

Assessing the Economic Impacts of Agricultural Equipment Emission Reduction Strategies on the Agricultural Economy in the San Joaquin Valley: Phase Two, 2018 Costs

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Executive Summary

This study is the second phase in a series of studies developed in collaboration with experts to understand the regulatory environment faced by farmers in the San Joaquin Valley (SJV) of California. In 2018 the first phase, “A Framework for Assessing the Economic Impacts of Agricultural Equipment Emission Reduction Strategies on the Agricultural Economy in the San Joaquin Valley”, was completed (McCullough et al., 2018). A major component of that project was a series of 22 case studies that focused on assessing the total cost of regulatory requirements for farms in 2012 compared to their individual costs of production. These case studies ranged across seven representative crops, three farm sizes, and various locations within the SJV. The first study also developed a suite of economic models designed to enhance California Air Resources Board’s (CARB) existing economic analysis capability. Findings of the case study analysis portion of the first project provided a snapshot of the regulatory environment in 2012.

This study serves as the update to the original case study analysis and provides a comparison of the regulatory environment faced by the case study participants, as well as an analysis of the changes in the broader agricultural industry in California per changes in the United States Department of Agriculture (USDA) Census of Agriculture from 2012-2017. This report provides the general insights and trends found in the case studies and their individual narratives from 2012 to 2018/2019.

Many new regulations have been enacted that affect farms in California since 2012 with the most notable related to water, food safety, and labor wage requirements. The Revised Irrigated Lands Program requires groundwater testing for nitrates and the creation of Salt and Nitrate Management Plans for crops. The Sustainable Groundwater Management Act (SGMA) requires the formation of Sustainable Groundwater Agencies in high and medium priority basins that will create plans to bring their basins into sustainable levels of groundwater use. The Produce Rule of the Food Safety Modernization Act (FSMA) requires prevention measures, testing, and audits for produce that will be consumed without processing. As of January 2018, growers with fields near schools or daycare centers were banned from applying chemicals during the weekday hours of 6 a.m. to 6 p.m. and must provide the schools with the list of all substances applied to the fields. Aerial spraying is banned altogether on those acres.

From the labor perspective; the Affordable Care Act requires all employers with 50 or more full-time or full-time-equivalent employees to provide health care coverage for their workforce and file requisite paperwork regarding the coverage to both the Internal Revenue Service (IRS) and employees. In 2016 California Assembly Bill (AB) 1513 was initiated for employers of piece-rate workers, requiring compensation for rest or other non-productive time so as not to penalize workers for taking rest breaks. AB 1522, the Healthy Workplace Healthy Families Act of 2014, requires employers to provide three days of paid sick leave for any employee who works 30 or more days within a year. This includes part-time and temporary workers and includes agricultural workers who, in 2018, worked 10-hour days. AB 1066 began to change overtime requirements in January 2019 such that agricultural workers now receive overtime pay after 9.5 hours/day or 55 hours/week. By January 1, 2022, the law will be fully implemented with overtime pay occurring for work exceeding 8 hours/day or 40 hours/week.

While regulations provide quantifiable benefits to society, there are inherent compliance costs to agricultural producers.

The compliance requirements for two regulatory areas were the same as in 2012: air quality and education and training. However, in most of the 22 cases, the costs of the compliance activities for these categories have increased as labor wages have increased. That being said, both categories exhibited a decrease in their respective shares of total per acre regulatory costs for 16 out of the 22 cases studies.

General insights about the regulatory environment faced by the 22 case studies in 2018/2019 in the San Joaquin Valley based upon the case study interviews include:

1. Many growers are contracting out services with high regulatory compliance costs. In many cases the farm's insurance company provided education/training workshops. Pest Control Advisors (PCAs) performed services such as spray reporting where the farmer used to handle this task, and water quality monitoring is becoming increasingly outsourced to consulting firms.
2. Average regulatory costs were higher for permanent crops (tree nuts, citrus, stone fruit, and grapes) than for field crops (cotton, silage, and tomatoes).
3. Labor-related requirements saw the largest dollar and percentage increase from 2012 to 2018 largely due to the new requirements regarding piece rate pay, paid sick leave, health care and reporting requirements associated with each policy. These categories will continue to increase as AB 1066 comes into full effect and workman's compensation compounds with salary increases.
4. Total regulatory costs increased on average 265% while total production cash costs increased by an average of 22%.
5. SGMA presents an area of uncertainty. Many growers expressed concern about unknown future costs of compliance and water availability, and most have spent considerable time participating in Groundwater Sustainability Agency (GSA) meetings. In addition, some GSAs have already instituted per-acre surcharges with expectations of future increases.
6. Many operations have changed or are considering switching to commodities and/or technologies with lower labor costs (e.g. raisins/stone fruit growers are transitioning to nuts, more mechanized harvesting in grapes, dairy farms are restructuring in order to survive increasing regulatory costs and low milk prices).
7. While regulatory compliance costs increased on average for all producers, it increased at a higher rate for larger farm sizes. This is primarily due to labor wage requirements that disproportionately affect larger growers.
8. In this study, the use of diesel exhaust fluid (DEF) was considered a regulatory cost for farms operating Tier 4 tractors. In 2004 the United States EPA finalized Tier 4 emission

standards requiring most nonroad diesel engines produced after 2014 to have advanced emission control technologies. These standards exist for most nonroad diesel engines, not just those used in agricultural operations, and often require the use DEF for NOx control.

9. Due to the difficulty in obtaining total fuel consumption across all diesel-fueled equipment on a farm, the cost of ultra-low sulfur diesel fuel was not included as a regulatory cost. Since 2010, at least 80% of diesel refined for use in off-road vehicles must be ULSD, and California requires ULSD for all off-road vehicles use. Though the US Energy Information Administration does not report off-road diesel prices, a review of retail diesel prices since 2007 less state taxes, shows that California ULSD prices are \$0.21-\$0.32 higher per gallon.
10. As noted in the 2012 study, pesticide costs of regulation were largely underreported because of the difficult nature of discerning regulatory costs embedded in PCA fees and chemical prices.
11. The variability in regulatory costs across regulatory category, commodity, and farm size increased despite most farms' efforts to reduce reliance on labor associated with regulatory compliance costs such as implementing electronic record keeping and compliance e-filing.
12. In three cases where farms employed labor contractors, the variability in contractor pricing and structure made it difficult to extract the exact cost of new labor wage regulations and the total cost of education.
13. Regulatory costs assessed at the processing level and the passthrough of those costs to case study farms were not recorded. In the case of citrus, growers in the study noted that food safety costs assessed at the packing house were being passed down in the form of differential pricing, but the extent was unknown.
14. Machinery replacement decisions have significant impacts on a farm's financial standing. Leases and purchase loans affect farms in different ways, and providing options for growers with different cash flow, leverage, and working capital constraints may reduce the impact on their ability to further invest in the expansion of their operation.
15. As noted above, at the time of grower interviews, there were four enacted regulations with phase-in periods past 2018/2019 and since an updated prohibition on agricultural burning. A brief discussion these regulations is found in the section *The Regulatory Environment Beyond 2021*.

It is important to note the regulatory environment in which California farmers operate in the context of the broader agricultural industry. Depending on the size and commodity, growers may have limited ability to "pass on" regulatory costs to consumers. The majority of farmers in SJV are very small producers, 55.7% of 22,500 farms in the SJV have fewer than 50 acres with another 20.8% farming fewer than 180 acres, making them absolute price takers in their markets (USDA 2019). In these cases, as is with most smaller farms across the United States, they have

limited ability to pass on marginal increases in production costs associated with increased regulation. The inability to pass through regulatory costs also applies to most large farms as well. The regulatory costs, and associated opportunity cost of regulation, manifest themselves in reduced profits.

Second, farms face both output price risk (defined by world market supply and demand) and yield risk (a function of weather and other external growing conditions within a season), whereas most industries only face output price risk. This adds a layer of complexity in risk management when both price and yield are variable based upon external factors. When regulatory compliance costs are added to production costs, holding all else constant, the probability of making profit decreases.

This study is the first of its kind to lay the framework for examining the changes in the regulatory environment faced by farms in California's SJV. The tools developed in the first phase of the study have been updated and modeling efforts have been enhanced to better understand the impact of regulation on agricultural production costs. While this study is limited to a small number of case studies in a focused region of California, it is the largest of its kind and provides insight to the nature of California agriculture.

Introduction

The objective of this study is to update and provide a basis of comparison for the initial study published in 2018 (McCullough, et al. 2018). The initial study created the framework to assess the impact of additional regulation on farms in the San Joaquin Valley (SJV) of California in 2012. The study built three tools based upon a series of 22 in-depth case study interviews that could be updated as production cost and returns and regulatory costs changed. This study serves as the update to the original case study analysis and provides a comparison of the regulatory environment faced by the case study participants, as well as an analysis of the changes in the broader agricultural industry in California per changes in the United States Department of Agriculture (USDA) Census of Agricultural from 2012-2017.

The regulatory environment in California has evolved in the past eight years as a response to new laws regarding worker health and safety, an increased scrutiny on food handling practices, and a prolonged drought that brought to light the overdraft of many California groundwater basins. For example, the Sustainable Groundwater Management Act, a set of California bills, were passed due to the realization that common groundwater pumping practices in areas of the state might lead to a permanent reduction in available water supplies. That being said, regulation compliance may result in increased costs for growers.

Compliance costs can be classified into two broad categories: direct and indirect. Direct costs are those that result in a payment for regulatory compliance such as the fee paid to the air district to obtain a burn permit. Indirect costs usually relate to the opportunity costs created by a regulation such as the farm owner's time spent attending safety training workshops. Indirect costs, in particular, can be "hidden" as these costs are not typically included in the accounting of standard production costs. As a result, the profitability of the farm can be overstated, in some cases quite significantly. In addition, because a large portion of these costs are associated with farm labor wages, the variability of profitability and loss can be largely understated.

The primary focus of the final report is a documentation and discussion of changes in the regulatory environment faced by the case study farms since 2012. To that end, we refer the reader to McCullough et al. (2018) for a discussion of the implementation of these costs into the modeling framework developed therein, as well as the case study sampling and selection methodology. Adjustments to the case study interview process will be discussed next, followed by a brief discussion of regulatory changes since 2012 (a more detailed discussion can be found in the supplemental report, "USDA Census of Agriculture Trends 2012-2017" prepared by ERA Economics for this study) and a summary of current regulatory compliance costs at the farm level. A discussion of the financial information on capital assets will conclude the report. The individual case study narratives can be found in the Appendix of this report.

The Case Study Process, Participants, and Adjustments

In order to maintain consistency, the same growers that participated in the first phase were contacted and asked to participate in the 2018 study. These growers were originally selected by the project’s Agricultural Advisory Group, comprised of agricultural stakeholders and representatives from CARB, the San Joaquin Valley Air Pollution Control District (SJVAPCD), and the USDA Natural Resources Conservation Service. The growers were selected as representative farms for seven broad commodity groups: citrus, stone fruit, tree nut, grapes, cotton, silage, and vegetables. They also were selected based upon their size relative to the average farm size in the commodity group and their location within the SJV to isolate differences in both production and regulatory costs across region and size. Table 1 provides the sample selection for the 22 case studies.

Table 1. Case study selection

Commodity Group	Citrus	Stone Fruits	Tree Nuts	Grapes	Cotton	Corn for Silage	Tomatoes
Survey Locations	2	2	3	2	2	3	1
	<i>South, Central</i>	<i>South, Central</i>	<i>South, Central, North</i>	<i>South, North</i>	<i>South, Central</i>	<i>South, Central, North</i>	<i>Central</i>
Farm Size Selection							
Under 50 acres	1	1	2	1	0	1	0
51-250 acres	1	1	1	2	1	2	1
251 acres or more	1	0	1	1	1	2	1
Total Sample Farms	3	2	4	4	2	5	2

The interviews commenced in February 2019 and concluded in February 2020. Due to harvest schedules, among other scheduling difficulties, the interviews took place throughout the 12-month period with several follow-up phone calls and emails for clarification afterwards. Each grower was emailed their original 2012 production cost information. The original interviews utilized UC Cooperative Extension enterprise budgets as a baseline, however, each grower maintained their own records in a different form so returning to their individual accounting system proved a more efficient task than starting from public enterprise budgets.

After per-acre production costs were recorded, each grower was asked about regulatory compliance costs across a variety of categories. Table 2 lists the regulatory categories as well as a number of potential costs faced by individual farms. With the inclusion of Affordable Care Act (ACA) Requirements and Labor Wage Requirements the number of categories grew from 9 to 11. In addition, the number of costs per category expanded from the original 2012 list. While the growers did not receive their original regulatory compliance cost worksheet prior to meeting, it was used during the interview process to ensure consistency of compliance costs.

Table 2. Sample Regulatory Costs, 2018

Education/Training for Regulatory Compliance	Food Safety - Produce Rule
Safety training – employees	Clerical staff time for food safety documentation
Safety training – managers	Management time spent on food safety issues
Safety training – owners	Field staff time spent on food safety
Safety training - program costs	Toilet/washroom cleaning, machine cleaning/sanitizing, etc.
Labor/Employment Issues - Time Spent/Cost of program	External food safety consultants
Pesticide/Fertilizer Issues Time - Spent/Cost of program	External food safety record keeping service
Water Quality Issues - Time Spent/Cost of program	Self-audits by internal food safety staff
Food Safety Training - Time Spent/Cost of program	Third Party audits
Sexual harassment training - managers	Raw product testing
Other - please list	Materials for trapping animals
	Additional costs for environmental assessment
	Microbial water tests for food safety
	Sanitization of equipment/machines
	Time spent in annual update of food safety program
Air Quality Requirements	Labor Health & Safety Requirements
Burn Permit	Toilets/handwashing facilities, supplies (not for food safety)
Application Fee for Conservation Management Practice plans	Water provision
Time Spent in filling out forms, drawing maps, etc.	Shade structures
Sanding/watering roads	OSHA required equipment (gloves, goggles, etc.)
Time	
Equipment Cost	
Labor	
Materials	
Other - please list	
Water Quality Requirements	Capital Investment
Cost to join water waiver coalition	Increased technology expense to offset regulatory cost
Permits/paperwork to comply with ground water quality	Cost share for mandatory diesel engine replacement
Nitrogen management plan	Specific mobile equipment replacement
Nitrate well testing	Equipment for food safety or other regulatory compliance
Ground water allocation requirements	Upgrades of documentation systems
SGMA compliance - GSA costs	Investments to improve microbial quality of water
	Investments to reduce flooding
Department of Pesticide Regulation	Risk Management
Filing paperwork/record keeping	Increased liability insurance cost
Increased cost of biologically based pesticides	Legal costs related to regulatory compliance
Increased application time	Other - please list
PCA Cost	
Buffer zone yield losses	
Posting buffer zone signs	
Other - please list	
Other Regulatory Costs	ACA Requirements
Hazardous Waste Permit	ACA farm labor
Environmental Fee Return	ACA reporting
	Labor Wage Requirements
	Nonproductive time for piece rate workers
	Mandatory sick leave
	Filing Payroll Taxes, State Employee Forms, Fuel Taxes

As was done in the first phase, narratives were developed for each case interview to document the grower’s individual experiences with regulatory compliance. This allows for a more holistic view of the operations and documents the growers’ compliance activities for each regulatory category. As with all case study analysis, context is extremely important. All regulatory costs should be viewed and discussed in the context of that particular case study. Generalizations are

only made when that experience is documented in multiple cases across either commodity, farm size, or both.

Each interview took several months to complete from making the initial contact with the grower to the actual interview. The in-person interview averaged less than two hours. All participants shared the requested information, providing an estimate of the regulatory costs they face on an annual basis.

Finally, three of the original 22 case study participants are not included in this analysis and have been replaced by comparably sized participants that grow the same commodity. The reason for their exclusion is particular to each farm. One grower had stopped farming entirely, another grower no longer produces the commodity for which they were originally interviewed, and the third grower declined participation. In each case, the Agricultural Advisory Group identified replacement growers that closely reflected the size and location of the excluded participants. The interview process mirrored that of the others with the exception that information regarding current and historical production and regulatory costs were collected when available.

New Regulations Since 2012

A large portion of the changes in total regulatory costs for the case study growers relate to new and impending regulations since 2012. Therefore, a brief discussion of new regulations is warranted, however, we refer the reader to the supplemental report “USDA Census of Agriculture Trends 2012-2017”, prepared by ERA Economics for this study, for details on broader changes in California agriculture since 2012. The largest increase in regulatory compliance costs for case study growers since 2012 are attributed to three regulatory categories; water quality (and quantity) requirements, the Food Safety and Modernization Act, and labor wage requirements.

The Irrigated Lands Program was initially established in 2003. In 2008, the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) was formed to address ongoing nitrate and salinity pollution in groundwater. In 2018, the Central Valley Water Board adopted CV-SALTS’ recommendation to create a Central Valley-wide Salt and Nitrate Control Program, which requires groundwater testing for nitrates and salinity and the development of Salt and Nitrate Management Plans for crops (California Water Boards Central Valley-R5). Well sampling consists of collecting water samples from each individual well, which are then sent to a third-party lab for testing. Crop residues and soils are also tested for nutrient content. Salt and Nitrate Management Plans are gradually being phased in with some water basin/subbasins already requiring them from growers and some gearing up for compliance in 2019/2020.

The Sustainable Groundwater Management Act (SGMA), a series of bills signed in 2014, requires the formation of Groundwater Sustainability Agencies (GSAs) in high and medium priority basins that will create plans to bring their basins into sustainable levels of groundwater use. The SJV consists of many high and medium priority basins and GSAs spent a great deal of time developing their plans in 2018/2019. Because the case studies are diversified across the SJV, a wide variety of compliance costs were associated with the formation of GSAs and their plans (California Department of Water Resources).

The Food and Drug Administration (FDA) Food Safety Modernization Act (FSMA) was signed into federal law by President Obama in 2011. As part of that legislation, the Produce Safety rule came into effect in 2016 and requires prevention measures, testing, and audits for produce that will be consumed without processing. Covered farms are being phased into compliance based on size. Large farms, those with an average annual value of produce sold over a three-year period of more than \$500,000, started compliance measures in January 2018; medium, \$250,000-\$500,000 average annual value, started in January 2019; and small, less than \$250,000 average annual value, started in 2020 (U.S. Food and Drug Administration). The case study growers span this range and so we find a range in compliance costs during this phase-in period.

From the labor perspective; the Affordable Care Act, signed into law in 2010 and enforced in 2014, requires all employers with 50 or more full-time or full-time-equivalent employees to provide health care coverage for their workforce and file requisite paperwork regarding the coverage to both the IRS and employees (U.S. Department of Labor). In 2016, California AB 1513 was initiated for employers of piece-rate workers. It requires compensation for rest breaks or other non-productive time so as not to penalize workers for taking required breaks (California Department of Industrial Relations (1)). California AB 1522, the Healthy Workplace Healthy Families Act of 2014, requires employers to provide three days of paid sick leave for any employee who works 30 or more days within a year. This includes part-time and temporary workers with a 2018 agricultural workday of 10 hours (CA DIR (2)). Finally, California AB 1066 began to change overtime wages in January 2019 such that agricultural workers now receive overtime pay after 9.5 hours/day or 55 hours/week. By January 1, 2022, the law will be fully implemented with overtime pay occurring for work exceeding 8 hours/day or 40 hours/week (CA DIR (3)). While not all these labor wage requirements were in effect in 2018/2019, during the interview process growers spoke of their changes in production practices in anticipation of increased labor costs, most notably reducing labor-intensive practices and reducing acreage of labor-intensive crops.

