries are unrelated to climate policies and thus are outside the scope of this report.⁶¹



2. Workforce Outcomes to Date

a. Job Growth

The biomass energy sector has been shrinking over the past decade and directly employed only 77 people in 2016, down from 119 in 2013.⁶² The wood products manufacturing sector—which sources an estimated 80 percent of its lumber and other wood material from out of state—employed 21,766 people in 2016, down from 36,750 in 2005, largely because of increased automation technologies.⁶³ Most employment in wood products manufacturing is unrelated to state climate policy, however, as mentioned above.

A comprehensive approach to avoiding greenhouse gas emissions from wildfire and increasing the carbon sink of forests could include economic development policies to expand incentives for biomass conversion. Such policies might reverse the stagnation in this sector, although the feasibility and degree of reversal would depend on an improvement in the price competitiveness of bioenergy, the ability of manufacturers to develop new market niches for alternative wood products, and the amount of new state funding.

b. Job Quality and Job Access

Because the Scoping Plan’s policies regarding forest biomass and wood products manufacturing have not yet been implemented, it is difficult to assess future impacts on job quality or access.

3. Workforce Recommendations

a. Demand-Side Workforce Policy Levers for Job Quality and Job Access

- ❖ **Use inclusive public procurement policies for large capital equipment purchases, public contracts for services, and in grant programs.**

The California Wood Innovations Small Grants Program can require that the evaluation of proposals offers bidders the opportunity to disclose estimates of jobs created, wages, and job access, with these rankings considered as part of the overall points calculated in the final award selection process. See Chapters 2 and 7 for discussions and examples of inclusive procurement policies.



The grant programs also should require and verify that all contractors and subcontractors, including nonprofit organizations, meet pre-established, clearly defined minimum standards of contractor responsibility, including possession of all applicable licenses, bonding, and insurance (including workers' compensation), as well as compliance with employment, occupational health and safety, and labor laws.

C. Urban Forests, Wetlands, and Coastal Carbon Sinks

Urban forestry is clearly related to climate policy because street trees and parklands play an important role as carbon sinks and in combatting the “heat island” effect of cities. Although many programs are funded through climate-related funding sources, much of this work has been operating under one program or another for decades because of its role in improving urban quality of life apart from greenhouse gas emission reduction.

For urban forestry, CARB planned two steps in late 2018 or early 2019: 1) to update its NWL emissions inventory to include urban forestry; and 2) to create an implementation plan that includes urban forests, which are important not just as carbon sinks, but to counteract the “heat island” effect of urban areas during hot weather.⁶⁴ Under Assembly Bill 1530 (Gonzalez Fletcher, Chapter 720, Statutes of 2017),⁶⁵ Cal Fire was instructed to expand the scope of its urban forestry program, especially its grant programs to community street tree-planting groups. AB 1530 also authorized Cal Fire to carry out “development and coordination of training programs for neighborhood and local agency tree-planting and maintenance crews.” As of the writing of this report, these programs were still under development.

In FY 2017-18, the Legislature allocated GGRF monies to two main programs to help cities increase the size and resilience of urban forests: \$20 million for the Urban and Community Forestry Program (Cal Fire)⁶⁶ and \$26 million for the Urban Greening Program (California Natural Resources Agency).⁶⁷ Other GGRF grant programs to increase carbon sinks, adaptation, and resilience include the Wildlife Conservation Board's Climate Adaptation Program,⁶⁸ which funds conservation easements; the Department of Fish and Wildlife's Wetlands Restoration for Greenhouse Gas Reduction Program,⁶⁹ which funds restoration of coastal and delta wetlands and mountain meadows; and the Coastal Conservancy's Climate Ready Program,⁷⁰ which funds planning and implementation of projects for sea-level-rise adaptation.



