Economic Impact of the 2015 Drought on Farm Revenue and Employment

Richard E. Howitt, Josué Medellín-Azuara, Duncan MacEwan, Jay R. Lund, and Daniel A. Sumner

We estimate that a net water shortage of 2.6 million-acre feet could cause 564,000 acres to be fallowed and result in a loss of $850 million in crop production value. The surface water shortage of 8.8 million acre-feet will be replaced by about 6.2 million acre-feet of increased groundwater pumping, at a cost of about $600 million. We estimate the dairy and cattle industries will lose $350 million in revenues. We estimate the direct economic cost of the 2015 drought will be $1.8 billion, with a loss of 8,550 direct farm jobs. Including spillover effects, statewide losses are close to $2.7 billion in output and 18,600 full-time and part-time jobs.

During California's periodic droughts, water shortages lead to fallowing and significant reductions in output from California agriculture. Adaptation methods include changing the typical crop mix by using water for crops with higher revenue per unit of water, substituting groundwater for surface water, water transfers, and additional use of technology.

Estimated changes in water supplies were based on a survey of water districts conducted in the spring of 2015, public announcements of water deliveries from federal and state water projects, and information on groundwater tables from the California Department of Water Resources (DWR) C2VSim model. We used the Statewide Agricultural Production Model (SWAP) to estimate the economic impacts of the 2015 drought. Our preliminary estimates of the impacts of the drought on cropping patterns were reported in Howitt et al. (2015).

We estimated an 8.8 million acre-foot (maf) loss in surface water availability could be partially offset by increased groundwater pumping of 6.2 maf statewide. We used the SWAP model to estimate the additional fallowing of 564,000 acres, and a decrease in crop revenue of about $850 million. Additional losses for cattle and calves ($100 million) and dairies ($250 million), due to reduced winter pasture and higher cost of forage crops, are also expected. The combination of these losses lowers revenue by about $1.2 billion, compared to a normal water year. We estimate groundwater pumping costs could increase by $600 million in 2015 as a result of higher pumping volumes and lower groundwater levels.

Crop Revenue Losses

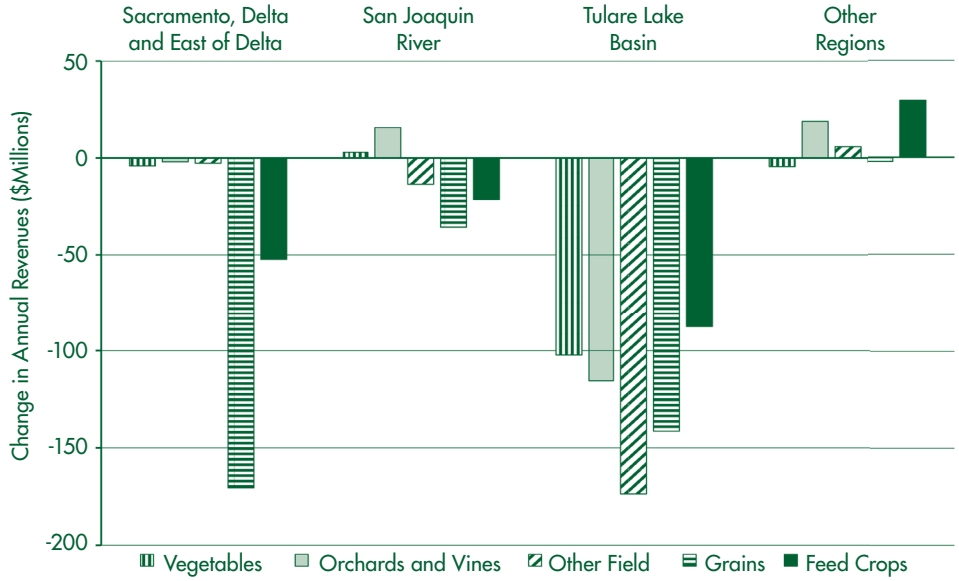
Crop revenue declines vary by region and crop category. Figure 1 shows disaggregated losses. Based on data through late May, our SWAP model estimates that the Sacramento Valley, extending from Shasta County to the delta, will face revenue losses of over $200 million in feed and grain crops while maintaining most vegetable and orchard production. More recent data on water availability and planted acreage are likely to raise these estimates.

