PHILIP A. WILLIAMS, State Bar No. 296683
General Counsel
WESTLANDS WATER DISTRICT
400 Capitol Mall, 28th Floor
Sacramento, California 95814
Telephone: (916) 321-4500
Facsimile: (559) 241-6277

Attorney for WESTLANDS WATER DISTRICT

BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

IN RE CALIFORNIA WATERFIX CALIFORNIA DEPARTMENT OF WATER RESOURCES AND U.S. BUREAU OF RECLAMATION PETITION FOR CHANGES IN WATER RIGHTS, POINT OF DIVERSION/RE-DIVERSION	**TESTIMONY OF DR. MICHAEL SHIRES**

I, Dr. Michael Shires, do hereby declare:

I am an Associate Professor of Public Policy and Associate Dean for Strategy and Special Projects at the School of Public Policy at Pepperdine University. In my capacity as a scholar and professor, I have executed many policy analyses and research projects examining the fiscal, economic, budgetary, and human aspects of policy choices, both those made by public agencies and private actors. I offer my testimony today in my capacity as a scholar in the areas of economic development, fiscal analysis, and public policy analysis. A Statement of my Qualifications is submitted concurrently with my written testimony as Exhibit WWD-20. My expertise is in the systemic and economics of policy. My research in the area of economic development dates back more than 14 years and my work in public finance more than 27 years. It looks especially at issues that affect the quality of life and economic opportunity for middle and lower income households and focuses on the ways in which policy either impacts that opportunity or could be improved by changes in policy. I received a Bachelor of Arts degree in Economics from the University of

California at Los Angeles, an MBA with concentrations in accounting and marketing from the John E. Anderson School of Management at UCLA, a M. Phil. in Public Policy Analysis from the Pardee RAND Graduate School and a Ph.D. in Public Policy Analysis from the Pardee RAND Graduate School. I have co-authored a national ranking of the best places to do business in the United States annually with Joel Kotkin which have been published in *Inc. Magazine, Forbes* magazine, and most recently on Forbes.com. I have conducted and led numerous research projects examining the fiscal and economic implications of policy choices as part of university research teams, for private policy thinktanks, individually, and for a range of direct clients. I not only do research, but also lecture and give public speeches on various policy topics.

Summary of Testimony

In this testimony, I will describe the economic impacts that agricultural activities within Westlands Water District ("Westlands") have on the region surrounding it. My analysis demonstrates the contributions of Westlands and growers within Westlands to the local economy and the demographic implications of those contributions. I will provide a preliminary assessment of the consequences of current water policies on crop production, and will provide a preview of what some of the implications a change from current water policies may have. A PowerPoint presentation that I will use in presenting my oral testimony is Exhibit WWD-19.

I. Introduction to the Economic Context and Demographics Within and Surrounding Westlands

As a major agricultural production area, Westlands Water District has an economic impact not only on local markets, but also on regional and global markets. The district's almond production, for example, is part of one of the U.S.'s major export successes. But there are two stories involved in understanding the economic impact that Westlands Water District has on surrounding economies. The first is rooted in the reality of the towns and communities that are found in and around the district. It is critical to understand that, absent a vibrant agricultural industry, these communities would have no economic base or activity from which to draw their livelihoods. The second is rooted in the broader and more traditional economic impact analysis that one pursues in understanding how the value added of an industry in a specific location impacts not only the local communities, but

also the surrounding areas and quite possibly national production of goods and exports. The balance of this paper is broken into two sets of analyses addressing each of these threads—first addressing the local and them moving to the industrial-scale impacts.

As a local region, the two counties served by the Westlands Water District are expected to grow by more than 700,000 people in the period from 2010 to 2060 with an average increase of 11 percent a decade for each of the next five decades, as show in Figure 1. The State of California is projected to increase only 6.7 percent per decade, showing a higher growth rate for the Fresno and Kings Counties than the rest of the state. This population is also projected to identify as increasingly Hispanic rising from 50.4 percent in Fresno County in 2010 to 62.4 percent, and rising from 50.9 percent Hispanic in Kings County in 2010 to 60.9 percent in 2060. To sustain a consistent quality of life and a stable economy, the region will need to grow the employment base significantly over this period.

Figure 1—Population Estimates and Projections, Fresno and Kings Counties and California, 2010-2060

Estimated and Projected Population

Year	Fresno County	Kings County	California
2010	932,969	154,276	37,341,978
2020	1,055,106	167,465	40,619,346
2030	1,200,666	192,562	44,085,600
2040	1,332,913	218,394	47,233,240
2050	1,464,413	240,599	49,779,362
2060	1,587,852	259,506	51,663,771

Percent Growth by Decade

Period	**Fresno County**	**Kings County**	**California**
2010 - 2020	13.1%	8.5%	8.8%
2020 - 2030	13.8%	15.0%	8.5%
2030 - 2040	11.0%	13.4%	7.1%
2040 - 2050	9.9%	10.2%	5.4%
2050 - 2060	8.4%	7.9%	3.8%

Share of Population Claiming Hispanic Ethnicity

	Fresno County	Kings County	California
2010	50.4%	50.9%	37.7%
2020	53.5%	54.1%	40.4%
2030	56.4%	56.1%	43.0%
2040	59.0%	57.7%	45.5%
2050	60.9%	59.3%	47.6%
2060	62.4%	60.9%	49.3%

SOURCE: California Department of Finance, Demographic Research Unit, baseline population projections by county, series P-1 and P-3, http://www.dof.ca.gov/Forecasting/Demographics/projections/, accessed July 20, 2016.

Demographically, this region is expected to become increasingly Hispanic, even relative to the state. Figure 2 shows the current and projected racial and ethnic makeup of the two-county Westlands region and the state. Reflecting a long-standing trend, Hispanics are the largest race/ethnic group statewide and within Fresno and Kings Counties, and are expected to continue to grow as a share of the overall population, rising to almost half the statewide population by 2060. Within Kings and Fresno Counties, however, Hispanics already comprise a majority of the population and are expected to rise to more than 60 percent in each by the year 2060.

Figure 2—Projected Population, By Race/Ethnicity, Fresno and Kings Counties and California, 2010-2060

Fresno County-

Year	African-American	Hispanic	Asian-PI	White	Other	Total	Percent Hispanic
2010	45,671	469,789	89,567	306,216	21,726	932,969	***50.4%***
2020	51,602	564,098	104,818	307,439	27,149	1,055,106	***53.5%***
2030	56,827	677,096	123,603	310,124	33,016	1,200,666	***56.4%***
2040	59,888	786,406	140,691	305,659	40,269	1,332,913	***59.0%***
2050	61,531	891,693	159,940	303,355	47,894	1,464,413	***60.9%***
2060	61,546	990,043	176,849	303,794	55,620	1,587,852	***62.4%***
50-year Change	***34.8%***	***110.7%***	***97.4%***	***-0.8%***	***156.0%***	***70.2%***	

Kings County

Year	African-American	Hispanic	Asian-PI	White	Other	Total	Percent Hispanic
2010	10,514	78,484	5,761	54,943	4,574	154,276	***50.9%***
2020	10,773	90,630	5,910	54,486	5,666	167,465	***54.1%***
2030	11,783	107,952	7,882	57,968	6,977	192,562	***56.1%***
2040	12,586	126,083	10,128	61,060	8,537	218,394	***57.7%***
2050	12,911	142,573	11,823	63,399	9,893	240,599	***59.3%***
2060	12,955	158,026	12,690	64,707	11,128	259,506	***60.9%***
50-year Change	***23.2%***	***101.3%***	***120.3%***	***17.8%***	***143.3%***	***68.2%***	

California

Year	African-American	Hispanic	Asian-PI	White	Other	Total	Percent Hispanic
2010	2,194,007	14,072,269	4,950,467	15,039,953	1,085,282	37,341,978	***37.7%***
2020	2,285,418	16,398,208	5,653,028	14,936,172	1,346,520	40,619,346	***40.4%***
2030	2,356,684	18,973,905	6,320,499	14,798,858	1,635,654	44,085,600	***43.0%***
2040	2,357,738	21,475,903	7,096,451	14,342,695	1,960,453	47,233,240	***45.5%***
2050	2,305,377	23,684,647	7,797,044	13,690,921	2,301,373	49,779,362	***47.6%***
2060	2,225,050	25,486,948	8,264,210	13,051,009	2,636,554	51,663,771	***49.3%***
50-year Change	***1.4%***	***81.1%***	***66.9%***	***-13.2%***	***142.9%***	***38.4%***	

SOURCE: California Department of Finance, Demographic Research Unit, baseline population projections by county, series P-1 and P-3, http://www.dof.ca.gov/Forecasting/Demographics/projections/, accessed July 20, 2016.

While both counties currently have much lower income profiles than the state, the gap between the state overall and the two counties in the Westlands service area continues to widen, as is seen in Figure 10 which shows household income trends since the Great Recession. While state median household incomes have remained relatively flat in nominal terms over the past four years, household incomes in Fresno and Kings Counties are down more than 3 percent. When inflation is added into the mix, households in the Fresno and Kings Counties have seen an overall decrease of more than eight percent of real household income. Furthermore, the number of households with

annual incomes of less than $25,000 continue to grow relatively consistently each year in both Fresno and Kings Counties while the state has remained flat in recent years.

Figure 3—Trends in Median Household Income, California, Fresno and Kings Counties, 2011-2014

Region	2011	2012	2013	2014	Change 2011-2014
Median Household Income (current dollars)					
California	61,632	61,400	61,094	61,489	-0.2%
Fresno County	46,903	45,741	45,563	45,201	-3.6%
Kings County	48,838	48,761	48,133	47,341	-3.1%
Real Median Household Income (2010 dollars)					
California	59,821	58,246	57,133	56,537	-5.5%
Fresno County	45,525	43,392	42,609	41,560	-8.7%
Kings County	47,403	46,257	45,012	43,528	-8.2%
Percent Households Under $25,000 Income					
California	19.8%	20.2%	20.5%	20.4%	3.0%
Fresno County	27.5%	28.2%	28.3%	28.5%	3.6%
Kings County	23.4%	23.9%	24.8%	25.3%	8.1%

SOURCE: U.S. Bureau of the Census, American Communities Survey.