The 2018 Regulatory Environment

This section summarizes both the regulatory environment faced by farms in the case study interviews in the 2018/2019 season and regulatory cost changes from the 2012 season. Again, because the sample of case studies is limited to 22 and focused in the SJV, broad generalities cannot be made to the entire California agricultural industry. However, valuable insights can be made into the regulatory environment under which all farmers in the study region operate.

As shown in the first phase of this study, regulatory costs vary significantly over farm size, crop mix, and location. In addition to presenting average costs of production and regulation, we want to stress the increase in the variability, measured by standard deviation, in these costs. Table 3 presents the average cash production costs per acre by commodity. Operating cash costs are the sum of cultural (variable costs associated with growing crops such as seed, fertilizer, etc.), harvest/contracting, and interest, and details of specific costs (chemical, labor, etc.) are omitted to preserve the anonymity of participants.

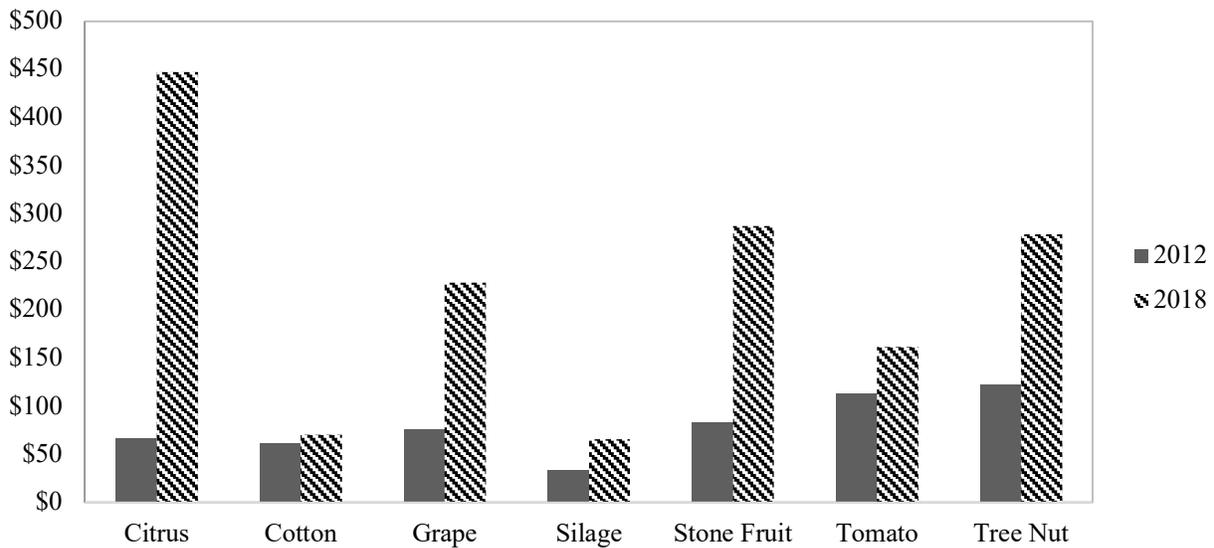
Table 3. Average 2018 production costs per acre by commodity

	Citrus	Cotton	Grape	Silage	Stone Fruit	Tomato	Tree Nut
	\$/acre						
Cultural Cost	\$3,052	\$1,174	\$3,544	\$752	\$4,191	\$2,058	\$2,335
Harvest/Contracting Cost	\$5,295	\$187	\$4,126	\$152	\$1,520	\$617	\$473
Interest on Operating Cost	\$109	\$36	\$305	\$11	\$0	\$34	\$78
Total Overhead Cost	\$314	\$380	\$729	\$199	\$558	\$458	\$584
Total Cash Cost	\$8,770	\$1,777	\$8,704	\$1,113	\$6,268	\$3,166	\$3,470

These cash costs per acre are on average 22% higher than those for 2012. Nineteen of the case study participants saw increases in cash costs per acre for a variety of reasons, however, most were linked to increases in wage rates and other input prices. Those case studies that experienced decreases in production costs were mostly associated with changes in management practices such as changing the mix of chemical applications to be more cost effective. Regulatory costs, on the other hand, increased on average 265% from 2012, which is an average annual growth rate of 24%. Because of the increased costs of regulatory compliance, many growers have begun to contract out services that they used to perform in-house. For instance, many growers reported using outside services and new technology to submit regulatory paperwork such as pesticide use reports.

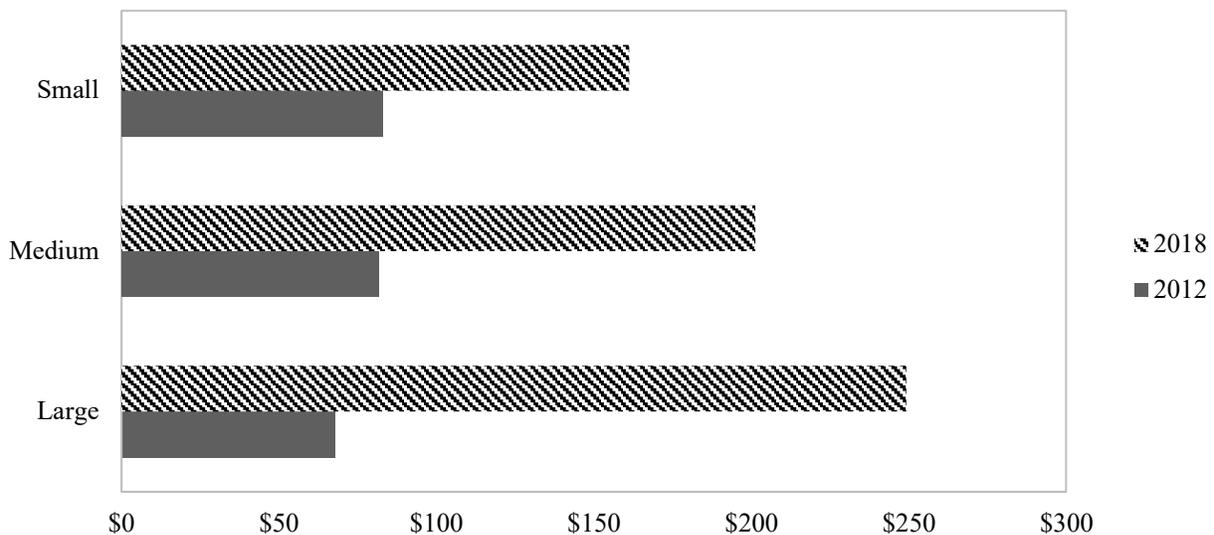
Figure 1 presents the average total regulatory costs for each commodity in the 2012 and 2018/2019 growing seasons. Note that these numbers do not directly reflect the first phase due to the inclusion of the three new case study participants, and averages across commodity groups are taken from a small set of farms, two to five interviews per group, so values cannot be thought of as general results for the commodity group. They do, however, illustrate the wide range in variability of regulatory costs among crop groups. The commonality drawn from comparing crop groups is that average regulatory costs were higher for permanent crops (tree nuts, citrus, stone fruit, and grapes) than for field crops (cotton, silage, and tomatoes). At the same time many operations have changed or are considering changes toward commodities and/or technologies with lower labor costs (e.g. transitioning to permanent crops such as nuts, see the supplemental report “USDA Census of Agriculture Trends 2012-2017” for a more detailed discussion on this topic).

Figure 1. Average total regulatory costs per acre by commodity type, 2012 & 2018



In contrast to 2012, regulatory compliance costs have shifted with respect to farm size. While the regulatory costs increased on average for all producers, it increased at a higher rate for larger farm sizes, see Figure 2. This is largely due to labor wage requirements that are dependent on the number of employed workers. A number of the large firms have hired human resource specialists or retained lawyers specifically for regulatory compliance.

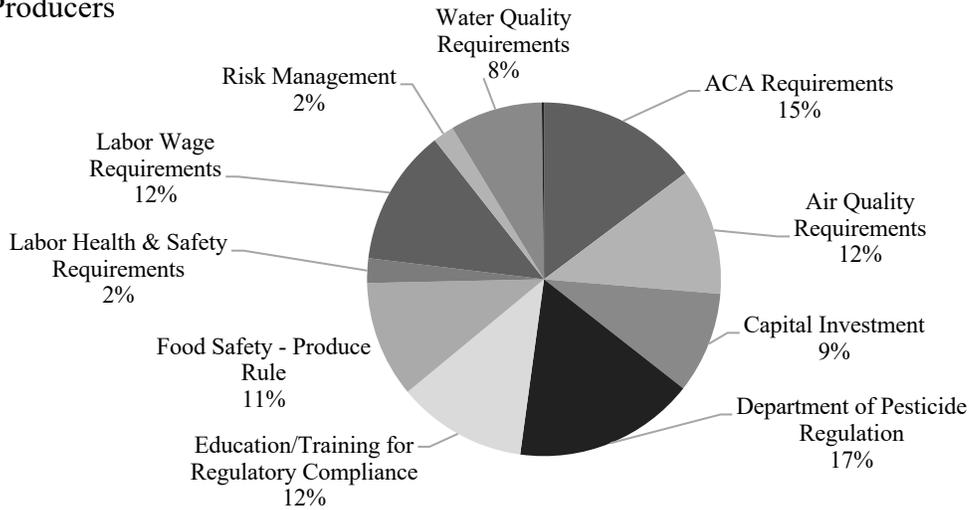
Figure 2. Average total regulatory costs per acre by farm size, 2012 & 2018



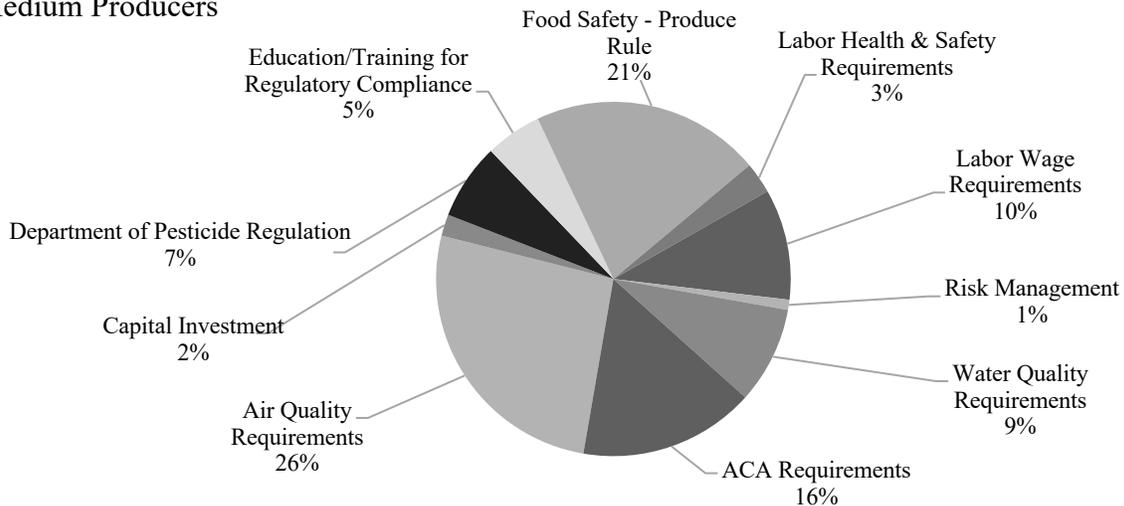
The breakdown of regulatory compliance for large farms appears to be more evenly spread across all categories as compared to medium and small farms. Figure 3 presents the percentage breakdown of regulatory costs by category across farm size. The primary driver for these differences lies in individual case attributes, however, it is worth noting that large producers are not exempt from any regulatory category.

Figure 3. Percent of regulatory costs by category across the three farm sizes

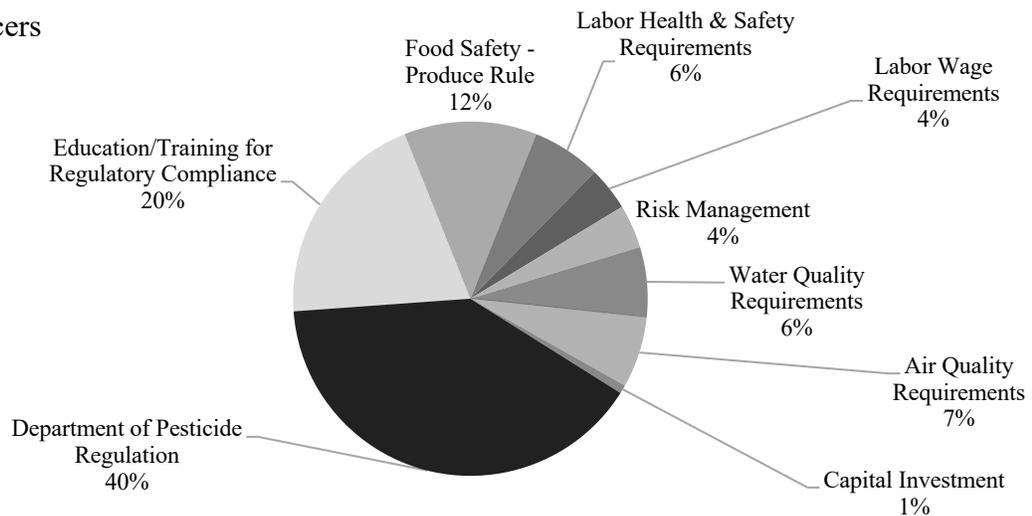
Large Producers



Medium Producers

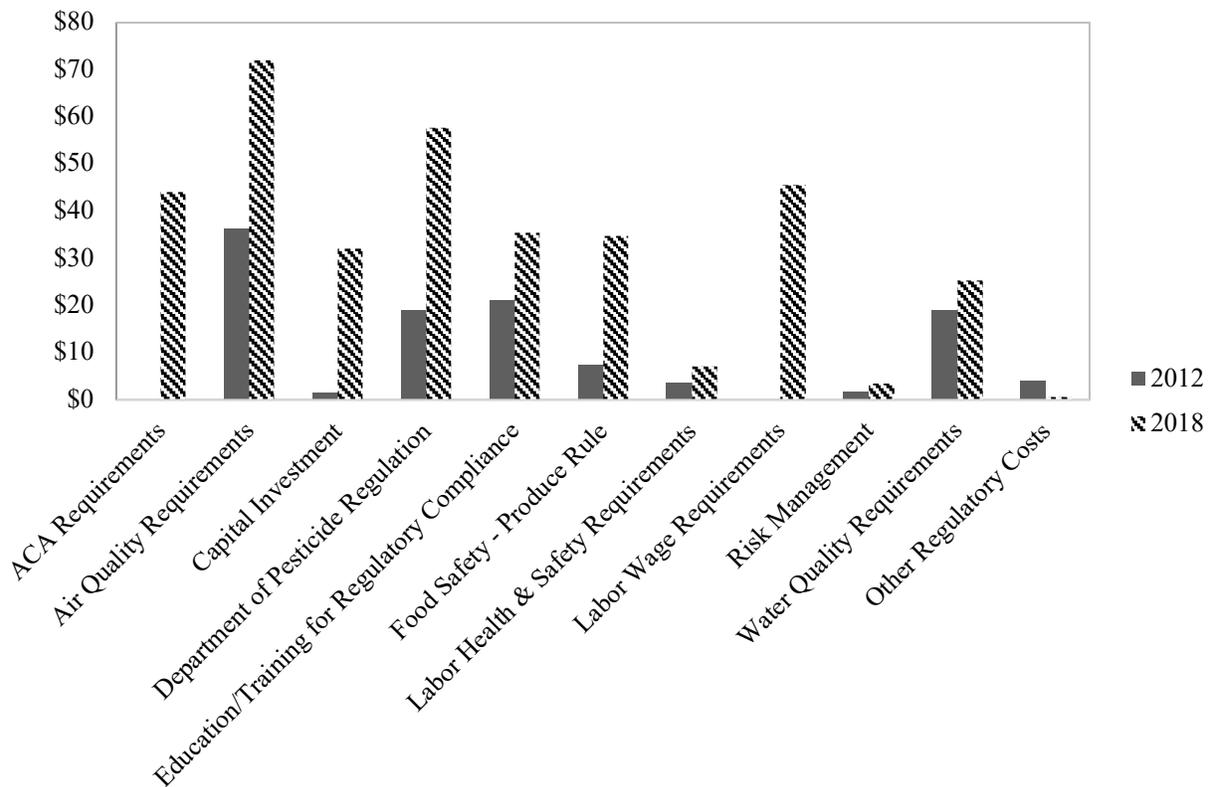


Small Producers



As mentioned before, the variability in regulatory costs across regulatory category, commodity, and farm size has increased. This in particular, illustrates the fact that no two farms are alike. Every individual producer approaches regulatory compliance in a different way, and we have yet to find a metric of efficiency, as is often cited in production economics, when dealing with compliance costs. Figure 4 presents the standard deviation (or variability) of regulatory costs per acre by regulatory category for each study year. The increase in variability can be attributed to many factors across farm size, commodity, and location.

Figure 4. Standard deviation of total regulatory costs per acre by regulatory category, 2012 & 2018



The average incurred cost of regulation across all farms varies widely across regulatory category, Table 4. In 2018 the highest cost category was Air Quality Requirements, followed by Food Safety and ACA Requirements for applicable farms, and then Department of Pesticide Regulation. This is a change from 2012 when Education and Training was the second largest regulatory category; it is now fifth on average, and only slightly above Water Quality Requirements. All categories, except for Other Regulatory Costs, experienced substantial growth in the six-year time period, with most more than doubling their 2012 values. Where it was uncommon in 2012 for a category to cost more than \$20/acre, all but four are above it in 2018.

Not all farms incurred costs from every category; food safety does not apply to cotton or silage and small farms do not incur mandatory healthcare costs. Education and Training does, however, apply to every farm and clearly demonstrates the differences among crop systems. This category is directly tied to the number of farm employees as well as the intensity of farm labor in

production. For example, the level of safety training during harvest varied between crops that are mechanically harvested versus those that are still primarily hand harvested. Very few farms noted having Risk Management costs associated with regulation. The instances where they were reported were tied to location, where the grower had to maintain flood insurance, or they had legal costs related to regulatory compliance in 2018.

