

Economic Impacts of the 2016 California Drought for Agriculture

Executive Summary

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California's agricultural powerhouse and its extensive water supply system have been challenged by recent years of drought. After four years of severely dry conditions, a wetter 2016 winter and spring helped California partially recover surface water storage and increased recharge to some aquifers. Nevertheless, statewide storage in reservoirs remains below historical average and groundwater remains in substantial overdraft in many areas.

Table ES - 1: Summary of agricultural impacts of the 2016 California drought

Description	Impact	Base year levels	Percent change
Surface water shortage (million acre-ft)	2.6	18.0	-14%
Groundwater replacement (m acre-ft)	1.9	8.4	23%
Net water shortage (million acre-ft)	0.7	26.4	-2.6%
Drought-related idle land (acres)	78,780	1.2 million*	6.6%
Crop revenue losses (\$)	\$247 million	\$37 billion	0.6%
Dairy and livestock revenue losses (\$)	Minor	\$12.4 billion	NA
Costs of additional pumping (\$)	\$303 million	\$780 million	38.8%
Direct costs of drought (\$)	\$550 million	NA	NA
Total economic impact (\$)	\$603 million	NA	NA
Direct drought job losses (farm seasonal)	1,815	200,000 [#]	0.9%
Total job losses from drought	4,700	NA	NA

* NASA-ARC 2015 estimate of normal Central Valley idle land.

[#]Total agricultural employment is about 412,000, of which 200,000 is farm production.

Following methods in previous drought assessments (Howitt et al. 2014, 2015), we employ primary information from surveys of major irrigation districts on water delivery expectations, public announcements of federal and state water contract allocations, local water projects, access to groundwater, and anticipated

water market transfers. These data describing water supply conditions are inputs to the SWAP model, which estimates changes in statewide cropping patterns, farm revenues, and production costs in response to the drought. Impacts to dairies and livestock are estimated using sector statistics and trends. A region-wide impact analysis of employment, value added and gross output also was conducted. Table ES-1 summarizes estimated impacts of drought on California agriculture for 2016.

Agriculture in California remains strong, with moderate growth in value, and in some cases employment, despite four years of dry conditions. In 2016, several agricultural regions face water supply shortages due to streamflow temperature, endangered species regulations, and salinity control requirements. In these regions we estimate an increase in crop fallowing, reduced revenues, and employment, especially in areas without access to groundwater. The findings of our 2016 drought impact analysis can be summarized as:

1. In 2016, persistent drought conditions will likely result in surface water supply losses of about 2.6 MAF, of which 1.9 MAF will be replaced with additional groundwater pumping. As in previous dry years, groundwater reserves are critical for managing drought. Overall drought effects are much milder than in 2014 or 2015. Drought effects to agriculture in 2016 were driven largely by low water availability south of the Delta and restrictions on ability to move water across the Delta.
2. Crop fallowing as a result of water shortage is estimated to be approximately 80 thousand acres relative to average water supply conditions, representing just below 1 percent of all irrigated area in California. About 90 percent of land fallowed due to drought is in the Central Valley south of the Delta.
3. We estimate the 2016 drought results in \$247 million loss of farm-gate revenues and 1,815 full and part time jobs statewide. As in previous drought years, losses are concentrated in the Central Valley south of the Delta.
4. When the spillover effects to other sectors of the economy are considered, we estimate total output value losses of \$600 million and 4,700 full and part time jobs statewide due to drought in agriculture. Despite the drought, overall agricultural value and employment grew statewide during recent drought years due to several factors including favorable global prices for some crops.
5. High dairy prices in 2014 were followed by higher forage costs and lower milk prices in 2015 and 2016. Forage costs have since decreased due to wetter conditions. The dairy sector is more vulnerable to market conditions than drought.
6. Some areas including highway corridors in the Central Valley have increased risk of dust exposure due to agricultural fallowing in drought.
7. Groundwater continues to be the buffer water supply during drought. However, analysis of well completion reports and groundwater depth monitoring data in the Tulare region indicate well maintenance and replacement costs could increase as water levels fall below critical points in well screens. From 2012 to 2015 an increase of \$1.7 per acre-foot per year in pumping costs is likely to have occurred.
8. A diversified and global California economy also has dampened the adverse effects of recent water shortages in agriculture. Losses from water cutbacks to irrigated areas, revenue losses, and statewide impacts have been large, but economic losses have been much less severe than water cutbacks statewide.

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