II. The Economic Role of Agriculture in the Westlands Water District

Employment in Fresno County is heavily impacted by agriculture. Figure 4 shows the breakdown in employment in the county over the past five years. Direct jobs on farms account for more than one in eight jobs in the county. This share has been dropping over the past several years, as reduced crop outputs and changing crop mixes have impacted the demand for farm labor in the county.

Figure 4–Employment by Census-defined Industry Category, Fresno County, 2010-2015

Jobs by Industry	2010	2011	2012	2013	2014	2015
Farm Jobs	46,000	47,900	48,900	49,200	48,800	47,300
Mining, Logging & Construction	12,200	11,700	12,400	13,400	14,200	15,200
Manufacturing	24,100	23,800	23,700	23,000	24,000	25,500
Trade, Transportation & Utilities	55,100	57,300	58,200	60,700	61,900	63,500
Services	132,100	132,700	135,400	141,000	146,500	151,600
Government	67,100	65,700	64,100	64,200	66,300	68,800
Total Employment	**336,600**	**339,100**	**342,700**	**351,500**	**361,700**	**371,900**
Percent Employment by Industry	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Farm Jobs	13.7%	14.1%	14.3%	14.0%	13.5%	12.7%
Mining, Logging & Construction	3.6%	3.5%	3.6%	3.8%	3.9%	4.1%
Manufacturing	7.2%	7.0%	6.9%	6.5%	6.6%	6.9%
Trade, Transportation & Utilities	16.4%	16.9%	17.0%	17.3%	17.1%	17.1%
Services	39.2%	39.1%	39.5%	40.1%	40.5%	40.8%
Government	19.9%	19.4%	18.7%	18.3%	18.3%	18.5%
Total Employment	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Statewide - Farm Share of Jobs	**2.6%**	**2.6%**	**2.6%**	**2.6%**	**2.6%**	**2.6%**
Statewide - Food Mfg Share of Jobs	**1.0%**	**1.0%**	**1.0%**	**1.0%**	**1.0%**	**0.9%**
tatewide - Manufacturing Share of Jobs	**8.5%**	**8.4%**	**8.3%**	**8.1%**	**8.0%**	**7.8%**

SOURCE: California Employment Development Department data.

Kings County's economy is even more dependent on agriculture than Fresno County, as seen in Figure 5. Farm employment accounts for one in six jobs in Kings County compared to one in eight in Fresno County. Government employment in Kings County is a major driver, accounting for almost one-third of all jobs, whereas it only accounted for 18.5 percent of Fresno County employment in 2015. In fact, government employs nearly twice the number of people directly employed on farms. The overall share of jobs across each sector of the economy has remained relatively stable over the past five years, although there have been very modest gains in the number of farm jobs.

Figure 5 – Employment by Census-defined Industry Category, Kings County, 2010-2015

Jobs by Industry	2010	2011	2012	2013	2014	2015
Farm Jobs	6,600	6,200	6,500	6,900	6,900	7,500
Mining, Logging & Construction	900	900	800	800	800	900
Manufacturing	4,100	4,300	4,400	4,500	4,600	4,900
Trade, Transportation & Utilities	5,200	5,300	5,400	5,600	5,700	5,800
Services	11,500	11,300	11,600	11,800	12,300	12,400
Government	15,000	14,800	14,600	14,300	14,300	14,500
Total Employment	**43,300**	**42,800**	**43,300**	**43,900**	**44,600**	**46,000**

Percent Employment by Industry	2010	2011	2012	2013	2014	2015
Farm Jobs	15.2%	14.5%	15.0%	15.7%	15.5%	16.3%
Mining, Logging & Construction	2.1%	2.1%	1.8%	1.8%	1.8%	2.0%
Manufacturing	9.5%	10.0%	10.2%	10.3%	10.3%	10.7%
Trade, Transportation & Utilities	12.0%	12.4%	12.5%	12.8%	12.8%	12.6%
Services	26.6%	26.4%	26.8%	26.9%	27.6%	27.0%
Government	34.6%	34.6%	33.7%	32.6%	32.1%	31.5%
Total Employment	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Statewide - Farm Share of Jobs	**2.6%**	**2.6%**	**2.6%**	**2.6%**	**2.6%**	**2.6%**
tatewide - Food Mfg Share of Jobs	**1.0%**	**1.0%**	**1.0%**	**1.0%**	**1.0%**	**0.9%**
tatewide - Manufacturing Share of Jobs	**8.5%**	**8.4%**	**8.3%**	**8.1%**	**8.0%**	**7.8%**

SOURCE: California Employment Development Department data.

At the same time, these tables understate the true impact of farming on the local economy. For each farm job identified in Figures 4 and 5, the regional economic models[1] predict there will be another 1.49 jobs directly related to providing support activities for agriculture in activities such as packing, soil preparation, processing, labor management, etc. In another study about agriculture's impact on the southern California economy published in 2012, 195,000 farming jobs *directly* supported some 198,000 jobs in agricultural processing and another 187,000 jobs in "Ag-support activities."[2] When the full economic impact of these farming jobs was counted, each farming job was associated with nearly 2.18 additional jobs elsewhere in the economy and each job in processing

[1] From IMPLAN regional modeling multiplier tables.

[2] Vergati, Jessica A. and Daniel A. Sumner, *Contributions of Agriculture to Employment and the Economy in Southern California*, University of California Agricultural Issues Center, July 2012, p. 45.

created by this production was associated with another 3.33 jobs. While there is some variation in regions, it is likely that the regional models for the two-county region are conservative in their estimations because they are only capturing economic impacts of economic activity within the specified region (Fresno and Kings Counties) while the southern California models capture a broader sense of the impacts that agricultural output region has on production that happens elsewhere in the state.

But the "Farm Jobs" category denoted Figures 4 and 5 and these multipliers tell only part of the story. Within all of the employment sectors denoted in these tables are employers and businesses for who significant shares of their businesses are dependent on agricultural customers—especially in the areas of transportation, retail sales, and business services. While the multipliers capture the incremental impact of employment and economic impacts of direct agricultural production for some of these companies, many of the retailers who sell farm equipment, vehicle fuel, plumbing and irrigation supplies, etc. are heavily dependent on agricultural customers. Thus, the impact of losing sales across the sector adds up quickly. At some point, much as is the case with farmers, there comes a tipping point where the entire firm goes out of business. When this happens, the overall impact on employment is much greater than the marginal impacts identified in the regional impact models because the entire staff becomes unemployed. Even in the government employment sector, these impacts are significant. As agricultural employment in the region declines, as is seen in Figure 4 in Fresno County, agricultural workers are forced to migrate to other regions of the state or nation. This in turn leads to fewer residents of the region and thus lower enrollment in local schools and thus fewer dollars to hire teachers and staff and purchase materials and supplies in the local school districts. These impacts are likely to be exacerbated as limited access to water supplies and shifting crop mixes put downward pressure on the core agricultural employment base in the region.

Another way to see the importance of agriculture in the region is to look at its major employers. The major employers in Fresno County also reflect the strong and dominant role of agriculture to the local economy, as shown in Figure 6.

Figure 6—Major Employers in Fresno County, Grouped by Size, 2014

Employer Name	Location	Industry	Size
Community Regional Medical Ctr	Fresno	Hospitals	5,000 - 9,999 Employees
Fresno Community Hosp & Med Ce	Fresno	Physicians & Surgeons	
Fresno Community Hospitals	Fresno	Hospitals	
Liberty Tax Svc	Fresno	Tax Return Preparation & Filing	
State Center Community College	Fresno	Schools-Universities & Colleges	
California Teaching Fellows	Fresno	Employment Service-Govt Co Fraternal	1,000 - 4,999 Employees
Cargill Meat Solutions	Fresno	Locker Plants	
Foster Farms	Fresno	Poultry Farms	
Fresno County Economic Comm	Fresno	Pre-Schools	
Fresno County Sheriff's Dept	Fresno	Police Departments	
Fresno Police Dept	Fresno	Police Departments	
Fresno Police Dept	Fresno	Police Departments	
Fresno State	Fresno	Schools-Universities & Colleges	
Kaiser Foundation Hospitals	Fresno	Hospitals	
Phebe Conley Art Gallery	Fresno	Art Galleries & Dealers (Part of Fresno State University)	
Pitman Farms	Sanger	Farms	
Pleasant Valley State Prison	Coalinga	Government Offices-State	
Shehadey Pavilion At St Agnes	Fresno	Hospitals	
St Agnes Medical Ctr	Fresno	Hospitals	
Stamoules Produce Co	Mendota	Fruits & Vegetables & Produce-Retail	
US Veterans Hospital	Fresno	Hospitals	
Aetna	Fresno	Insurance	500 - 999 Employees
Cargill	Fresno	Meat Packers (mfrs)	
Fresno Police-Mgmt Support	Fresno	Police Departments	
Zacky Farms	Fresno	Poultry & Eggs NEC	

SOURCE: California Employment Development Department data.

While the list of largest employers is dominated by government, hospitals, and educational institutions (17 out of the 25 listed), two-thirds of the remaining private employers are farming and agricultural-related. Clearly, agriculture is the dominant private contributor to the Fresno County economy.

Kings County shows a similar pattern. Its list of major employers shown in Figure 7 reflects this dependence on government and agriculture for employment. Of the 25 top employers, 10 are again hospitals, governments, or educational institutions—fewer than Fresno County. Of the remaining 15, 60 percent (9 out of 15) are agriculturally-related. Given the relatively smaller size of the economy, the firms are also smaller.

