URBAN & COMMUNITY FORE$TRY

ECONOMIC CONTRIBUTION TO CALIFORNIA, 2021

STATEWIDE REPORT

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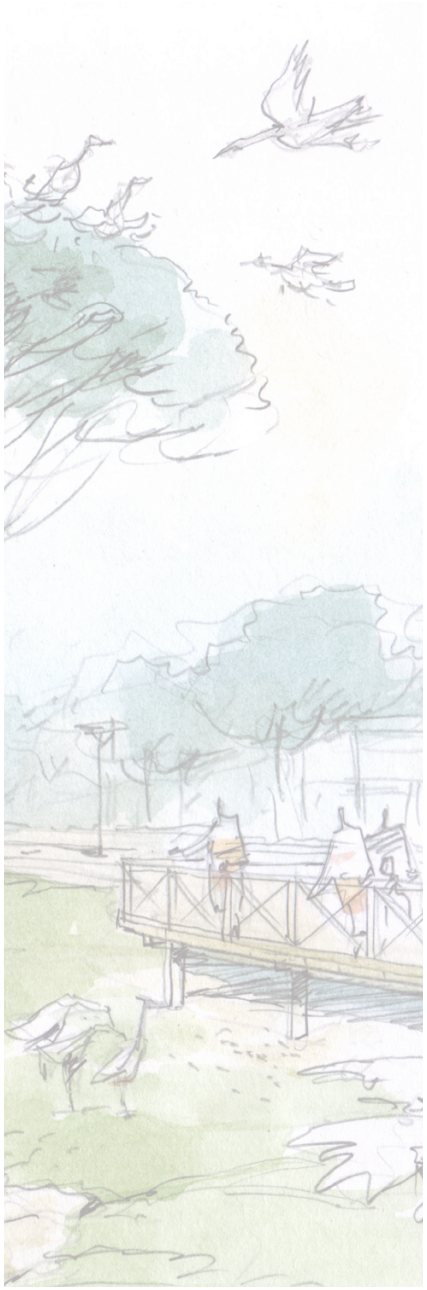

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I EXECUTIVE SUMMARY

Urban and community forests not only provide numerous ecosystem services to rapidly growing urban and suburban areas but are also a critical component of regional economies with a substantial economic contribution. In addition to municipal and nonprofit entities, the green and utility industries are key providers of urban and community forestry *(U&CF)* related services, contributing substantially to local and state economies. This study estimates the economic contributions of the U&CF businesses and activities in California as well as six select regions in California. In this study, we define U&CF as all activities that support or care for the trees in cities, towns, suburbs, and other developed areas *(including producing, planting, maintaining, and removing trees).*

Economic contribution analysis of the urban and community forestry sector helps communicate to policy makers and legislators the monetary benefits in terms of gross domestic product contribution and jobs in the specified economy. By following the methodological approach devised by Parajuli et al. *(2022),* we incorporated the involvement of six different groups into the broader scope of U&CF industries and activities:

1. **Private Green Industries**
2. **Investor-owned and Cooperative Utility Companies**
3. **Public Agencies (County and Municipal Governments)**
4. **State Agencies**
5. **Higher Education Institutions**
6. **Non-profit Organizations**

We employed the Economic Impact Analysis for Planning *(IMPLAN)* software and 2021 data for the California state and county package to estimate direct, indirect, and induced effects based on an input-output modeling framework. Since IMPLAN does not have separate industries specific to U&CF businesses and activities, we utilized the industry-level employment data from the US Census Bureau. In order to extract the U&CF portion of the industry from the broader green industry, we conducted primary surveys of all six groups that are involved in U&CF in California. Similar to Parajuli et al. *(2022)* and Parajuli et al. *(2023),* the survey instrument for the private sector was primarily designed to separate U&CF from broader green industries in the state (as defined by IMPLAN), while the survey questions for the public sector focused on capturing the involvement of local and municipal governments and other public agencies involved in U&CF related activities. Then, we ran the economic contribution analysis on IMPLAN online by combining all six different industries.

Results from the input-output modeling suggest that in 2021, the U&CF sector in California **directly** contributed roughly $7.0 billion to the state industry output and $4.1 billion in value-added (sum of labor income, other property income, and production and import taxes) by supporting 52,054 full- and part-time jobs. **Including direct, indirect, and induced effects,** the U&CF sector had a **total contribution** of $12.9 billion in industry output to the state economy in California, employing more than 78,560 people with a payroll of roughly $5.1 billion. The private sector, predominantly landscaping services and tree care providers, represented over 95% of the direct jobs (49,253 jobs) and industry output *($6.6 billion)* in California. Public agencies *(municipalities, counties, and state agencies)* collectively contributed about $400 million in total industry output by supporting 2,636 jobs to the state economy. Higher education institutions and non-profit organizations had total job contributions of 696 and 624 jobs, respectively. Lastly, investor-owned and cooperative utilities were found to support 172 total jobs. Estimate SAM multipliers suggest that every $1.00 spent in the U&CF sector by various sectors generated an additional $0.85 in the state economy in California. Similarly, every job in U&CF activities and businesses supported an additional 0.51 jobs in California in 2021.

II GLOSSARY

Urban and Community Forestry (U&CF)
All activities *(including producing, planting, maintaining, and removing trees)* that support or care for the trees in cities, towns, suburbs, and other developed areas.

Direct Effect
The expenditures or initial production changes associated with an industry or sector in the study area which are entered into the Input-Output analysis. These changes can be positive or negative and display how the study area's economy will respond.

Employee Compensation
Total payroll cost of an employee, inclusive of wages, salaries, payroll taxes, and benefits such as health insurance and retirement.

Employment
The number of full-time, part-time, and seasonal jobs associated with a specific industry.

IMPLAN©
Modeling software that performs Input-Output analysis. The modeling framework enables users to create regional economic models and multipliers for one or more counties or states in the United States. Version 3 of the IMPLAN© software accounts for commodity production and consumption for 536 industry sectors, 10 household income levels, taxes to local/state and federal governments, capital investment, imports and exports, transfer payments, and business inventories.

Indirect Effect
The economic impact of local industries purchasing goods and services from other industries along supply chains.

Induced Effect
The economic impact of household spending of labor income following deductions from taxes, savings, and income for commuting.

Industry
A group of entities or businesses participating in similar types of economic activities.

Labor Income
The sum of employee compensation and proprietor income.

Multipliers
The measure of an industry's connection to the economy of the study area in terms of purchases, payments of wages and taxes, and other transactions.

Municipality
The Census definition of an incorporated place, which is a type of governmental unit, incorporated under state law as a city, town (except in New England, New York, and Wisconsin), borough (except in Alaska and New York), or village, generally to provide governmental services for a concentration of people within legally prescribed boundaries (U.S. Census Bureau, 2018).

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Glossary continued . . .

North American Industry Classification System *(NAICS)*

An industrial classification scheme established and utilized by countries in North America for grouping entities by similar production processes.

Output

The value in dollars of production within a study area. It equates to the total of sales and net inventory change.

Proprietor Income

Production income of sole proprietorships, partnerships, and tax-exempt cooperatives.

Region or Regional Economy

The geographic area of interest (i.e., one or more county or state) and its economic activity.

Sector

The industries that make up the complete economy including businesses, households and institutions, and government. In the North American Industrial Classification System (NAICS), sectors are one of the major areas of economic activity and are classified at the 2-digit level.

Social Accounting Matrix (SAM)

SAM captures all monetary market transactions, including what are called an economy's "ripple effect," during a study period by building upon Input-Output models to include transactions between industries and institutions, including those between institutions themselves.

Total Effect

The sum of direct, indirect, and induced effects.

Value-added *(Gross State Product [GSP])*

The total of labor income, other property income, and production and import taxes. It is also the difference between an industry's total output and the cost of its intermediate inputs. GSP equals the sum of value-added for all economic sectors within the state.

To understand the relationship between labor income, value added and output:

Labor Income = **Employee Compensation**
+ Proprietor Income

Value Added = **Labor income**
+ Taxes on Production and Imports
+ Other Property Income

Output = **Value Added**
+ Intermediate Inputs

III INTRODUCTION

While just 5% of California's total land area *(8,219 square miles)* is classified as urban *(Cox, 2016),* the state holds the highest population among all U.S. states, with 94.2% of California's population residing in urban areas *(United States Census Bureau, 2023).* The urban tree canopy in California constitutes 19% of its urban land *(McPherson et al., 2017),* contrasting with the U.S. average tree canopy of 39.6% *(Nowak et al., 2022).* This scenario presents a significant opportunity for California to enhance its focus on urban and community forestry *(U&CF),* offering the multitude of benefits that trees can bring to residents and communities.

Urban and community forests not only provide numerous ecosystem services to rapidly growing urban and sub-urban areas, but also are a critical component of a regional economy with a substantial economic contribution. While the private green and utility industries offer the bulk of goods and services to establish and maintain urban forests, non-profits and public agencies including higher education institutions also represent an important share of urban and community forestry *(U&CF)* activities *(Parajuli et al. 2022, Parajuli et al. 2023).* For the purposes of this report, we define U&CF as all activities that support or care for the trees in cities, towns, suburbs, and other developed areas, including producing, planting, maintaining, and removing trees as well as community education about urban forests.

California first began U&CF efforts with the establishment of the California Urban Forestry Act of 1978. The California Department of Forestry and Fire Protection *(CAL FIRE)* was assigned to offer U&CF financial and technical assistance to municipalities and local governments. This support aimed to enhance the management of urban forests throughout the state. Funding for urban and community forestry programs in California's municipalities primarily comes from the general fund, supplemented by contributions from the California Climate Investments and bonds *(Thompson & Reimer, Jeff L., 2018).* State funding for these initiatives has seen consistent growth, with grants in the 2021-2022 fiscal year totaling $29.9 million *(California Wildfire & Forest Resilience, 2022).* These grants focus on diverse initiatives, such as planting over 37,000 trees, reducing greenhouse gas emissions, advancing education and workforce development, and improving urban forest management. Notably, the Inflation Reduction Act in 2023 allocated increased funding for urban and community forestry across the United States, with California receiving approximately $103 million.

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Economic contribution analysis of U&CF informs citizens, legislators, and decision makers about the impacts of the industry on gross domestic product and workforce development. With support from CALFIRE, two studies in the 1990s and 2000s produced a detailed economic impact of urban forestry in California *(Templeton and Goldman 1996, Templeton et al. 2011).* The most recent of these reports was based on 2009 data, so the recent development of more sophisticated tools and economic contribution analyses *(Parajuli et al. 2022, Parajuli et al. 2023)* provides an opportunity to perform an updated and in-depth economic impact study of U&CF in California. Parajuli et al. *(2022)* and Parajuli et al. *(2023)* recently developed the methodologies featured in the peer-reviewed literature to develop a comprehensive scope of urban and community forestry and the detailed economic contribution analysis approach that captures activities conducted by private, public, and non-profit organizations in the Northeast-Midwest region as well as Southern region of the United States.

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F1 MAP DEPICTING CALIFORNIA AND SELECT REGIONS

This study aims to estimate the economic contribution of the U&CF sector in California using the 2021 economy-wide data and a peer-reviewed economic contribution analysis methodology. By closely following Parajuli et al. *(2022)* and Parajuli et al. *(2023),* we incorporated private green industry businesses, public agencies *(including county and municipal governments),* non-profits, and higher education institutions that are directly involved in U&CF in California. Next, we compiled the employment profile of all the related industries and agencies using responses to an online survey of each U&CF group along with several other secondary sources. We used IMPLAN to estimate the economic contribution of U&CF to the regional economy in terms of several economic and business metrics including jobs, labor income, value-added, and tax collections *(IMPLAN, 2021).* These results highlighting the significant economic contributions of U&CF should be very useful to the private sector for marketing and communication efforts. Other sectors, such as the public agencies and NPOs, may also find these results valuable to advocate for support to sustain and expand U&CF programs in their jurisdictions.