1. Industries and Occupations Affected

Much of California’s urban and suburban tree planting is carried out by nonprofits that are members of the California Urban Forests Council, which receives funding from Cal Fire and the U.S. Forest Service. Examples include TreePeople in Los Angeles, Urban Releaf in Oakland, and Friends of the Urban Forest in San Francisco. These organizations primarily use volunteer labor, such as neighborhood groups and homeowners who plant trees in front of their houses. Maintenance of existing trees on streets and in parks is carried out by municipal or county employees from the parks or urban forestry departments, which also typically serve in a supervisory or coordinating capacity for the nonprofit tree-planting efforts.⁷¹

2. Workforce Outcomes to Date

a. Job Growth

Much of the state’s urban greening work predates implementation of climate-related programs, but the GGRF provides a new source of funding. These programs are generally small and create only a few jobs. For example a 2018 study by the Luskin School of Public Affairs at the University of California, Los Angeles (UCLA) estimated that the state’s Urban & Community Forestry Program funded by the GGRF had created a total of 146 direct job-years in FY 2013-14 through FY 2015-16 from a total of \$15.7 million in grants.⁷²

b. Job Quality and Job Access

Urban tree maintenance or planting programs directly operated by local government agencies are covered by collective bargaining agreements in cases where they exist for those agencies. No specific wage information is available for the many tree-planting programs operated by nonprofits—although as mentioned, most nonprofits rely on volunteer labor of local residents. Jobs in urban greening that are contracted out may be covered by local living wage ordinances in jurisdictions where they exist, providing a floor on wages and benefits for covered workers.⁷³

The grants provided under the Wetlands Restoration and Climate Ready programs have also been small. Since 2014, the former has funded 12 projects for \$21 million total, while the latter has given \$7.3 million to 42 projects. Most are carried out by municipal and county government agencies, while a few are carried out by nonprofit organizations. No information is available about wages or benefits.



c. Workforce Training

As mentioned above, the training programs authorized under AB 1530 have not yet started operations. Some nonprofits run their own training programs with state funds, such as the Green Teens program run by Friends of the Urban Forest in San Francisco. This program pays minimum wage for low-income, at-risk youth age 14 to 19 to learn tree care, planting, and landscaping, but it has no defined career pathways to employment upon graduation.⁷⁴

3. Workforce Recommendations

a. Demand-Side Workforce Policy Levers for Job Quality and Job Access

❖ Use inclusive public procurement policies for large capital equipment purchases, contracts for public services, and in grant programs.

Grant programs for urban forestry, wetlands, and coastal carbon sinks can require that the evaluation of proposals offers bidders the opportunity to disclose estimates of jobs created, wages, and job access, with these rankings considered as part of the overall points calculated in the final award selection process. See Chapters 2 and 7 for discussions and examples of inclusive procurement policies.

The grant programs also should require and verify that all contractors and sub-contractors, including nonprofit organizations, meet pre-established, clearly defined minimum standards of contractor responsibility, including possession of all applicable licenses, bonding, and insurance (including workers' compensation), as well as compliance with employment, occupational health and safety, and labor laws.

❖ Use in-sourcing or exclusive franchise contracting models to support labor and environmental standards for public services and some incentive and low-income programs.

While it is important to continue encouraging volunteer labor in tree planting by community members, grants for urban forestry and wetlands and coastal restoration have the opportunity to encourage local governments to use in-house workers, and/or put minimum standards on wages and benefits or wage parity requirements on work performed by contractors.



b. Supply-Side Workforce Development Strategies

❖ Expand high-road industry partnership initiatives to include urban forestry and related activities.

AB 1530 did not specify the type of training programs to be created with its funds. The state should explore the creation of career pathways from tree-planter to arborist, or other more highly-skilled careers. At this time, there is insufficient information to assess the feasibility of career paths in the urban forestry area. Career planning efforts should follow the best practices laid out in Chapter 3, using the high road industry-led training partnership model.