The northern San Joaquin Valley, from south of the delta to just north of Fresno County, has relatively small losses and even revenue increases for some crops due to slightly higher crop prices for vegetables, orchards, and vines. Other areas, like the Central and South Coast, may also see slight revenue increases. As shown in Figure 1, we estimate that the Tulare Lake Basin will face severe revenue losses totaling about $620 million across all crop categories.

Jobs and Broader Economic Impacts of the Agricultural Drought

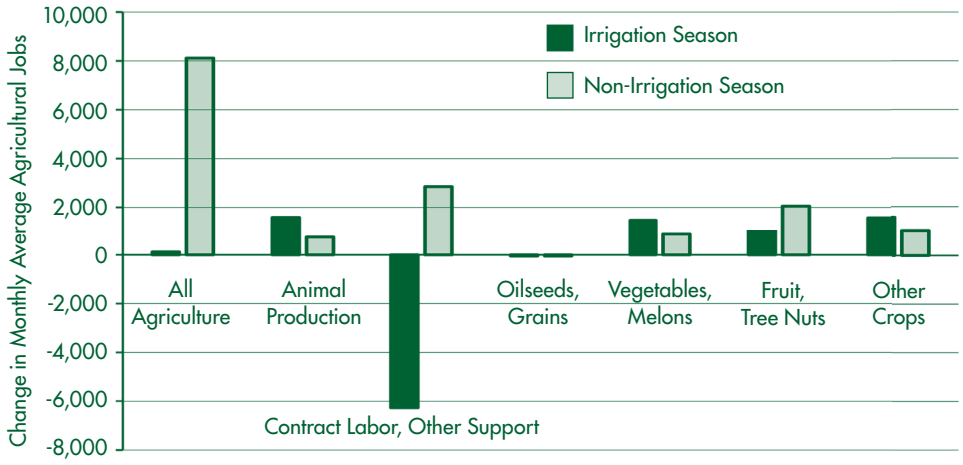
Based on crop fallowing, about 8,550 direct full-time and part-time jobs could be lost, 7,670 in crops and nearly 980 in livestock and dairies. This estimate incorporates the fact that about two seasonal jobs equal one full-time

Figure 1. Chnages in Revenue by Crop Category and Region



Source: Howitt et al., 2015. "Preliminary Analysis: 2015 Drought Economic Impact Study." Center for Watershed Sciences, UC Davis.

Figure 2. Change in Monthly Average Agricultural Jobs by Season and Commodity Category



Source: Data from the California Employment Development Department

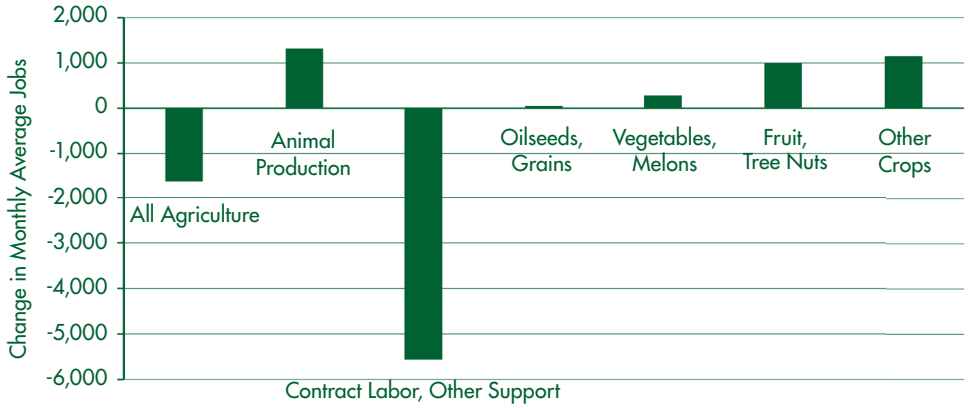
equivalent job. Most employment losses occur in the Tulare Lake Basin. Changes in field crops and grains account for nearly 6,840 of the direct job losses.