Additionally, this study contributes to a recent nationwide initiative assessing the economic impacts of U&CF regionally in the United States. This national effort began with assessments of the Northeastern and Midwestern states in 2018 *(Parajuli et al., 2022),* followed by a similar assessment in the Southern states in 2019 *(Parajuli et al., 2023).*

IV SCOPE OF URBAN AND COMMUNITY FORESTRY INDUSTRIES AND ACTIVITIES

Private Industries
Landscaping Services *(NAICS 561730)* Examples include arboriculture, tree pruning, removal, trimming, landscape care and maintenance, ornamental tree/shrub maintenance, plant appraisal.
Nursery and Tree Production *(NAICS 111421)* Examples include nurseries with tree production for urban and community forestry.
Nursery, Garden, and Farm Supply Stores *(NAICS 444220)* Examples include stores retailing nursery trees and garden products that are grown elsewhere.
Farm and Garden Machinery and Equipment Merchant Wholesalers *(NAICS 423820)* Examples include wholesale distribution of specialized machinery, equipment and parts used in farm, lawn and garden activities.
Nursery Stock and Florists' Supplies Merchant Wholesalers *(NAICS 424930)* Example includes machinery.
Landscape Architectural Services *(NAICS 541320)* Examples include land use, city and urban planning services, parks and other recreational areas planning services.
Private Investor-owned and Cooperative Utility Companies *(NAICS 561730)* Examples include overhead utility line and rights-of-way maintenance.
Public Sector
County and Municipal Governments
State Agencies Involved in Urban and Community Forestry
Higher Education Institutions
Management of Tree and Urban Forests on College and University Campuses
Non-profit Organizations

T1 SCOPE OF URBAN AND COMMUNITY FORESTRY (U&CF) RELATED INDUSTRIES AND ACTIVITIES IN CALIFORNIA*

To be consistent with other U&CF economic contribution reports, we adapted the definition of urban and community forestry *(U&CF)* as all activities that support or care for the trees in cities, towns, suburbs, and other developed areas *(including producing, planting, maintaining, and removing trees)* in California. Since there are no well-defined industries specific to U&CF, and IMPLAN integrates U&CF-related industries into broader green industry sectors, the first crucial step of economic contribution analysis was to delineate the scope of U&CF activities in the study region. In our project stakeholder meeting with various members of the California Urban Forest Advisory Committee *(CUFAC)* held online on February 1, 2022, we discussed the detailed scope of U&CF groups including private industries, public agencies, NPOs, investor-owned utility companies, and higher education institutions. Participants approved our proposed scope of U&CF industries and activities, which were in line with the previous similar studies in the Northeastern-Midwest states *(Parajuli et al. 2022)* and Southern states *(Parajuli et al. 2023).*

(*) Known in parentheses for private industries are North American Industry Classification System (NAICS) codes.

V METHODS

Since IMPLAN does not specify particular industries and data associated with solely U&CF, we employed the approach devised by Parajuli et al. *(2022)* to compile a complete profile of employments related to establishment, care, and maintenance of urban and community forests in California. While most of the data related to the private sector can be retrieved from publicly available sources, such as the US Census Bureau, primary surveys of U&CF related businesses and organizations are required to fully quantify and segregate the U&CF portion of the businesses and activities from the overall green industry. Through several rounds of a web-based survey of private businesses, the U&CF industries were separated from the broader green industries in California. Similarly, several group-specific surveys were conducted to fully quantify the public and non-profit sector involvement in U&CF. Respondents were asked to answer survey questions about their U&CF activities in California that occurred during the 2021 calendar year.

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SURVEYS

We slightly revised the survey instrument used in Parajuli et al. *(2023)* in the Southern states by incorporating the information collected from the project meeting with stakeholders. We conducted an online survey with questions tailored to each of the six sectors to assess economic and employment activities in California's U&CF activities. The survey instrument had six separate sections specific to six groups:

1. **Private Green Industry Businesses**
2. **Public Agencies (County and Municipal Governments)**
3. **State Agencies**
4. **Higher Education Institutions**
5. **Investor-owned and Cooperative Utilities Working in Tree-line Maintenance**
6. **Non-profit Organizations**

The study region covers the entire state of California and six select regions within California: Bay Area, Central Coast, Central Valley, Southern Border, LA-Orange region, and Inland Empire **(F1).** The survey was beta tested by a small group of California stakeholders prior to the survey release. All aspects of the survey were approved by the NCSU Institutional Review Board *(IRB-25150).* The survey campaign evolved into three rounds as additional effort was deemed necessary to increase the number of respondents from each sector. Survey recruitment included convenience sampling through social media posts, newsletter advertisements, and postcards, and random sampling through email invitations to *(i)* purchased contacts from Exact Data, which compiles the contact information of businesses by their NAICS codes, and (ii) registered businesses from California's Contractors State License Board public database.

various survey approaches were applied in order to collect representative responses from each U&CF group in California. The first round of the survey was administered from September to December 2022, the second round from January to March 2023, and the third round from May to June 2023. The initial email invitation with the survey link was followed by three email reminders each survey round. The first survey round received 39 responses; thus, we conducted a second survey round where we adjusted the recruitment strategy to include an incentive of a $100 Amazon gift card awarded to 25 randomly selected participants. During the second survey round, we received over 2000 fraudulent *(bot)* responses on Qualtrics from individuals outside of the target study population who sought the incentive. An analytical review of the survey responses was applied to remove these fraudulent responses. The remaining responses from the second survey round totaled 131 responses. A third survey round was deemed necessary in an effort to increase the number of responses from the public sector. During the third survey round, we offered municipalities the additional option of completing a paper-based survey and mailing their responses to an North Carolina State University mailbox. The third survey round resulted in 19 responses. **FIGURE 2** presents the detailed breakdown of our recruitment strategies and audience reached in various rounds of surveys.

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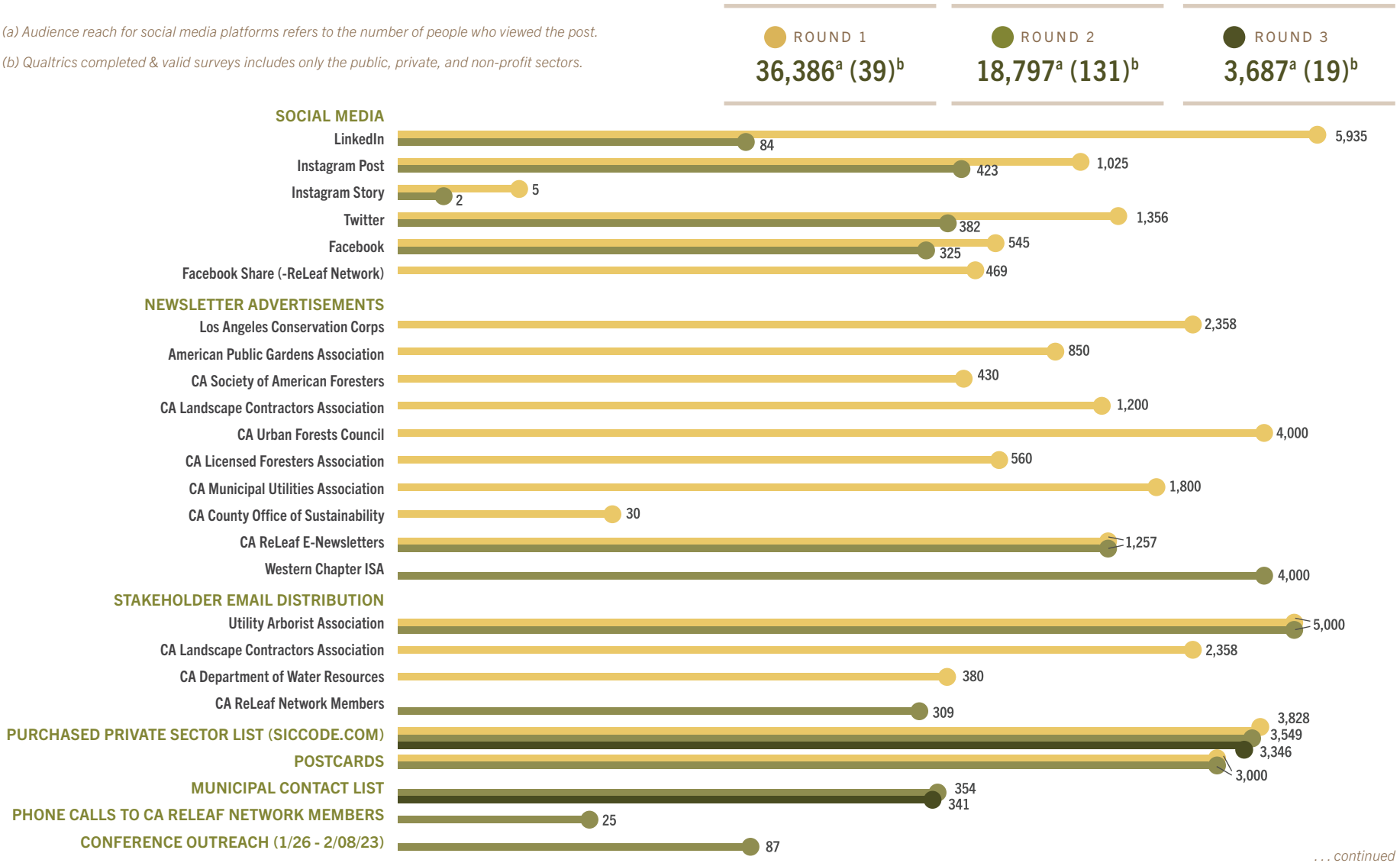
Surveys continued . . .

F2 SUMMARY OF OUTREACH METHODS USED DURING SURVEY DISTRIBUTION AND THE NUMBER OF PEOPLE REACHED DURING EACH SURVEY ROUND

(a) Audience reach for social media platforms refers to the number of people who viewed the post.

(b) Qualtrics completed & valid surveys includes only the public, private, and non-profit sectors.



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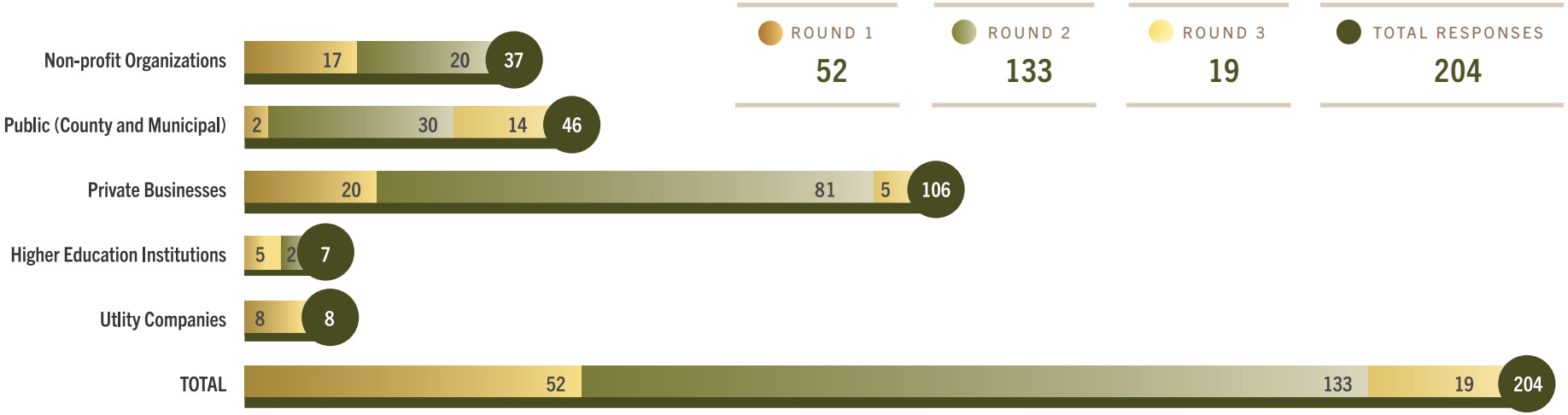
F3 VALID SURVEY RESPONSES GATHERED DURING EACH SURVEY ROUND FOR VARIOUS SECTORS



We collected contact information, specifically emails of private green industry businesses and other non-private groups, from various sources. The contact details of private businesses involved in the green industry in California were purchased from Exact Data, and we sent the email invitation to the survey to 3,906 different private business entities active in California. After accounting for the opt-out, invalid addresses, and bot responses, we obtained 106 valid and usable responses from the private sector.