Figure 7—Major Employers in Kings County, Grouped by Size, 2014

Employer Name	Location	Industry	Size
US Naval Air Station	Lemoore	Government Offices-US	5,000 - 9,999 Employees
California State Prison	Corcoran	Government Offices-State	1,000 - 4,999 Employees
California State Prison	Corcoran	Government Offices-State	
Del Monte Foods Inc	Hanford	Food Products & Manufacturers	
Kings County Admin	Hanford	Government Offices-County	
Kings County Government Ctr	Hanford	Government Offices-County	
Tachi Palace Hotel & Casino	Lemoore	Casinos	
Adventist Medical Ctr Hanford	Hanford	Hospitals	500 - 999 Employees
Walmart Supercenter	Hanford	Department Stores	
Central Valley Meat Co Inc	Hanford	Meat Packers (mfrs)	250 - 499 Employees
Lemoore High School	Lemoore	Schools	
Leprino Foods Co	Lemoore	Cheese Processors (mfrs)	
Marquez Brothers Intl Inc	Hanford	Mexican Food Products-Wholesale	
Olam Spices & Vegetables	Hanford	Agricultural Products	
US Naval Hospital	Lemoore	Hospitals	
Warmerdam Packing	Hanford	Fruits & Vegetables-Growers & Shippers	
Zepeda's Farm Labor Svc	Corcoran	Labor Contractors	
Badasci & Wood Transport	Lemoore	Trucking	100 - 249 Employees
COVERIS	Hanford	Sewing Contractors (mfrs)	
Hanford Regional Healthcare	Hanford	Physicians & Surgeons	
Hanford Sentinel	Hanford	Newspapers (publishers/Mfrs)	
J G Boswell Co	Corcoran	Manufacturers - Wine Barrels	
Keller Ford Lincoln	Hanford	Automobile Dealers-New Cars	
Kmart	Lemoore	Department Stores	
West Hills College-Lemoore	Lemoore	Schools-Universities & Colleges	

SOURCE: California Employment Development Department data.

The bottom line is that both Fresno and Kings Counties are heavily dependent on agriculture to fuel their local economies. Significant degradations in this sector will likely impact the counties' already-elevated poor populations and put increasing impacts on the social safety net and infrastructure of the region. While the thrust of assessing the potential risks of this dependence is left for a later study, the analysis will now turn to the direct economic impacts associated with the operations of the Westlands Water District.

III. Some of the Broader Implications of Westlands Water District's Economic Impact at the Industry Level

The economic impact of the Westlands Water District is primarily driven by the output of its two main customer bases: farmers growing crops in the district and the businesses and

governments in the area who rely on the Westlands Water District to transport water for their uses. In the latter case, the district provides infrastructure to transport water from the state and federal water projects to customers in adjoining communities, such as the Lemoore Naval Air Station, and the cities of Huron, Avenal, and Coalinga. In these instances, the district does not provide water treatment for these customers, but rather delivery of the water to their sites for handling and treatment. Since each of these jurisdictions is then responsible for preparing the water for customer and business uses, this analysis will not include an economic impact footprint for these communities other than the transport function.

On the agricultural side, however, Westlands Water District's provision of water resources and infrastructure leads directly to the creation of economic value in the form of crops and the business of creating them. Whether it is through the direct delivery of "allocated," transferred, or purchased water; the provision of transport infrastructure; or the measuring, tracking, and pricing locally-derived water supplies, WWD plays a central role in the creation of farm products that have measurable and direct economic benefits.

The extent of agricultural crop production within the Westlands Water District is considerable, as shown in Figure 8, totaling nearly $1.8 billion dollars of estimated crop value on just over 351,000 acres of farms.

Figure 8—Westlands Water District Estimated Crop Acreage and Value, 2015 Growing Season

Sector	Acres	Estimated Value
Grain farming	33,187	25,334,037
Vegetable and melon farming	109,947	573,137,179
Fruit farming	27,166	160,801,620
Tree Nut farming	149,324	869,169,854
All other crop farming	32,269	132,318,569
Total Farming	**351,893**	**1,760,761,260**

SOURCE: District data and Fresno Farm Bureau *Annual Crop Report, 2014.*

A. Farming Serves as the Economic Engine

Farming as an economic process functions much like many natural resource-driven industries. One must first find a location that has the critical resources available to produce the

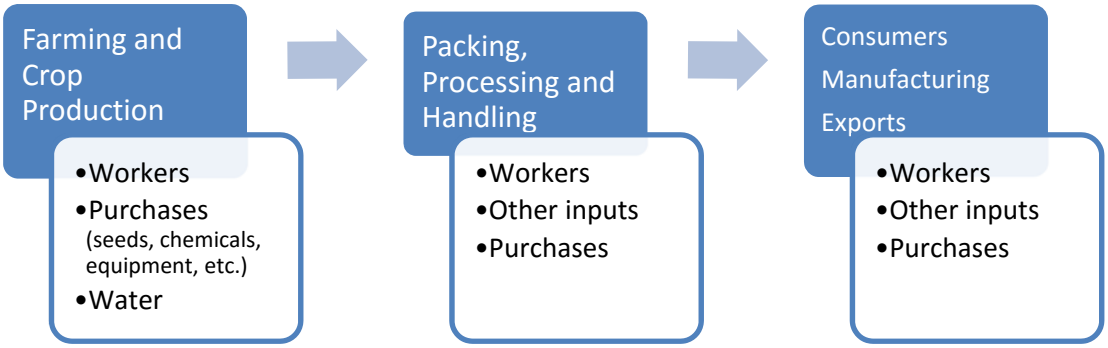
product in question. For mining, as an example, it is the presence of the requisite ores in enough concentrations to be commercially feasible to harvest. In the case of farming, one must find locations with the right types of soils, farmable geography (mostly flat), appropriate growing seasons, consistently mild (or predictable) weather patterns, and water. The Central Valley is richly endowed with all but the last of these—water. California, with remarkable foresight and planning addressed the need for water by investing, in partnership with the federal government and local land owners, in the infrastructure to provide water in commercially viable quantities and, as a result, California produces the vast majority of fresh produce and vegetables consumed in the United States and, for some types of products, the world.

While the recent drought, combined with state and federal regulatory actions, has hampered the effective functioning of this system, farmers in the state's Central Valley have adapted to this changing environment through the use of technology and modified planting strategies. This has resulted in some significant changes to local planting patterns in recent years that, if sustained into the future, will affect the price and portfolio of fruits and vegetables available to consumers.

To produce these crops, the farmers hire employees; buy seed, fertilizers, farm equipment, fuel, water, irrigation equipment and supplies, fuel, and other supplies; hire attorneys, accountants, consultants, and other experts; build facilities, homes, roads; and, in today's tech-savvy farming, develop computer and electronic monitoring infrastructure to track the status of their crops in real time. All of these activities contribute to the economic footprint of their farming activities.

Beyond this, as Figure 9 shows, these crops are then transported to other locations for packing and processing for immediate processing or eventual distribution to consumers, food product manufacturing, animal feeding, and other uses—both locally, domestically and internationally. Within each of these steps in the food production process, additional inputs are required including labor (workers), infrastructure, production inputs (e.g. containers, electricity, other food products, etc.), and utilities like vehicle fuel, electricity, and gas.

Figure 9—Model of Farming's Economic Impact



Each of the steps in the production process is dependent on the preceding steps and factors which affect one step in the process which will affect the quantity and quality of inputs available for subsequent steps. Rising water prices or restricted supplies, for example, will result in fewer crops, which will in turn result in less produce available for packaging or processing, and eventually less produce available to food manufacturers and consumers. This ripple effect is important, both in estimating the economic impact that farming has, because it goes beyond the traditional "multipliers" people think of in economic processing to affect other entire sectors of the economy.

B. Estimating the Economic Impact of the Westlands Water District

To estimate the economic impact of the Westlands Water District, this testimony will look at three components of its role in the local economy: (1) the economic value of the crops produced by the farmers who use its water and water infrastructure to produce economic value; (2) the economic value associated with the secondary markets that take these crops to their ultimate market destination; and (3) the economic value of the goods and services directly purchased by the District to provide the water infrastructure and services incumbent in its mission and business model. Each of these components is analyzed and aggregated to provide an overall impact.

1. Methodology

To estimate the economic impact of the three areas listed above, the primary economic value of each of the activities was input into the IMPLAN® economic modeling program. IMPLAN is the industry standard for providing economic impact analyses of specific activities. It is an "input-output" type simulation model that use detailed economic data to calibrate its estimates of the subsequent impacts of various economic and policy-related activities. It breaks the economy down

into approximately 400 sectors and uses detailed coefficient matrices to estimate the dynamic effects of policy choices through multiple iterations of impacts.

IMPLAN requires breaking the policy or impact to be analyzed into specific activities that fit its framework of sectors. With these inputs the model then provides the detailed impacts on employment, total economic output, proprietor income, labor income, and government tax revenues.

Generally, there are four steps to building these models: (1) defining the geography for the modeling; (2) breaking the policy or entity's impact into the requisite model sectors; (3) inserting them into the model; and (4) assembling and interpreting the results from the many scenarios.

For purposes of this analysis, Fresno County-level data was used to assess the economic impacts. Similar models were constructed using census tract-delineated boundaries for the district, and building separate models for both the Fresno and Kings County components of the Westlands Water District, although their results are excluded here because adding the complexity associated with each did not materially affect the findings presented here using the Fresno County-based model. Crop acreage data was combined with the most recent available valuation information published in the Fresno County *2014 Annual Crop & Livestock Report*[3] to estimate crop values. Industry-specific studies of Secondary Agricultural Production levels were reviewed in combination with geographically-generated estimates from the IMPLAN model's 2014 data to create the requisite estimates of Secondary Agricultural Production valuations. Finally, sensitivity analyses were prepared for each to ensure that the uncertainty around each estimate did not materially reverse any of the findings presented here.