Impact analysis allows us to trace expenditure patterns in a regional economy caused by an economic event. When agricultural crop revenues are reduced due to water shortages, expenditures on agricultural-related sectors such as fertilizers, agrochemicals, or farm consulting services are also reduced. These indirect economic impacts cause the direct on-farm impacts to ripple through the economy. Moreover, those households that rely on agriculture and agriculture-related sectors for income spend less on consumer goods and services; these induced effects also ripple through the economy, reducing economic activity and jobs further. The sum of direct, indirect, and induced effects is often referred to as the total or multiplier effect of an economic event on the region's economy.

Howitt et al. (2015) uses this type of analysis to show the direct and total effects of the agricultural drought in the California economy. Multiplier effects on employment, sector output, and value added are examined. Employment represents full-time and part-time jobs; sector output refers to sales from agriculture and all other sectors in the economy; and value added is a measure of net gain in economic value after netting out any double counting across sectors. Value added includes salaries, self-employment income, other property income (e.g., corporate income, rent) and indirect business taxes.

Preliminary estimates in Howitt et al. (2015) show that indirect and induced effects from the 8,550 direct job losses and their spillover effects result in a loss of about 18,600 jobs in California in total. Likewise, direct agricultural revenue losses of about $1.8 billion generate a loss of $2.7 billion in state value of output across the whole economy. We estimate a loss of farm value added of $420 million and an overall loss of $1.25 billion in California value added.

Figure 3. Changes in San Joaquin Valley Agricultural Jobs by Crop Category During the Irrigation Season from 2013 to 2014



Source: Author calculations using data from the California Employment Development Department

Understanding Drought Losses in the Context of a Growing Agriculture

Despite the recurrence of droughts, California's $45 billion agricultural economy has grown in recent decades, as it has shifted to commodities generating more revenue per acre and per acre-foot. This includes an increasing proportion of cropland devoted to tree and vine crops. Many of the expanding crop groups in California, including orchards, berries and vegetables, are more labor intensive than the more mechanized field crop categories.

Impacts of the drought in the context of changes in overall farm employment merit careful examination. For example, Howitt et al. (2014) estimated that the drought would cause a loss of about 7,500 direct farm jobs—almost 2% of about 400,000 farm jobs in California. Recently released annual data show that farm jobs in California (including those hired by farms directly and those hired by labor contractors) rose by about 4,000 jobs, or about 1% from 2013 to 2014 (California Employment and Development Department). This result does not contradict losses due to drought and reinforces the point that labor-intensive agriculture has, in fact, been growing, and job growth would have been larger, but for the continuing drought.

Figure 2 shows that while agricultural jobs grew in aggregate, that growth was in the fall and winter months of the 2013–2014 water year, in what is considered the non-irrigation season. The jobs associated with the main irrigated crop production period in the Central Valley, from April to September, showed no change in employment. Figure 3 shows that where irrigation availability declined most in the San Joaquin Valley, irrigation-season jobs fell in total—especially for contract workers.

Figure 4 puts the 2014 employment data into perspective. Agricultural jobs have grown in California in each of the last five years from 2010 to 2014, especially in the non-irrigation season. Growth was faster in the two pre-drought years and 2014 was the second lowest. Much of the non-irrigation season employment occurs in coastal regions with year-round employment in berries and vegetables—crops that are minimally affected by the drought.

Irrigation season employment, which is important in the Central Valley and is affected by drought, failed to grow in 2014—the only time in this five-year period—after substantial growth in every year except 2011. These data are consistent with substantial drought-induced job losses for some of the most vulnerable workers in California in 2014 and again in 2015.