The first list of email contacts from municipalities was collected with help from California ReLeaf and their urban forest contacts around the state. The email addresses that were undeliverable in the first round were substituted using the staff directory page of the respective city or county website. The selection of the most appropriate staff member who could respond to the survey was made based on their job title, such as manager, superintendent, or director, using the city or county websites to determine whether urban forestry activities were overseen by the Parks and Recreation department or the Public Works department. In addition, newsletter advertisements and direct calls from California ReLeaf to industry contacts were also employed for both public agencies, higher education institutions, and non-profit organizations. Additionally, several recruiting efforts such as social media campaigns and newsletter advertisements were conducted through a broad range of stakeholder organizations as listed in **(F3).** Out of the 115 non-profit organizations working on U&CF in California, we received 37 usable responses. After a number of survey recruitment efforts, only 46 responses from county and municipal governments in California were received. Only 7 and 8 valid responses were obtained from higher education institutions and utility companies, respectively.

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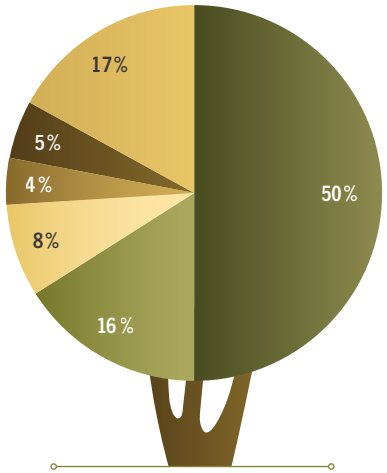
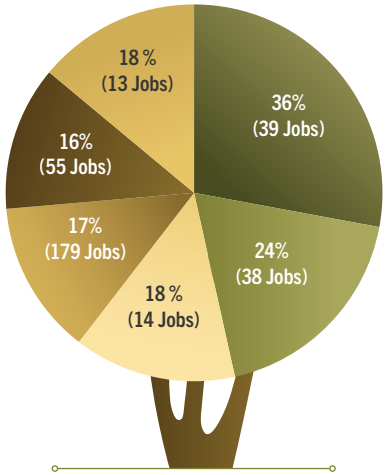
F4 PERCENTAGE OF PRIVATE SECTOR RESPONSES TO THE STATE-WIDE SURVEY IN CALIFORNIA BY BUSINESS TYPE

The number of responses from the private industry group varied by business type **(F4).** Companies involved in landscaping or tree care services *(NAICS 561730)* represented 50% of the usable responses from the private industry group, whereas landscape architectural services *(NAICS 541320)* constituted about 17% of the usable responses. Nursery, greenhouse, and tree production *(NAICS 111421)* followed closely with 16% of the usable responses from the private industry group. Next, nursery and garden supplies stores *(NAICS 444220)* made up 8% of the usable responses. The remaining wholesalers and retailers involved in U&CF represent a small portion of the total respondents.



F5 EMPLOYMENT IN U&CF-RELATED PRIVATE BUSINESSES IN CALIFORNIA DURING 2021 BROKEN DOWN BY INDUSTRY SECTORS IN THE NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS)

FIGURE 5 presents the average number of employees per business and the average percentage of employees involved in U&CF-related activities per business. According to the results from the primary survey, private landscaping and tree care services employed the largest percentage of workers in U&CF on average in 2021 *(35.5%).* Approximately 24% of nursery and tree production employees performed work in U&CF related activities. On average, about 18% of the employees in landscape architectural services work on U&CF activities in California.



- Landscaping and Tree Care Services (561730)
- Nursery, Greenhouse, and Tree Production (111421)
- Nursery, Garden Center, and Farm Supply Stores (444220)
- Farm and Garden Machinery and Equipment Merchant Wholesalers (423820)
- Nursery and Florists' Supplies Merchant Wholesalers (424930)
- Landscape Architectural Services (541320)

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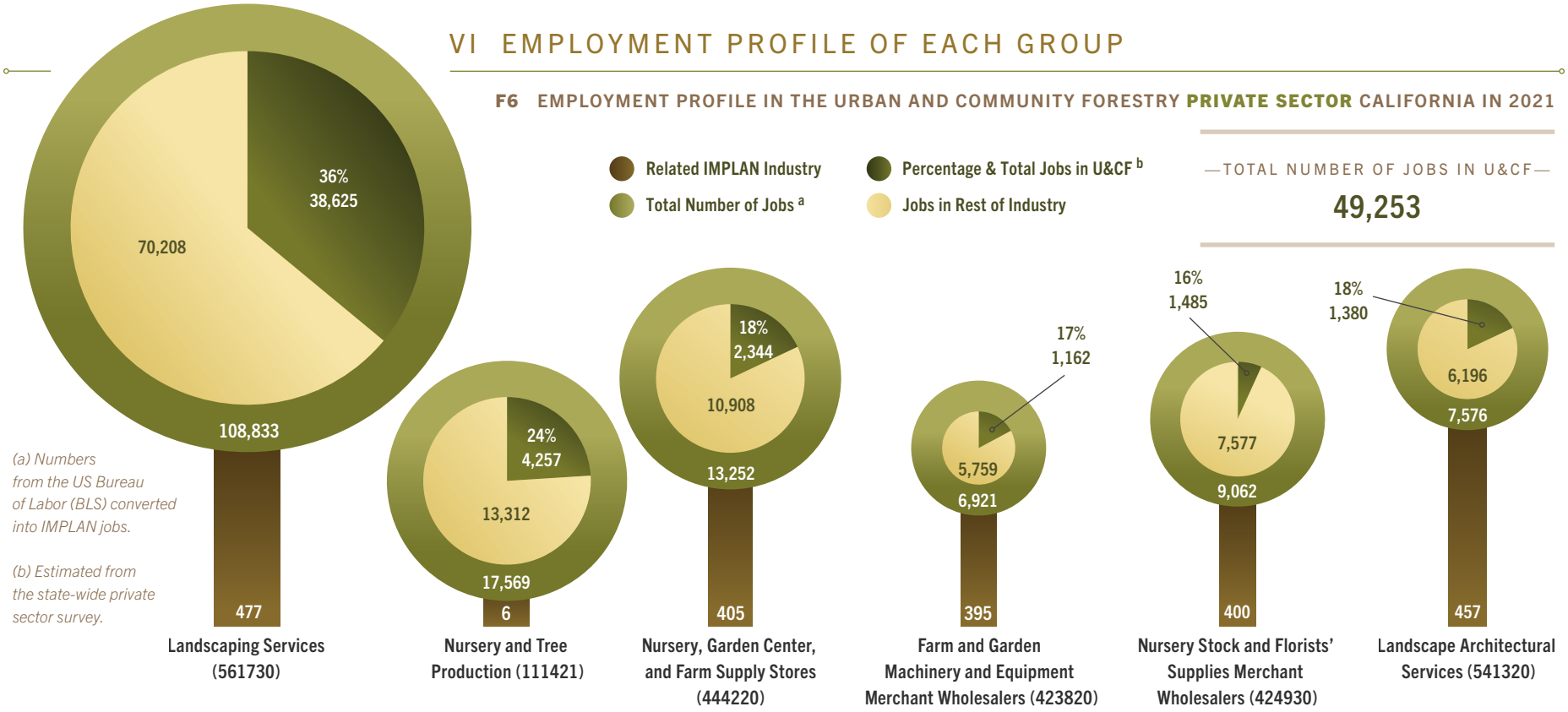
VI EMPLOYMENT PROFILE OF EACH GROUP

F6 EMPLOYMENT PROFILE IN THE URBAN AND COMMUNITY FORESTRY **PRIVATE SECTOR** CALIFORNIA IN 2021



(a) Numbers from the US Bureau of Labor (BLS) converted into IMPLAN jobs.

(b) Estimated from the state-wide private sector survey.

The primary source of the industry-level employment data is the Quarterly Census of Employment and Wages *(CEW)* of the US Census Bureau, which reports the periodic employment profile of private businesses broken down by the North American Industry Classification System *(NAICS)* category. We utilized our state-wide surveys of private green industry businesses to parse out the portion of U&CF jobs from the broader private green industry sector. Since the CEW does not incorporate self-employed jobs and businesses with their own social insurance programs *(IMPLAN Data Team, 2021),* the 2019 IMPLAN data is utilized to estimate proprietary jobs specifically in landscaping services *(NAICS 561730)* and nursery and tree production businesses *(NAICS 111421).*

FIGURE 6 presents the annual employment profile of private businesses involved in U&CF activities in California in 2021. In 2021, the private sector contributed over 49,253 direct U&CF related jobs in California. Similar to other regions and states *(Parajuli et al. 2022, Parajuli et al. 2023),* private landscaping and tree care services was the top employer among private green industry businesses in California, which supported 38,625 full-time, part-time, temporary and seasonal employees in 2021. Nursery and tree production was the second largest industry which employed 4,257 jobs in U&CF annually in California, followed by nursery and related supplies wholesalers and retailers.

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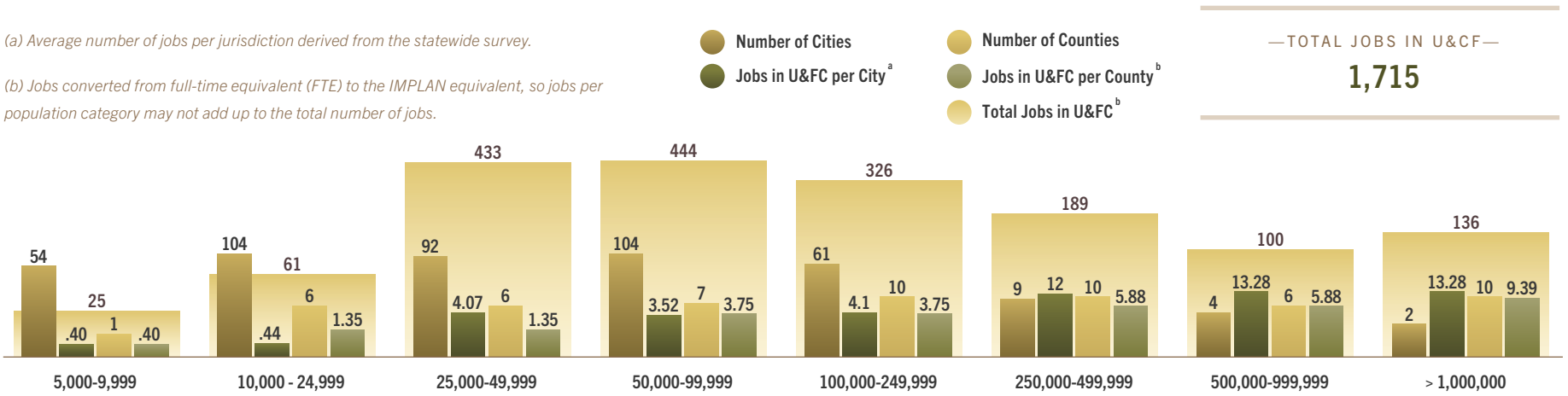
F7 URBAN AND COMMUNITY FORESTRY (U&CF) JOBS IN LOCAL GOVERNMENT PUBLIC AGENCIES IN CALIFORNIA, 2021

(a) Average number of jobs per jurisdiction derived from the statewide survey.