2. Westlands Water District has a Major Economic Impact

With the methodological issues addressed, it is possible to estimate the overall impact of the operations of Westlands Water District on the economy. Figure 10 provides the results of this analysis.

Westlands Water District, in aggregate, is directly and indirectly responsible for some $3.6 billion dollars of economic activity and nearly 29,000 jobs across the economy. Most of these

[3] It should be noted that while the 2015 Kings County crop report was available to the author, the narrow range of crops detailed there limited its usefulness for building the models.

impacts are through what the model calls "direct effects"—specifically through the growing of agricultural products and the value added associated with the processing and handling of those products—representing some $2.6 billion of the economic impact and more than 21,000 jobs.

"Indirect effect" impacts, which account for another $189 million in economic impacts, are the economic activity associated with the activities necessary to accomplish the main production process, but not actually part of it. For example, when a farmer buys a truck to haul produce as part of their operation, this will create jobs in the truck manufacturing sector as the demand for trucks goes up by one. In this case it generally represents the economic activity fueled by the non-labor inputs necessary to farm—including things like chemicals, planting and harvesting equipment, irrigation equipment and supplies, electricity, seed, spare parts, etc. It is worth noting that while these indirect impacts are proportionately smaller than the direct effects, this difference is NOT a measure of profitability. This model looks more directly at the value added of the activities, not their relative profitability.

Figure 10—Overall Economic Impact of the Westlands Water District, 2015

EMPLOYMENT	Jobs Created	Share
Direct effects of agricultural production	21,444.3	74.3%
Economic impact due to inputs to agricultural production (indirect effects)	1,396.1	4.8%
Impacts due to increased employee income and consumption (induced effects)	6,011.3	20.8%
Total Effect	**28,851.6**	**100.0%**

ECONOMIC IMPACT	Total Impact	Share
Direct effects of agricultural production	$2,611,525,840	72.6%
Economic impact due to inputs to agricultural production (indirect effects)	188,568,049	5.2%
Impacts due to increased employee income and consumption (induced effects)	795,875,686	22.1%
Total Effect	**$3,595,969,575**	**100.0%**

SOURCE: IMPLAN Pro and this analysis.

"Induced effect" economic activity is associated with the new spending power that individuals and firms have as a result of their participation in the production of the crops and its

successor activities. It reflects the things that individuals and firms buy in the economy as the result of their wages and earnings. As people work in the sector and earn wages, they go out and buy food, clothes, cars, etc. These purchases then create economic demand for these products which in turn creates more jobs and economic activity in other sectors. As a result of the jobs created directly and indirectly through the Westlands Water Districts and its customers, almost $800 million in new economic activity and 6,000 additional jobs are created.

Figure 11 shows this economic activity separated across the three tasks delineated above (growing crops, subsequent food production,[4] and Westlands' spending).

Figure 11—Overall Economic Impact of the Westlands Water District, By Activity Category, 2015

EMPLOYMENT	Jobs Created	Share
Crop Production	10,687.4	37.0%
Secondary Agricultural Production	17,680.5	61.3%
Westlands Operational Activity	483.7	1.7%
Total Effect	**28,851.6**	**100.0%**

ECONOMIC IMPACT	Total Impact	Share
Crop Production	$2,310,713,960	64.3%
Secondary Agricultural Production	1,189,807,246	33.1%
Westlands Operational Activity	95,448,369	2.7%
Total Effect	**$3,595,969,575**	**100.0%**

SOURCE: IMPLAN Pro and this analysis.

As this analysis shows, while the primary economic impact on total output of the Westlands Water District is through the direct production of crops, its employment impacts are concentrated in the secondary agricultural production dimension—in the packing, handling, processing, and subsequent manufacturing of food products derived from the agricultural products of District farmers. There are two important implications of this result. First, as Figure 8 shows, none of these

[4] Subsequent food production (also called "Secondary Agricultural Production") was difficult to model due to the large variety of crops produced in WWD and the limited literature on value added in each. Our literature review focused on two of the largest contributors to the agricultural output of the region—almonds and processed tomatoes—for which there is some detailed literature available. Sensitivity analyses were performed that showed the results presented here to be robust under a range of assumptions.

jobs will exist if the crop production does not happen—there must be tomatoes to process if you are a tomato processor. Second, many of these jobs may well occur well beyond the physical boundaries of the Westlands Water District. One of the challenges of modelling a relatively small and sparsely populated geographic area like Westlands is that much of especially the Secondary Agricultural Production will likely occur at regional processing facilities that may be located in nearby towns, or perhaps even in distant locations.

C. Estimating the Impact of the Drought on the Westlands Water District's Contribution to the Economy

As a major water provider and the largest agricultural water district in the nation, the recent, prolonged drought has had significant impact on the district's ability to deliver water, and the ability of its growers to fully contribute to the economy. This has been driven by the decision by the state and federal regulators for regulatory reasons to limit the share of the overall water allocation that the District receives. As a result, the level of water received by the district, and hence available to sell to their customers for farming purposes, has vacillated dramatically over the past two decades.

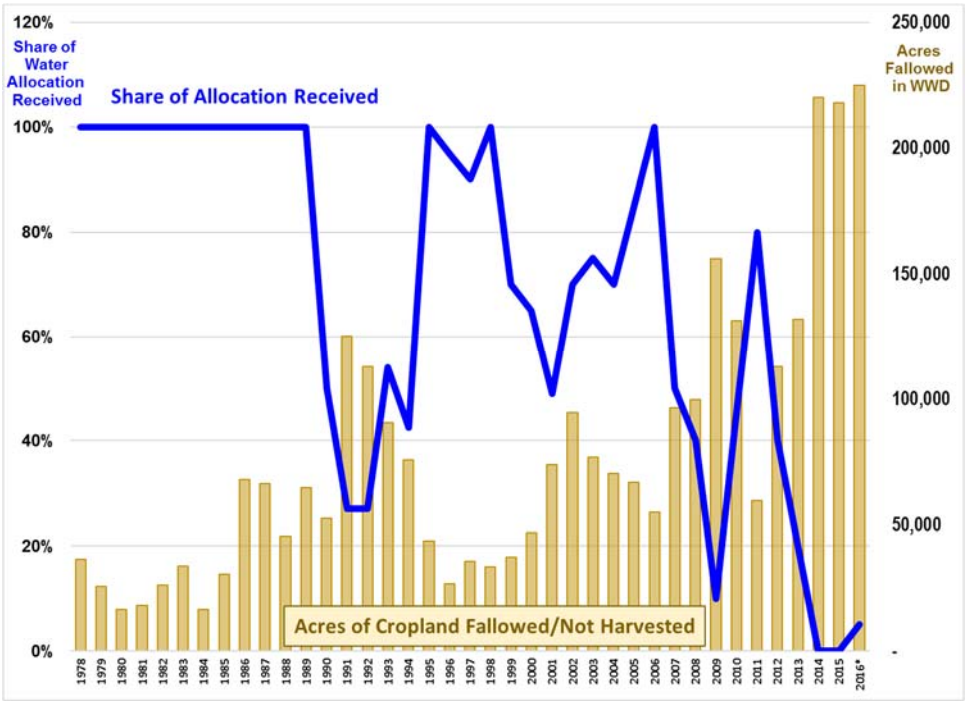
1. Estimating the Economic Impact of Fallowing Prime Farmland

This not only affects the volume of water available to customers, but increases the cost of water to farmers as they either have to purchase expensive water from other sources or pay to pump groundwater.[5] Consequently, farmers are more likely to fallow ground during years when the district receives a lower share of its allocation as seen in Figure 12.

There is a direct and inverse relationship between the share of the water allocation received by Westlands and the level of acreage fallowed by farmers within the district. Because of the volatility in the blue line, and its persistence at very low levels over the past two decades, Westlands Water District farmers have become global leaders in water-efficient farming. Driving through the Central Valley, it is a sure sign that you have passed out of the Westlands Water District when you spot flood irrigation. All water transfers for irrigation within Westlands are in enclosed pipe and more than 95 percent of its irrigation is typically through drip or concentrated delivery systems.

[5] Groundwater also has more salinity issues involved which can be detrimental to crop health and yields.

Figure 12—Share of Water Allocation Received and Acres Fallowed/Not Harvested, Westlands Water District, FYE 1979 through 2016

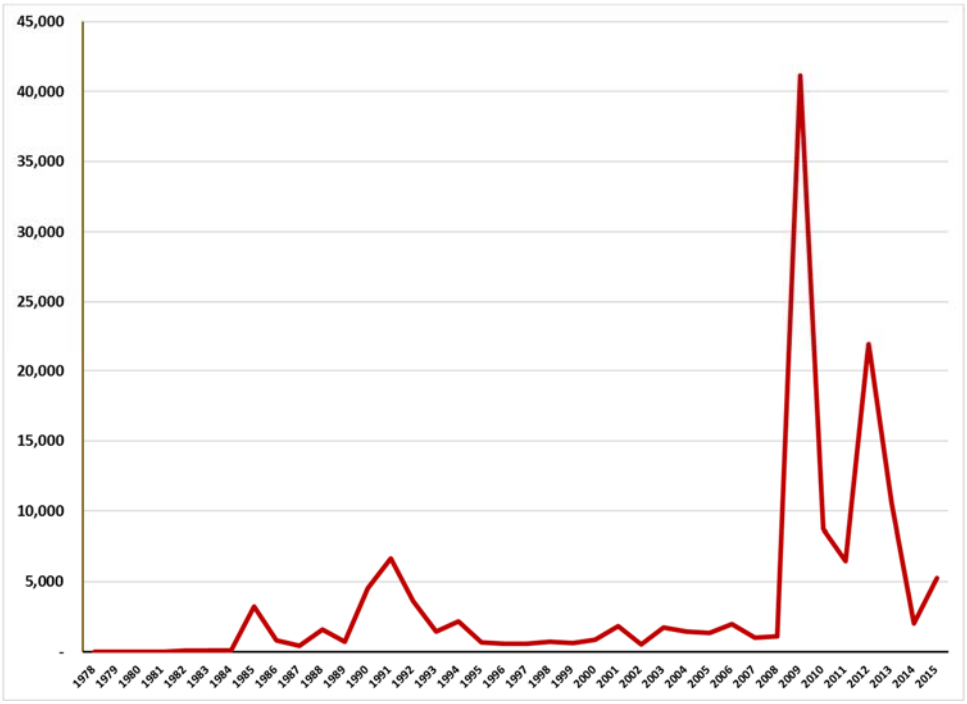


SOURCE: Westlands Water District data.