Table 4. Average of incurred regulatory costs by regulatory category, 2012 & 2018

Regulatory Categories	2012 Average Cost/Acre	2018 Average Cost/Acre	Percent change
ACA Requirements	--	\$37.94	--
	\$28.26	\$47.47	68%
	\$2.54	\$15.68	516%
	\$13.33	\$35.47	166%
	\$17.32	\$23.76	37%
	\$6.11	\$39.18	541%
	\$4.92	\$8.37	70%
	\$28.97	\$32.79	13%
	\$2.01	\$4.68	133%
	\$11.29	\$23.01	104%
	\$2.32	\$0.45	-81%

Labor Wage Requirements saw the largest dollar increase across all 22 cases. This was largely due to the new requirements regarding piece rate and paid sick leave, and reporting requirements associated with each. Tables 5 and 6 present the breakdown of average regulatory costs by type across the commodity groups and their respective percentages. While three of the seven commodity groups show air quality requirements as their largest compliance cost category, this category also had the largest variation among case studies. This can largely be attributed to two regulatory-induced practices and different farms utilizing different approaches: disposal of biomass from removed orchards, and dust control as a part of a farm’s Conservation Management Practices (CMP) plan. Individual differences are discussed in the Appendix.

Table 5. Average incurred regulatory costs per acre by category across commodity groupings, 2018

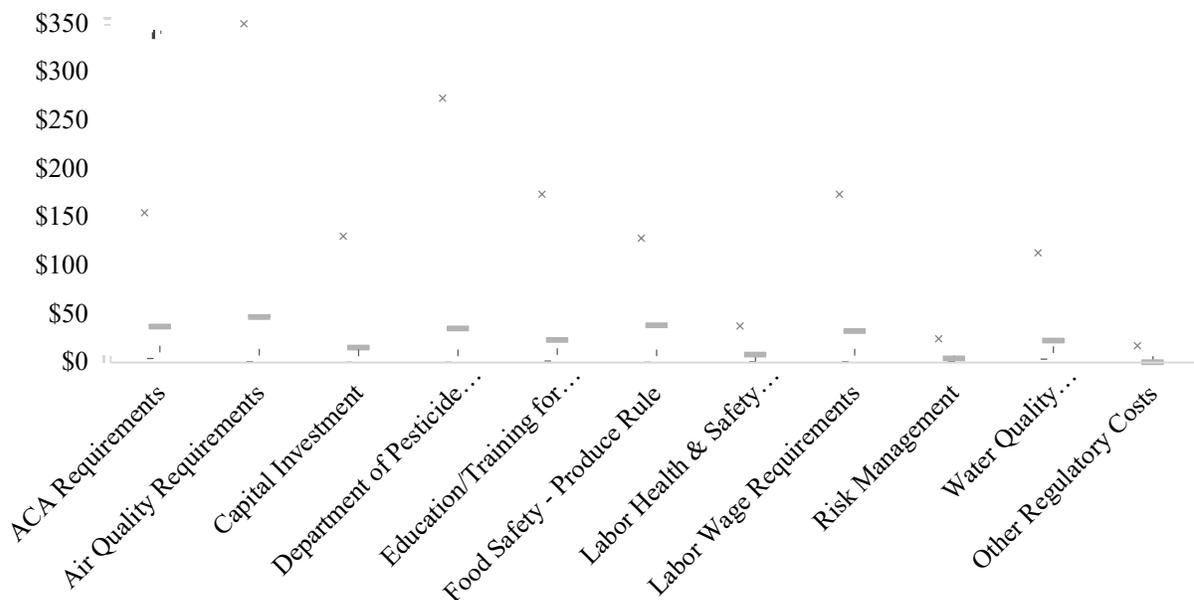
Regulatory Cost	Citrus	Cotton	Grape	Silage	Stone Fruit	Tomato	Tree Nut
ACA Requirements			\$107.94	\$15.56		\$24.46	\$19.43
Air Quality Requirements	\$52.00	\$3.41	\$32.62	\$16.14	\$168.50	\$51.50	\$57.59
Capital Investment	\$58.23	\$1.69	\$5.48	\$2.09	\$0.19	\$13.05	\$19.39
Department of Pesticide Regulation	\$137.06	\$6.65	\$16.93	\$9.84	\$8.15	\$26.78	\$42.27
Education/Training for Regulatory Compliance	\$61.23	\$9.27	\$15.29	\$3.60	\$25.05	\$6.12	\$44.77
Food Safety - Produce Rule	\$63.03		\$35.34		\$57.05	\$3.00	\$24.29
Labor Health & Safety Requirements	\$8.43	\$1.34	\$13.61	\$2.93	\$10.78	\$4.54	\$14.74
Labor Wage Requirements	\$52.51	\$3.93	\$47.19	\$2.91	\$25.42	\$9.17	\$85.93
Risk Management		\$0.85		\$8.40	\$7.43	\$0.47	\$5.47
Water Quality Requirements	\$33.94	\$43.87	\$30.03	\$15.28	\$6.83	\$36.81	\$8.23
Other Regulatory Costs		\$1.12	\$0.05	\$0.17			
Average Total	\$447.02	\$70.30	\$228.46	\$65.69	\$287.49	\$161.93	\$278.47

Table 6. Percent of average regulatory costs by category across commodity groupings, 2018

Regulatory Cost	Citrus	Cotton	Grape	Silage	Stone Fruit	Tomato	Tree Nut
ACA Requirements	0.0%	0.0%	47.2%	23.7%	0.0%	15.1%	7.0%
Air Quality Requirements	11.6%	4.9%	14.3%	24.6%	58.6%	31.8%	20.7%
Capital Investment	13.0%	2.4%	2.4%	3.2%	0.1%	8.1%	7.0%
Department of Pesticide Regulation	30.7%	9.5%	7.4%	15.0%	2.8%	16.5%	15.2%
Education/Training for Regulatory Compliance	13.7%	13.2%	6.7%	5.5%	8.7%	3.8%	16.1%
Food Safety - Produce Rule	14.1%	0.0%	15.5%	0.0%	19.8%	1.9%	8.7%
Labor Health & Safety Requirements	1.9%	1.9%	6.0%	4.5%	3.7%	2.8%	5.3%
Labor Wage Requirements	11.7%	5.6%	20.7%	4.4%	8.8%	5.7%	30.9%
Risk Management	0.0%	1.2%	0.0%	12.8%	2.6%	0.3%	2.0%
Water Quality Requirements	7.6%	62.4%	13.1%	23.3%	2.4%	22.7%	3.0%
Other Regulatory Costs	0.0%	1.6%	0.0%	0.3%	0.0%	0.0%	0.0%
Total	100.0%						

Figure 5 illustrates the variability in the different regulatory categories by plotting the minimum, average, and maximum value for each type. Again, we stress the variability within most categories. As stated before, Air Quality Requirements had the highest average and the largest variation in costs. The co-gen plants that some farms used to ship removed, chipped trees and prunings are no longer in operation, increasing the cost of disposal. Some farms reported taking out smaller blocks at a time in order to avoid these costs. In addition, at least one grower discussed how the timing of removal had to be aligned with an early season harvest so that the biomass could be burned in the early fall.

Figure 5. Minimum, Average, and Maximum regulatory costs per acre by regulatory category, 2018



As noted in 2012, in addition to acreage removal, farms used a wide range of methods to mitigate dust on their dirt roads. The vast majority still utilize water trucks and spray the roads

continuously during harvest. There were, however, more cases where farms took advantage of alternative methods of dust control, from obtaining crushed asphalt from nearby road construction projects to taking advantage of cost-share programs for road surfacing. An additional Air Quality Requirement was the use of diesel exhaust fluid (DEF) for Tier 4 mobile equipment.

For some growers there was an increase in the Capital Investment category to offset other regulatory costs. In most cases, this was noted as the investment in new software for regulatory reporting. In some cases, we saw a decrease in reporting time under categories such as Department of Pesticide Regulation as a result of this technological adoption

The category that generated the most discussion was Water Quality Requirements. Growers expressed significant uncertainty with respect to the implementation of SGMA and how that would affect their individual operations. Furthermore, the growers were located in areas with vastly different water resources. Some farms reported knowing that water would be very scarce in the future and others reported that they held very strong rights to surface-delivered water. In most cases, however, growers reported spending a considerable amount of time participating in GSA meetings. As in 2012, the water coalitions that the different growers belonged to charged different fees, this was still the case in 2018, however, some GSAs have already instituted per-acre surcharges with expectations of substantial increases in the future (see sgma.water.ca.gov for a full list of GSAs and the most current Groundwater Sustainability Plans that detail how the different GSAs are planning for sustainable groundwater use). In addition, some farms have spent time developing their Salt and Nutrient Management Plans.

There are three categories in which costs may be underreported: Department of Pesticide Regulation, Food Safety, and Labor Wage Requirements. As was the case in 2012, pesticide costs of regulation were largely underreported because of the difficult nature of discerning regulatory costs embedded in Pest Control Advisor (PCA) fees and pesticide prices. In general, independent PCAs charge a per-acre fee for their services. PCAs that work for chemical companies do not typically charge a fee, but their salaries are embedded in the cost of the chemicals sold to the grower. In addition, a portion of the regulatory cost to get a label (specific chemical) approved for use on a particular crop in California may be included in the price of that chemical. Data is not available to determine the percentage of regulatory costs that are built into chemical prices, and thus we are unable to fully document these costs.

Similar to chemical costs discussed above, a portion of the regulatory costs for Food Safety Regulation assessed at the processing level may be passed along to the grower. These costs and how they may pass through to case study farms were not recorded. In the case of citrus, growers noted that food safety costs assessed at the packing house were accounted for in grower's price, but the extent was unknown as it was not separately indicated on the grower's receipts.

Finally, labor wage requirements may have been underreported when farms employed farm labor contractors. In these cases, the farm labor contractor would be responsible for a portion of Education and Training for Regulatory Compliance, paid sick leave, non-productive time for piece rate, and, if they employed more than 50 workers, mandatory health care coverage. The variability in farm labor contractor pricing and structure made it difficult to extract the exact cost

of the new labor wage regulations and the total cost of education and training. One grower, however, negotiated the exact regulatory cost of their hired contract labor with the labor contractor and stated that if they had not done that, they believed they would have been charged a higher rate.

The Regulatory Environment Beyond 2021

The regulatory environment continues to evolve, with on-going phase-in periods for four existing regulations and an updated prohibition on agricultural burning that will have significant impacts on tree and vine producers. A brief discussion of each follows:

- **SGMA:** Groundwater use and recharge are mandated to reach sustainable levels by 2040, and those basins and subbasins with severe or moderate overdraft submitted their plans for sustainability in January 2020 (CA DPR). The sustainability plans for each basin vary. While there is a clear need for sustainable water management to maintain a thriving agricultural industry, this regulation may have unintended consequences. For instance, the authors have ongoing research examining the economic impact of permanently fallowed acreage because of water restrictions on disadvantaged communities that rely on agriculture as a significant source of income (McCullough et al., 2020).
- Increased minimum wage to \$15 per hour, which is fully phased in by 2023 for all employers. While the mandated wage increase will be beneficial to those households employed in the sector, it is unclear whether this will be a net gain for the community because of the potential decrease in the number jobs available and/or hours worked.
- Reduced agricultural work week to 40 hours, which will be fully implemented in 2022. The combined impact of these two labor laws may have longer term implications for the number of agricultural laborers and jobs (Rutledge and Taylor 2019). The number of agricultural workers in the SJV decreased by over 90,000 between 2012 and 2017, driven by an increase in mechanization, as well as a general decrease in the supply of labor. Given recent labor shortages and the switch to less labor-intensive crops, these trends are expected to continue.
- **Truck and Bus Rule:** While specific costs associated with this rule are not documented in this study, any agricultural operation with heavy trucks (GVW of 14,000 lbs) must have replaced older engines with 2010 engines or newer by 2023 for emissions compliance. Though other industries had to comply by 2020, agriculture was exempt until 2023, and can only remain exempt if a vehicle has annual mileage of 1000 or less.
- **Prohibition on Agricultural Burning:** Agricultural burning has been phasing out since the passage of SB 705 in 2003. Since then, growers have reduced open agricultural burning by 80%, and many growers report high costs of compliance with chipping, incorporating biomass into the soil, and long lead times in burn permit approval. In February 2021, CARB staff recommended nearly complete burn prohibitions by January 2025. Options for biomass disposal are limited as most SJV co-generation plants closed when federal subsidies expired. The industry is expected to have high costs of adaptation, as labor,

capital, and transportation costs will increase substantially as the rule is implemented over the next three years.

These known regulations will only add to the regulatory costs faced by California agricultural producers as they are fully phased in and are certain to complicate the industry's competitive status as the regulatory burden increases.

Financial Considerations of Capital Asset Replacement

The regulatory costs evaluated in this study (as well as any additional regulations that a farm might face in the future) have implications for a farm's liquidity and cash flow. This, in turn, may impact their ability to replace farm equipment. As part of this study, a brief overview is made of the financial considerations of lenders when determining credit approval for farms wishing to purchase or lease agricultural machinery.

Machinery ownership and operating costs represent significant expenses for agricultural producers. The fleet management decisions that a grower makes, including replacement schedules and financing choices, can have impacts on the profitability of their operation as well as their cash flow, liquidity, and the ability to access capital for other investment and growth projects. In this section we discuss typical lending and leasing terms for agricultural machinery and how growers are assessed by lenders for credit approval. This is informed by interviews with loan officers, credit analysts and leasing specialists from multiple Farm Credit System banks as well as machinery dealers operating in the San Joaquin Valley.

Typical machinery lease and purchase terms

When updating their equipment and machinery fleets, growers can choose to lease or purchase. Typical agricultural machinery loans, obtained either through the grower's lender or through a machinery dealer, are fairly short term (usually between three and seven years), have higher interest rates than can be obtained on real-estate loans, and can be structured with either annual or monthly payments depending on the buyer's cash flow patterns and preferences. Machinery loans from some agricultural lenders and machinery dealers are offered with fixed interest rates, while others may offer variable rate loans as an option. Typical down payments for machinery purchases are around 30%, though some agricultural lenders have recently started offering loans with no cash down payments required.

Leases, also offered by major agricultural lenders and machinery dealers, typically have monthly or annual payments that are calculated using amortization methods and interest rates that are very similar to loan options. However, leases are offered with no cash down payment, and are the recommended option for most buyers that prefer to not put money down at the time of purchase. Aside from the potential benefits of maintaining working capital, leases may have tax advantages depending on the structure of the lease, and buyers should consult with their tax professionals for clarifications and recommendations.

Assessing buyers for credit worthiness

The manner in which buyers of machinery are assessed for creditworthiness depends on their existing relationships with their lenders and the size of the loan. Smaller machinery loans, through agricultural banks or machinery dealers, may be processed with a simple credit check and stated income, assets, and liabilities. Larger loans will often require more robust credit analysis and customers may be asked for financial statements and three years of tax returns. Machinery dealers tend to be more willing to lend to customers with marginal equity positions, as it is less costly for these lenders to retake possession and resell used machinery. With both types of lenders, documentation requests are likely to be more significant for new customers.

Lenders will typically assess credit worthiness by looking at measures of a borrower’s liquidity, leverage, and cash flow. Although the specific ratios used by each lender may differ, there are three key financial metrics to evaluate a borrower’s capacity to repay a machinery loan. These include the current ratio, debt-to-equity ratio, and debt-coverage ratio, which measure a borrower’s liquidity, leverage, and cash flow, respectively. Financial ratio definitions and target values are presented in Table 7.

Table 7. Financial Ratio Definitions and Target Values

Metric	Measures	Definition	Target Value
Current Ratio	Liquidity	Current Assets / Current Liabilities	> 1.2
Debt-to-Equity Ratio	Leverage	Total Liabilities / Total Equity	< 1.0
Debt Coverage Ratio	Cash Flow	EBITDA / Debt Service	> 1.1

The current ratio should be greater than 1.2, indicating that the value of current assets is 120% of the customer’s current liabilities. The debt-to-equity ratio should be less than 1.0 and the debt coverage ratio should be greater than 1.1 or 1.2. It is important to note that lenders may be flexible with these values, particularly when working with existing customers. For example, a customer that has a level of debt that is higher than optimal, and results in a high debt-to-equity ratio, might still be approved for a loan if cash flow and liquidity remain strong.

Buyers of machinery may be just as concerned about how the purchase will affect their future financial position as they are about whether or not lenders will approve machinery loans based on their current financial position. Machinery purchases can have big impacts on a farm’s balance sheet, increasing debt and leverage ratios as well as reducing liquidity. This may seriously impact the ability of farmers to invest further in expanding their operation. Although leases do not require down payments and can preserve net working capital, the amortization on most leases is rapid and lease payments can significantly reduce cash flow.

Summary

It is important to note the regulatory environment in which California farmers operate in the context of the broader agricultural industry. Depending on the size and commodity, growers may have very little ability to “pass on” regulatory costs to consumers and the majority of farmers in SJV are very small producers, 55.7% of 22,500 farms in the SJV have fewer than 50 acres with another 20.8% farming fewer than 180 acres, making them absolute price takers in their markets (USDA 2019). In these cases, they have very little ability to pass on marginal increases in

production costs associated with increased regulation. The inability to pass on regulatory costs is also true of most large farms. The regulatory costs, and associated opportunity cost of regulation, manifest themselves in decreased returns to ownership.

Second, farms face both output price risk (defined by world market supply and demand) and yield risk (a function of weather and other external growing conditions within a season), whereas most industries only face output price risk. This adds a layer of complexity in risk management when both price and yield are variable based upon external factors. When regulatory compliance costs are added to production costs, holding all else constant, the probability of making profit decreases.

This study serves as the first of its kind that lays the framework for examining the changes in the regulatory environment faced by farms in the SJV of California. The tools developed in the first phase of the study have been updated and modeling efforts have been enhanced to better understand the impact of regulations on agricultural production costs. While this study is limited to a small sample of case studies in a focused region of California, it is the largest of its kind and provides insight to the nature of California agriculture.

There are limitations to the current study, described in the first phase, and next steps that should be considered to refine the regulatory analysis framework. We present some of these findings here:

1. As noted above, the cost of regulation may be largely underreported when considering the compliance costs faced by downstream agribusinesses. There is limited economic literature, and very few primary studies, that analyze the impact of a change in regulation at the processing/packaging levels and through the distribution system where firms tend to have much more market power than individual growers.
2. Completing additional case studies across other crops and locations would expand the sample size and improve the modeling accuracy. One finding after both phases is the wide and increasing variability in regulatory costs across farms that produce the same crop. Growers manage regulation in different ways. Additional studies can describe these changes both qualitatively and quantitatively.

Finally, there are other concurrent studies being performed focusing on the effects of particular regulation in the SJV. It would be beneficial for all interested parties, both from the production and regulatory agency perspective, to understand the broader implications of the intersection of all regulation in the agribusiness supply chain in a holistic fashion.

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Appendix: Case Study Narratives

Cotton

The 2012 study included two Pima cotton growers, representing one medium and one large. The large grower was unable to participate in the continued study, so a new grower was selected.

Medium Cotton Grower – Central SJV

The cooperating grower is located in Central San Joaquin Valley. The diversified operation grows a variety of field and tree crops in addition to cotton; including garlic, onions, alfalfa, tomatoes, and hay in 2018. The acreage grown from 2012 remained somewhat steady, with just under 400 acres of Pima cotton. However, trade disputes had reduced the cotton prices by at least \$.15/lb at the time of the interview in November 2019, and the grower had reduced cotton plantings in 2019 by about one third.