(b) Jobs converted from full-time equivalent (FTE) to the IMPLAN equivalent, so jobs per population category may not add up to the total number of jobs.



Besides private green industry businesses, several investor-owned and cooperative utility companies are also greatly involved in tree-line clearing and vegetation management in urban and suburban regions. According to the primary survey of utility companies, we estimated that in 2021, the average per company in-house expenses of investor-owned and cooperative utility companies in vegetation management in California was about $1.31 million per year. In order to estimate the total expenditure of investor-owned and cooperative utility companies in vegetation management, we multiplied the number of companies by the average expenditure per company. We estimated that the 10 investor owned and cooperative utility companies in California supported 116 U&CF jobs in 2021, which was the input value for the economic contribution analysis.

Public agencies, such as municipal and county governments, have a vital role in managing U&CF in most of the populated towns and cities. We estimated the total number of public employees involved in U&CF based on the population size of the jurisdiction that these agencies serve in California. We obtained the number of cities and counties by population size in all counties and cities in California from the Population Division of the U.S. Census Bureau *(US Census Bureau, 2023).* Then, using the average number of employees in a city and county from our state-wide survey of municipalities and counties in California, we estimated the total number of jobs in U&CF employed by city and county governments **(F7).** Our results suggest that county and municipal governments in California employed about 1,715 people directly working in U&CF activities in 2021. Similarly, our economic contribution analysis included the number of employees in CAL FIRE, the California Department of Transportation, the California Department of General Services, and state hospitals who were directly involved in U&CF in California. According to the information collected from our state-wide survey coupled with public record requests, in 2021, state agencies employed 62 U&CF positions in California.

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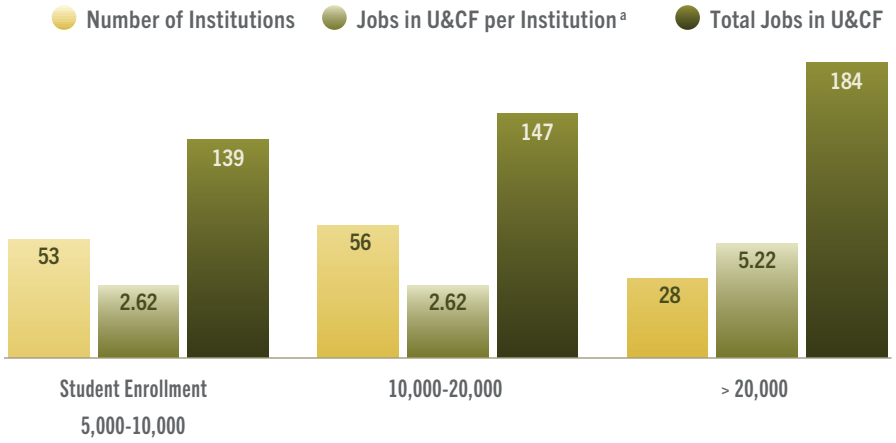
F8 U&CF EMPLOYMENT IN HIGHER ED INSTITUTIONS IN CALIFORNIA, 2021

—NUMBER OF INSTITUTIONS—	—TOTAL JOBS IN U&CF —
137	469

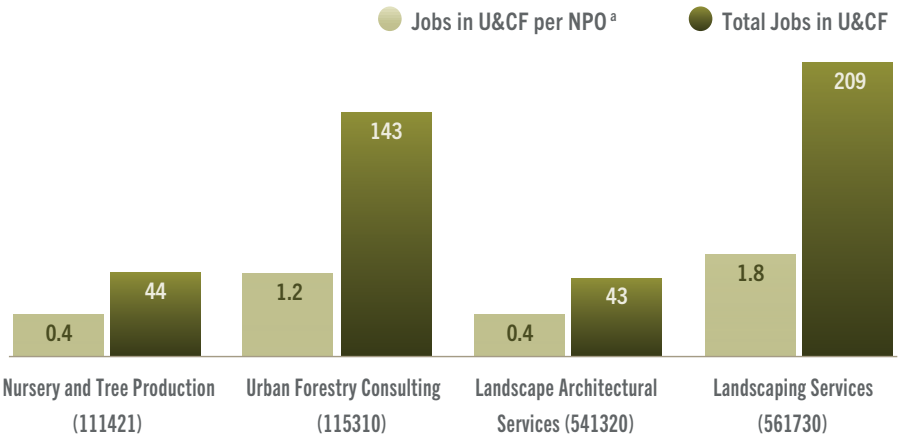


Furthermore, based on the student enrollment size, we estimated the total annual U&CF jobs supported by higher education institutions in California. First, we collected the total number of higher education institutions and student enrollments in California from CollegeSimply *(CollegeSimply, 2023).* We then estimated the total U&CF jobs in colleges and universities by multiplying the number of institutions by the average number of jobs per institution, which we calculated using our state-wide survey of higher education institutions **(F8)**. In 2021, the 137 higher education institutions with at least 5,000 student enrollments supported 469 full- and part-time jobs involved in U&CF activities in California.

(a) Average number of jobs per institution derived from the statewide survey of higher education institutions.

F9 U&CF EMPLOYMENT IN NON-PROFIT ORGANIZATIONS IN CALIFORNIA, 2021. THERE WERE AN ESTIMATED 115 U&CF NPOS IN CALIFORNIA, 2021

— U&CF JOBS PER ORGANIZATION —	—TOTAL JOBS IN U&CF —
3.8	438



We also included the involvement of non-profit organizations *(NPOs)* in U&CF activities while estimating the economic contribution of U&CF in California. Our statewide survey of NPOs revealed that on average, an NPO supports 3.8 jobs in U&CF activities: about 1.8 jobs in landscaping and tree care services, 0.4 jobs in nursery and tree production, 1.2 jobs in forestry consulting services, and 0.4 jobs in landscape architectural services **(F9)**. Collectively, in 2021, NPOs in California supported 438 jobs directly working in U&CF activities.

(a) Average number of jobs per organization derived from the statewide survey of NPOs in California.

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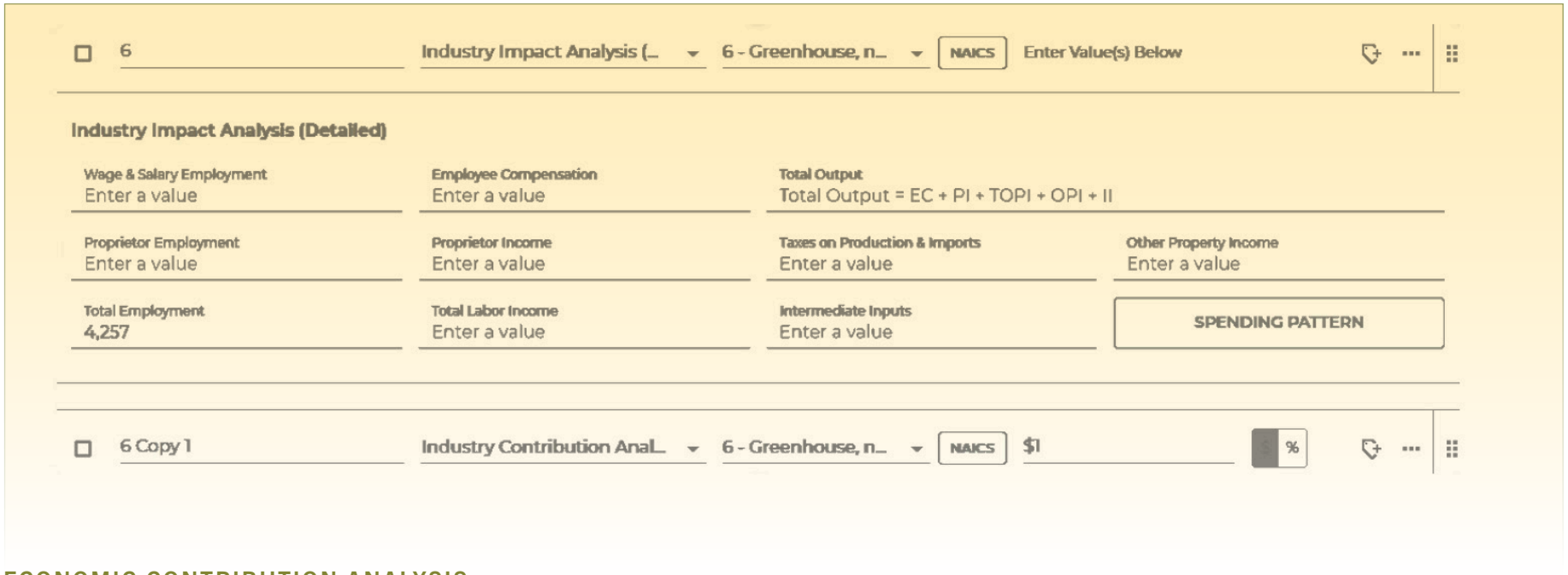
F10 ECONOMIC CONTRIBUTION ANALYSIS APPROACH USING **IMPLAN ONLINE**



ECONOMIC CONTRIBUTION ANALYSIS

We applied the empirical approach developed by Parajuli et al. *(2022)* to evaluate the economic contribution of U&CF industries and activities in California. Economic contributions are usually evaluated in terms of several business and economic metrics, such as employment, labor income, value-added, industry output, and local, state, and federal tax collections. Each term is defined in the glossary of terms section. The IMPLAN software, an input-output regional economic modeling system, was used to estimate economy-wide ripple effects in the regional economy stemming from direct economic activities in U&CF-related industries. We used the 2021 California state-level IMPLAN model to develop a state input-output model with a trade flows specification and social accounts for households. Regarding the economic contribution method, we used the built-in option in IMPLAN online cloud system, referred to as an industry contribution analysis. This method follows a similar approach to the model customization within IMPLAN, explained in Parajuli et al. *(2018),* for multi-sector contribution analysis.

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In the state IMPLAN model with 2021 California data, the employment statistics prepared in **FIGURES 11 THROUGH 13** were entered to set up events and activities in respective IMPLAN industry sectors. For instance, U&CF jobs in landscaping services, nursery and tree production, and landscape architectural services supported by the private sector were entered in IMPLAN sectors 477, 6, and 457, respectively. The industry sectors involved in retail and wholesale businesses *(IMPLAN 395, 400, and 405)* were utilized to estimate the indirect and induced effects from wholesalers and retailers involved in U&CF in California. Jobs supported by investor-owned and cooperative utility companies were entered in landscaping services *(IMPLAN industry sector 477).*

While our major input to the IMPLAN events is the employment data, the industry contribution analysis option in IMPLAN online does not allow for entry of the employment data directly. After consulting with the IMPLAN representative *(Kenny Groom: Dec 1, 2023, via Email),* we used a combination of a detailed industry impact analysis event with an industry contribution event. For instance, to run the economic contribution of the nursery and tree production industry, we set up an industry impact analysis event with the employment number of 4257 in industry 6, then we set up a separate industry contribution analysis event in industry 6 with $1 as the event value **(F10).** When we ran the analysis, we placed them both in the same group to restrict all feedback linkages to industry 6, which is a required step in the economic contribution analysis.

Modeling the contribution of government enterprises and public universities is not as straightforward as that of private industries in IMPLAN. Added complexity arises because the software is unable to directly attribute intermediate expenditures to these industry sectors *(Clouse, 2021).* In other words, government and non-profit organizations, including public colleges and universities, are not a part of the industry listing as they do not have production functions or multipliers *(Clouse, 2019).*

Using the developed complete employment profile of these local and state governments, higher education institutions, and non-profit organizations, we employed the industry impact analysis *(detailed)* approach specified in IMPLAN online *(Nealy, 2022).* The spending patterns of these government payroll jobs should be linked with private industries. As public agencies and organizations are mostly involved in arboriculture, tree planting, and urban forest management, their contributions align well with IMPLAN industry 477. Since we collected employment data as inputs to the IMPLAN events, we used the similar two-event setup *(industry impact analysis for employment data and the industry contribution analysis with $1 event value)* using the IMPLAN industry 477 - landscaping services for county, municipal, state-agencies, and higher education institutions. Further, for the non-profit sector, we employed a similar two-event approach of economic contribution analysis in IMPLAN online using their involvement in 4 different private industries as listed in **(F13)**.