The brown columns in Figure 12 represent acres of otherwise potentially agriculturally productive land each year that are lost to production. In recent years another trend has risen into greater prominence—planting a crop and then choosing not to harvest it. In the recent drought years, when water supplies have been unreliable, this lost harvest has skyrocketed, as shown in Figure 13.

These trends are of particular concern because not only do they represent lost revenues and value added for the local economy, but they also add additional financial pressure on local farmers because they incur many of the costs of soil preparation and planting and cultivation (including the application of scarce water resources) and then receive no revenues as a result of that investment. Consequently, this is done only as a last resort when the net costs of sustaining and eventually harvesting the crop exceed the expected revenues from selling it in the marketplace.

**Figure 13—Acreage Planted but Not Harvested,
Westlands Water District, 1978-2015**

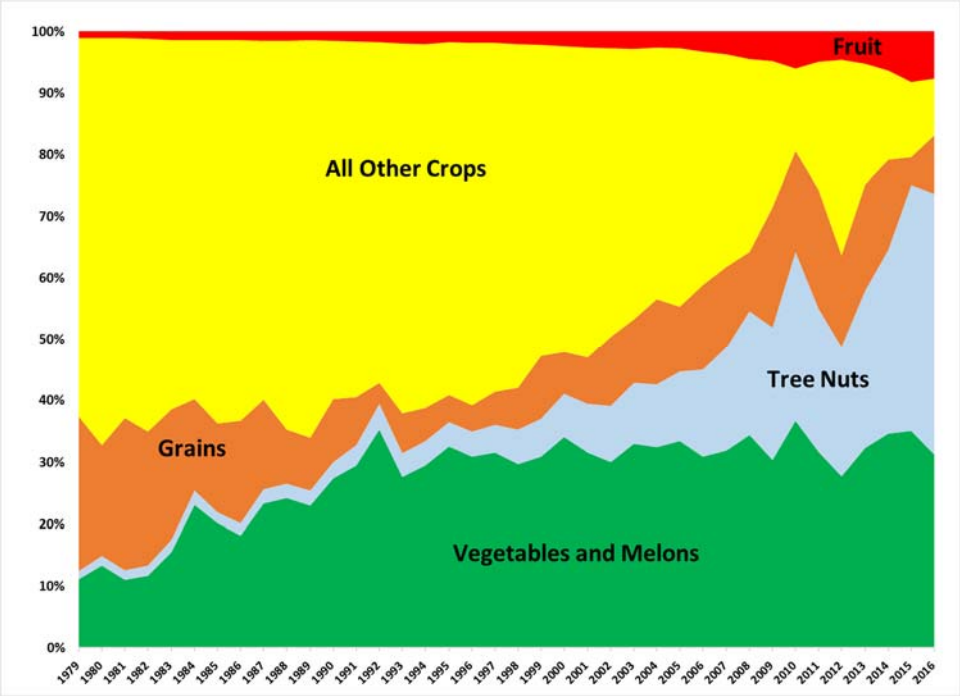


SOURCE: Westlands Water District data.

2. Understanding the Implications of the Changing Crop Composition on the District's Economic Impact

Despite significant investments in innovations and investments to minimize unnecessary water loss within the district, water availability has reshaped the way that crops are farmed, but also the types of crops that are farmed. Over time, the types of crops farmers raise within the Westlands Water District have changed switching from more water and labor-intensive crops like grasses, cotton, and beans to higher-margin crops like almonds, pistachios, and wine grapes. This transition has been accelerated and amplified by the recent drought as shown in in Figure 14.

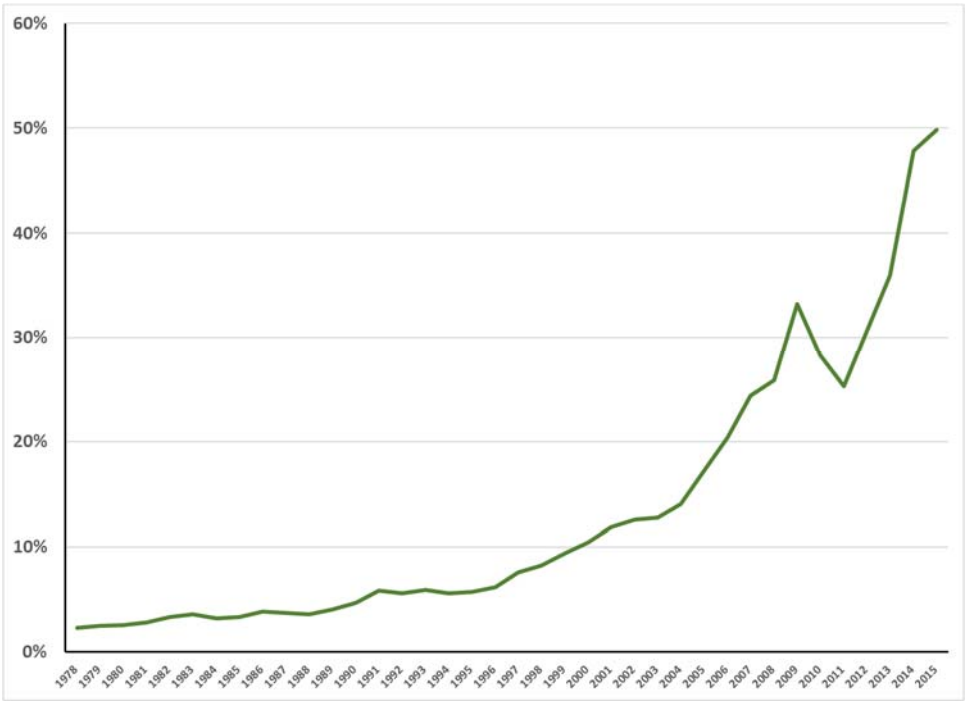
Figure 14—Agricultural Acreage Planted in Westlands Water District, by Category, FYE 1979 through 2016



SOURCE: Westlands Water District data.

Vegetables and melons have remained relatively constant in recent years, while selected fruit and tree nuts have surged. Concurrent with this expansion in these higher margin crops, "grains" and "other crops" which include grasses and cotton, have declined as a share of planted acreage. This has had two impacts—the first has been to reduce the flexibility of the farmers to respond to changes in global demand for crops and products. Tree nuts and wine grapes are long-term investments that require several years of lead time to get into production and, once producing, relatively expensive to clear. That makes them a long-term commitment by farmers and any acreage committed to them is committed for the long term. Figure 15 shows the rising importance of these permanent crops to the Westlands growing area. This makes it more difficult for farmers to shift production in response to changing market demand, or even the availability of more water. The elevated availability of fallowed land can offset this inflexibility a bit, but it is a long-term issue for the region's economy.

Figure 15—Share of Planted Acreage with Permanent Crops, Westlands Water District, 1978-2015



SOURCE: Westlands Water District Data. NOTE: Crops included here as permanent crops include tree nut crops, grapes, and fruit trees.

The second implication of this shifting portfolio of agricultural production within the district has to do with displacing local temporary workforces. Many of the displaced crops require significant interactions with workers as they are planted, weeded, cared for, and harvested. Crops like lettuce and tomatoes, for example, require a temporary workforce. Additionally, many of these crops have shorter growing seasons and, for some of them, multiple crops can be planted, grown and harvested on a piece of land in a single growing season. Tree nuts have modestly high labor needs up front and then require less manpower over the life of the production. As a result, shifting from labor-intensive production to less labor-intensive production for the same acreage should produce a reduced demand for agricultural labor which means we would expect to see fewer jobs under the "direct effects" listed in Figures 16 and 17. At the same time, if the crops produce much higher yields in terms of value added (part of why farmers are turning to these crops during the drought), these direct job losses may be offset in part by slightly higher "induced effects" and (if inputs are more expensive) "indirect effects."

(a) Different Crops Have Different Labor Requirements

One of the primary drivers of this result is that different crops have different labor requirements. Tree nuts like almonds, for example, have a large labor and capital investment up front as the trees are planted and then relatively little labor needed as they grow into production, and proportionately fewer workers for harvesting. Fresh food crops like lettuce, broccoli, and onions require more intensive hand labor throughout the crop life cycle.

To analyze this question, a simulation was developed using the detailed economic profile of the region wherein 1,000 acres were placed into production using the average value yield per acre for that category. This yield was then inserted into the model to ascertain the net economic impact of using that 1,000 acres for that crop. The purpose was to identify the net job impacts per acre of production across each of the sectors. The results are presented in Figure 16.

Figure 16—Simulated Employment Impacts for Growing 1,000 Acres of Farming Production, By Sector, Fresno County, 2015

Sector	Direct Jobs	Total Jobs	Total Output
Grain farming	0.7	6.4	1,375,811
Vegetable and melon farming	14.5	26.9	6,756,223
Fruit farming	34.3	48.7	7,644,591
Tree nut farming	17.8	31.4	7,544,658
All other crop farming	34.0	50.8	6,008,825

SOURCE: IMPLAN Modeling simulations.