D. Agriculture

Employment in the agriculture sector is similar to the forestry sector with respect to job quality, including wages and working conditions for vulnerable workers. Specifically, the agriculture sector includes many of the state's lowest paid workers. The 2017 statewide median hourly wage for farm and nursery workers was \$11.23, only slightly higher than for forestry workers.⁷⁵ Undocumented immigrants are believed to comprise a high share of the workforce in the crop, dairy, and livestock segments of the agriculture sector, and these workers face significant barriers to accessing labor law protections.⁷⁶

D1. Methane Capture from Animal Husbandry

Under Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016),⁷⁷ CARB is to create a strategy for reducing short-lived climate pollutants, including methane emissions from dairies and poultry and swine farms, by 40 percent below 2013 levels by 2030. CARB advises three-quarters of the emissions reduction should come from dairies, mostly through the installation of anaerobic digesters to process methane emissions. The reductions are voluntary until 2024, after which the state will impose mandatory cuts on dairies that fail to meet their targets. Methane capture outside of the agriculture/dairy sector is addressed in Chapter 9 on waste.

Under Assembly Bill 1613 (Blakeslee, Chapter 713, Statutes of 2007),⁷⁸ \$50 million was appropriated for reducing dairy methane emissions through development of anaerobic digesters and alternative manure management practices. Grant funding is being administered through the California Department of Food and Agriculture (CDFA) Dairy Digester Research and Development Program (DDRDP). As of July 2018, 18 projects totaling \$35 million had been funded by the DDRDP, with \$79 million in matching funds from the recipients.⁷⁹ In addition, the Alternative Manure Management Program (AMMP)



provides grants to livestock operations for practices that involve handling manure without an anaerobic digester. The AMMP is slated to receive between \$19 million and \$33 million in GGRF funding in 2018.⁸⁰ It is unclear whether the current funding levels will be sufficient to allow the state to attain its ambitious 2030 methane emission reduction goals, so additional appropriations for these programs may be needed.

1. Industries and Occupations Affected

Dairy digester grant recipients are selected by the CDFA. The digesters are built and operated by a small number of specialized contractors who can provide all related services, including development, financing, regulatory, marketing/sales, and operations.⁸¹ Typically, the contractor or a team of contractors are the official grant applicant in partnership with the dairy. In some cases, however, the dairy acts as the grant applicant and then contracts to the contractors for turnkey installation and other services. Actual ownership of the equipment varies—the dairy may own the system directly and pay for construction and maintenance, or the contractor may own the digester and pay a lease fee to the dairy. In all cases, day-to-day operation of the methane-capture equipment requires little skilled labor and is carried out by the dairy's own employees. These tasks typically occupy a small portion of workers' normal daily activities. In most cases, the contractors come periodically to maintain the equipment and systems.⁸²

Since methane capture is an emerging technology, most of the contractors have developed out of other industries and continue to work in them—for example, construction of biogas generators for the urban waste and recycling industry and many fields of engineering and public works.⁸³

There are two primary destinations for the bio-methane produced in these projects. Eleven of the 18 projects feed SoCalGas lines and are led by a project team of California Bioenergy, 4 Creeks Engineering, Anaergia, 4C Global, and SoCalGas, while seven projects are owned by Calgren Dairy Fuels and feed the new Calgren ethanol plant in Tulare County, which will connect to utility pipelines.⁸⁴

In addition, under a 2017 CPUC initiative, SoCalGas, PG&E, SDG&E and Southwest Gas have issued a request for proposals allowing dairies to carry out pilot projects.⁸⁵ As part of this initiative, in July 2018, Montauk Energy, a Pennsylvania firm that operates the Bowerman landfill in Irvine, signed a 20-year joint venture agreement to create a biogas refining facility south of Merced.⁸⁶



2. Workforce Outcomes to Date

a. Job Growth

Statewide dairy employment was 5,475 in 2016, a decrease of only 10 since 2013.⁸⁷ Climate policy has had little, if any influence on the number of jobs in this industry subsector. The UCLA Luskin study estimated that the state's dairy digester grants of \$11.3 million from FY 2013 through FY 2015 created a total of 32 direct job-years.

b. Job Quality and Access

No wage data are available for this subsector. Wages and working conditions are likely poor nonetheless, because the work to operate the digesters is primarily carried out by dairy workers who had a statewide median hourly wage of \$13.02 in 2017.⁸⁸

c. Workforce Training

Engineering services for dairy digesters require significant professional training. No specialized training programs are known to exist for the blue-collar jobs in dairy digesters (manufacturing, installation, and maintenance), or for the dairy workers who operate digester facilities.