Once we created all events representing all six U&CF groups in line with IMPLAN industries, we grouped them to conduct a multi-industry economic contribution analysis of U&CF in California. We used the IMPLAN data model covering the entire state of California from 2021 i.e. both data year and dollar year were 2021.

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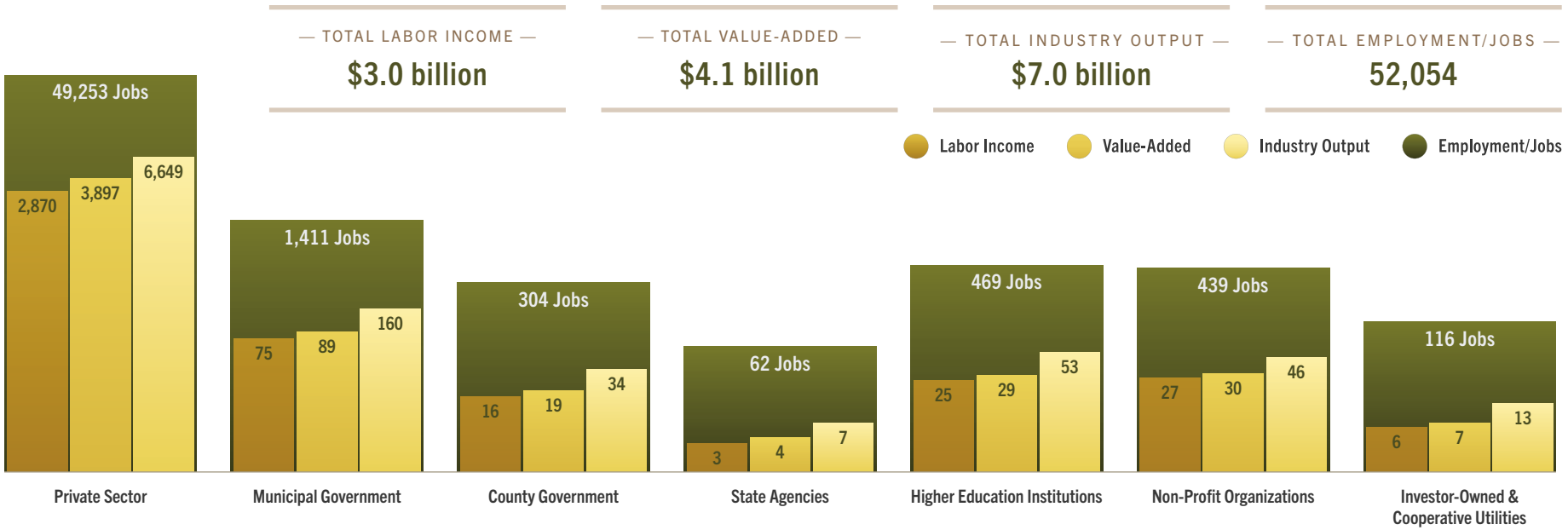
VIII. ECONOMIC CONTRIBUTION RESULTS

F11 DIRECT EFFECT ECONOMIC CONTRIBUTION OF U&CF IN CALIFORNIA, 2021, REPORTED IN 2021 DOLLARS



By incorporating six different sectors, including the private, non-profit, higher education and public organizations involved in U&CF, we conducted a multi-industry economic contribution analysis using IMPLAN online to evaluate the overall state-wide economic contribution of U&CF in California. We estimated that in 2021, U&CF in California directly supported about 52,054 full- and part-time jobs in various businesses and activities in the state economy **(F11).** Further, the total job contribution of U&CF including direct, indirect, and induced employment was estimated to be over 78,500 jobs. In terms of direct employment, the private sector accounted for the largest workforce in U&CF at approximately 49,253 jobs throughout the state. Local governments *(municipal and county)* supported approximately 1,715 U&CF jobs. Higher education institutions and non-profit organizations supported over 400 U&CF jobs each. In terms of labor income, U&CF in California collectively contributed about $3 billion directly, and approximately $5.1 billion including the multiplier effects throughout the state economy. Appendix A breaks down the total economic contributions from U&CF activities in California by direct, indirect, and induced effects stemming from the six contributing industry groups and organizations. **FIGURE 11** reports seven sectors due to the separation of county and municipal governments during the analysis.

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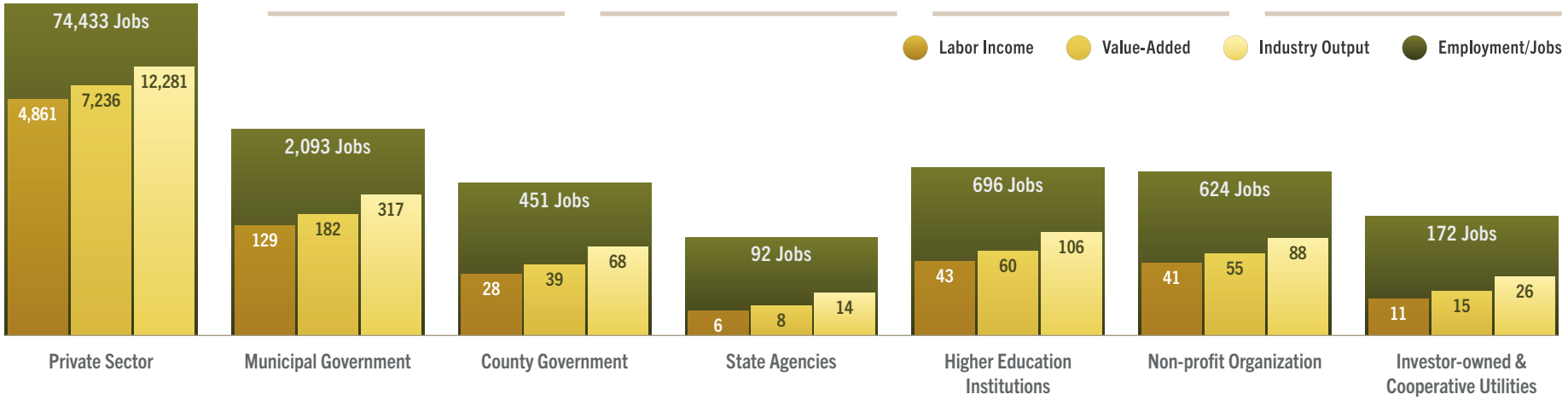
F12 TOTAL EFFECT ECONOMIC CONTRIBUTION OF U&CF IN CALIFORNIA, 2021, REPORTED IN 2021 DOLLARS

— TOTAL LABOR INCOME —	— TOTAL VALUE-ADDED —	— TOTAL INDUSTRY OUTPUT —	— TOTAL EMPLOYMENT/JOBS —
$5.1 billion	$7.6 billion	$13.0 billion	78,561



In terms of value-added, which is equivalent to gross domestic product, U&CF in California contributed approximately $4.1 billion to the state economy directly, and with the indirect and induced effects, the total value-added contribution in 2021 was about $7.6 billion **(F12).** Similarly, in terms of industry output representing all economic activities, the direct and total contributions of U&CF in California in 2021 were about $7 billion and $12.9 billion, respectively. In terms of the interlinkages among the industry sectors, the overall social accounting matrix (SAM) multiplier associated with employment was estimated to be 1.51, which indicates that each job in U&CF in California resulted in an additional 0.51 jobs in other sectors of the economy. Similarly, a multiplier associated with industry output of 1.85 suggests that every $1.00 spent in U&CF generated another $0.85 in industry output in the state economy in California **(F12).**

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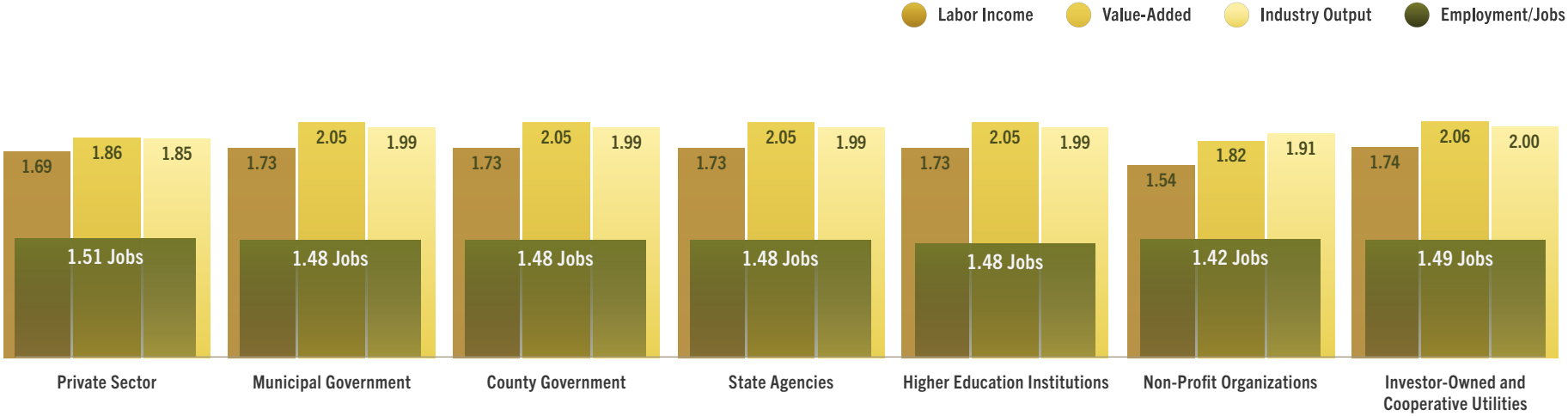
F13 SAM MULTIPLIER ECONOMIC CONTRIBUTION OF URBAN AND COMMUNITY FORESTRY (U&CF) IN CALIFORNIA, 2021

— TOTAL LABOR INCOME —	— TOTAL VALUE-ADDED —	— TOTAL INDUSTRY OUTPUT —	— TOTAL EMPLOYMENT/JOBS —
1.69	1.86	1.85	1.51



The economic contribution of U&CF varies widely among the seven sectors and groups incorporated into this analysis. For example, the private sector constitutes about 95% of the economic contribution of U&CF in California. The public agencies (municipal, county, and state agencies) collectively contributed about $400 million in total industry output by supporting over 2,600 jobs in the state economy **(F13).** Higher education institutions and non-profit organizations had total job contributions of 696 and 624, respectively. Moreover, we found that that the investor-owned utility companies had the largest SAM multiplier values in all business matrices **(F13).** The SAM value of 2.00 associated with the industry output of the utility sector indicates that every $1.00 generated in U&CF by the investor-owned and cooperative utility sector contributed an additional $1 to the other sectors in California economy.