Regulatory compliance for education and training was primarily handled by an outside consultant who worked for the worker's comp insurance agency and was paid a flat fee of \$2,500. The training was comprehensive and included employee safety, pesticide, tractor, forklift, heat stress and respirator training. 2018 was the first year for the respirator requirement. The 10 employees all attend four trainings per year for 12 hours total per employee. The owner also attends about five hours of the safety meetings and spends two hours per year in training for his private applicator's license. The office administrator works with the consultant for about an hour each quarter. The farm spent \$5,016 in education and training for regulatory compliance, which comprised 7.72% of the total regulatory costs for cotton.

Air quality compliance required a burn permit as well as an annual fee for two CMP plans to the San Joaquin Valley Air Pollution Control District (SJVAPCD). The grower has received a number of SWEEP grants (State Water Efficiency and Enhancement Program), and he spent about two hours per year reporting equipment use hours. To control dust during the cotton harvest, an employee waters the roads for a month, which costs over \$4,000 in time and equipment costs, but the grower does this for cotton quality purposes, not for air quality requirements. Thus, his air quality compliance costs were \$774 in 2018, or 0.6% of his total regulatory costs.

Water quality was this grower's largest cost of compliance once again, but for different reasons as compared to 2012. With the advent of SGMA, the GSA fee is \$2.50 per acre, but is expected to rise to over \$20 per acre once it is fully implemented. The grower estimated he spent 16 hours in meetings and trainings to become self-certified for nitrogen management in 2018 and for continuing education to maintain his certification. Nitrogen well testing and preparing and filing the nitrogen management plan (NMP) cost \$380 in time and fees. In 2018, the grower had cotton in the Westlands Irrigation District, which requires drip tape for all crops, at a cost of \$75 per acre for installation and post-harvest removal. The total cost of water quality compliance was \$30,290, which was nearly 73% of the grower's regulatory cost for cotton.

Pesticide compliance includes the cost of the PCA at \$12 per acre. The grower does the pesticide use reporting for any grower-applied chemicals, and also takes care of the permitting, which he estimates takes about six hours per year. The farm does not have any buffer zones nor is it near a school zone. Pesticide regulations in 2018 cost the grower \$4,962, which comprised 11.34% of his total regulatory compliance.

Labor health and safety requirements are relatively minimal as the labor contractors that work in the area have shade structures, and the growers tend to share their use. The grower does have two of his own shade trailers, and he replaces the tarps as needed. During the summer he provides ice water and other supplies and estimates that he spends about \$300/year. The grower's total cost of labor health and safety compliance was \$850, which comprised 0.67% of his compliance costs.

The grower had minimal costs in capital investment and risk management practices for regulatory compliance; in 2018 he retrofitted two diesel booster pumps to electric under the SWEEP program, and though each pump was replaced by the program for \$85,000 each, he had to pay for the retrofitting costs of about \$20,000 for infrastructure. The motors are expected to last 10 years, so this cost is allocated over a decade. The capital cost of investment for regulatory compliance was \$2,000 for 2018, or 1.6% of total regulatory costs. The grower increased his liability insurance umbrella policy to increase coverage against regulatory claims, and that cost \$1,000 in 2018, or 0.8% of the total.

The grower noted that he has pre-emptively replaced four tractors under the various air quality grant programs. He also noted that weight regulations and emission regulations on cotton trucks are increasing the costs of cotton ginning, though those costs were not calculated as they are post-harvest costs. The grower also noted that he changed his business ownership structure to an LLC, which cost \$4,000 in legal fees to transition from a partnership. The primary benefit is liability protection of personal assets. This was not calculated as a regulatory cost, however.

Many growers were required to comply with the Affordable Care Act, but this grower falls below the threshold for employees, so we do not calculate any compliance costs for health care provision. The grower does pay 80% of the employees' health insurance, but this is voluntary. The grower noted that worker's compensation premiums have declined, both because of reductions in the state base rate as well as his farm's own safety record.

The Labor Wage Requirements are primarily the cost of required sick leave for his eight hourly employees; as agricultural workers in 2018 their workday was 10 hours, so this costs the grower \$3,888 per year. His office assistant estimates about 78 hours of time annually to file required forms for state payroll as well as federal and state employee forms. The grower's annual cost of labor wage requirements amounts to \$6,852, or 5.3% of regulatory costs.

The grower's total cost of regulatory compliance for 2018 for his cotton crop was \$109.14 per acre, which comprised 6% of his production costs.

2012 to 2018: In 2012, the grower reported slightly higher costs of regulation; \$113.89 per acre. The primary differences between the reporting years fall into pesticide and labor health & safety regulations. In 2018, the grower reported much higher costs of pesticide regulation, as he had a

separate PCA fee. Meanwhile the 2018 costs of labor health and safety compliance declined as he was able to use many contractor-provided shade structures rather than having to move around the ones he owns. Costs of water regulations were also down slightly as the grower reported lower costs of providing required drip tape on his cotton acreage in the Westlands. Labor wage requirements were higher, at \$5.80 per acre; this category did not exist in 2012. Overall, the grower's reported costs of regulations in 2018 were 3.4% lower than in 2012.

Large Cotton Grower – South SJV

The cotton grower is located in the South San Joaquin Valley, and has a diversified farming operation that includes alfalfa, table grapes and tree nuts. In order to create an annual comparison this case will compare 2012 regulatory costs from a comparable grower to their 2019 costs. The grower does not have 2012 information available.

The farm is run primarily by family members who all take on various roles including management. The farm employs four full-time workers. The cost of education and training to maintain regulatory compliance is \$10.12 per acre, or 28.3% of the regulatory costs. These costs consist primarily of watching safety videos and safety training when operating equipment. The farm provides a \$500 safety incentive bonus to all employees. In addition, the owners spend on average five full days a year attending meetings to keeping up with regulatory requirements.

Air quality requirements include a burn permit, CMP fee, dust mitigation practices on their roads, and DEF expenses. Dust mitigation practices for the other crops the farm grows is much more intensive and so they apportion only 35 hours a year to cotton. The farm's total cost of air quality compliance in 2019 was \$6.17 per acre, or 17.3% of regulatory costs.

The farm spends \$3 per acre on water waiver coalition fees, and also must submit an NMP for ground water quality compliance. The owner spends about 40 hours per year on the plan. In addition to the cost of testing sampled water, they spent six hours gathering samples for nitrate testing. The owners time spent about five hours a month associated with learning about SGMA. In 2019, the total cost of water quality compliance was \$13.43 per acre, or 37.55% of the total costs.

The only regulatory costs associated with pesticides consisted of reporting time. The owners have implemented a new electronic system for monitoring and reporting which has decreased reporting time to about 10 hours a year. They did, however, mention that the limitation on Lorsban use could be potentially devastating. If late season pests such as aphid and whiteflies return to unmanageable levels without effective replacement chemistry, sticky cotton (the result of these pests) could permanently damage the California cotton industry. Large mills have specifically excluded certain gins with a history of sticky cotton from their purchasing sources. It's uncertain if this is a permanent decision, a short-term decision, or if it will be reviewed each year. Either way it's drastically affecting the ability of California cotton farmers to generate positive profit. The estimated cost for pesticide regulations is \$0.91, or 2.6% of total regulatory costs.

For labor health and safety requirements, the farm provides toilets, water, and safety equipment at an annual cost of \$2,500. They have a permanent shade structure that costs \$750 a year to maintain. The costs of compliance for labor health & safety regulations were \$1.96 per acre in 2019, or 5.5% of regulatory costs.

In 2019 the farm did not incur any regulatory costs associated with capital investments, risk management, the Affordable Care Act, and the Food Safety rules they adhere to do not apply to cotton. Five years ago, they added optional aerial application coverage to their insurance coverage to protect from potential drift.

Labor wage requirements consist of paid sick leave costs (30 hours for each employee) and reporting time. These requirements total \$2.05 per acre. Finally, the farm maintains its own aboveground diesel tank which requires about seven hours a year in maintenance and compliance.

The farm's overall cost of compliance in 2019 was \$35.76 per acre, or 2.1% of production costs.

2012 to 2019: In 2012, the previous case study participant of comparable production reported regulatory costs of \$7.97 per acre with Education/Training making up 54% of total costs. All regulatory costs increased in addition to having compliance costs in more categories. Between the two cases, production costs increased 157% while the regulatory costs as a share of production costs increased 75%.

Stone Fruit

Stone fruit interviews include two stone fruit producers in the San Joaquin Valley, one small and one medium grower.

Small Stone Fruit Grower – Central SJV

The grower had several smaller blocks of land planted to stone fruit, almonds and grapes in 2018. The grower owns an additional 200 acres but rents to other growers who are planting almonds. Peaches make up 38% of his farming operation.

This grower has a full-time, off-farm job, and thus contracts much of the work for his farming operation. Much of mandatory safety education and labor training for regulatory purposes falls to his contractor, the fee for which is wrapped up in the 37% commission he pays, so it is difficult to assess. However, the workers are given a 15-minute safety training refresher for each week of pruning and harvesting, so over the three weeks of pruning, three weeks of thinning and nine weeks of harvest, about five person-hours per week are spent in regulatory compliance, which costs \$1,125. The grower's one permanent employee spends about 15 minutes per week in safety training over the 30-week stone fruit season. The permanent employee also had to attend 8 hours of food safety training, and the grower's time spent in training and compliance was 8 hours for water quality regulatory training. As this grower is in an area affected by SGMA, he attended multiple meetings throughout 2018 to learn about compliance under the GSA, approximately

four hours per month. The grower's total costs of education and training for regulatory compliance was \$25.26 per acre, which comprised 61.3% of his regulatory costs for stone fruit.

The grower's air quality regulatory costs were substantially lower in 2018, primarily because he didn't have any removed trees that required chipping. His farm is too small to fall under a CMP, so there is no fee for either the plan, or required costs of mitigation. His only reported cost of air quality compliance was a burn permit to cover the entire farm, so his air quality compliance costs were only \$1.74 per acre, just 4.2% of his regulatory costs. The grower did report buying a tractor with higher-tier emission ratings; he spent \$25,000 on the tractor and received a \$14,000 cost share from a government program, this is not included in their regulatory cost assessment.

Water quality is an area of expanding regulatory costs; the Irrigated Lands Program fee for the Kings River Water Coalition was \$2.75 per acre in 2018. Mosquito abatement fees were \$3.21 per acre. The NMP was due for 2020, but he did not have to test any wells in 2018; he estimated that it would likely cost around \$4 per acre when that is implemented. Water costs increased by \$10 per acre, but it is difficult to know whether that has a regulatory component or is an outgrowth of the drought that ended in 2018. The biggest impact on water regulations will be when SGMA is fully implemented; some predict that the GSA fees will escalate to \$19/acre. In 2018, the grower's cost for water quality compliance was \$5.96, or 14.5% of regulatory costs.

Pesticide regulations are the grower's second highest cost of regulation. Regulatory fees resulted in a \$3/acre increase from the chemical applicator. Because he contracts for all of his pesticide applications, he let his PCA license expire.

The applicator/PCA does all the reporting; the grower spends no time on that regulatory activity. However, he is required to provide the fruit packing plant with chemical reports as part of the food safety requirements, he estimates that took about five hours in 2018. Overall, pesticide regulations, which are likely underreported because he does not pay a separate PCA bill, were \$6.64 per acre in 2018, which were 16.1% of regulatory costs.

Food safety, which was an increased regulatory area under the Produce Rule of FSMA, was fully implemented for his farm size in 2019. In preparation, the farm's Food Safety plan was updated, which took the grower's employee 8 hours. Overall his food safety regulatory costs were \$1.61 per acre, which was almost 4% of his regulatory compliance.

As all of this grower's workforce is part time and seasonal except for one, and all of his employees are technically hired by the labor contractor, the grower has none of the direct costs of regulation associated with employees, such as labor health and safety equipment, shade structures, water provision, or paid sick leave. He has also reduced reliance on labor by harvesting his fruit mechanically. However, he is indirectly paying labor regulatory costs as part of the labor contractor commission.

Overall, the grower's cost of regulatory compliance in 2018 was \$41.20 per acre, which was 0.6% of his production costs.

2012 to 2018: Compared to this grower's 2012 costs of regulation, his regulatory costs have *decreased* by 66.8%, which seems unlikely given California's increased regulatory environment. However, there are two simple explanations. First, in 2012, the grower spent over \$60 per acre in chipping costs, and he had no tree removals in 2018. That alone explains over 70% of the regulatory cost differences. He made two additional decisions that greatly affected the costs of education and training: he let his pesticide license expire, so he did not have the cost of continuing education, and he now harvests everything mechanically, saving the cost of training harvest crews. Also, because his peaches are harvested for canning, they do not have the same level of food safety requirements as those harvested for fresh market.

Medium Stone Fruit Grower – Southern SJV

The medium stone fruit producer primarily grew for the fresh market, though at harvest some of the crop might be sent for frozen processing depending on market conditions. They also grew a variety of citrus and almonds. Since 2012, this grower has expanded by purchasing more land for citrus and almonds. They have also removed several peach orchards to transition to almonds. The new trees are also topped at 8-9 feet to reduce labor costs. In another labor-saving adaptation, they are also testing platform picking machines. Peaches now comprise just under 10% of their total farm acreage, down from 1/3 of the 2012 acreage.

The farm is family owned and operated, and two of the three owners share the management responsibilities of the farm. They hire their own workforce and have 20 fulltime employees with two farm managers. The owners handle all of the required safety training, which includes pesticide safety, sexual harassment prevention, ladder safety and pruning safety. Everyone attends three trainings on these topics per year, and the farm managers and owners also invest time in attending and/or preparing and presenting materials. The owners also maintain their own PCA licenses and provide those services for the farm; those trainings involve 16 hours per year for each of the three owners. The owners also work to stay abreast of changing labor regulations, which takes about four hours per year. Food safety is an area of increased compliance; the two farm managers each spend about eight hours on food safety training per year and each employee spends at least 1.5 hours per year on training for food safety. Combined, education and training for regulatory compliance costs the growers \$24.83 per acre.

Air quality regulations for the growers include burn permits and CMP fees. The owners spend about four hours each filling out forms, but the farm roads do not need to be sanded or watered for dust control. However, with the number of orchards removed, they did have chipping and chip removal costs, which were reported as \$400 per acre. As in 2012, this farm's air quality compliance costs were by far the highest of any category, at \$335.26 per acre, or 62.8% of their total compliance costs.

Water quality compliance primarily includes the water coalition fees for the whole farm, as well as preparing and filing the NMP. The owners each spent time preparing for SGMA implementation by attending GSA meetings through their irrigation district. The NMP does not yet call for well testing, however, water quality tests are required for food safety and are recorded under that category. The farm's cost of water quality compliance in 2018 was \$7.70 per acre or 1.4% of regulatory costs.

For pesticide regulation, the additional regulatory costs (besides the education and training reported above) involve filing pesticide use reports and record keeping; this mostly falls to one of the owners and he estimates it takes 80 hours. The farm does not require buffer zones, and no outside PCA is needed for stone fruit. Pesticide regulations are calculated at \$9.67 per acre, or 1.8% of regulatory costs.

As this farm produces fresh fruit, the Produce Rule of FSMA caused an increase in regulations that were not evident in 2012. One of the owners takes responsibility for documenting the food safety plan and monitoring the farm's food safety activities, and he spends about 40 hours per year on those tasks. Harvest foremen have various equipment and training responsibilities that take about 15 hours per year. Worker hygiene requirements take 20 minutes per day all season for each worker; equipment sanitizing takes about seven hours each season and toilets are cleaned weekly. An external food safety fee is charged per box at the packing house. The owners must test the farm wells for microbial contamination; this takes about a day of one owner's time, and another day is spent in updating the food safety plan each year. Overall, compliance with FSMA amounts to \$112.50 per acre, or 20.1% of the farm's regulatory costs.

Because the farm employs their own workers, all labor health and safety requirements are their responsibility. They supply ice, water, cleaning and other supplies for the toilets, as well as personal protective gear for their employees. One of the farm managers spends about an hour of time each day during the season to ensure that water is available. These items add up to \$10.78 per acre, or 2% of regulatory costs.

The farm invested in software to monitor soil moisture as a result of SGMA implementation, and also pays \$4,000 per year in various agricultural organization memberships to keep up with regulatory requirements. These capital investment and risk management costs for regulatory compliance are, respectively, \$0.19 and \$7.43 per acre, and combined they account for 1.5% of regulatory costs. The farm did purchase a new tractor for \$50,000 under a cost-share program in preparation for future regulatory requirements. However, we did not include that cost as a 2018 regulatory expense.

The farm does not fall under the Affordable Care Act as it has fewer than 50 employees. However, they do incur labor wage regulatory costs, though they have tried to minimize them by eliminating piece rate pay. The largest cost is the mandatory three days of sick leave provided to each worker. Other costs include the filing of payroll and fuel taxes and one owner's time spent checking for any wage garnishments for employees. The total value of labor wage regulations sums to \$25.42 per acre, or 4.8% of regulatory costs. Overall, the growers' cost of regulation is \$533.78 per acre, or 9.5% of production costs.

2012 to 2018: This grower had the largest increase in regulatory compliance in the study; from \$41.95 in 2012 to over \$500 per acre in 2018, which is a 1,173% increase. The most significant changes were in air quality, primarily from chipping, which increased tenfold because so many orchard acres were removed. Education and training costs increased by almost \$20/acre; employees must now be trained on many other areas such as heat stress and food safety. Several categories that either didn't exist or were very negligible in cost are now significant for this grower; most notably food safety (increased over \$100 per acre) and labor wage requirements

that increased from \$0 to \$25.42 per acre. In addition, since these growers handle the training and most certification work themselves and hire their own workers, one might argue that their costs might be higher than average because they are relatively small and don't gain efficiencies from spreading out costs over more acreage.

Tree Nut

Four tree nut growers were interviewed; two large, one medium and one small.

Large Tree Nut Grower 1 – Northern SJV

This farm in northern San Joaquin Valley farms mostly almonds, with a small acreage of walnuts.

This farm employs most of its own workers but has increasingly turned to labor contractors. Education and training for regulatory purposes comprise hundreds of hours of time among the 13 employees, two ranch managers, one farm manager and the owner. Everyone affiliated with the farm participates in quarterly meetings that last six hours each and cover comprehensive topics such as chemicals, equipment, food safety and overall safety trainings. In addition, the employees must all undergo respiratory training, which costs \$30 per person, and each person is screened for asthma, as that creates another level of caution for respirator use. Employees also participate in tailgate meetings, which are run by supervisors and take about an hour per week. Supervisors must also take sexual harassment prevention training, which costs \$50 per person and takes four hours. Training for water quality issues, sediment erosion control and maintaining the owner's pest control license adds another 28 hours of time spent in regulatory education and training. Overall, the grower's cost of education and training for 2018 was \$16.20 per acre, or 8.7% of regulatory costs.