The differences in overall job yields in each sector for a 1,000-acre planting are striking, while the largest differences are driven by the disparate market valuations. The first column in Figure 16 points to the differences in manpower necessary to produce crops within each of the farming sectors, and the differences are large ranging from 0.7 to 34.3 jobs per 1,000 acres of production. The second column then describes the overall labor impact associated with the production in these crops while the third column describes the overall production-related economic impact associated with growing the crops. Even when the direct job impact is similar, as is the case with grain farming, the input costs can vary such that the overall employment impact is significantly higher. The bottom line is that the composition of agricultural production across these sectors can produce significantly different labor market outcomes.

Given the complex interaction between crop yield per acre, labor required for each crop, and acreage of each crop planted, what impacts have the changing crop distributions identified in Figure 14 have on the overall demand for labor within the Westlands Water District? To answer this question, a simulation was conducted to isolate the effects of crop composition on labor demand within the agricultural production in the District.

To assess the impact of the changing crop mix, it was necessary to find a way to hold valuation constant while allowing the distribution of crops across the sectors to vary. Accordingly, the computed crop value of the 2015 crop year sectoral was reapportioned across the six sectors using the crop value shares from 1993 and 2008. This was done by taking the percent of 1993's crop valuation for grain farming, for example, and multiplying it times the 2015 total crop valuation. This was done for each of the major sectors to create a total direct output for agricultural that was the same, but that reflected the mix of crops for 1993 and 2008. These results were then run through the IMPLAN model to ascertain the direct and total levels of labor generated by each profile's mix of crops and are presented in Figure 17.

Figure 17—Simulated Effects of Crop Mix Profiles on Demand for Labor Involved in Crop Production - Westlands Water District, 2015

EMPLOYMENT	Estimated Using 1993 Crop Profile	Estimated Using 2008 Crop Profile	Actual Using 2015 Crop Profile
Direct Effect	10,019.2	8,870.1	6,199.2
Indirect Effect	3,030.0	1,185.0	981.8
Induced Effect	3,292.9	3,299.8	3,506.4
Total Effect	**16,342.1**	**13,354.9**	**10,687.4**

SOURCE: IMPLAN Pro and this analysis. NOTE: This analysis does not explicitly measure the actual effects of the specific crop changes from 1993 to 2015, but rather it documents the patterns that underlie those changes.

The fourth column, marked "Actual Using 2015 Crop Profile" reflects the actual estimated values of labor impacts for the latest crop year. The other two columns show what that labor impact would be if the overall valuation produced in 2015 had been generated using the relative shares of crops present in the 1993 and 2008 crop years.[6] The changing crop mix has resulted in significant

[6] The purpose of the simulation is to hold the overall valuation constant and to focus on the employment effects induced by crop mix changes. Clearly to achieve some of these valuations in these years, additional acres of crops would need to be planted and may not be feasible even if

downward pressure on overall labor demand within the district as the acreage planted has shifted from high-labor crops to less-labor intensive crops. Almost two-thirds of the modeled job change is related to this direct effect. The remaining one-third is focused around the "Indirect Effects" associated with the changing crop mix. This means that the inputs associated with the production of the crops are less labor intensive for the newer crops. Long-term stock like almond trees, for example, have lower annual labor costs to maintain from year-to-year on average than the annual costs associated with planting, maintaining, and harvesting lettuce, onions or tomatoes. As a result, the number of indirect jobs created by the District as it continues its long-term shift into more tree nuts and wine grapes have declined.

(b) Short and Long-Term Labor Trends for "Permanent" Crops May be Divergent

One headline making the news in recent months has been the profitability and higher employment levels realized by agriculture in some recent years, despite very low water access. While the higher profitability is easily explained by the shifting production from low-margin crops like grasses, cotton, and grains toward fruit, tree nuts and other permanent crops like wine grapes, the labor component is not as obvious given the evidence shown in Figure 17, where these crops have long-term lower labor demands.

The answer which reconciles this inconsistency lies in two threads: (1) the shift away from cotton, alfalfa, and grains; and (2) the life-cycle dimension of these permanent crops. First, large scale crops like cotton and grains have very low labor demands because they are large scale and heavily automated crops. Note that the direct jobs created in Figure 14 for 1,000 acres of planting for these crops are less than 1.0 and total jobs are in the 2-6 range. So shifting acreage from these uses to any other crop categories in Figure 16 will increase the specific labor demanded per acre planted significantly.

The second issue arising from the crop shift to permanent crops, however, has important long-term implications for employment in the region. Since almonds, pistachios, and walnuts grow

adequate water and capital were available.

on trees, the ground preparation, planting and early care for these crops are the most labor-intensive part of the crop life cycle. This means that the early years see higher labor use levels and the subsequent years see much lower levels of labor use. Since the trend toward nut trees and grapevines has intensified in recent years, the region is currently in the midst of this labor-intensive portion of the crop life cycle. As the trees mature, this intensity will likely wane and labor demand could decline over time.

An associated complicator is the "permanent" nature of these crops—they cannot be replaced easily with other crops if environmental and crop conditions change. Furthermore, these crops must be watered every year to protect the investment—you cannot fallow a living tree or vine. This means that farmers who are pursuing this strategy will be locked into acquiring water to protect their investment—thereby increasing the long-term pressure on groundwater supplies if surface water availability does not increase.

IV. The Importance of Westlands Water District's Contribution to the Supply of Fresh Nuts, Fruit, and Vegetables

Westlands irrigated agriculture is a significant contributor to both the region and national economies. Crops produced within Westlands' boundaries produced an estimated 23.4 percent of the crop-related agricultural production in Fresno County in 2014 and 7 percent of the crop-related agricultural production in Kings County in 2014.[7] Given that Fresno County ranked third in the state in 2014 for overall agricultural production and Kings County ranked 8th, this is a significant contribution. Figure 18 shows the overall shares of county, state and national crop production produced by farmers who are part of the Westlands Water District.

Westlands growers contribute more than 26 percent of fruit and nut production in Fresno County, and almost half of the vegetable and melon produced in the county. Similarly, for Kings County, the modest acreage that falls within Westlands Water District accounts for 18 percent of

[7] Even though the 2015 county-level results are available for 2014, the values are not available at the state level. Using 2014 pricing data, Westlands Water District agricultural output accounted for an estimated 23.8 percent of overall crop value in Fresno County in 2015 and 9.3 percent of Kings County overall crop values.

Kings County fruit and nut crops, and more than one-fourth of the vegetable and melon crops. Nationally, Westlands growers provide 3.4 percent of the national production of fresh fruit and nuts and 3.1 percent of the national production of vegetables and melons—an impressive total given the small scale of the district relative to the total arable land in the United States. This points to the unique character of this farming region and its ability to provide fresh fruits and vegetables to the nation year-round.

Figure 18—Westlands Water District Overall Share of Fresh Fruit and Vegetable Crops, Estimated Crop Values by Category, 2014
(thousands of dollars)

	Westlands Water District	Fresno County	Kings County	California	United States
Fruit and Nut Crops	1,025,072	3,478,342	569,018	20,774,151	30,101,275
getable and Melon Crops	593,470	1,192,387	219,293	8,288,768	18,852,397
All other	197,751	418,112	494,899	9,111,737	160,340,590
Total	**$1,816,293**	**$5,088,841**	**$1,283,210**	**$38,174,656**	**$209,294,262**
Westlands Water District - Share of Overall Output					
Fruit and Nut Crops		26.2% [a]	17.8% [a]	4.9%	3.4%
getable and Melon Crops		44.5% [a]	25.5% [a]	7.2%	3.1%
All other		43.4% [a]	3.0% [a]	2.2%	0.1%
Total		**23.4%** [a]	**7.0%** [a]	**4.8%**	**0.9%**

SOURCE: Westlands Water District data; Fresno County Department of Agriculture, *2014 Fresno County Annual Crop & Livestock Report*; Kings County Department of Agriculture/Measurement Standards, *Kings County Agricultural Crop Report 2014*; California Department of Food and Agriculture, *California Agricultural Statistics Review2014-15;* United States Department of Agriculture, *Agricultural Statistics 2014.* [a]-includes only the share of production of farms within the Westlands Water District that are within each respective county-imputed from 2015 data.

California's growing regions are the nation's primary source of fresh fruit, nuts, and vegetables as shown in Figure 19. California growers account for well over half the total U.S. production of nearly every category of fresh fruit and vegetables consumed in the United States—accounting for more than 85 percent of the production for 23 crops and more than 45 percent of the U.S. production of 36 crops.

Figure 19—Crops for Which California Accounts for More Than 20 Percent of Total U.S. Production, 2014

Share of Total US Production	Crop
95% – 100%	Almonds, Artichoke, Broccoli, Celery, Dates, Figs, Garlic, Kiwifruit, Olives, Pistachios, Plums, Prunes, Processed Strawberries, Processing Tomatoes, Walnuts
85% – 95%	Nectarines, Lemons, Fresh Strawberries, Cauliflower, Apricots, Leaf Lettuce
65% - 85%	Avocados, Fresh Carrots, Tangerines & Mandarins, Honeydew Melons, Peaches, Head Lettuce, Romaine Lettuce, Fresh Spinach, Chile Peppers, Raspberries
45% - 65%	Cantaloupe, Bell Peppers, Asparagus
20% - 45%	Onions, Fresh Tomatoes, Fresh Cabbage, Pears, Fresh Market Corn

SOURCE: California Department of Food and Agriculture, *California Agricultural Statistics Review2014-15;* United States Department of Agriculture, *Agricultural Statistics 2014.*

Growers in the Fresno and Kings Counties play a central role in this agricultural leadership. Figure 20 shows the 32 crops for which growers in Fresno and Kings County are in the top five producers in California. For many of these crops, Fresno and Kings Counties produce a major share of the state's overall production. For some crops like garlic (84 percent), honeydew melons (63 percent), cotton lint (59 percent), cottonseed (51 percent), nectarines (50 percent), and plums (57 percent), the two counties produce a dominant share of the state's production. For many others, the two counties represent more than one-sixth of the state's production. These crops include alfalfa (29 percent), almonds (17 percent), apricots (27 percent) asparagus (29 percent), blueberries (19 percent), cantaloupes (49 percent), cherries (16 percent), chili peppers (36 percent), fresh sweet corn (38 percent), onions (26 percent), peaches (37 percent), pistachios (28 percent), fresh tomatoes (34 percent), processing tomatoes (44 percent) and vegetable/vine crop seeds (16 percent).