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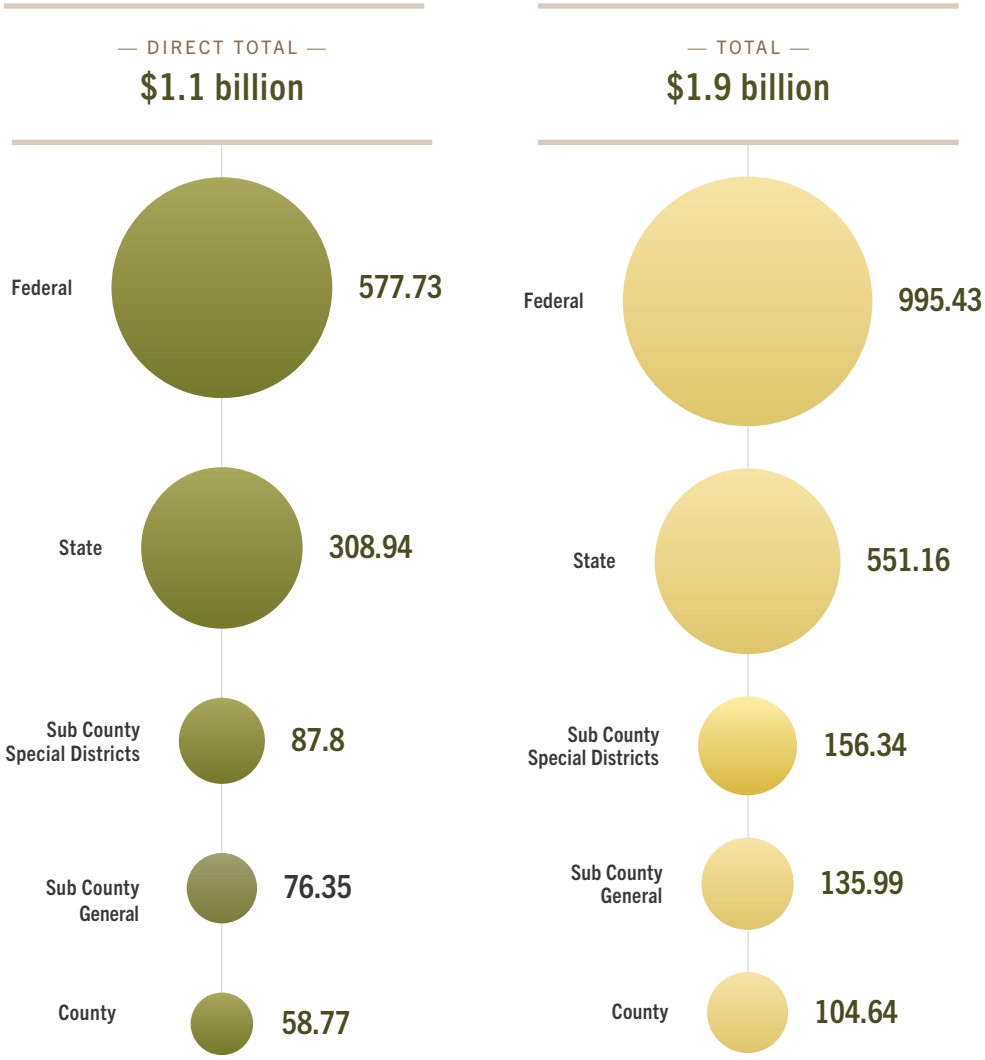
F14 DIRECT TAX CONTRIBUTION OF URBAN AND COMMUNITY FORESTRY (U&CF) IN CALIFORNIA IN 2021, REPORTED IN 2021 DOLLARS



Besides jobs, labor income, and value-added, U&CF in California also contributes to local, state, and federal taxes significantly **(F14).** In 2021, U&CF businesses and employees in California paid approximately $1.1 billion directly to local, state, and federal taxes. With indirect and induced effects included, the total tax contribution of the aggregated U&CF sector in California was about $1.9 billion in various taxes.

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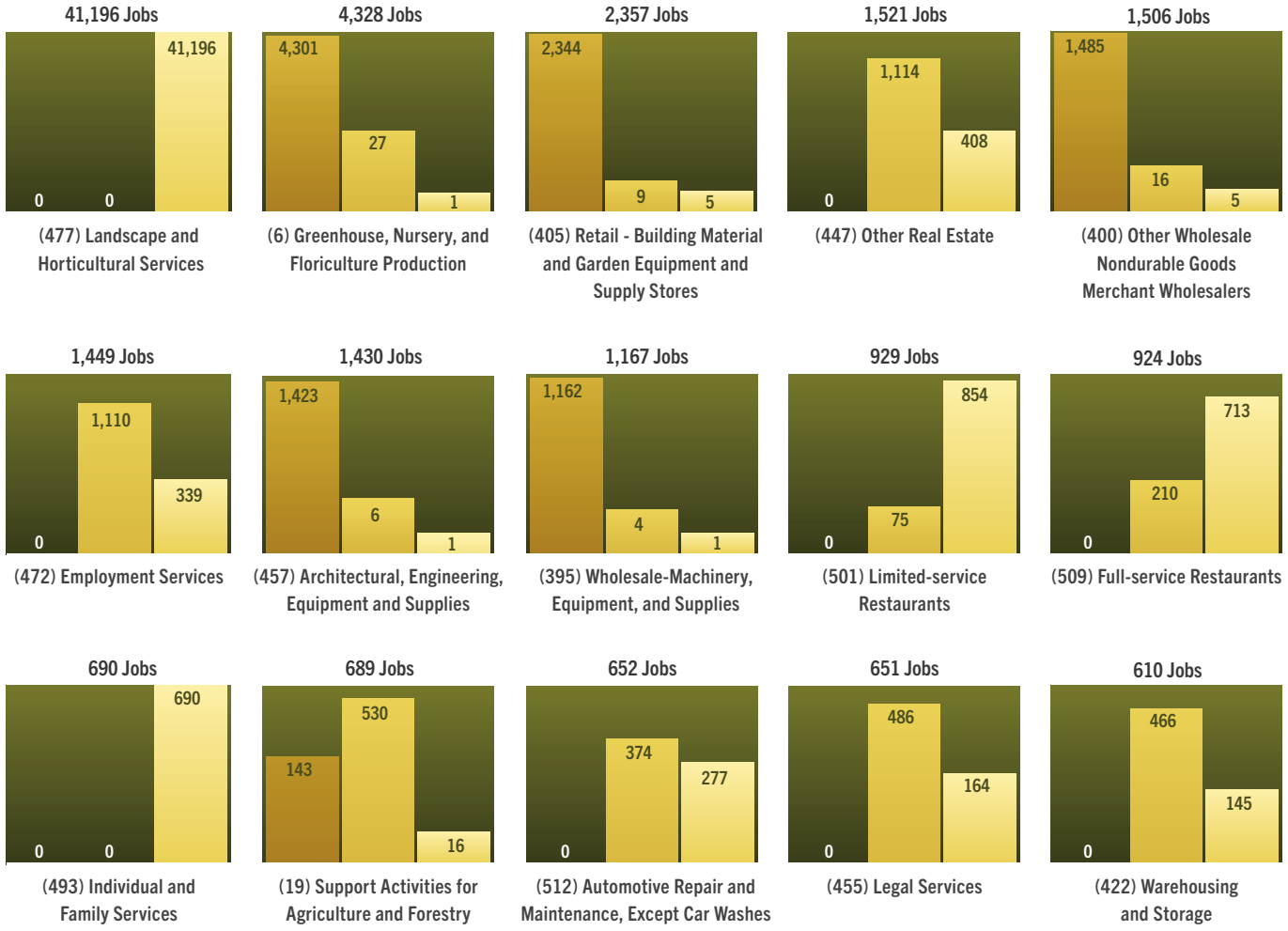
— TOTAL EMPLOYMENT —

43,912

Direct Jobs
Indirect Jobs
Induced Jobs
Total Jobs

FIGURE 15 presents the top 15 industries in California that have the highest employment contributions from U&CF. U&CF employment contributed 43,912 jobs in landscape and horticultural services to the state economy. Through the indirect and induced effects, other critical sectors in the economy, such as real estate, employment services, legal and warehousing businesses, benefited substantially from the various U&CF activities in California.

F15 TOP 15 INDUSTRIES AFFECTED BY U&CF EMPLOYMENT IN CALIFORNIA, 2021



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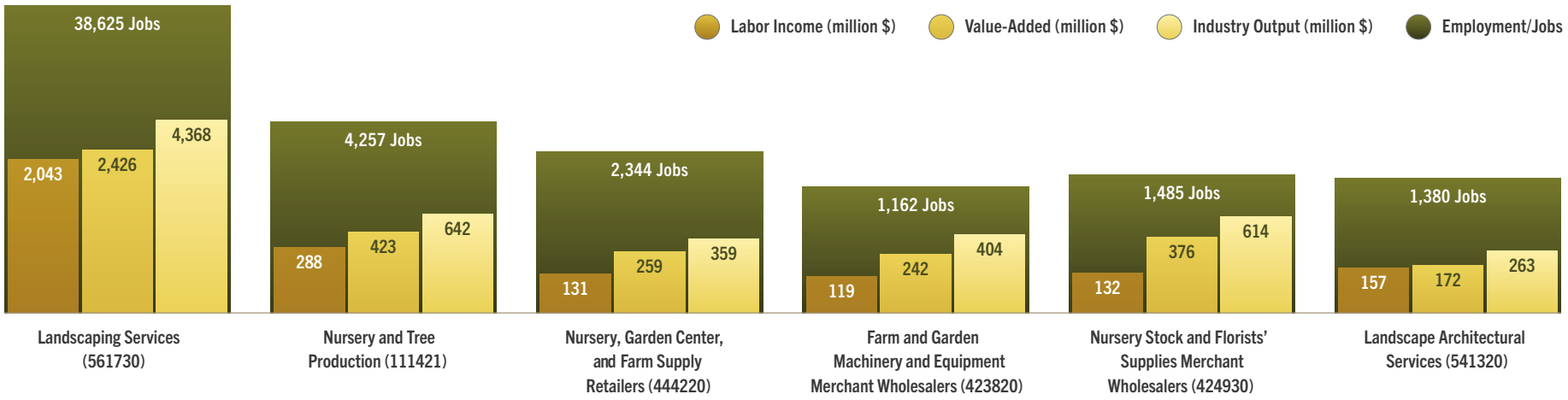
F16 DIRECT EFFECT ECONOMIC CONTRIBUTION OF U&CF FROM THE PRIVATE SECTOR IN CALIFORNIA, 2021, REPORTED IN 2021 DOLLARS

—TOTAL LABOR INCOME—	—TOTAL VALUE-ADDED—	—TOTAL INDUSTRY OUTPUT—	—TOTAL JOBS—
$2.9 billion	$3.9 billion	$6.7 billion	49,253



As the private sector represents over 95% of the total economic contribution in U&CF in California, we further explored the economic contribution of each green industry group within the private sector using the similar economic contribution analysis approach **(F16).** Among the six major business types explored in this study, landscaping services *(NAICS 561730)* represent over 65% of the U&CF employment contribution from the private sector, followed by nursery and tree production businesses. The private landscaping and tree care services, including various aspects of urban trees management, plantation, and arboriculture services, supported approximately 57,300 jobs in U&CF in California in 2021. Furthermore, businesses involved in nursery and tree production for U&CF contributed over $1.1 billion in total industry output, supporting 6,745 full- and part-time jobs in California.