3. Workforce Recommendations

a. Demand-Side Workforce Policy Levers for Job Quality and Job Access

❖ Use inclusive procurement policies grant programs for dairy digesters.

The dairy digester program relies on a handful of medium to large contractors that offer a comprehensive package of specialized, turnkey services. For the installation of dairy digesters, since the turnkey contractors rely heavily on grant funding, the inclusive procurement policies can have substantial influence on the development of this small but critical emerging industry.

As with all grant programs under state climate policy, grants for dairy digesters and other methane capture projects can require that the evaluation of proposals offer bidders the opportunity to disclose estimates of jobs created, wages, and job access, with these rankings considered as part of the overall points calculated in the final selection process. See Chapters 2 and 7 for discussions and examples of inclusive procurement policies.



The grant programs also should require and verify that all contractors and subcontractors meet pre-established, clearly defined minimum standards of contractor responsibility, including all applicable licenses, bonding and insurance (including workers' compensation), employment and labor law compliance, and no OSHA violations.

b. Supply-Side Workforce Development Strategies

❖ Expand High Road Industry Partnership initiatives to include methane digestion.

At this time, there is insufficient information to assess the need for or feasibility of high road industry training partnerships in this emerging industry. As with other emerging technologies, analysis of skill needs in pilot projects can help anticipate the need for skills upgrading and identify potential training partnerships, as described in Chapter 2.

D2. Agricultural Water Management and Other Programs

A variety of programs exist in this sub-sector, with relatively little impact on job growth, job quality, or job access to date. They are intended to improve energy efficiency in agricultural operations, particularly related to water usage. This objective is particularly important because agriculture uses about 40 percent of the state's managed water supply, roughly four times more than cities, which requires energy to pump, transport, and distribute. See Chapter 10 on the water sector for a more comprehensive discussion of water.

The State Water Efficiency and Enhancement Program (SWEEP), administered by the CDFA, provides grants to install irrigation systems, soil moisture monitoring systems, and other technologies that reduce greenhouse gas emissions and save water in agricultural operations. Eligible system components include soil moisture monitoring, drip systems, switching to low-pressure irrigation systems, and installation of renewable energy systems to reduce on-farm water use and energy consumption. From the program's beginning in 2014 until mid-2018, a total of 614 projects had been funded at \$62.7 million, and more than \$40.8 million in local matching funds.⁸⁹

The Sustainable Groundwater Planning Grant Program of the Department of Water Resources (DWR) provides funds authorized under Prop. 1 to develop and implement sustainable groundwater planning and projects.⁹⁰ These funds support the goals of the 2014 Sustainable Groundwater Management Act, which requires local agencies to sustainably manage the state's groundwater basins. In the 2018 funding cycle, a total of 78 grants were made, totaling \$85.8 million.



The Water-Energy Grant Program, administered by the DWR, uses GGRF funds to provide grants to implement water efficiency programs or projects that reduce greenhouse gas emissions and reduce water and energy use. Eligible applicants are local agencies, joint powers authorities, and nonprofit organizations. Eligible projects include water efficiency programs (targeting residential, commercial, and institutional buildings), or projects that reduce greenhouse gases and/or water and/or energy use. While the agriculture sector is eligible for these funds, no agriculture-related project has been funded through the two grant cycles (2014 and 2016).⁹¹

The Healthy Soils Program is another program in this subsector, and is a collaboration of state agencies and departments led by the CDFA to install irrigation systems on farms that save energy and reduce greenhouse gas emissions. The program provides grants to commercial farmers to help them purchase and install energy-efficient irrigation equipment, such as soil moisture monitors as well as drip and low-pressure irrigation systems. As of August 2018, the program had made a total of \$13 million in grants.⁹² All of these grants are directly to the farms themselves, which then contract with specialized firms as needed. Installation of water- and/or energy-efficient irrigation equipment under the Healthy Soils Program does not require new specialized skills and is typically done by regular farm employees; some eligible equipment requires specialized skills to install however.