The District's contributing shares are even- higher. For example, Westlands almond growers produce almost half of the almond production in Fresno County—accounting for an estimated 43 percent. Even more impressive, almond growers within Westlands' boundaries produced more than 10 percent of the state's $5.9 billion of almond production (California Department of Food and Agriculture, 2015). California in turn produced 82 percent of the world's production of almonds, (Pierson, 2014) meaning that Westlands growers provided more than 8

percent of the global supply of almonds. Similarly, Westlands growers accounted for an estimated two-thirds of all processed tomatoes grown within Fresno County and roughly one-

Figure 20—Crops for Which Fresno and Kings County Are in the Top Five Counties in California, 2014

Commodity	Fresno County Rank in Calif.	Fresno County Share of Calif Crop Value	Kings County Rank in Calif.	Kings County Share of Calif Crop Value	Westlands WD Share of Fresno County Value Produced	Westlands WD Share of Kings County Value Produced	Westlands Share of State Value Produced
Alfalfa Seed	2	29%					
Almonds	3	17%			43%	23%	10%
Apricots	2	15%	4	12%	21%	43%	14%
Artichokes	5	1%					
Asparagus	2	29%			36%		16%
Blueberries	4	19%			26%		5%
Broccoli	5	2%			23%		0%
Cantaloupes	1	49%			94%		36%
Cherries	3	9%	5	7%	29%	1%	4%
Chili Peppers	2	36%			16%		2%
Corn (Sweet)	1	38%			83%		15%
Cotton Lint	2	22%	1	37%			12%
Cottonseed	3	20%	1	31%			0%
Dates	3	1%					
Garlic	1	84%			15%		14%
Grain Hay	5	6%					
Grapes (all)	2	13%			10%	6%	2%
Honeydew Melons	1	63%			66%		35%
Kiwifruit	4	3%			0%		0%
Lettuce	4	4%			100%		5%
Nectarines	2	43%	3	7%	0%	19%	3%
Onions	2	26%			53%		25%
Oranges	3	9%			12%		3%
Peaches (all)	1	32%	5	5%	0%		2%
Pears	5	3%			0%		0%
Pistachios	2	23%	5	8%	52%	40%	16%
Plums	1	48%	3	9%	0%	5%	1%
Tangerines	3	8%			0%		0%
Tomatoes (Fresh Market)	1	34%			22%		8%
Tomatoes (Processing)	1	32%	3	12%	67%	21%	24%
Veg and Vinecrop Seeds	3	16%					
Watermelon	5	12%			80%		13%

SOURCE: Westlands Water District data; Fresno County Department of Agriculture, *2014 Fresno County Annual Crop & Livestock Report*; Kings County Department of Agriculture/Measurement Standards, *Kings County Agricultural Crop Report 2014*; California Department of Food and Agriculture, *California Agricultural Statistics Review2014-15;* United States Department of Agriculture, *Agricultural Statistics 2014.* [a]-includes only the share of production of farms within the Westlands Water District that are within each respective county-imputed from 2015 data.

fourth the state total. Statewide, Westlands growers in both counties accounted for an estimated 24 percent of processed tomato production (California Tomato Growers Association, 2016).[8]

Crops highlighted in orange in the Figure 20 indicate crops for which Westlands Water District farmers produce more than *three* percent of the national total of the crop and those highlighted in yellow indicate crops for which Westlands Water District farmers produce more than *nine* percent of the total U.S. crop value, with honeydew melons (23.5 percent), processing tomatoes (22.8 percent) and pistachios (19.6 percent) reflecting the highest values.

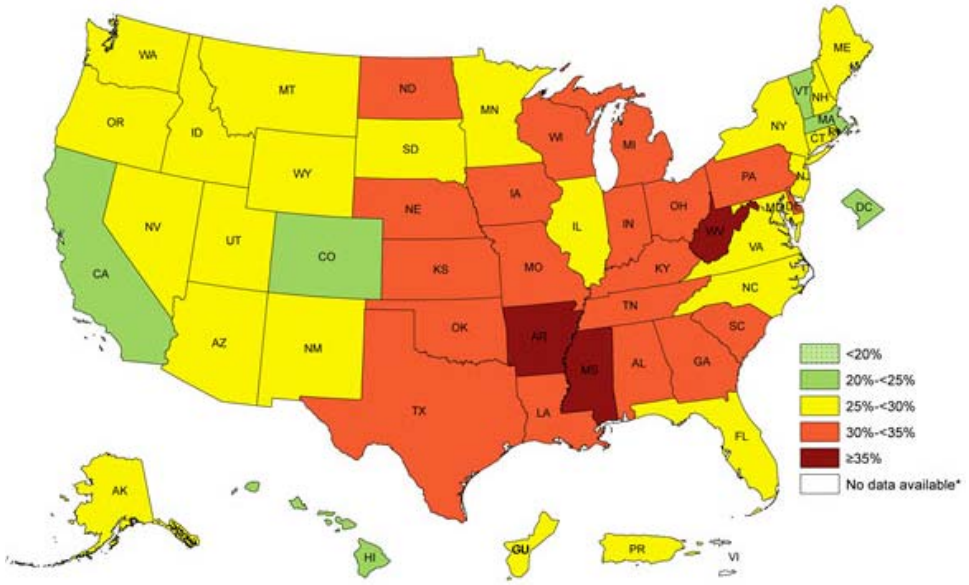
Figures 20 and 21 read like a shopping list for the nation's healthy-eating initiatives to counter obesity in the United States. Figure 21 shows the self-reported obesity rates across the nation. Some 34.9 percent or 78.6 million U.S. adults were obese in 2011-12 and 17 percent of youth.[9] The annual medical cost alone totals $147 billion in 2008.[10] Only 5 states have self-reported obesity rates of less than 20 percent. California's production of healthy fresh fruit and vegetables remain a critical component in slowing and possibly reversing the growth of this destructive health trend.

[8] Imputed using state pricing and crop data from the California Tomato Growers Association.

[9] Ogden, Cynthia, *et.al.*, "Prevalence of Childhood and Adult Obesity in the United States, 2011-12," *Journal of the American Medical Association*, 2014, 311 (8): 806-814. http://jama.jamanetwork.com/article.aspx?articleid=1832542, accessed August 21, 2016.

[10] Finkelstein, Eric A. *et al*, "Annual Medical Spending Attributable to Obesity: Payer- and Service-specific Estimates," *Heath Affairs*, 2009, 28: 822-831. http://content.healthaffairs.org/content/28/5/w822.full.pdf+html, accessed August 21, 2016.

Figure 21—Self-reported Obesity Among U.S. Adults, by State and Territory, 2014



SOURCE: Centers for Disease Control and Prevention, Behavior Risk Factor Surveillance System, http://www.cdc.gov/obesity/data/prevalence-maps.html, accessed August 21, 2016.

California and its agricultural regions play a critical role in turning back the tide in obesity in the United States and sustaining a critical supply of fresh fruits and vegetables for consumers.

Agricultural exports totaled $21.59 billion for California in 2014, the most recent year for which data are available. Figure 22 shows the exports for the top 15 products for California agricultural exports.

Figure 22—Top 15 Agricultural Exports, California, 2014

Rank	Commodity	Export Value *($millions)*
1	Almonds	4,532
2	Dairy and Products	2,425
3	Walnuts	1,448
4	Wine	1,392
5	Pistachios	1,125
6	Table Grapes	890
7	Processed Tomatoes	776
8	Rice	714
9	Oranges and Products	575
10	Raisins	410
11	Strawberries	408
12	Beef and Products	404
13	Cotton	379
14	Lettuce	337
15	Seeds for Sowing	324

SOURCE: California Department of Food and Agriculture, *California Agricultural Exports, 2014-2015*.

Of these fifteen commodities, growers in the Westlands Water District contribute significantly to the state's supply of nine of these commodities, including almonds, wine (by providing wine grapes), pistachios, table grapes, processed tomatoes, raisins, cotton, lettuce, and seeds for sowing. Additionally, hay, grain and feed production from farms within the district contribute to two others—dairy and beef products.

V. Replacing Lost Agricultural Production Introduces New Challenges

The importance of agricultural production to the economies of these localities and the state cannot be overstated and go far beyond the economic case presented in this analysis for jobs and wealth creation across the income distribution. These are important points—California's farms create jobs for low-skill and low-educational attainment workers. These workers are not easily transferred into other roles in the economy. In many instances, these workers have acquired specialized skills, experience and training that is uniquely specific to the agricultural industry. Additionally, neither the educational or physical infrastructure exist in these remote communities to provide workers the opportunity to transition to other occupations.

It is important to remember that the United States has a limited range of places where the geography, climate, soil, economy and regulatory environments combine to allow the growing of many varied crops in the California Central Valley. In an increasingly global market place, not only does it provide an opportunity for U.S. agricultural products to be sold globally—creating new markets and demand for products—but it also means that local production can be supplanted by crops produced in other countries. In fact, the United States imports significant quantities of agricultural products, including fresh fruit and produce from abroad. Figure 23 shows the imports of fresh or frozen fruit and fresh vegetables into the United States.