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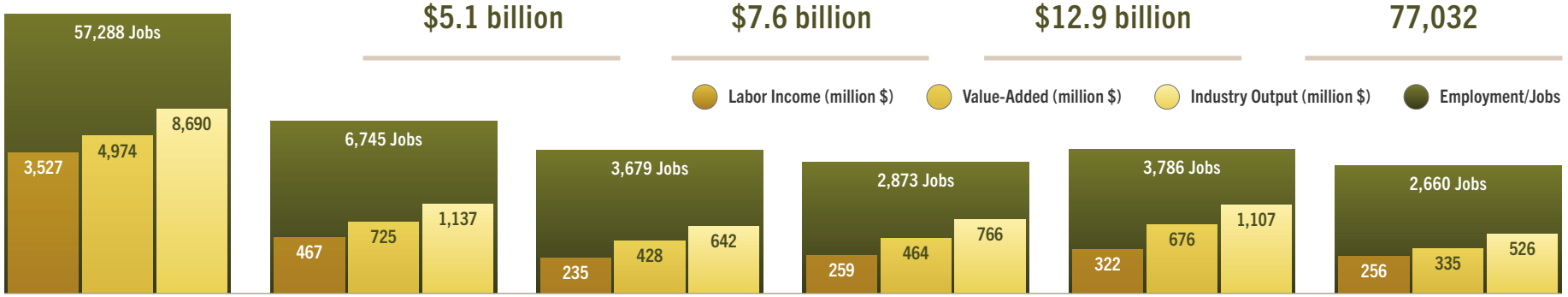
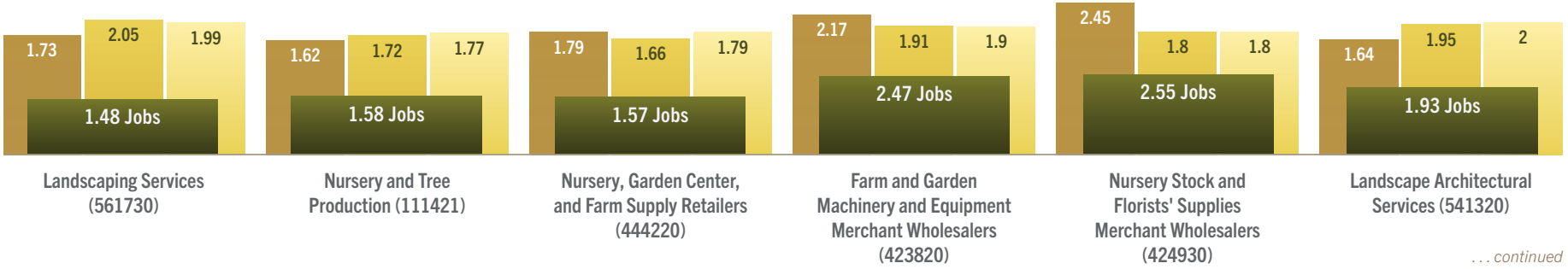
F17 TOTAL EFFECT ECONOMIC CONTRIBUTION OF U&CF FROM THE PRIVATE SECTOR IN CALIFORNIA, 2021 REPORTED IN 2021 DOLLARS

—TOTAL LABOR INCOME—	—TOTAL VALUE-ADDED—	—TOTAL INDUSTRY OUTPUT—	—TOTAL JOBS—
$5.1 billion	$7.6 billion	$12.9 billion	77,032



F18 SAM MULTIPLIER ECONOMIC CONTRIBUTION OF U&CF FROM THE PRIVATE SECTOR IN CALIFORNIA, 2021, REPORTED IN 2021 DOLLARS

—TOTAL LABOR INCOME—	—TOTAL VALUE-ADDED—	—TOTAL INDUSTRY OUTPUT—	—TOTAL JOBS—
1.77	1.95	1.94	1.5



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F19 ECONOMIC CONTRIBUTION TRENDS IN CALIFORNIA IN THE LAST THREE DECADES

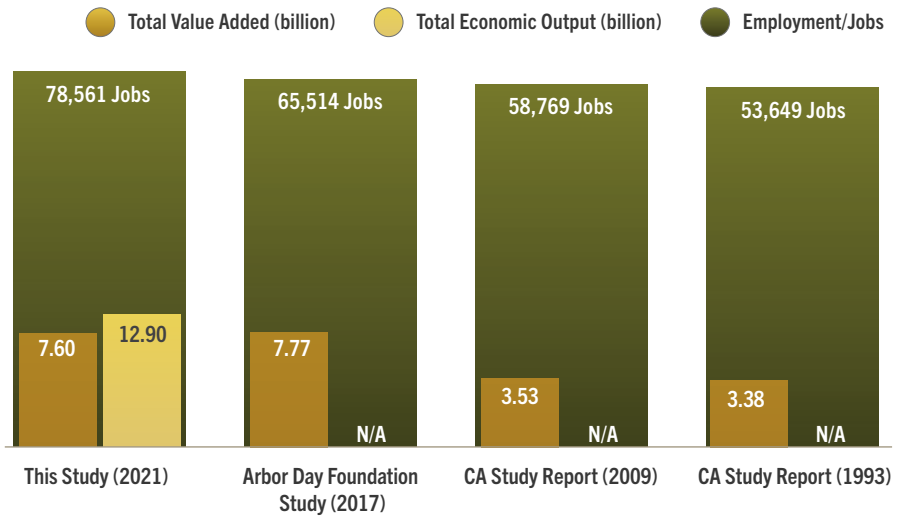

FIGURE 19 lists a few previous studies, including this study, which evaluated the economic contribution of U&CF in California within the past three decades. Of note, it is difficult to compare these studies as they varied widely in their adopted methodology, the scope of U&CF considered, and more importantly different timing. This study is the most recent and adopts the peer-reviewed economic contribution analysis approach. Further, the scope of U&CF in this study is broader with a focus on incorporating the footprint of six various private businesses, non-profit organizations, public agencies, and higher education institutions involved in U&CF in California. It is obvious that our estimated economic metrics are higher compared to the previous studies. Though these are not likewise comparisons, this study suggests that U&CF in California grew substantially in the last decade, compared to a study from 2009.

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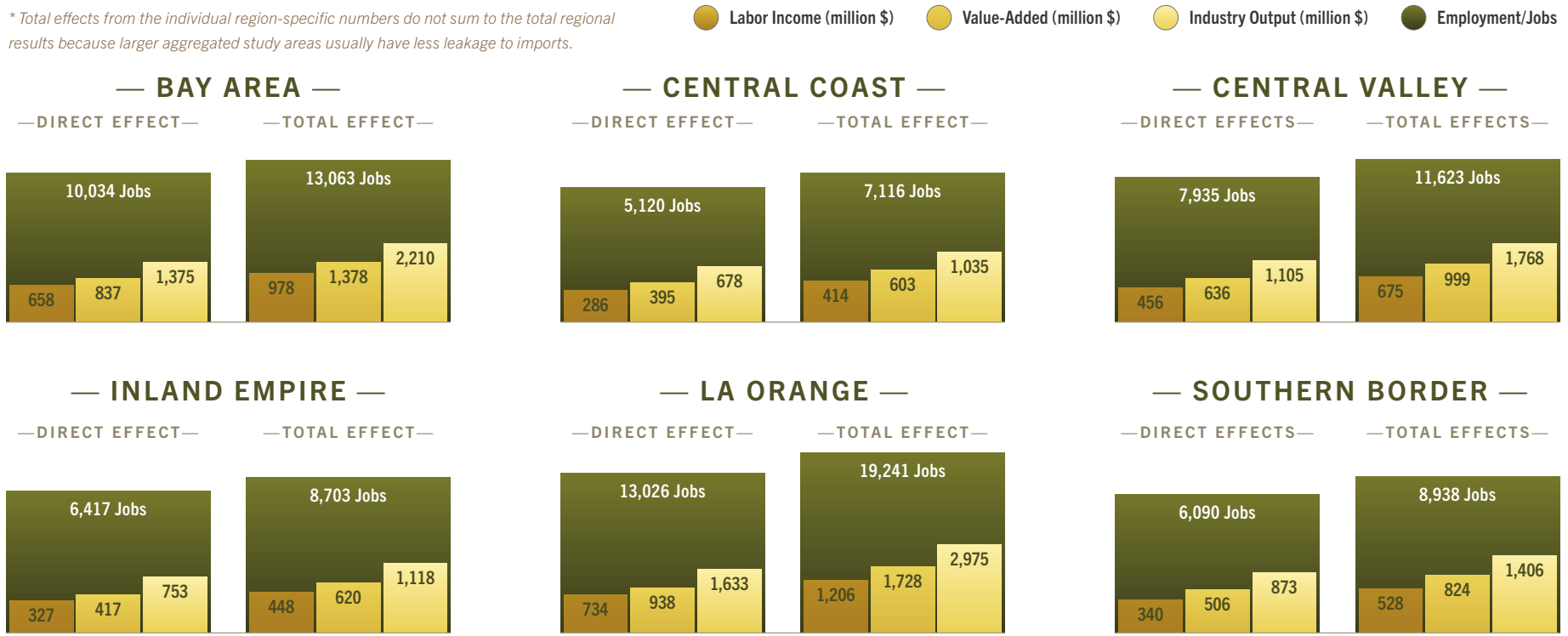
F20 SUMMARY OF URBAN AND COMMUNITY FORESTRY DIRECT AND TOTAL ECONOMIC CONTRIBUTIONS BY SELECT REGIONS IN CALIFORNIA IN 2021, REPORTED IN 2021 DOLLARS

** Total effects from the individual region-specific numbers do not sum to the total regional results because larger aggregated study areas usually have less leakage to imports.*



In addition to the state-wide economic contribution modeling, we developed six separate select-region models in California to examine the region-specific U&CF economic contributions. Using the same methodological approach, we estimated the region-specific economic contributions of U&CF in California. **FIGURE 17** summarizes the direct and total economic contributions by select regions. Among the six regions that represent most of California, LA Orange had the highest economic contributions by employment, labor income, value-added and the total economic industry output. U&CF in LA Orange, in 2021, supported over 19,241 total jobs with over $1.7 billion in value added. Bay Area was the second largest contributor in terms of U&CF jobs and other economic metrics, followed by Central Valley. The detailed economic contributions of U&CF in each select region are presented in the separate reports.

IX. CONCLUSION

With its growing importance in terms of intrinsic values in urban and suburban landscapes, urban and community forestry is considered an integral component of urban and regional planning and management through its role in the broader urban greening movement. Along with various ecosystem benefits, U&CF is found to contribute significantly in terms of jobs and overall economic activities to the regional economy. In this report, by using the approach developed by Parajuli et al. *(2022),* we estimated the economic contributions of U&CF in California in 2021. A periodic tracing of the growth and trends in U&CF from an economic contribution standpoint provides useful statistics and points of discussion for all U&CF stakeholders to promote, advertise, and garner additional support for the industry.

Results from our IMPLAN model indicate that in 2021, U&CF in California, in aggregate, contributed about $12.9 billion to the state economy by supporting 78,561 full- and part-time jobs across the state. Results also suggest that most U&CF-related employment opportunities in California are in the private sector, which collectively represents industries related to urban tree care services, nursery and tree production, machinery supplies, and landscape architecture. The results also indicate that landscaping services were the most dominant private sector, contributing to nearly 38,625 direct jobs in California. The magnitude of the SAM multipliers associated with the private sector were higher than those associated with the public sectors. Similarly, through public sector investments and support in U&CF, public agencies contributed about 2500 total jobs to the California economy.

The framework and findings documented in this report also have important management and policy implications:

- For consistency and comparison purposes, we closely followed the peer-reviewed economic contribution methodology developed by Parajuli et al. *(2022)* to conduct the economic contribution analysis in California using survey data collected from U&CF respondents and the IMPLAN model specific to California in 2021.
- The comprehensive nature of this study leads to a robust picture of U&CF contributions, including areas that require attention in the economic contribution analysis approach, specifically in the public and non-profit sectors.
- Our findings could support the justification for enhancement of current programs or creation of new measures to support U&CF activities in California.
- Results from this study could be utilized to inform targeted technical and financial assistance to jurisdictions that require capacity building.
- Private sector U&CF industries could use the findings of this study to highlight their economic contribution to the states and region at large while communicating with the public and policymakers on issues pertinent to their industries.