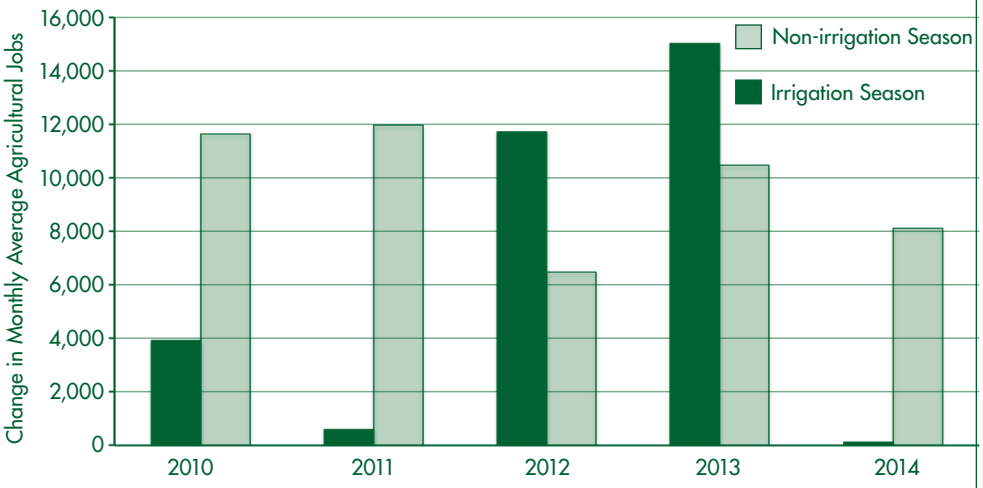
Conclusions

Droughts in California pose substantial challenges for agriculture. Yet the water system supporting agriculture has proven resilient in past droughts. The current drought is causing large economic losses but given innovative responses by farmers and others, those losses have been manageable and California agriculture is positioned to weather this drought.

Groundwater has again been instrumental in replacing much of the loss of surface-water deliveries during the drought. With that said, continuous overdraft of groundwater, a fast-growing proportion of permanent crops, and the use of irrigation systems that minimize recharge reduce the ability to cope with future droughts. Innovations in legal and regulatory institutions and in irrigation incentives are needed to reduce overdraft and renew efforts to recharge underground aquifers for future use.

The 2015 agricultural drought will be costly for farmers, workers, and the California economy. We estimate losses of 18,600 jobs and $2.7 billion in output. California agriculture is diverse and the effects of drought differ by region and crop category. The largest losses are in field crops and in the Central Valley. Regions with smaller irrigation water cutbacks, such as the Central Coast, have relied on groundwater to maintain production. Where these regions tend to grow labor-intensive crops, employment has continued to expand. But, of course, this does not relieve much stress in those regions with severe losses in output and employment.

Figure 4. Change in Agricultural Employment from the Previous Year, by Season



Source: Author calculations using data from the California Employment Development Department

Suggested Citation:

Howitt, Richard E., Josué Medellín-Azuara, Duncan MacEwan, Jay R. Lund, and Daniel A. Sumner. "Economic Impact Drought on Farm Revenue, Employment and Economic Activity." *ARE Update* 18(5):9-11. University of California Giannini Foundation of Agricultural Economics.

Richard Howitt is a professor emeritus in the ARE department at UC Davis. Josué Medellín-Azuara is a research fellow and Jay Lund is a professor, both in the civil and environmental engineering department and the Center for Watershed Sciences at UC Davis. Duncan MacEwan is a principal at ERA Economics. Daniel Sumner is the Frank H. Buck Distinguished Professor in the ARE department at UC Davis. They can be contacted by email at howitt@primal.ucdavis.edu, jmedellin@ucdavis.edu, jrlund @ucdavis.edu, Duncan@eraeconomics. com, and dasumner@ucdavis.edu. respectively.

For additional information, the authors recommend:

Howitt R., D. MacEwan, J. Medellin-Azuara, J.R. Lund, and D.A. Sumner, 2015. "Preliminary Analysis: 2015 Drought Economic Impact Study." Center for Watershed Sciences UC Davis, California. https://watershed.ucdavis.edu/files/content/news/2015Drought_PrelimAnalysis.pdf.

Howitt R., J. Medellin-Azuara, D. MacEwan D, J. Lund, and D.A. Sumner, 2014. "Economic Analysis of the 2014 Drought for California Agriculture." Center for Watershed Sciences, UC Davis, California. https://watershed.ucdavis.edu/2014-drought-report.

Medellín-Azuara, J., R.E. Howitt, D. MacEwan, D.A. Sumner and J. Lund, 2015. "Drought Killing Farm Jobs - Even As They Grow." Center for Watershed Sciences, UC Davis, California Water Blog, Davis California. http://californiawaterblog.com/2015/06/08/california-drought-killing-farm-jobs-even-as-they-grow/