There are compelling reasons, however, why the transition of the U.S. fresh fruit, nut and vegetable supplies to a more heavily import-driven model may not be prudent.

A. A Reliable Domestic Agricultural Sector is Essential to a Robust National Security Strategy

When evaluating national security strategies, one of the core goals is to ensure that a nation retains a predictable, defensible and reliable source of key resources and materials. In times of national distress or military conflict, securing reliable food supplies for citizens and troops is critical. For this reason, domestic production of textiles, foodstuffs, steel, rare earth minerals and other strategic resources is desirable. A stable and robust food supply is one of the first of these. Since many of the climates that could support stable production of fresh fruits, nuts and vegetables tend to be in areas closer to the equator and further from the harsh winters of the northern latitudes, they tend to be concentrated in lesser-developed regions of the globe, such as in Central and South America. Politically, these regions can be unreliable and, in times of international crisis, can turn hostile to U.S. interests (as has been seen in Venezuela, El Salvador, Nicaragua, etc.) Relying on these regions for long-term food supplies raises concerns about national security and safety.

Figure 23—U.S. Imports of Fresh or Frozen Fruit and Fresh Vegetables, 2014

Commodity Category – Fruit	Value of Imported Fruit *($000)*	Commodity Category – Vegetables	Value of Imported Fruit *($000)*
Apples	237,193	Tomatoes	1,936,263
Avocados	1,480,924	Asparagus	497,581
Berries (except Strawberries)	1,415,920	Beans	96,076
Bananas	2,185,461	Cabbage	33,716
Citrus	872,151	Carrots	74,816
Grapes	1,195,201	Cauliflower & Broccoli	176,819
Kiwifruit	100,522	Celery	22,509
Mangoes	467,746	Cucumbers	627,885
Melons	560,572	Eggplant	58,927
Peaches	40,388	Endive	4,648
Pears	119,466	Garlic	131,122
Pineapples	655,172	Lettuce	202,298
Plums	30,259	Okra	27,099
Strawberries	503,926	Onions	354,206
Other	354,734	Peas	72,164
		Peppers	1,273,512
		Potatoes	172,820
		Radishes	19,263
		Squash	303,461
		Other vegetables	575,041
Total Fresh or Frozen Fruit	**10,219,635**	**Total Fresh Vegetables**	**6,660,226**

SOURCE: United States Department of Agriculture, *Agricultural Statistics 2015*, Table 15-5.

B. Domestic Agricultural Production is Held to Higher Standards of Accountability

Turning to international sources for U.S. agricultural consumption opens the door to U.S. economic activity subsidizing farming, labor, and environmental practices that do not meet U.S. and California standards. While this topic has received considerable attention in areas of agricultural imports where domestic production is not possible, for example with "fair-trade coffee," it has not emerged significantly in the other areas of agricultural production where there significant U.S. production. This is because, for most of these crops, the U.S. production dwarfs the import sector and U.S. crops are grown under some of the most stringent regulations possible.[11]

[11] There are other regions with more stringent regulations in some of the dimensions discussed here,

1. Food Safety Regulation Varies

Many Central and South American countries lack the extensive regulations that the U.S. imposes on all steps of production in the growing of its food supply. Chemical types and use are heavily regulated, pests and other potential hazards are monitored, impurities are tested, and food handling processes are specific and regularly enforced through regular inspections by the United States Department of Agriculture and the Food and Drug Administration, as well as state and local regulatory bodies. In many of the regions which would step in to replace a shrinking volume of U.S. agricultural production, these provisions are either lacking entirely, or unenforced with little or no public accountability. Additionally, monitoring systems to address failures of the food safety processes are woefully inadequate and incomplete. In 2011, for example a salmonella outbreak that affected more than 1,400 North Americans involving produce imported to the United States was traced to contaminated water supplies in the Mexican states of Tamaulipas and Nuevo Leon.[12] It is worth noting that it was the U.S. FDA that identified the source of the problem in collaboration, not Mexican agricultural authorities, who were cooperative but incapable of executing the search. Many of the protective institutions and the attendant infrastructure do not exist outside U.S. borders.

2. Environmental Regulations are Often Lacking

The Endangered Species Act, the Clean Water Act, the Clean Air Act and a myriad of other federal, state and local regulations ensure that the overall environmental impacts of any activity, but especially the commercial process of farming, produce a minimal impact on the environment and the ecosystems impacted by farming behaviors. The Environmental Protection Agency and an open legal system powered by well-organized environmental groups constantly provide accountability and oversight to ensure that negative impacts on the natural environment, both intended and unintended, are measured, monitored and, if necessary, mitigated.

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such as the European Union and the Scandinavian countries. However, most of these regions, because of geography, climate, and other factors, do not have significant agricultural export sectors.

[12] Mitchell, David. "CDC says salmonella outbreak is over," *The Packer*, August 29, 2011. Website http://www.thepacker.com/fruit-vegetable-news/cdc_says_salmonella_outbreak_is_over_122115419.html. Accessed August 21, 2016.

These protections and regulations not only affect the farming methods used, but also the availability of resources like water, the types of chemicals allowed to fight pests and weeds, modes of deployment (spray, powder, liquid), levels of acceptable runoff, worker safety and exposure handing chemicals, etc. Numerous studies point to the negative impacts of the use of known toxic chemicals on workers and the environment. A study by the Directorate for Food, Agriculture and Fisheries for the Organization for Economic Cooperation and Development (OECD) documented many of these concerns and issues in a study in 2000 which identified pollution and negative "potential impacts on environmental amenities" as areas of concern.[13]

In that study, the authors also evaluated the environmental impacts associated with agricultural production and noted that it could raise issues in those places to which agricultural production is redirected because of the absence of strict environmental rules, strategies and enforcement mechanisms. In many instances, new agricultural development in the destination communities is seen as a new source of opportunity and wealth—effectively transferring these jobs from California to places that lack the careful attention to environmental impacts found here. The greater transfer of seed stocks, fruit and produce, and intermediate goods also opens the borders to transfers of non-native species that can supplant local species, even to the point of extinction, and harm other domestic crops (as in the case of the Mediterranean fruit fly or a whole host of other pests).

3. Labor Regulations and Standards Diverge

Finally, there is the question of different labor standards. California and the United States have been very aggressive in establishing high standards for wages, worker safety, and worker protections within the agricultural sector. Whether it is specifying wages, work rules, safety requirements, or general labor laws such as those that ban child labor, agricultural production in the

[13] OECD, *Domestic and International Environmental Impacts of Agricultural Trade Liberalization*, 2000 (Peter Wakenhorst). http://www.iatp.org/files/Domestic_and_International_Environmental_Impac.htm, accessed July 15, 2016.

United States must be done in a way that meets a high set of standards. These standards are not automatically binding on U.S. agricultural trading partners.

Mexico, for example, is the source of many fresh fruit and vegetable imports. In December 2014, the *Los Angeles Times* did a four-part series on the labor abuses in Mexico's farming system. One article noted that "an estimated 100,000 Mexican children under 14 pick crops for pay."[14] In another article in the same series about the tomato harvest, it documented worker abuses that included providing substandard and unlivable housing, withholding wages to prevent workers from quitting, gouging workers at company stores to keep them indebted to the employer, and intimidating workers with guards and barbed-wire fences. All of this while paying workers the equivalent of $8 to $12 per day.[15] In May of 2015, after a bitter strike, Mexican farmworkers struck a deal with the Mexican interior ministry that daily wages would double from 100 to 200 pesos—about $13 a day. These labor wages and standards would not be acceptable in the United States or California, but a rising import stream to replace California production could force American consumers to subsidize these very practices.

4. Water Use Efficiency is Higher in California, and Especially in Westlands Water District

Since Mexico is the largest U.S. agricultural trading partner, it makes since to think about the regions of Mexico where the fresh fruit and produce imported to the U.S. are grown. In many instances, this happens in areas of the country where water is abundant and conservation is not critical. But a significant portion of Mexican irrigation is from underground aquifers. Many of the issues raised in these areas parallel the challenges currently faced in California. And yet there is no accountability or mechanisms to regulate these uses.

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[14] Richard Marosi, "Product of Mexico: In Mexico's fields, children toil to harvest crops that make it to American Tables," *Los Angeles Times,* December 14, 2014, http://graphics.latimes.com/product-of-mexico-children/, accessed August 25, 2016.

[15] Richard Marosi, "Product of Mexico: Hardship on Mexico's farms, a bounty for U.S. tables," *Los Angeles Times*, December 7, 2014, http://graphics.latimes.com/product-of-mexico-camps/, accessed August 25, 2016.

Finally, it would be beneficial to California to invest its scarce water resources into the places that can make them go the furthest. Westlands Water District is one of the national leaders in water conservation through the use of technology. More than 95 percent of the irrigation in the District is through drip or concentrated irrigation systems. Westlands not only uses an underground, fully-enclosed distribution system, but also uses more than 3,300 water meters throughout the District to ensure the most stringent conservation practices exist and that any losses due to leakage are immediately addressed. As a result, the district is a leader in ensuring that as much as possible each gallon of water available is delivered and used efficiently. Most other water districts have yet to make these investments to ensure that the water used is used efficiently—allowing good water to go to waste.

The state should consider developing a scale of "blueness" wherein water districts and jurisdictions who have invested in the infrastructure to minimize water waste and loss are rewarded for these investments. Some districts, like Westlands Water District, are pioneers in these areas. Given that a drop of water is a drop of water, no matter who uses it, it would be in the state's best interest to ensure that those who are using those drops would do so in the way that maximizes the economic and social benefit extracted from its use. Farmers who make investments in technologies that minimize water waste and maximize the effectiveness of its delivery should be recognized for their efforts, and raised up as role models for all agricultural production across the state.