Air quality regulations comprise the largest component of this grower's compliance costs. These costs include burn permits (\$26 each) for each burn site, as well as permits to run irrigation motors (\$75 each). The largest costs are in dust mitigation on roads and in the orchards during harvest, as well as orchard removal. The grower spends over 240 hours in labor and equipment time to oil the farm roads each year; an employee spends about 1.5 hours each day during the growing season conducting this task, and the materials cost \$3,500. The most significant cost in 2018 was the cost of chipping 75 acres of an orchard and incorporating the chips into the ground at a cost of \$1,000 per acre. This is an annual activity, as the grower replants about 5% of the trees each year. There is no longer a cogeneration plant that will take the chips; most plants have shuttered so growers have had to adapt. Another costly regulatory practice is that of reducing the number of passes with the almond sweeper to one during harvest. The employees now complete the final stage of harvest with hand rakes. Four people can complete 100 acres in a 10-hour day, so this practice takes more than 600 hours of labor. The total cost of air quality regulations is \$65.49 per acre, which is 35% of the farm's regulatory cost.

Water quality regulations have increased, with several new programs including sediment erosion and nitrogen control plans. The grower belongs to two water waiver coalitions; both cost \$4.75 per acre. The owner spends at least two days per year filling out and filing the NMP, and also

spends about 12 hours of time annually testing wells for nitrates. Each of the 20 well tests costs \$35. In addition, the sediment erosion control plan takes several hours of training each year and requires the grower to plant cover crops at a cost of \$25-30 per acre. Overall, water quality regulations cost \$10.76 per acre, which is 5.8% of regulatory costs.

Pesticide regulations comprise the second largest regulatory cost for this farm. Though the owner has both his PCA and Certified Crop Advisor (CCA) license he also contracts with an outside PCA for \$25 per acre. The owner enters the use reports, though this is more efficient with the use of an automated software program; it only takes about two hours per month during the season. The grower noted that fumigation costs have increased significantly, for both the application and the chemicals. Regulations restrict the allowable acreage for fumigation at one time, so the applicator has to make multiple trips for larger fields. The grower estimated that the extra trips cost an additional \$200 per acre over the 5% of the farm's annual fumigated acreage. Overall, the grower's costs of pesticide regulation in 2018 was \$35.35 per acre, or 18.9% of total regulatory costs.

Food safety regulatory costs are minimal at this point, but growers must accurately label their trucks with the potential for pathogens; all almonds in the U.S. are pasteurized and fumigated. The cost of certification for this verification labeling only added \$0.33/acre in regulatory costs.

Labor health and safety requirements included the cost of supplying toilets and handwashing facilities, clean cool water and personal protective gear, which cost \$14.60 per acre and contributed 7.8% of total regulatory costs.

To reduce the dust at harvest time, the grower invested in a \$175,000 'low dust' pickup machine, but he took advantage of a subsidy program in which he was paid \$36/acre to use the machine for three years. That left \$13,000 to allocate over the estimated 10-year lifespan of the machine. The owner also uses an automated farm management software program that he estimates 10% of its use is in regulatory reporting and recordkeeping. The farm's capital investment for regulatory compliance is \$.95, or 0.5% of the total. This grower has taken advantage of a number of voluntary grants for equipment replacement and has replaced multiple pieces of equipment and converted several diesel irrigation pumps to solar.

A significant regulatory change for this grower is the advent of the Affordable Care Act. The business is large enough to be required to pay health coverage for all employees; the grower pays \$48,000 per year, and a staff member spends about 48 hours per year in reporting and renewal requirements. This adds \$34.59 per acre, or 18.5% of regulatory expenses. Labor wage requirements are another important change in regulatory costs; the three days of sick leave for each employee add \$10.69 per acre, and account for 5.7% of compliance costs.

In total, this grower spends \$188.96 per acre for regulatory compliance, which is 5.2% of production costs.

2012 to 2018: In 2012, this grower's cost of regulation was \$64.60 per acre; by 2018 regulatory costs increased by 192%. The regulatory proportion of production costs more than doubled; regulations accounted for 2.5% of production costs in 2019. The most significant regulatory cost

increases for this grower involved labor; primarily health care regulations and mandatory sick leave and reporting time, neither of which existed as regulatory costs in 2012, and labor health & safety costs also substantially increased. The loss of the co-gen plant and subsequent increase in chipping costs more than doubled the cost of air quality compliance. No regulatory categories showed a decreased cost.

Large Tree Nut Grower 2 – Southern SJV

This large grower farms several thousand acres that are planted about 80% in almonds and 20% in pistachios. Their cropping mix has stayed relatively the same since 2012, with small acreage of table grapes added in.

Education and training for regulatory compliance is primarily handled by an outside firm at a cost of \$16,400 annually. All employees attend monthly safety meetings, in addition to weekly tailgate meetings. To encourage safe workplace behavior and to incentivize trainings, the farm hosts an annual safety barbeque in which awards are presented. The owner and managers also take part in these trainings. The farm hired a human resources director two years ago who is primarily tasked with employee safety training. A manager keeps up with pesticide and fertilizer trainings, and managers must also attend sexual harassment prevention trainings. Overall the cost of education and training for regulatory compliance costs \$50.67 per acre, or 11.2% of the total regulatory expenses.

Air quality compliance is this grower's second highest cost of regulatory compliance. They require a burn permit as well as six CMP plan registration fees. One person is responsible for all regulatory compliance, the largest of which is air quality, so the costs of that \$65,000 salary are accounted for in this category. Dust mitigation on roads is one of the largest components of regulatory costs, as the labor and equipment costs for watering roads is \$65/hour, and the material costs for crushed asphalt was \$26,500 in 2018. The farm also spent \$175,000 on chipping/removal for orchards; the chips went to one of the remaining co-gen plants in the valley. The cost of air quality compliance in 2018 was \$121.88 per acre, or 27% of the total regulatory costs.

Water quality costs are partly recorded in food safety, as some of the water testing is required under food safety regulations. The farm belongs to a water coalition that costs \$500 per year and has also had to prepare an NMP which took 60 hours of a manager's time. The farm falls within a SGMA GSA, and the cost in 2018 was \$1.50 per acre. Total water quality costs (excluding food safety water quality costs) were \$3.56 per acre, or 0.8% of regulatory costs.

Pesticide regulation includes 24 hours of the manager's time annually, and he estimates that biological controls for navel orange worms rather than using insecticides cost \$14 per acre. The PCA costs \$20 per acre, so the total cost of pesticide regulatory compliance is \$35.36 per acre.

Food safety is a significant cost for this grower; he has a part-time clerical employee who handles the food safety documentation, and has management, field staff and foreman time invested in food safety practices. The grower pays an external audit service to conduct a "dummy" audit to prepare for the real audit. Third party audits cost \$3,500 and raw product

testing costs \$1,750. In addition, wells must be tested for microbial contamination at \$4,800 per year. Their total cost of food safety compliance for 2018 was \$28.58 per acre or 6.3% of total regulatory expenses.

Though this farm relies on contracted labor for 20% of its hourly workforce, it shares the cost of some of the labor health and safety requirements with the contractor. The toilets and sanitation facilities and supplies are supplied solely by the contractor, but the farm shares in the cost of water provision, shade structures and personal protective gear. These regulatory costs add up to \$7.33 per acre, or 1.6% of total regulatory costs.

The grower made significant capital investments in 2018 with respect to water quality and quantity monitoring on each well. Technology was installed on each well to measure and record both water quality indicators and amount of water pumped at a cost of \$109,000; these are to comply with food safety requirements and to prepare for SGMA. The farm also upgraded chlorine systems to improve microbial tests. These investments accounted for \$37.83 per acre in 2018, or 8.4% of regulatory costs.

To mitigate risk of regulatory liability, the farm added insurance for pesticide drift liability to its policy for a premium of \$12,000. The per acre cost of risk management for regulatory issues was \$4.00 per acre, or 0.9% of the total regulatory costs.

The grower falls under the Affordable Care Act requirements and spends \$12,816 in health insurance premiums for the workers who are attributed to the farm operation, as this grower also has a separate farm-related business that shares employees. Reporting requirements for ACA are covered under the HR costs documented in a previous section.

Labor wage requirements are this grower's largest regulatory expense; he estimates these costs at 8% of total payroll, which includes sick leave and nonproductive time expenses. The grower estimates that it costs \$25,000 in staff time to file payroll taxes, employee forms and fuel taxes. The grower also incurred \$25,000 in legal fees associated with a regulatory wage rate dispute with an employee. This category of expenses adds up to \$158.33 per acre, or 35% of regulatory costs.

Overall, this grower spent \$451.81 per acre on regulatory compliance in 2018, or 8.9% of production costs.

2012 to 2018: This grower's regulatory costs increased by 233% from 2012. The largest increases fell in the labor wage requirements, which escalated to \$150 per acre from zero, and air quality compliance increased from \$38.12 per acre in 2012 to \$121.88. Food safety compliance increased from \$0 to \$28.58, and pesticide regulation increased from just over \$1 per acre to more than \$35 per acre. The grower also must provide health insurance, increasing these costs from \$0 to \$4.27 per acre. In addition to the overall costs of regulation more than doubling; regulatory expenses comprised a much larger costs of production; in 2012, regulatory costs were 3.9% of production costs; they now comprise almost 9% of production costs.

Medium Tree Nut Grower – Central SJV

This medium-sized tree nut farm also grows citrus and melons; almonds comprise about 60% of the farming enterprise. The enterprise is similar to 2012 except that the cherry acreage was removed because of high labor costs, and more acreage is now devoted to melons.

The farm is family owned and has three full-time hourly employees; the owner also manages the operation. A family member also helps with management responsibilities. Education and training for regulatory compliance are provided by an outside company for \$4,200 per year; all employees participate in respirator fit test, heat stress, pesticide and forklift training. These trainings take place six times per year and take about 45 minutes each for all employees; tailgate trainings also occur throughout the year. The owner maintains his private applicator's license, which takes three hours of training per year, and he also has CPR certification. The owner also attends several hours of Almond Board meetings each year to keep up with regulatory compliance issues. Overall, maintaining compliance with education and training requirements cost \$34.06 per acre in 2018, or 14.4% of the total regulatory costs.

Air quality regulations include a burn permit that costs \$80, and an application fee for a CMP at \$117. The grower spent two hours updating maps for the farm and filling out forms for the plan. The farm hires out dust control on the road and spends about \$2,000 per year, using oil instead of water. The grower spent \$600 to install a sprinkler system around the shop to mitigate dust from trucks; it was much more cost effective than having an employee hose it down every day. The farm must shred pruned tree branches, that costs \$1,700 per year. The farm also owns new Tier 4 tractors that require DEF; that costs \$100 per year for the farming operation. Overall, the grower spent \$32.91 on air quality compliance in 2018 or 13.9% of regulatory costs.

Water quality regulatory costs include the Kings River Water Coalition, which costs \$531 annually. The farm uses an outside consulting group to create the NMP and file the paperwork. The owner spends about five hours of time on providing information to the consulting group regarding crop acreage, yield, etc. The well closest to the house must be tested every year at a cost of \$195. The overall cost of water quality regulation for this grower was \$7.35 per acre or 3.1% of regulatory costs.

Pesticide regulatory compliance is largely wrapped up in the cost of chemicals, as the PCA's services and reporting are included as part of the pesticide purchases. The grower spends about 10 hours per year posting buffer zone signs, so the cost of pesticide regulation as he experiences it is \$5.91 per acre, though he is indirectly paying for use reporting, tissue sampling and other services through increased costs of chemicals.

The grower pays \$4,000 for a food safety general management plan for Global GAP certification. He also spends time each month inventorying the chemical room for products used on his almonds and fruit crops; this task takes about 50 hours a year. He also is required to ensure that proper signs are posted regarding hand and eye wash protocol, proper storage, etc. The cost of food safety regulations was \$53.79 per acre, or 22.7% of regulatory costs.

Labor health and safety requirements are comprised of about \$100 per month for toilet and handwashing facilities and supplies, as well as drinking water testing for the employee's water supply. The cost of supplying water and ice is about \$500 per year, and the shade structures cost about \$1,200, but those last about five years. The grower spends about \$250 each year on personal protective gear for his employees. The cost of this regulatory category is \$17.18 per acre, or 7.3% of the total cost of regulations.

This grower had no reported costs of capital investment or risk management in 2018, however they did participate in a number of cost-share programs for mobile equipment and intend to continue to take advantage of these programs.

The farm does not meet the requirements for the Affordable Care Act. However, the owner is required to provide three days of paid sick leave as labor wage requirement, and he spends about 125 hours per year filing various required employee forms, payroll taxes and fuel taxes. These labor wage requirements cost \$88.75 per acre, or 37% of his regulatory expenses.

The total cost of regulation in 2018 for this medium almond grower was \$239.95 per acre, or 8% of production costs.

2012 to 2018: The regulatory costs for this grower increased by 31.65% from 2012 to 2018. Air quality compliance was particularly expensive for the grower in 2012 as he had removed 30 acres of almonds that year; the shredding and chipping costs added \$90 per acre. Thus, the air quality category decreased in 2018 from \$166.62 to \$32.91 per acre, because only the tree prunings had to be shredded in 2018. Food safety costs increased from \$0 to \$53.79 per acre, and labor wage requirements increased from \$0 to \$88.75 per acre. The regulatory portion of his production costs increased slightly, from 7.5% of overall costs to 8% in 2018.

Small Tree Nut Grower - Southern SJV

This small tree nut producer grows less than 50 acres of almonds, and the rest of the farm is dedicated to stone fruit and citrus.

Education and training comprise a significant portion of this grower's regulatory expenses; his almond farm is a separate entity from a larger, jointly owned family operation. However, he uses the same labor force as the rest of the farm, and so his costs of regulatory compliance are the same as for his other operation, with the exception of food-safety and stone fruit specific trainings. The farm owners maintain their own PCA licenses and provide those services for the farm, so the time involved in trainings and certifications are included in this category. The grower also attends about three days of meetings for water use and almond regulations annually. Overall, his costs of regulatory compliance are \$78.14 per acre for education and training, which is 33.5% of his costs of regulation.

Air quality regulations are minimal for this grower as his farm is too small to require a CMP which would require dust control and other air quality mitigation measures. He spends about five hours per year calling to schedule burns of tree prunings, and his burn permit costs \$38. Air quality compliance costs \$10.08 per acre, or 4.3% of regulatory costs.

As with other growers, water quality compliance costs have increased, but some were not fully phased in as of 2018; the grower had to provide a soil test in 2019 as well as an NMP, but these were not part of 2018 regulatory costs. The Kings River Water Coalition fees as well as paying a consultant to develop the NMP occurred in 2018; this amounted to \$11.25 per acre, or 4.8% of regulatory costs. SGMA costs are unknown at this point but will likely incur higher fees in 2020 and beyond.

Maintaining compliance with the Department of Pesticide Regulation was the largest regulatory cost for this farm; he pays an independent PCA for the almonds that amounts to over \$27 per acre, and he maintains his private applicator's license. The grower also files his own paperwork for pesticide reporting, which takes about 20 hours of time throughout the year. The grower's cost of pesticide compliance was \$92.44 per acre, which was almost 40% of his regulatory costs.

While almonds are currently not regulated under the Produce Rule of FSMA, there was some discussion as to whether they would be in 2018, and the grower attended 8 hours of meetings in 2018 in preparation. This was his only food safety regulatory cost in 2018, and it amounted to \$14.44 per acre, or 6.2% of regulatory expenses.

The farm reported no capital investment for regulatory purposes, and it also falls below the ACA threshold. The farm also has no labor wage requirements reported, as those are absorbed by the larger farm entity. However, the farm does maintain a Farm Bureau membership to stay ahead of regulatory issues, which costs \$6.94 per acre, or 3% of regulatory costs.

This grower's cost of regulatory compliance is \$233.17 per acre or 10.7% of production costs.

2012 to 2018: This grower's regulatory costs increased by 122.7%, with increases in every category. Those areas with the most dramatic rise include air quality (\$1.48 vs. \$10.08 in 2018), pesticide regulations (\$15.57 vs. \$92.44) and food safety, which was not included in 2012 and has risen to \$14.44 per acre in 2018. Labor health and safety requirements went up fourfold, and water quality compliance more than doubled. The impact of regulatory costs on production also doubled; in 2012 regulatory costs comprised 5.1% of production costs while in 2018, they accounted for 10.7% of production costs.

Processing Tomatoes

Processing tomato interviews include two producers in the San Joaquin Valley, one medium and one large grower.

Large Tomato Grower – Central San Joaquin Valley

This grower is a large, diversified vegetable and field crop producer, with over 5,000 acres of crops. Processing tomatoes comprise about ¼ of their production.

Education and training for this grower consists of quarterly meetings that cover fertilizer, tractor safety, pesticide safety, heat stress, sexual harassment prevention and forklift safety. Some trainings are for the entire workforce and some are job specific. Anyone with supervisory

responsibilities completes CPR training. In addition, the farm holds weekly tailgate safety meetings specific to the current tasks on the farm. An outside consultant conducts the safety trainings, their fee is \$10,000 annually. Managers undergo sexual harassment prevention training, and various management level employees spend time training on the labor and employment issues, pesticide certifications, water quality and food safety issues. Overall, the time invested in trainings adds up to over \$30,000 and the per-acre cost of compliance is \$4.70 per acre, or 6.5% of regulatory costs.

Air quality compliance costs consist of burn permits and CMP fees that cost over \$2,500. A manager spends about 15 hours annually filling out forms for the plan. As with many other growers, the largest component of air quality compliance is dust mitigation on farm roads. This farm has nearly 700 hours of employee time invested in this task annually. They grade the roads prior to running the water truck, and the farm tries to use as much recycled asphalt and gravel and other similar materials to reduce the dust. The grower's cost of air quality compliance in processing tomatoes was \$3.89 per acre, or 5.4% of regulatory costs.

Water quality compliance is this grower's largest regulatory cost category; the farm spends almost \$15,000 annually in water waver coalition fees. The farm is now required to complete an NMP, and staff spend 40 hours annually filing paperwork and developing the plan. Wells must be tested for nitrates. The farm also encompasses several water districts and pays fees to belong to various GSAs that amount to \$19 per acre. In addition, the grower spent many hours in 2018 attending meetings for SGMA compliance and impending groundwater sustainability plans developed by the GSA, approximately 10 hours per month. Overall, the farm spent \$25.72 per acre in water regulatory compliance in 2018, which was 35.5% of the total regulatory costs.

Pesticide regulatory costs include filing use reports, which takes over 500 hours annually. The farm uses an outside PCA, but those services are included in the cost of chemicals, so this regulatory area is underreported in terms of costs. The farm's only other reported cost of pesticide regulations is in posting buffer zone signs, as well as recording the time and date of posting as well as sign removal, which is part of the compliance process. The farm's reported cost of pesticide compliance is \$3.02 per acre, or 4.2% of regulatory costs, but this is likely far lower than the actual costs of compliance because of the hidden costs of regulation.

While processing tomatoes are generally exempt from the Produce Rule of FSMA, because this farm is large and diversified, there is a spillover effect into tomatoes for food safety compliance. The grower reports many hours spent by clerical, management and field staff on food safety issues and documentation as well as self-audits by the farm's staff. Sanitizing equipment is another time-consuming task conducted as part of food safety requirements. Food safety compliance costs \$3.00 per acre, or 4.1% of total regulatory costs.