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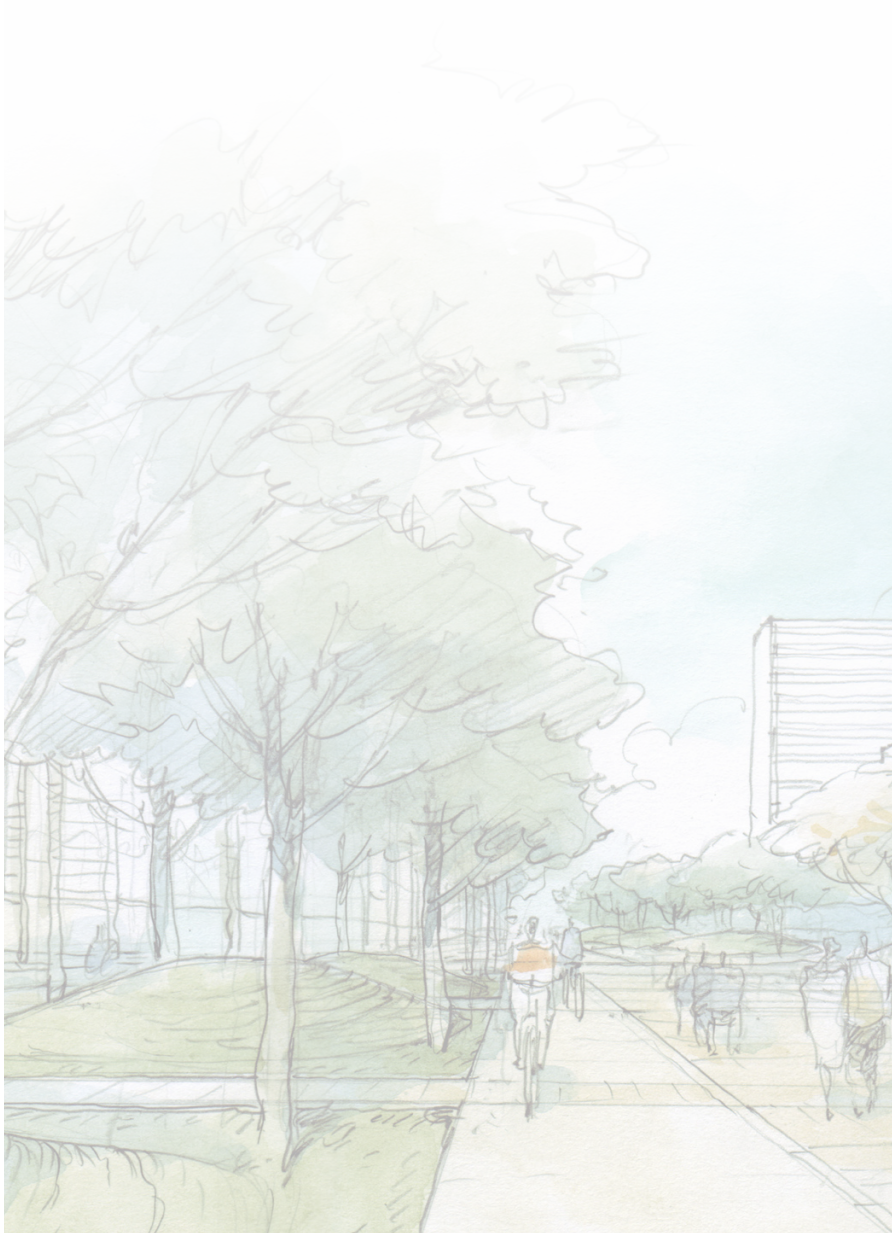

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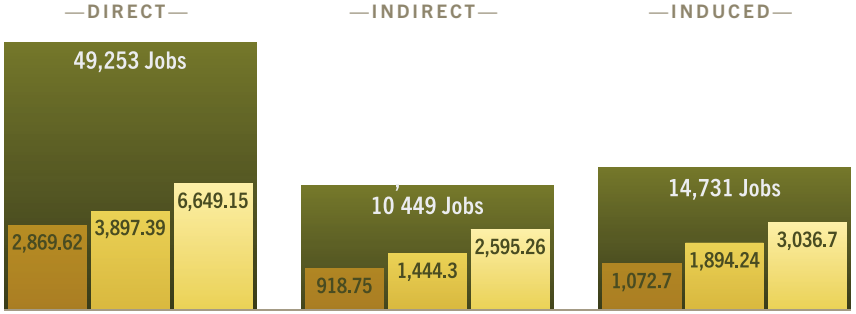
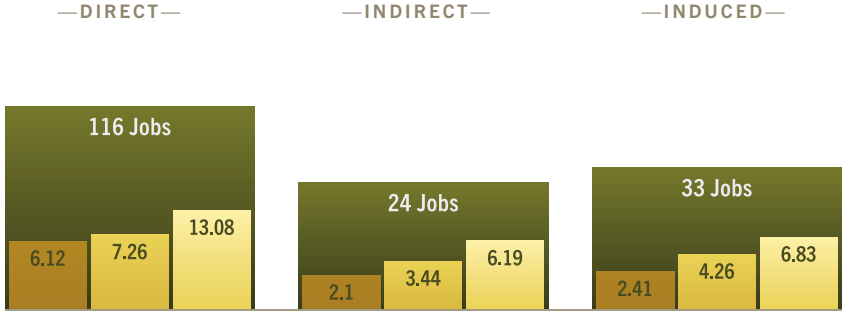
F18 ECONOMIC CONTRIBUTIONS (DIRECT, INDIRECT, INDUCED, AND TOTAL) OF ALL SECTORS FEATURED IN THE STUDY

— PRIVATE SECTOR —



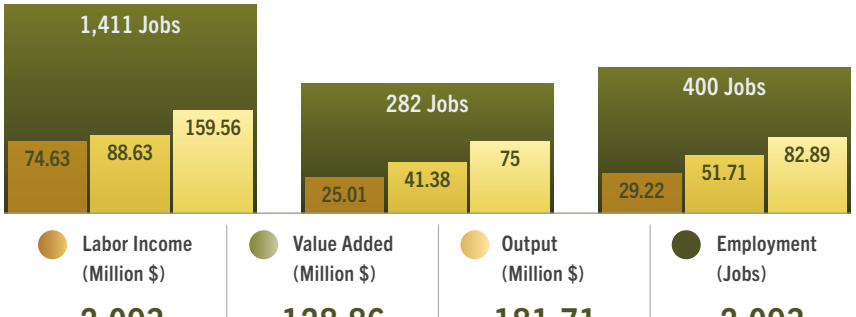
Labor Income (Billion $)	Value Added (Billion $)	Output (Billion $)	Employment (Jobs)
4.86	7.24	12.28	74,433

— INVESTOR-OWNED UTILITIES —



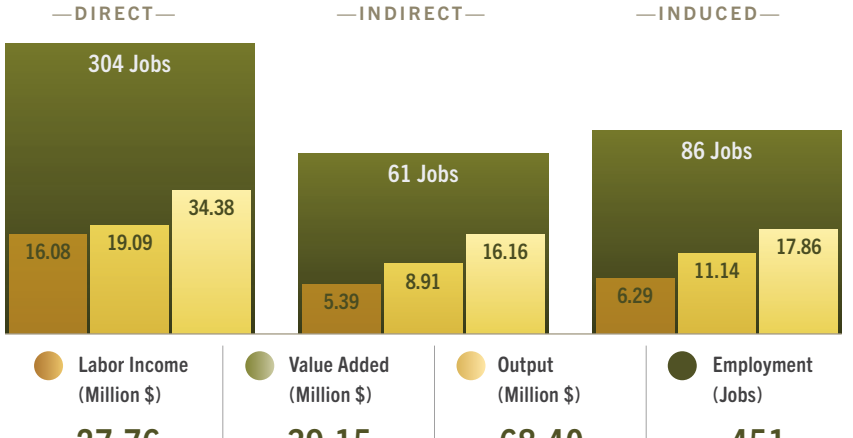
Labor Income (Million $)	Value Added (Million $)	Output (Million $)	Employment (Jobs)
10.62	14.96	26.10	172

— MUNICIPAL GOVERNMENT —



Labor Income (Million $)	Value Added (Million $)	Output (Million $)	Employment (Jobs)
2,093	128.86	181.71	2,093

— COUNTY GOVERNMENT —



Labor Income (Million $)	Value Added (Million $)	Output (Million $)	Employment (Jobs)
27.76	39.15	68.40	451

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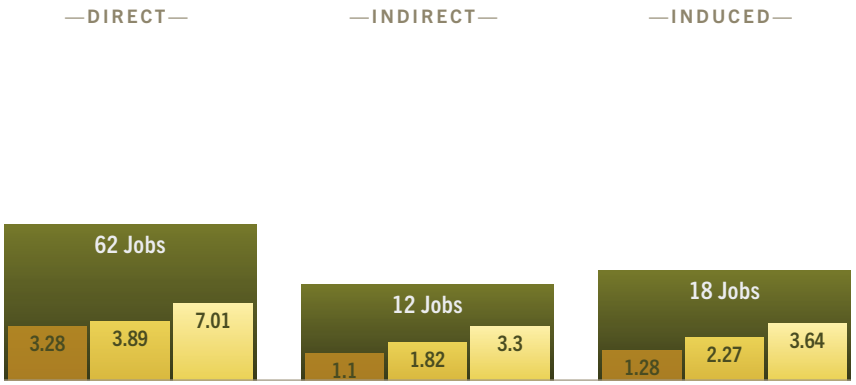
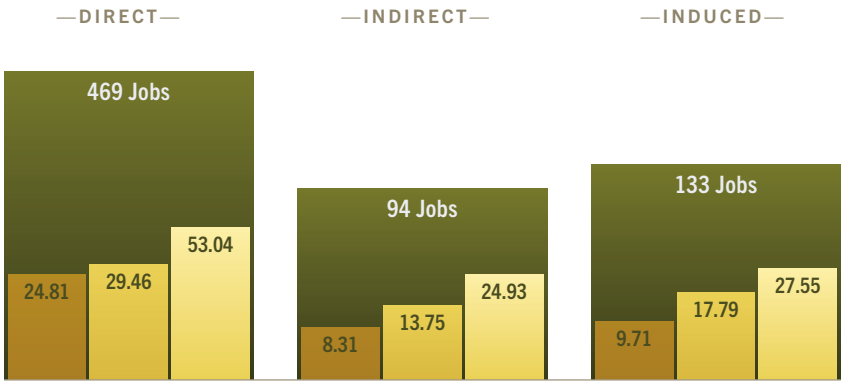
— STATE AGENCIES —



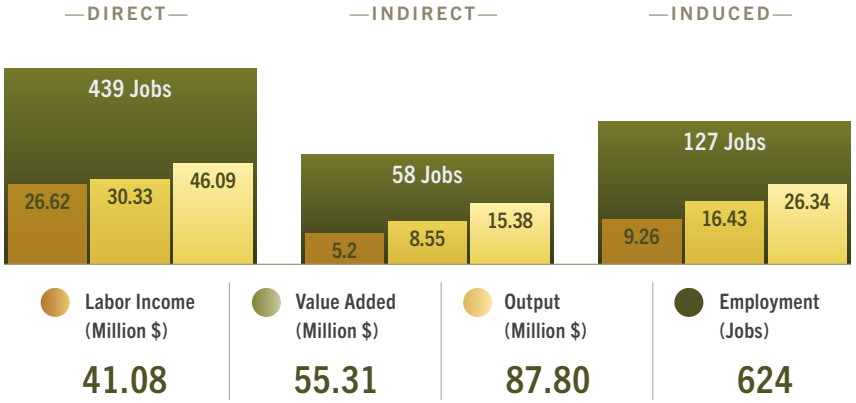
Labor Income (Million $)	Value Added (Million $)	Output (Million $)	Employment (Jobs)
5.66	7.98	13.95	92

— HIGHER EDUCATION —



Labor Income (Million $)	Value Added (Million $)	Output (Million $)	Employment (Jobs)
42.83	60.40	105.52	696

— NON-PROFIT —



Labor Income (Million $)	Value Added (Million $)	Output (Million $)	Employment (Jobs)
41.08	55.31	87.80	624

"This institution is an equal opportunity provider."

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MAIL

U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250- 9410

FAX

(202) 690-7442

EMAIL

program.intake@usda.gov.