The Strategic Growth Council's Sustainable Agricultural Lands Conservation (SALC) Program was created in the 2014 state budget and provides GGRF grants for conservation easements to protect at-risk farmland from development. In 2018, the program awarded \$33.9 million to 27 land protection projects on 46,253 acres.⁹³

In addition, the state has several key policies to help the agriculture sector adopt distributed generation, including the partial exemption for sales and use tax for renewable energy generation and storage equipment at agricultural facilities.⁹⁴ This policy includes 100 percent exemption on state taxes levied when at least one-half of the electricity used to power a farm's agricultural equipment is generated by solar photovoltaics, biomass, wind, or other renewable energy technology.⁹⁵

To help cut greenhouse gas emissions from farm equipment, Assembly Bill 134 (Committee on Budget, Chapter 254, Statutes of 2017)⁹⁶ and Assembly Bill 109 (Ting, Chapter 249, Statutes of 2017)⁹⁷ authorized \$135 million for the Funding Agricultural Replacement Measures for Emission Reductions (FARMER) Program.⁹⁸ This program, administered by local air districts, provides grants for agricultural harvesting equipment, heavy-duty trucks, agricultural pump engines, tractors, and other equipment used in agricultural operations that will achieve greenhouse gas emission reductions from the agriculture sector.



1. Workforce Outcomes to Date

The wide variety of agricultural activities promoted by the climate measures just described affect many segments of the agriculture industry in California. Data was not available to identify particular occupations within agriculture where activities are concentrated.

a. Job Growth

The UCLA Luskin study estimated that the state's \$55 million in grants from FY 2013 through FY 2015 in energy-efficient irrigation and water conservation created 120 direct job-years. No estimates are available for the other farm-related programs.

b. Job Quality and Access

No wage data are available for the specific agricultural work in this subsector.

c. Workforce Training

No specialized training programs are known to exist for this subsector.



III. Key Recommendations for the Natural and Working Lands Sector

Exhibit 11.5. Key Recommendations for the Natural and Working Lands Sector

Demand Side	
Forest and Wildlands Management (Fire suppression and prevention)	<ul style="list-style-type: none"> ❖ Use inclusive procurement policies for public procurement of contracts for work in firefighting and fire prevention, including vegetation management, tree thinning and planting, and habitat restoration.
Biomass Energy and Woods Products Manufacturing	<ul style="list-style-type: none"> ❖ Use inclusive procurement policies for public procurement grants programs for biomass energy and wood products manufacturing.
Urban Forests, Wetlands, and Coastal Carbon Sinks	<ul style="list-style-type: none"> ❖ Use inclusive procurement policies for public procurement grants programs for urban forests, wetlands, and coastal carbon sinks. ❖ Use in-sourcing to support labor and environmental standards for activities performed by public-sector workers, such as landscaping or responsible contractor requirements for contracted work.
Agriculture	<ul style="list-style-type: none"> ❖ Use inclusive procurement policies for public procurement grants programs for agriculture.
All Natural and Working Lands Subsectors	<ul style="list-style-type: none"> ❖ Use job impact metrics to measure the impact of climate incentive and investment programs on quantity of jobs, job quality and job access. ❖ Incorporate workforce analysis into emerging technology support programs.



Supply Side	
Forest and Wildlands Management (Fire suppression and prevention)	<ul style="list-style-type: none"> ❖ Expand the state-certified apprenticeship program for firefighters. ❖ Expand high-road industry partnership initiatives to include fire prevention and forestry. ❖ Train workers on Know-Your-Rights for fire prevention and forestry contract work. ❖ Continue efforts to unblock the prison-to-job pipeline for inmate firefighters.
Urban Forests, Wetlands, and Coastal Carbon Sinks	<ul style="list-style-type: none"> ❖ Expand high-road industry partnership initiatives to include urban forestry and related activities.
All Natural and Working Lands Subsectors	<ul style="list-style-type: none"> ❖ Track training program outcomes for graduation rates, attainment of industry-recognized credentials, job placement, retention, wages and wage progression.



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