Providing supplies and water for labor health and safety costs over \$40,000 per year, and includes toilets and handwashing facilities and supplies, water jugs, water and ice provided to employees as well as shade structures for field workers. The farm also provides safety equipment such as goggles, gloves, and other protective gear. Labor health and safety requirements cost \$6.07 per acre, or 8.4% of total compliance costs.

The farm reported miscellaneous compliance activities such as notifications to dig to various utilities, registering the truck scale, and hazardous materials registrations that cost \$0.35 per acre.

Providing health care to workers is the farm's second largest regulatory category; in 2018 the farm spent over \$170,000 in health care premiums. They purchased a software program to aid in reporting compliance and spend 30 hours of staff time in ACA compliance. Overall, the farm spent \$24.46 per acre in 2018, or 33.8% of regulatory costs.

Labor wage requirements were reported as paid sick leave time for hourly and salaried employees for sick time actually taken in 2018 as well as 60 hours of reporting time for staff for payroll taxes and employee forms. This category was \$3.61, or 4.8% of total costs.

Overall, this grower spends \$74.81 per acre on regulatory costs, or 2.1% of total production costs.

2012 to 2018: This grower was one of the few that reported lower costs of regulations as compared to 2012. Part of that may be because we were unable to schedule an in-person interview, so we may not have been able to fully document the opportunity costs of management and staff time that are spent on regulatory activities. The largest regulatory cost categories that showed declines were in air quality and pesticide regulations. The grower reported far fewer hours spent in dust control activities on farm roads in 2012, perhaps because there are fewer miles of farm road that require daily watering; the manager tries to use recycled gravel or asphalt to cover road surfaces as often as possible. Pesticide regulatory costs decreased because the grower reported many hours spent in hand-weeding buffer zone areas around tomato fields in 2012, this cost was not reported in 2018. Significant cost increases occurred in the health care (\$0 to \$24.46) and water quality requirements, which increased by over \$20 per acre. Overall, the grower's reported costs of regulation decreased, from \$77.91 per acre in 2012 to \$73.53 per acre in 2018, a 5.6% decline.

Medium Tomato Grower – Central SJV

This grower has a diversified farm that includes processing tomatoes, grain, alfalfa, almonds and grapes. The processing tomatoes comprise about 20% of the farm's total acreage.

Regulatory costs for education and training include quarterly meetings of three hours each for all of the farm's 12 employees, as well as the owners and managers. General safety issues, tractor, forklift, compressed air and heat stress topics are covered. Typically, the insurance company conducts the trainings and other times a contractor or consultant does them, and their fee is about \$200 per training. Depending on which chemicals are being used on the farm, several employees have to undergo respirator training. The owner and managers have to attend sexual harassment prevention training as well, and the owner spent four hours to self-certify in water quality assessment, which then will require two hours of training each year going forward. The owner also attends SJVAPCD hearings to keep updated with air quality regulations. He also maintains his private applicator's license which takes six hours of time annually. The cost of maintaining education and training compliance are \$7.55 per acre, or 3% of the total regulatory costs.

Air quality regulatory requirements include a burn permit, and three CMP fees of \$117 each. The grower was audited by the SJVAPCD in 2018 and spent about two hours going over his plan and walking through the farm with the regulators. His manager also spends about 10 hours annually reporting truck and tractor use for regulatory requirements. The largest cost of compliance is in watering roads around the farm for dust mitigation; from mid-April to early October, the water truck runs a double shift six days a week. The grower estimates the cost of water, labor and equipment to be \$73 per hour. The costs of air quality compliance add up to \$99.11 per acre, or nearly 40% of the total regulatory costs.

Water quality regulations are comprised of the water waiver coalition fee of \$3.35 per acre. His manager takes care of the NMP, a new requirement in 2018, which requires well testing four times per year in addition to soil and plant material tests. The grower estimates these costs at \$15 per acre. His manager spends about 30 hours per year filing reports with the Regional Water Quality Control Board, and then manages the nitrogen budget and documents how well it corresponds to the NMP. This grower is in an area that will be greatly affected by SGMA, and the cost of the GSA that governs the local groundwater basin is \$10 per acre. In addition, this grower is very involved in both the water quality coalition as well as the GSA and estimates that he spent 200 hours of time on these efforts in 2018. The cost of groundwater quality regulations was \$47.89 in 2018, or 19.1% of the overall regulatory costs. These do not include the upcoming Central Valley Salinity and Alkalinity (CV SALTS) program, that will be paid via the irrigation districts starting in 2019. The grower also estimates that the costs of SGMA will likely double from its 2018 costs as it is fully implemented starting in 2020.

Pesticide regulations are this grower's second largest cost of regulation; his manager spends about 100 hours annually in filing and reporting pesticides used. The grower uses Agrian, an agricultural software package, which reduces the reporting time. The tomato cannery requires a pesticide use report before harvest. New chemicals are now in use because of stricter pesticide regulations; one product used for black mold costs \$8/acre more than the old fungicide and the new wormicide, BELT, costs \$6/acre more than the previous product, Lannate. The grower uses a PCA on the tomatoes for the purposes of nutrient and water management to help with regulations, and the PCA fee is \$32/acre. Overall, the cost of pesticide regulation is \$50.54, or 20.2% of regulatory fees.

Processing tomatoes currently do not fall under the Produce Rule of FSMA, so the grower did not report any costs specific to food safety regulations. With respect to labor health and safety requirements, most of the provision of safety gear, toilet/sanitation facilities, water and shade structures are provided by the labor contractor. The grower reported a cost share of \$2.25 per acre for facilities provision and \$0.75/acre for personal protective gear; these are estimates based on a portion of the contractor's commission.

In order to reduce electricity costs imposed by PG&E's Time of Use rate change, the grower invested \$56,000 in technology to automate the irrigation pumps to run at the lower rate time; he can now control the pumps via cell phone. This cost was prorated over 10 years. The grower also replaced a stationary diesel engine in 2018 at a cost of \$48,000; the engine has a 4-year estimated life and will cover 600 acres. He also upgraded the Agrian software model because of the increased regulatory reporting time for requirements; the free version is no longer sufficient for

his purposes. This costs \$6,700 annually. The grower's capital investments for regulatory issues were \$25.76 per acre or 10.3% of regulatory expenses.

The grower also increased his liability insurance coverage to allow for additional regulatory liability; that cost is \$1,000 per year; which was only 0.2% of regulatory costs.

The Affordable Care Act does not affect this grower as the number of employees is below the benchmark. However, he must now provide three days of sick leave for his three full-time employees and managers. His office assistant spends about 25% of her time filing employee forms, payroll and fuel taxes. The grower's labor wage requirements cost \$16.01 per acre, or 16.4% of overall regulatory costs.

Overall, this grower spends \$250.33 per acre on regulatory costs, or 9% of his total production costs.

2012 to 2018: This grower had one of the lower increases in regulatory costs; even though some cost categories increased substantially, others stayed nearly the same or decreased. Air quality regulatory costs doubled, water quality regulatory compliance went up nearly tenfold and the farm made significant capital investments to offset regulatory costs. However, reported costs of pesticide regulation decreased, mostly because of a lower PCA fee reported at \$32 per acre in 2018 vs \$48 per acre in 2012. The cost of filing pesticide regulatory paperwork also decreased with the use of software. The cost of regulatory compliance increased by 68% during the study period. In 2012, regulatory costs were 7% of production costs, and in 2018, they comprised 9% of production costs.

Grapes

Four grape growers were interviewed; two large and two medium in various regions of the San Joaquin Valley. The cases were split among wine, table and raisin grapes.

Large Grape Grower 1

This large wine grape grower in the Northern San Joaquin Valley had undergone significant changes in his operation since 2012. He was now down to 100 acres of grapes from over 500, and primarily has the grape acreage as a way to keep his six to seven employees fully employed throughout the year. He primarily grows tree nuts, which otherwise do not require year-round, full-time labor. He also likes to be more diversified, providing another reason for maintaining his grape acreage, which comprises about 15% of his farming operation.

Education and training take about 40 hours per year per employee, and he sends employees to monthly Farm Bureau workshops for trainings for all compulsory areas of pesticide, equipment, water quality, heat stress, and overall safety issues. These trainings cost \$1,000 per person. As the owner, he attends an additional eight hours over the 40 that his employees participate in. The grower's total cost of education and training for regulatory compliance is \$31.83 per acre, or 13.3% of regulatory costs.

Air quality regulations comprised the second highest regulatory area in 2018; these costs include a burn permit and three CMP fees, and the grower estimated that he spent 24 hours filing reports and filling out forms for the plan, as he was required to file an update. As with many SJV growers, his largest compliance cost is for dust control; he estimates that it costs \$20/acre to apply sand annually to the perimeter roads and his employees spend 8 hours per week for 20 weeks. The equipment operation costs \$25 per hour plus labor, and he estimates the water costs at \$200 per week. Overall, the grower spent \$44.11 on air quality compliance or 18.4% of total regulatory costs in 2018.

Water quality compliance costs have increased by 1,213% since 2018 for this grower and are his largest regulatory cost category. He belongs to two water quality coalitions that each cost \$5 per acre. His farm now requires an NMP, on which he spends about 50 hours per year, as he does all of the filing and reporting himself. The grower must take part in 4 hours of training each year to keep his self-certification for water quality compliance. He has 10 wells that must be tested, he estimates that costs \$1 per acre. The grower has attended many SGMA meetings to stay updated on compliance issues as the GSP was written, as his farm falls within two white areas and one water district. He spent about 25 hours per month attending meetings in 2018. In addition, the GSA now imposes a \$19 assessment, starting in 2018. The grower's overall cost of water quality compliance was \$97.92 per acre, or 41% of regulatory costs.

The grower files his own paperwork on pesticide use reports, which takes about four hours per month, and is the only reported cost of pesticide regulation. However, he did note that using approved biologically based pesticides take increased application time as the chemicals have to be used more often. His reported cost of pesticide regulation is \$10 per acre, or 4.2% of regulatory costs.

Food safety regulatory costs are minimal for wine grapes; he spends about two hours per month on documentation, and his employees spend about six hours per month in total on food safety regulatory activities. His cost of food safety regulation is \$7.18 per acre, or 3% of total compliance costs.

Labor health and safety requirements, including toilet provision, shade structures and water/ice cost \$12 per acre, by the grower's estimation. Providing gloves, goggles, and personal protective gear were estimated to cost another \$10 per acre, bringing the cost of this category to \$22 per acre, or 9.1% of regulatory costs.

The grower reported no capital investment or risk management costs that were due to regulation, and his operation falls below the ACA requirements. However, he does have to provide three days of sick leave for each employee, and it takes 8 hours of his time per month to file employee forms and payroll taxes. Though it wasn't a requirement in 2018, the grower noted that he would soon have to file plans for hazardous material and waste in case of fire. In 2018, however, the grower's cost of labor wage requirements was \$26.37 per acre, or 11% of his total regulatory expenses.

The total costs of regulatory compliance for this grower was \$239.40, or 9% of his production costs.

2012 to 2018: The costs of regulation increased by 290% for this grower, most notably in the areas of air quality, education and training, labor wage and safety requirements and water quality. The grower's cost of regulation was \$61.38 per acre in 2012. Air quality cost increases result from the higher prices for materials, labor and equipment, while the labor wage and safety requirements were nonexistent in 2012. Those two categories added almost \$50 per acre in compliance costs. Water quality monitoring, reporting and training all added over \$90 per acre to regulatory costs as compared to 2012. Regulatory costs comprised less than 2% of production costs in 2012, but 9% by 2018.

Large Grape Grower 2

The large table grape grower is located in southern San Joaquin Valley. The farm grows a variety of table grapes and citrus and has expanded the table grape acreage since 2012.

Education and training regulatory compliance programs are handled primarily by the labor contractor, but the full-time workers assigned to the farm operation undergo 40 hours each of comprehensive safety training, including pesticide, equipment and heat stress. Workers also have tailgate meetings during the workday. Most of the workforce also take part in a one-hour sexual harassment prevention training each year and food safety training takes 400 hours total in employee time. The grower's total cost of education and training compliance is \$7.80 per acre, or 3% of regulatory costs.

Air quality requirements include burn permits, and nine CMP filing fees. The grower's primary cost of air quality compliance is dust control, and while he estimates that the total cost is \$60 per acre in materials (the farm uses oil for dust mitigation) and \$20 per acre in road prep, which includes labor and equipment costs. Our previous interview noted that 60% of the dust control was for fruit quality, and 40% for regulatory compliance. Thus, we assessed \$32 per acre for those dust control measures. The grower's total cost of air quality compliance is \$32.66 per acre, or \$12.5% of regulatory costs.

Water quality compliance includes nearly \$4 per acre for two water waver coalitions. The farm must complete an NMP, which takes an employee 120 hours to develop. The farm does not yet have to test wells and soil each year; in 2018 they conducted these tests every other year, and the cost is about \$2,000. As most of the farm's land is within water districts now governed by GSAs under SGMA, the grower attended at least 60 hours of meetings in 2018 to prepare for the implementation of the groundwater sustainability plans. The farm's total cost of water quality compliance was \$6.85 per acre, or 2.6% of regulatory costs.

The grower uses a PCA to make pesticide recommendations, which costs \$1,800 per month, and even though the custom applicator takes care of the paperwork filing for use reports, the internal documentation of pesticide use and recordkeeping is \$2.50 per acre. The farm uses Agrian; the subscription that allows for regulatory documentation and filing reports costs \$4,000 annually. The grower's total cost of pesticide compliance costs \$8.90 per acre, or 3.4% of regulatory costs.

The implementation of the Produce Rule of FSMA is the farm's second most expensive regulatory category. The farm has a full-time food safety employee and also devotes additional

clerical staff time to food safety documentation and record keeping. Management spends about \$4,000 per year of time on food safety updates, and field staff spend about \$16,000 worth of time. Harvest foremen inspect equipment, clean and sanitize equipment and conduct trainings, which costs about \$10 per acre, and workers who clean machinery and ensure that sanitation facilities are clean adds another \$12.50 per acre. Internal food safety staff spend about \$2,200 per year in self audits, and third-party audits cost \$4,500. Raw product testing costs \$23,000 and microbial water tests cost \$600. Staff members spend about \$3,500 of time to update the food safety program; all told the farm spends \$53.08 on food safety compliance, which is 20.3% of the total costs.

Most of the costs of compliance for labor health & safety regulations are handled by the labor contractor and are included in the farm's 31% commission. The cost of toilet provision is accounted for under the food safety category, as that is also a requirement of FSMA. The farm pays for the workers' personal protective equipment, however, which costs \$2.50 per acre, or 1% of total regulatory expenses.

The farm was required to purchase a new truck to stay in air quality compliance as their old truck exceeded emissions standards; that capital investment added \$10.25 per acre or nearly 4% of regulatory costs.

By far the largest regulatory category for this grower is the Affordable Care Act and other labor wage requirements. The farm reimburses the labor contractor \$300,000 for health care premiums and non-productive time value, including sick leave taken by employees, up to three days per person. The farm also hired a lawyer at a cost of \$240,000 annually to stay ahead of the new labor laws. Filing employee forms, payroll taxes and fuel taxes costs another \$18,000 of employee time, bringing the total cost of ACA and labor wage requirements to \$139.50 per acre or 53.3% of regulatory costs.

The farms' total cost of regulation in 2018 was \$261.54, or 1% of production costs.

2012 to 2018: In 2012, this grower spent \$64.90 per acre, by 2018 regulatory costs had increased by 303%. The most significant cost increases were the Affordable Care Act, Food Safety and Air Quality. Only two regulatory cost areas decreased, that of labor health & safety requirements and a slight decrease in education/training costs. Those are both likely due to the increased reliance on labor contractors who absorb some those regulatory costs initially but are reimbursed via their commissions. The cost of regulations as a proportion of production costs increased by 142%.

Medium Grape Grower 1 – North SJV

The wine grape grower is in the Northern San Joaquin Valley and has a diversified farming operation that includes wine grapes, stone fruit and tree nuts. Their main change besides managing a larger proportion of acres, is that they are harvesting many more grape acres mechanically to save labor costs. They also added stone fruit acreage as compared to 2012. Wine grapes make up nearly 30% of their farming operation.

The farm is run primarily by family members who all take on various roles including management. The farm employs nine full time workers in addition to family. The cost of education and training to maintain regulatory compliance is \$4.43 per acre, or 2.2% of the regulatory costs. These costs consist primarily of safety training for all employees, managers and the owner, and is comprised of 30 minutes per month for each employee during the season. It includes tractor and equipment safety, ladder safety and heat stress. The owner and managers take part in separate safety trainings and keep up with heat illness training, these trainings are run by the workers' compensation insurance representative. Two of the primary owner/managers spend about an hour per month on labor and employment training as well as keeping updated on pesticide and fertilizer safety issues.

Air quality requirements include a burn permit in two different counties as well as dust mitigation on roads. The employees spend about 30 hours watering roads, and the farm spends about \$20,000 on DEF for their tractors and other mobile equipment. The farm removed over 50 acres of vineyards in 2018 and had to hire a crew of 10 workers for five days to remove treated stakes so that the vines could be burned. The farm's total cost of air quality compliance in 2018 was \$37.83 per acre, or 17.1% of regulatory costs.

The farm spends \$5,000 per year on water waiver coalition fees, and also must submit an NMP for ground water quality compliance. Two of the owners spend about 10 hours per year on the plan. In 2018 they did not have to conduct well tests and their farm did not report any costs associated with SGMA or a GSA. However, in 2019, the farm had to start sampling all wells on the farm annually, which took about 20 hours of time. In 2018, the total cost of water quality compliance was \$7.22 per acre, or 3.3% of the total costs, however those costs are scheduled to rise as regulations are phased in.

Pesticide regulations have changed since 2012; in 2018 a regulation regarding notification of nearby schools/daycare centers went into effect. Any grower with fields within ¼ mile of a school site must provide the schools with notification of pesticide applications, and include a list of pesticides, the map of the fields, the grower and applicator contact information and must also keep a list of the applications for two years. There is also a minimum distance of application based on the type of drift expected in the application, these range from ¼ mile to 25 feet. The grower has begun spraying exclusively after 6 p.m. and estimates that the notification and documentation take about five hours each year. The grower does not pay a separate PCA fee, and the PCA handles all of the reporting and documentation. However, the PCA cost is hidden in the price of the chemicals and it is very difficult to estimate the regulatory margin built into the grower's price. The owner reported spending about 50 hours per year recycling used hazardous material containers from the pesticides. Overall, the grower estimated a cost of \$2.12 per acre for pesticide regulations, but these are underreported because of the hidden nature of some of the compliance costs.

This grower reported no food safety compliance costs for wine grapes. For labor health and safety requirements, the farm provides toilets at a cost of \$450 per month and estimates the cost of providing water and ice at \$200 monthly. The grower spent \$2,000 on shade structures, which last for two years. One of the family employees spends about 1/3 of his time delivering ice and water to the work crews. Other regulatory costs include \$2,000 for personal protective gear. The

costs of compliance for health & safety regulations were \$21.32 per acre in 2018, or 9.7% of regulatory costs.

Capital investment for compliance reasons in 2018 consisted of purchasing two tractor cabs that are required for certain chemical applications. These cost \$25,000 each, and the costs are spread over seven years; resulting in a \$5.49 per acre cost, or 2.5% of total compliance costs.

Though the farm employs fewer staff than typically falls under ACA requirements, because the farm provides health insurance for family employees, they are required to provide insurance for all employees. The average cost for each employee is \$8,000 annually. In addition, the farm's bookkeeper spent about \$3,000 worth of her time to investigate new health plan options when their existing insurer increased prices by 18%. She also spends about \$300 of her time in reporting ACA participation to the federal government. Overall, ACA is the farm's largest cost of compliance at \$74.38 per acre, or 34.6% of regulatory costs.

Labor wage requirements follow closely behind, at \$66.18 per acre, or 30% of compliance expenses. The grower estimates that required breaks and nonproductive wage time costs \$50 per acre. In addition, the bookkeeper spends about 1/3 of her time on documentation and reporting payroll taxes and employee forms to government entities. Paid sick leave for each employee accounts for over \$10,000 annually.

The farm's overall cost of compliance in 2018 was \$220.99 per acre, or 6% of production costs.

2012 to 2018: In 2012, the grape grower's regulatory costs were \$60.99 per acre, compliance costs have risen 262% since then. The most significant increases involved employee regulatory expenses, as the grower now pays for health insurance and must provide sick leave for the workers. This grower was providing those benefits in 2012, but since they were not required, they were not counted as a regulatory cost. Air quality was another area that showed a large increase; this was primarily because of the regulatory costs associated with vine removal. The percentage of regulatory costs as a proportion of production costs increased threefold, from 2% of production costs in 2012 to 6% in 2018.

Medium Grape Grower 2 – Central SJV

The raisin grape grower is located in the Central San Joaquin Valley and has a diversified farming operation that includes wine/raisin grapes, table grapes and tree nuts.

In order to create an annual comparison this case will compare 2014 to 2019 costs. The main change for this grower between the two years was the removal of 17% of vineyard acreage that was replaced by nuts.

The farm is run primarily by family members who all take on various roles including management. The farm employs six full-time workers in addition to family. The cost of education and training to maintain regulatory compliance is \$17.08 per acre, or 8.9% of the regulatory costs. These costs consist primarily of training for heat stress, safety when operating equipment, pruning, and spraying, as well as food safety training and sexual harassment

prevention training. In addition, the owner spends on average four hours a month attending meetings to stay current with regulatory requirements.

Air quality requirements include a burn permit, the CMP fee, and dust mitigation practices on their roads. The employees spent 167 hours watering roads, and the farm spent nearly \$7,000 on contract work for dust mitigation. The farm's total cost of air quality compliance in 2019 was \$15.87 per acre, or 8.27% of regulatory costs.

The farm spends \$2,970 per year on water waiver coalition fees, and also must submit an NMP for groundwater quality compliance. The owner spends about 20 hours per year on the plan. They did not have to conduct well tests on the farm, but it will be a requirement in 2020. The owner's time spent associated with learning about SGMA was included in their education and training costs. In 2019, the total cost of water quality compliance was \$8.13 per acre, or 4.2% of the total regulatory costs, however those costs are scheduled to rise as regulations are phased in.

The regulatory costs associated with pesticides primarily consisted of time spent reporting and the cost of an outside PCA consultant. Due to the nature of the grape crop, they do not use chemicals that require posting or yielded buffer zone losses. The owner spent on average three hours a month on filing paperwork. The farm uses a PCA on a regular basis, but their costs are included in the price of the chemicals. In addition, they hire a PCA consultant that charges \$40/acre. The estimated cost for pesticide regulations is \$46.69, or 24.3% of total regulatory costs, but these are underreported because of the hidden nature of some of the compliance costs.

Raisins are included in the Produce Rule of FSMA, so the grower incurred regulatory compliance cost in this category. The owner spends three hours a week between March and September documenting for food safety. In addition, they performed a self-audit that took 50 hours and tested five wells for microbial presence. The total cost of food safety regulation was \$45.76 per acre, or 23.9% of total regulatory costs.

For labor health and safety requirements, the farm provides toilets at a cost of \$400 per month. Due to the small crew size, the grower spends \$200 a year on portable shade structures, which last for three years. Other regulatory costs include \$1,000 for personal protective gear. The costs of compliance for labor health & safety regulations were \$8.61 per acre in 2019, or 4.5% of regulatory costs.

Capital investment for compliance purposes in 2019 consisted of maintaining a specialized software license for reporting. This cost category totals \$0.69 per acre, or 0.4% of total compliance costs.

The farm falls below the minimum employee level for the Affordable Care Act and did not have any regulatory costs associated with risk management.

Labor wage requirements consist of the largest regulatory compliance costs at \$49.03 per acre, or 25.6% of compliance expenses. The grower estimates that paid sick leave costs about \$20 per acre. In addition, the owner spends 15 hours a week of her time on documentation and reporting

payroll taxes and employee forms to government entities. The grower does not hire any piece-rate work so does not pay for non-productive time.

The farm's overall cost of compliance in 2019 was \$191.91 per acre, or 7.46% of production costs.

2014 to 2019: In 2014, this grower reported regulatory costs of \$115.36 per acre with pesticide regulations making up 36% of total costs. All regulatory costs increased or stayed relatively the same except for air quality requirements. In 2014 the grower spent considerably more time watering roads. They now apply a dust binder for a contracted price and apply much less water, bringing air quality costs down from \$22.93 per acre to \$15.87. The largest increase was due to food safety which did not exist in 2014. In 2014, regulatory costs as a share of production costs were 4.96%, in 2019 they had increased to 7.46% of production costs.

Corn Silage

Five silage growers were interviewed; two large and three medium in various regions of the San Joaquin Valley.

Large Silage Grower 1 – Central SJV

This large silage grower farms multiple crops, both annual and permanent. The silage accounts for about 26% of the farm's acreage. All silage is fed to the dairy cattle.

Education and training for regulatory compliance is handled primarily by one employee who does most of the human resource work on the farm. He spends nearly three weeks of time conducting safety training for employees or in preparation for training sessions. Employees spend over 200 hours in training for various tasks such as tractor safety, pesticide safety and sexual harassment prevention. Farm supervisors spend about 60 hours annually checking that employees are using personal protective equipment. The farm's overall cost of education and training for regulatory compliance is \$1.63 per acre, or 4% of regulatory costs.

Air quality regulatory activities involve Title V fees for the dairy/farm combined, and the application fee for CMP plans. One owner is responsible for reporting and documentation of air quality compliance, including preparing for SJVAPCD inspections and renewing their Title V permit. Many staff hours are also spent in calls and emails to various regulatory agencies regarding permitting issues. The farm also uses dust control measures on the farm roads, including watering the roads and grading and applying crushed asphalt per their permitting requirements. The farm also pays for burn permits. Overall the cost of air quality compliance is \$6.07 per acre, or 15% of regulatory expenses.

Water regulations are the farm's second largest cost of compliance at \$7.43 per acre. Because the farm uses dairy manure for fertilizer, the farm must conduct water tests as well as report fertilizer and manure information to the Water Board. The farm falls under a dairy order which is relevant to the corn silage because that's where the manure is used. The annual assessment costs over \$7.00 per acre, and a third-party firm completes reports and pulls samples for testing. The farm is

not part of a water quality coalition; the dairy order overrides it. With respect to SGMA, the farm is part of a GSA which is \$10 per acre but is assessed to silage at \$5 per acre because of double cropping. Overall, the cost of water regulatory compliance is 18.5% of the farm's regulatory costs.

Pesticide regulations are primarily the cost of the PCA, estimated by this grower at 15% of chemical costs. The farm spends about eight hours of staff time annually monitoring use reports and permits. The grower also now pays for custom spraying primarily to offset regulatory concerns with various chemicals; custom spraying is \$2.75 per acre. The total costs of pesticide compliance for this grower is \$12.33 per acre, or 31% of the farm's compliance expenses.

Labor health & safety requirements include providing toilets and sanitation supplies; a third-party firm services the toilets. The farm estimates the cost of water provision and ice at \$500 per year, and that the supervisor spends about 135 hours refilling coolers throughout the year. The farm does not provide shade structures as the employees are working on tractors and harvesters with cabs. However, the workers are provided with personal protective gear at a cost of over \$400 per year. Labor health & safety requirements are \$1.38 per acre, or 3.4% of regulatory costs.

The farm replaced a diesel engine in 2018 as a regulatory expense. The cost allocation to corn was just over \$4,000. The farm also is required to have annual flood insurance as a regulatory requirement based on their location in a flood plain. The farm's costs for these regulatory expenses are \$3.90 per acre, or 9.7% of total regulatory costs.

Additional regulatory costs for the farm include an environmental fee return as well as an EPA ID number renewal. These costs are minimal and add \$0.17 per acre. The farm's overall cost of regulation for the corn silage is \$40.19, or 4% of production costs.

2012 to 2018 The grower's cost of regulation increased by 578% since 2012, increasing from \$5.93 per acre. In 2012, air quality requirements comprised nearly all of the compliance costs; by 2018 water quality regulations had become more stringent, as had employee regulatory costs. The farm's largest regulatory expense is for pesticide compliance, that area increased from \$0.05 per acre to \$12.33 per acre. Part of that might be due to under reporting in 2012, as we did not have an estimated PCA cost that year. The farm outsourced spraying in 2018 to offset regulatory issues. Water quality compliance has become more expensive with the advent of NMPs and the requisite testing. The farm's percentage of regulatory costs as a proportion of production also increased; in 2012 the regulatory costs were .62% of production costs, in 2018 the proportion had increased to 4%.

Large Silage Grower 2 – Central SJV

This large silage grower produces over 2,000 acres of crops, with nearly 50% of the annual crop committed to corn silage. All silage is fed to the farm's dairy cattle. The farm has diversified since 2012, adding walnut and almond acreage while reducing the size of the dairy herd and changing cattle breeds. They are now able to grow all of their own forage, rather than buying hay from other farms.

Education and training for regulatory compliance involves safety training for all employees; typically, four meetings per year for an hour each. The insurance company handles the trainings and charges \$800 annually. The farm provides safety incentives to each employee and pays them \$100 each to attend the meetings, in addition to their regular pay, and also a \$100 quality award if the farm has no safety violations. These costs are voluntary, though, and are not counted in the regulatory expenses. Managers undergo two hours of sexual harassment prevention training per year. Irrigators participate in pesticide and tractor safety, and the managers also take part in these trainings. The owner maintains a pesticide applicators license, which requires three hours of continuing education annually. Four other employees also undergo three hours annually of pesticide training. Overall, the cost of training for compliance is \$2.48 per acre, or 3.2% of regulatory costs.

Air quality compliance is the farm's largest regulatory cost. The farm pays two CMP fees and has a burn permit. As with most other farms in this study, dust control is the largest component of this regulatory area. From May to September, the farm runs a water truck six days per week for 10 hours per day. The labor involved costs \$21.75 per acre, and the equipment maintenance cost is estimated at \$2.45 per acre. Overall the cost of air quality regulations is \$25.41 per acre, or 33.1% of regulatory costs.

Water quality regulations are primarily handled by a consulting company that charges over \$30,000 per year to file permits and complete paperwork for water quality with the Region 5 Water Quality Control Board. The farm is also part of a water waiver coalition, those fees are nearly \$2,000 annually. One of the irrigation staff spends two hours per week with field paperwork to comply with the farm's NMP, and office staff spend about an hour per week inputting data from the field paperwork into a spreadsheet. The wells are tested annually, which costs over \$200 in staff time. The farm is in a white area with no surface water allocation, so one of the farm owners spent about 16 hours in meetings regarding SGMA in 2018. The farm's overall cost of water regulation in 2018 was \$17.73 per acre, or 23.1% of total compliance costs.

Pesticide regulation involves about an hour of week of record keeping and documentation, in addition to the farm's PCA fee, which is over \$42,000 annually. The farm spends about \$200 for buffer zone signs annually. The farm's cost of pesticide compliance is \$13.94 per acre, or 18.2% of compliance costs.

Labor health and safety requirements are primarily water provision, which costs both staff time and actual water and ice costs. The farm spends \$250 on personal protective equipment for its workers. Toilets are provided by the dairy, and the workers are in covered vehicles for much of their workday, so shade structures aren't required. The costs of compliance for labor health and safety add up to \$1.39 per acre, or 1.8% of total regulatory costs.

The grower reported no capital expenses for regulatory compliance, but they did have mandatory flood insurance. The premium cost for the silage was \$8.40 per acre in 2018, or 10.9% of compliance costs.

The farm is large enough to meet the Affordable Care Act health care provision for its workers. Their health care premiums are over \$12,000 annually, and one of the owners spends about 16

hours of time annually in reporting enrollment to the federal government. The per-acre costs are \$5.97, or 7.8% of regulatory expenses.

The farm must also provide mandatory sick leave for its workers; in 2018 the cost of the days actually taken added up to over \$2,500. Documenting this time is an office staff responsibility, which takes about 35 hours per year. The total cost of this regulatory provision is \$1.44 per acre, or 1.9% of regulatory costs.

Overall, the farm spent \$76.77 per acre in regulatory compliance in 2018, or 6.3% of production costs.

2012 to 2018: This grower's regulatory costs in 2012 were \$57.46 per acre; by 2018 the compliance costs had risen by 33.6%. All regulatory cost areas increased, with the exception of water quality costs and employee education and training. This is mostly attributed to the fact that the grower has downsized their operations, and also the fact that much of the water quality compliance is primarily handled by a consulting company, which may be more efficient than conducting the compliance activities themselves. Pesticide regulatory costs increased because the farm now pays a separate PCA fee rather than their services being included in the cost of chemicals as in 2012. Air quality compliance costs rose partly because of the increased cost of labor for dust control. In 2012, the farm's regulatory percentage of production costs were 3.5% of production costs, but had risen to 6.3% by 2018.

Medium Silage Grower 1 – North Central SJV

This medium silage grower produces corn silage, alfalfa, tomatoes and tree nuts on less than 1,000 acres. The corn silage comprises over 60% of the total farm acreage. All silage is fed to the farm's dairy cattle.

Education and training for regulatory compliance included a biannual training that includes comprehensive safety topics, such as pesticides, equipment and heat stress. These trainings typically take two hours each, and the managers also participate. The farm managers also take part in 10 hours of training for labor and employment issues, and spend five hours keeping up with water quality regulations. The managers also spend 20 hours annually maintaining pesticide applicator's licenses. They also undergo sexual harassment prevention and CPR training. The total cost of education and training compliance is \$2.02 per acre, or 2.1% of regulatory costs.

Air quality is the farm's largest compliance cost. These costs include a burn permit and CMP fees, which cost over \$1,000. Dust control is this segment's most significant expense. The farm sands the roads every three years, at a cost of \$5,000 per year for materials. They also run a water truck for a large part of the year, they estimate this cost at \$10,000 for labor, equipment, maintenance and materials. The farm spent \$1,000 on speed limit signs to keep vehicles from stirring up more dust, those are estimated to last about five years. The farm uses a consulting firm to report all air and water quality compliance measures, this service costs \$385 per month. The farm had to line its diesel fuel tanks for air quality compliance. The farm also has Tier 4 tractors that use DEF which costs \$960 per year. The total cost of air quality compliance is \$27.20 per acre, or 28.4% of regulatory costs.

Water regulations are the farm's second highest cost of compliance. The farm belongs to the Central Valley Dairy Representative Monitoring Program, which has a \$81/month fee. The farm also pays a fee to the Water Board and spends about \$1,000 to keep the NMP updated. Well water nitrate testing costs \$125 per well annually, and each sample costs \$150. Silage samples must be taken at harvest and analyzed for nitrates; these cost \$80 per sample. The dairy manure used as fertilizer on the silage must also be sampled; those samples also cost \$80 each. The owner attended about nine meetings for SGMA to learn about regulations forthcoming as the GSPs were developed in 2018, and the farm managers spend about 80 hours per year attending SGMA-related meetings, but their time is allocated to this farm at \$250. Overall, the cost of water regulatory compliance was \$22.59 per acre in 2018, or 23.6% of regulatory expenses.

Pesticide regulatory compliance costs include \$8 per acre for PCA fees on silage and filing for permits, which is minimal at \$50 per year. The managers spend 10 hours filing use reports, and they estimate that it costs an additional \$12 per acre to use a non-VOC (volatile organic compound) pesticide on silage. The cost of pesticide compliance was \$20.65 per acre in 2018, or 21.5% of total regulatory costs.

The farm had to purchase two new 250-gallon diesel tanks as the old 1,000-gallon tank placed them in a different compliance category. The tanks cost \$1,000 each but are estimated to last 10 years. The farm managers also have an Agrian subscription, and the cost apportioned to the farm is \$35. The capital investments related to regulatory compliance in 2018 were \$0.28 per acre.

The farm is large enough to meet the threshold for Affordable Care Act compliance, and the farm spends over \$15,000 annually in health care premiums. Reporting costs are minimal, and this area of compliance cost \$18.40 per acre in 2018, or 19.2% of regulatory costs.

Labor wage requirements are primarily the cost of sick leave provision for the farm's four employees, this is valued at \$2,400. The office assistant spends about an hour per month filing forms for employee payroll taxes. The overall cost of labor wage compliance was \$3.62 per acre, or 3.8% of compliance costs.

This silage grower's overall cost of regulation was \$95.83 per acre, or 11.4% of production costs.

2012 to 2018: Regulatory costs increased by 135% over the time period. Significant cost increases included pesticide regulations, which grew from \$1.60 per acre in 2012 to \$20.65; water quality compliance which doubled from \$11.29 per acre to \$22.59 per acre, and health care provision. The large increase in pesticide compliance was primarily because of the replacement VOC-free pesticides. The grower also has a separate PCA fee which was not reported in 2012. Air quality compliance costs increased by 25%, mostly due to the increased labor wages. The farm's percentage of regulatory costs doubled, from 5.3% of production costs in 2012 to over 11% in 2018.

Medium Silage Grower 2 – Northern SJV

This farm grows over 1,000 acres of crops, including silage, oats alfalfa and grapes. The corn silage comprises just over 40% of the farm acreage. The grower has significantly downsized his dairy herd since 2012.

Education and training for regulatory compliance consists of comprehensive safety trainings conducted by an outside consultant who charges \$150/month. The employees take two hours each for spray safe training, heat stress and equipment safety. The owner and two managers also take part in these trainings. The owner and one manager also maintain their PCA certifications which requires two hours of continuing education each year. The two managers also maintain CPR/First Aid certifications, which takes four hours each annually. The total cost of education and training is \$2.58 per acre, or 7% of regulatory costs.

Air quality compliance consists of an SJVAPCD permit specifically for the farm side of the operation that costs over \$300. The primary regulatory activity is dust control on the farm roads; the grower estimates this cost at \$10,000 annually, including time, equipment operation and maintenance and water pumping. The farm does not have any equipment that requires DEF. The total costs of air quality regulations for the silage operation are \$6.37 per acre, or 17.2% of regulatory costs.

Water quality compliance is this farm's largest regulatory cost area and includes the water waiver coalition at \$81 per month. The grower is required to file an NMP, and the well sampling, silage sampling and plan documentation and filing cost the farm \$12,000 annually. The well nitrate testing costs \$26.50 per test. In addition, the farm belongs to a GSA that costs \$5 per acre for irrigation district recharge. The farm's total cost of water regulatory compliance is \$13.12 per acre, or 35.4% of regulatory costs.

Pesticide regulations require the manager to take four days annually to go to the Pest Control Office for permits and filing reports. The farm also uses Agrian to file use reports. Though the primary cost of the PCA is included in the chemical costs, they pay an outside PCA \$1,500 to scout the fields. Buffer zone signs cost \$100 per year. The grower's cost of pest control, which is likely underreported because of the hidden costs of the PCA fees, is \$2.17 per acre, or 5.8% of regulatory fees.

Labor health and safety regulations primarily include the cost of water provision and time spent providing it to the employees, as well as personal protective gear supplied to the workers. Toilets are part of the dairy's cost, and shade structures aren't required because the workers are on tractors with cabs. The farm spends \$7.82 per acre on this regulatory category, which is 21.1% of the regulatory costs on the farm.

The farm reported no capital investment or risk management costs due to regulation, and the farm has too few employees to require health insurance for workers. However, labor wage requirements add up to \$5.01 per acre, which is comprised mostly of sick leave provision for the farm employees as well as reporting and filing forms, which is done by the bookkeeper. This regulatory category adds \$5.01 per acre, or 13.5% of the costs of regulation.

Overall this silage grower's regulatory costs were \$37.06/acre, or 2.7% of production costs.

2012 to 2018: This grower reported one of the few cases in which regulatory costs declined over the time period; in 2012 the grower reported \$41.69 per acre in compliance costs, so their reported compliance costs decreased by 11%. The largest reductions were in air quality compliance costs and education and training, which dropped by \$10 and \$8 per acre respectively. The grower reported nearly twice the cost of dust control in 2012, at over \$20,000 in labor, fuel and equipment costs, however in 2018 he reported that dust control measures cost \$10,000. The grower also reported more time spent in 2012 on pesticide and fertilizer training for staff, as well as meeting with city officials. Labor wage requirements, health and safety equipment and water quality compliance all increased. In 2012, regulatory costs comprised 3.5% of production costs; in 2018 they were 2.7% of overall costs.

Medium Silage Grower 3 – Southern SJV

This medium size silage farm grows almost 2,000 acres of field crops; nearly 75% of the acreage is devoted to corn silage. All silage is fed to the farm's dairy cattle.

Education and training compliance involved quarterly safety training for all employees. The manager is also involved in this training, as are the four owners, who spend an additional four hours beyond the employee training. The program costs \$750 per quarter for the whole dairy and farm operation, but the prorated cost to the farm employees is less than 1/3 of that cost. One owner spends about 300 hours of time per year on labor regulations and onboarding new employees. Pesticide training is required for the managers to maintain their certifications. The managers and owner also participate in required trainings for sexual harassment prevention and CPR. The farm's total cost of regulation is \$9.29 per acre, or 11.8% of total regulatory costs.

Air quality regulations include a burn permit as well as over \$2,000 in CMP fees. One of the owners spends about 100 hours annually filling out forms and filing paperwork with the SJVAPCD. As with most farms in this study, the cost of dust control is the largest component of air quality compliance. The employees spend 350 hours of time watering roads, and the cost of running the equipment is about \$18.50 per hour in addition to the employee's time. The farm also had to buy additional trucks to maintain consistent dust control. The trucks spend about 25 hours in maintenance throughout the season. Overall, the farm's cost of air quality compliance is \$15.64 per acre, or 20% of the total costs of regulation.

Water quality falls closely behind air quality in terms of regulatory costs. The farm hired an outside consultant to develop and file the NMP; that annual cost is over \$16,000. Testing wells for nitrates costs over \$2,000 annually and managing the permits and paperwork to comply with groundwater quality costs the farm \$10,000 annually. Employees have to spend time bagging silage at harvest time for field samples as part of the NMP. In addition to water quality compliance, the farm is part of two different water districts and one owner attended approximately 20 hours' worth of meetings in 2018 to learn more about SGMA and potential regulatory changes with water pumping. The total costs for water regulatory compliance was \$15.52 per acre, or 19.8% of total regulation expenses.

The pesticide regulatory area is underreported as the PCA fees are part of the cost of chemicals. The only recorded expenses for pesticide regulation are five hours of filing paperwork and record keeping, which amounts to \$0.13 per acre.

Labor health and safety requirements involve provision of toilets and sanitation supplies, water, individual water jugs for each employee, shade structures and about \$200 per employee for personal protective gear. This category costs \$2.96 per acre, or 3.8% of regulatory costs.

The farm reported no regulatory expenses with respect to capital investment or risk management for 2018. However, the owner mentioned that in the future, they will likely invest in technology to track water use as SGMA is implemented in 2020 and beyond.

The farm meets the employee minimum for providing health care under the Affordable Care Act, and they spend \$1,000 in monthly premiums for the manager and \$350 monthly for each employee on the farm. This is the farm's largest regulatory cost at \$31.43 per acre, which is 40% of the total cost of regulation.

Labor wage requirements are primarily the provision of three days of mandatory sick leave per employee as well as the owner's time filing payroll taxes and other employee forms, including ACA documentation. This regulatory area costs the farm \$3.64 per acre, or 4.6% of overall regulatory expenses.

The total cost of regulatory compliance for this silage grower was \$78.60 in 2018, or 7% of production costs.

2012 to 2018: The grower's cost of regulation in 2012 was \$24.26 per acre, or 2.3% of production costs. The costs of regulation have increased at a higher rate than costs of production. Mandatory health care provision, as well as higher costs of air quality and more stringent water quality regulations are responsible for most of this grower's increased compliance costs; those three regulatory areas added nearly \$40 per acre. All regulatory cost categories increased for this grower.

Citrus

Three citrus growers were interviewed; large, medium and small.

Large Citrus Grower – Southern SJV

This large grower farms a variety of citrus across the southern San Joaquin Valley.

Education and training for regulatory compliance consisted of overall safety training of 60 hours for the employees and 60 hours for the managers. Labor and employment issues comprises a large portion of the training costs and was apportioned to this part of the farm at \$19.95 per acre. Pesticide and fertilizer trainings are calculated at \$25 per acre. About 2/3 of the employees take four hours of food safety training per year, and the managers each complete two hours of sexual harassment prevention training annually. Attending water meetings takes an enormous amount of

time for the farm's decision makers; they spent over 600 hours in 2018. The farm's cost of education and training was the highest of any farm in the study at \$159 per acre, or 18% of overall costs.

Air quality compliance includes a burn permit and applying dust control materials to roadways. The farm spends 1,500 hours of labor and over \$50,000 in materials such as decomposed granite and other dust control products to roads, bringing their per-acre cost of air quality regulations to \$65, or 7.5% of compliance costs.

Water quality requirements include the fees for two water quality coalitions that cost \$4.64 per acre. The NMP costs \$500 but the development, on-farm evaluation and requisite meetings for staff cost \$51.63 per acre in employee time. Wells must be tested for nitrates; the tests cost \$23 each but employees spend time collecting samples for analysis. The citrus part of the farm is not allocated any costs of SGMA compliance; that cost is allocated to other crops. The total cost of water quality compliance is \$57 per acre or 6.5% of total regulatory expenses.

Pesticide regulations are this farm's largest cost of compliance. The largest component is the increased cost of biologically based pesticides that are not only more expensive, but are specific to certain pests, rather than broad spectrum coverage. The farm also uses one additional spray to get the same level of pest control. The PCA service costs \$100 per hour. Posting buffer zone signs and 260 hours of reporting time for pesticide use round out the category, and the regulatory cost is \$257.63 per acre, or 29.3% of total regulatory expenses.

Food safety regulations have also greatly expanded for this grower. Hundreds of hours of staff time are devoted to these requirements; from clerical time for documentation to management time estimated at 300 hours per year. Harvest foremen each spend six hours per year on food safety, but the field staff time is not documented because the labor contractor takes care of that training. The farm spends 17 hours on conducting a self-audit for food safety, and \$28 per test for microbial analysis for irrigation water. The farm also spends six hours updating this ranch's food safety program. Overall, the farm spends \$89 per acre on food safety compliance, or 10% of the total regulatory costs.

Labor health & safety requirements include rentals for toilets and handwashing facilities as well as \$8.80 per acre for protective gear for workers. The labor contractor supplies water and shade structures, so those are part of the commission paid by the farm. This category costs \$11 per acre, or 1% of the total regulatory fees.

The farm has invested thousands of dollars in capital outlays for regulatory purposes. The farm upgraded wind machine engines and purchased new nurse trucks and one fuel truck for regulatory compliance. These equipment costs were depreciated out over seven years and allocated on a percentage basis to the citrus. The farm also installed a new irrigation monitoring system to improve microbial water quality and installed fences to reduce wildlife intrusions in the reservoir. They also spend \$5 per acre to maintain waterways to reduce flooding. Overall, the capital investments for regulatory purposes total \$115 per acre, or 13% of the total.

The farm reported no risk management costs to offset regulatory liability. The farm also has not yet reported ACA costs because they were providing healthcare for their employees before it became a requirement.

Labor wage requirements reported for this grower are sick leave time and nonproductive time that must be calculated separately from piece rate wages. This regulatory category adds \$124.71 per acre for this grower, or 14% of total regulatory costs.

Overall, this grower's costs of regulation for citrus was \$879 per acre in 2018, or 4.7% of production costs. This case study represented one of the highest regulatory costs per acre in 2018.

2012 to 2018: In 2012, this grower reported regulatory costs of \$133.68 per acre, with air quality and education/training comprising 75% of the costs. Every regulatory category significantly increased; air quality regulations increased by the smallest proportion. Labor wage requirements were not a cost in 2012, and food safety regulations were minimal. Additional health and safety training, along with food safety training, added greatly to the education and training compliance costs in 2018. In 2012, regulatory costs as a share of production costs were 1.4%, in 2018 they had increased to 4.5% of production costs.

Medium Citrus Grower – Central SJV

The mid-size citrus producer near Fresno also farms almonds, in addition to several varieties of citrus. This case study focused on one of the citrus variety's regulatory costs. The farm had downsized quite a bit since 2012, and now farms less than half of the acreage reported in the previous study. Citrus makes up about 15% of the acreage.

Required education and training take 10 hours per year for each of the employees and covers comprehensive safety topics such as forklift safety and heat stress. The insurance company conducts the training as part of the policy premium. Employees also take part in tailgate meetings that add up to an additional 1.25 hours each per year. The office manager spends about eight hours annually staying abreast of labor regulations. The owner is required to attend four hours of meetings on water quality regulations for the water coalition. He also must attend six hours of pesticide training to maintain his license. Food safety audits take 10 hours of time to prepare, plus four hours of training on food safety regulations. All employees except two take part in four hours of sexual harassment prevention training, which costs \$25 per person. The overall cost of education and training compliance is \$23.08 per acre, or 9.1% of total regulatory costs.

Air quality regulations are this grower's largest cost of compliance; primarily due to dust control measures. The farm paid for a burn permit, and they removed only 10 acres of citrus in 2018, so they were able to burn and not chip the removed trees. Burning larger amounts than 15 acres requires a significant permit fee to the SJVAPCD. The grower pays a CMP fee, and the office manager spends about three hours completing forms for air quality compliance. Watering roads for dust control takes employees at least two hours per day every workday during the summer months; this adds up to 240 hours. Labor, equipment, materials and maintenance costs are

estimated at \$80 per hour. The total cost of air quality compliance was \$68.30 per acre, or 27% of total regulatory costs.

Pesticide regulations primarily consist of PCA fees and recordkeeping and documentation; the office manager spends about four hours each month on pesticide records. The farm pays a PCA almost \$40 per acre for citrus, and it takes an employee about four hours to post buffer zone signs and subsequently watch the roads during spray applications to prevent over spraying. The costs of pesticide regulations are \$43.07 per acre, or 17% of total regulatory costs.

Food safety regulations are the farm's second largest compliance category. All trees must be skirted for food safety purposes, that task takes 30 hours annually. The owner conducts field inspections that takes two hours per block, and the office manager spends 20 hours documenting GAP procedures. Harvest crews each spend four hours on food safety training, and the self-audit conducted by the owner takes 10 hours. The third-party audit, paid for by the packing house, takes another three hours of the owner's time. The packing shed also pays for the microbial water tests. Overall, the costs of food safety compliance were \$52.21 in 2018, or 20.6% of regulatory costs.

Labor health & safety requirements involve the provision and upkeep of toilet and sanitation facilities, which takes about an hour per week and costs \$800 annually in supplies. The grower spends about \$240 on water and ice, and \$1,600 per year on personal protective gear for the employees. The farm built a shade trailer, the cost is allocated at \$120 per year. Overall, the cost of this category is \$12.42 per acre, or 5% of overall regulatory costs.

The grower reported no capital investment for regulatory issues nor risk management costs for regulatory reasons. The farm falls below the requirements for the ACA. However, the farm must provide mandatory sick leave to its workers, and the office manager spends two hours per week filing employee forms and payroll taxes. The cost of labor wage requirements is \$25.86, or 10.2% of regulatory costs.

The grower's overall cost of regulatory compliance is \$253.47 per acre, or 10.3% of production costs.

2012 to 2018: In 2012, the grower's regulatory costs were \$47.03 per acre and comprised less than 1% of the cost of production. By 2018 the regulatory costs had increased by 439%. All categories showed significant increases, with the highest being air quality compliance, the costs of which increased tenfold. Pesticide, food safety, water quality and labor wage regulations all contributed to the rise in costs. In some cases, the increases were the result of newer or more stringent regulations; in the case of pesticide compliance, the grower paid an independent PCA to scout the citrus acreage which was not part of the 2012 reported costs. The reduced acreage could also have an impact as regulatory costs are somewhat fixed in nature, so if acreage decreases, the per-acre cost increases.

Small Citrus Grower – Central SJV

The small citrus grower interviewed for the 2012 study had stopped farming by 2019, and so we were unable to interview him for the updated 2018 study. A new small citrus grower was identified, and we collected both 2012 and 2018 data at the time of the interview. The grower stated that because of the time lag between the 2012 production year and time of interview, they could not remember all of the regulatory costs discussed, so 2012 costs are likely underreported.

2012 Regulatory Costs

The 25-acre citrus farm was managed by a farm manager who charges an hourly rate for tasks completed on the farm plus a monthly management fee.

The education and training noted by the farm manager was only for three hours per year for each of the farm managers for pesticide compliance training. The rest of the training costs were absorbed as part of the overhead and were not specifically documented. The cost of education and training was \$3.30 per acre, or 16.3% of regulatory costs.

Air quality requirements consisted of only a burn permit in 2012, which was \$4 per acre. The farm is too small to require a CMP, and they did not remove any trees so there was no fee for chipping. Air quality comprised 19.7% of the farm's regulatory costs in 2012.

Water quality regulations included the cost of the water waiver coalition, which cost \$100, plus the farm manager attended an hour-long meeting for growers. The total cost of water quality compliance was \$4.55 per acre, or 22.4% of regulatory costs.

Pesticide costs were reported as four hours of filing paperwork for pesticide use reports, and the farm manager's business license as a qualified application as well as the private applicator's license. The PCA fees were included as part of the cost of chemicals. The pesticide regulations cost \$2.43 per acre in 2012, though these are likely underreported as they do not include a PCA fee. Pesticide regulations were 12% of total regulatory costs in 2012.

Labor health and safety costs were only the costs of safety gear in 2012, which added up to \$6 per acre, or nearly 30% of the regulatory costs. Overall, the grower's costs of regulatory compliance were \$20.18 per acre, or 0.6% of production costs.

2018 Regulatory Costs

By 2018, this grower had removed 15 acres of navel oranges to redevelop into pommelos, leaving 10 acres of citrus. The wage rates charged by the farm manager had increased from \$13.75 to \$17 per hour.

Education and training for regulatory compliance includes nine hours of employee safety training; these trainings take place three times per year and involve three people for one hour each. The farm manager and employees attend six hours of pesticide training, plus four other hours for spray licenses. These trainings are for the qualified applicator's license held by the

farm manager. The NMP takes four hours of training every three years and food safety training requires three hours per year. The total cost of regulatory compliance for education and training is \$2.03 per acre, or 3.3% of regulatory costs.

Air quality compliance is comprised of a burn permit, and because the emission regulations have changed since 2012, the DEF required for Tier 4 vehicles costs \$2,700. The farm was able to burn the 15 removed acres because it fell under the burn limits for citrus. The cost of air quality compliance for 2018 was \$22.27 per acre, or 10.7% of regulatory costs.

Water quality requirements in 2018 included a \$100 flat fee plus \$6.10 per acre. The NMP takes two hours of time for farm evaluation. As of 2018, these were the only reported costs of water quality compliance, though testing for nitrates is on the horizon. The farm is not in a critical overdraft area for SGMA, and thus it has not experienced increased costs as other areas have. The total cost of water quality regulation in 2018 was \$16.25 per acre, or 7.8% of total regulatory costs.

Pesticide regulatory costs include four hours of paperwork filing for use reports, as well as the Qualified Applicator License fee and the private applicator's license for the farm manager. The pest control advisor costs are estimated at 20% of the cost of chemicals, per information from the PCA. Though the farm does have acreage near schools, the farm manager noted that they spray on weekends if school is in session. They have to file reports with the county and notify schools. The total cost of pesticide regulation for this grower in 2018 was \$110.49 per acre, or 52.9% of the total regulatory costs.

Food safety is a new area of regulation for this grower since 2012. The farm manager spends an hour annually documenting food safety practices for the owner. The owner spends two hours of time on food safety issues per year. There are no food safety harvest costs that accrue to the grower, as the packing contractor includes those regulatory costs in their fees. The farm pays a third-party auditor \$20 per acre for food safety testing, including water testing. The farm manager spends five hours to walk through the farm with the food safety auditor, and also spends an hour taking samples for water tests for food safety. The farm manager spends 10 hours per year skirting trees for food safety concerns. The total cost of food safety was \$47.54 per acre in 2018, of 22.7% of total regulatory costs.

Labor health and safety requirements have expanded since 2018; the farm must provide water, toilet and handwashing facilities for the workers in addition to the protective gear required in 2012. However, because this farm is so small and is managed by an outside entity, it hasn't experienced a huge increase in costs, this category totaled \$2.17 per acre in 2018, or 1% of regulatory costs.

The farm manager has started to pay for a subscription to Agrian to be able to report pesticide use for the various farm entities it manages. That accounts for \$1.36 per acre for this small farm. The farm is too small to meet ACA requirements, but the farm management company does need to provide its workers with three days of mandatory sick leave, which adds up to \$6.95 per acre, or 3.3% of compliance costs.

The overall cost of regulatory compliance for this small citrus producer was \$209.08 in 2018, or 4% of production costs.

2012 to 2018: As previously noted, the grower was asked to recall regulatory costs from 2012 during an interview conducted at the end of 2019, which may have led to some underreporting. However, the lower regulatory costs reported in 2012 are consistent with most of the other case studies. The tenfold increase in regulatory costs is the second highest percentage increase of the case studies. Pesticide, food safety and water quality regulation were the categories with the highest increases.