

Preliminary Draft – Subject to Revision

Comparing Changes in Applied Water Use and the
Real Gross Value of Output for California Agriculture: 1967 to 2010**A look at the rising economic efficiency of California agricultural water use**

A Draft Paper by Jim Rich, Economist, DWR, DSIWM. February 10, 2015

Executive Summary

The real, inflation-adjusted gross revenue for California agriculture increased 86.5 percent between 1967 and 2010, from \$20.3 billion (in 2010 dollars) to \$37.9 billion. During that period the total California crop applied water use fell by 5.1 percent, from 31.2 million acre-feet in 1967, to 29.6 MAF in 2010.

The rising real value of our agricultural output, coupled with falling crop water use, has almost doubled the “economic efficiency” of agricultural water use in California during the 43 years between 1967 and 2010. In 1967 there was \$651 (in 2010 dollars) of gross agricultural revenue produced in California for each acre-foot of applied water. By 2010 this measure had risen to \$1,280/AF. That represents a 96.6 percent increase in 43 years. 2012 was a drought year. Despite that, California’s gross farm revenue rose to a new high: \$44.7 billion (in 2012 dollars).

Introduction

In 2014, much of California agriculture experienced significant negative impacts from the third year of a severe drought with major surface water shortages in many areas.¹ On January 17, 2014, our Governor issued an Executive Order proclaiming a “State of Emergency” due to the drought. The Proclamation directed DWR to lead State agencies in a “statewide water conservation campaign,” and to take other actions to help alleviate drought impacts.²

However, some in the environmental community have claimed that the most effective drought response would be for California agriculture to stop wasting water, increase its water conservation efforts, reduce the acres planted to “lower-value, water-intensive crops”,³ and increase the acres of higher-valued crops which they claim use less water.

Representatives of the California agricultural community, as well as State government officials, have disputed these contentions of inefficient agricultural water use. For instance, in a recent article, CDF&A Secretary Karen Ross is quoted as saying:

“Our water use efficiency record over the past few decades is pretty impressive, and I believe that new technology and the continued innovation of our people will ensure that California will continue to be an agricultural powerhouse,” Ross said ... She cited state statistics showing that between 1967 and 2007, the amount of water used in agriculture declined while per-acre crop production also rose about 85 percent.⁴

¹ From *A PROCLAMATION OF A STATE OF EMERGENCY*; Office of the California Governor; 1/17/14, and *Economic Analysis of the 2014 Drought for California Agriculture*; by Center for Watershed Sciences University of California, Davis, UC Agricultural Issues Center, and ERA Economics, Davis, CA; 7/15/14.

² From *A PROCLAMATION OF A STATE OF EMERGENCY*; Office of the California Governor; 1/17/14.

³ *More with Less: Agricultural Water Conservation and Efficiency in California, Executive Summary*; H. Cooley, et al; Pacific Institute, 9/08, p. 8.

⁴ *The Desert Sun*, “Calif. official: Innovation will enable farms to thrive”; October 21, 2014.

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The author has analyzed how over the past 43 years the real value of California agricultural output has changed with respect to the water applied to California farmland. Livestock and livestock products were included in this analysis, because the vast majority of California's animal-based agriculture depends, in part, on our irrigated crops.

Economic Analysis

Over the past 43 years the economic efficiency of water use by California agriculture has roughly doubled. The analysis behind this conclusion is detailed in a draft spreadsheet, *CA Ag GR v AW 67 10 JR 1114 B160 rev2.xls*, which is available upon request. Here is a summary of the results:

The values in Page A of the spreadsheet are based on water use estimates from or for DWR Bulletins 160-70, 160-74, 160-05, 160-09 and 160-13; 12/08 estimates of 2005 California total and unit applied water use from DWR Land & Water Use Scientists; and gross agricultural revenue and crop acreage estimates from USDA/NASS reports for 1967, 1972, 2000, 2005, 2007, 2010 and 2012. The following table is based on the above spreadsheet:

Year	Gross Agricultural Revenue \$ Billions (CY \$'s)	Real Gross Agricultural Revenue \$ Billions (2010 \$'s)	Total Crop Applied Water Millions of AF	Real Gross Ag. Revenue / AF of AW \$/AF (2010 \$'s)
1967	3.97	20.31	31.2	651
1972	5.1	20.67	31.7	652
2000	27.2	33.62	31.1	1,081
2005	32.4	35.65	27.30	1,306
2007	36.6	38.06	26.66	1,428
2010	37.88	37.88	29.6	1,280
2012	44.71	43.03	NA	NA
% Increase:				
1967 to 2007	821.9	87.4	-14.6	119.3
1967 to 2010	854.2	86.5	-5.1	96.6
1967 to 2000	585.1	65.5	-0.3	66.1
2000 to 2010	39.3	12.7	-4.8	18.4
2010 to 2012	18.0	13.6	NA	NA

We can see from the above table that the real, inflation-adjusted gross revenue for all of California agriculture increased 86.5 percent between 1967 and 2010, from \$20.3 billion (expressed in 2010 dollars) to \$37.9 billion. However, during that same time period, the estimated total crop applied water use in California fell by 5.1 percent, from 31.2 million acre-feet in 1967, to an estimate of about 29.6 MAF in 2010.

("Total crop applied water use" excludes stock water, groundwater recharge applied water, and conveyance applied water. It includes water applied to nonbearing acres. For details on how these estimates were calculated, please refer to Page A of the above-referenced spreadsheet.)

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Total crop applied water use varies significantly from year-to-year, depending not only on how many acres of which crops are grown, but also on how much irrigation water is available and the weather in California's major growing regions. Estimated total crop applied water use decreased 5.1 percent between 1967 and 2010 (a year of above-average precipitation and plentiful water supplies), and fell by 14.6 percent between 1967 and 2007 (the first year of a three-year drought).

Total gross crop revenue varies as crop acres, yields, and prices change over time. Gross revenues from animal agriculture also vary significantly from year-to-year. However, overall long-term trends have combined to produce an increase in real, inflation-adjusted annual agricultural gross revenue of about 86.5 percent between 1967 and 2010. Then the rate of increase accelerated, and real agricultural gross revenue per year increased about 13.6 percent between 2010 and 2012.

Because of the rising real value of our agricultural output, coupled with falling crop water use, the "economic efficiency" of agricultural water use in California roughly doubled during the past 40-to-43 years. Specifically, in California in 1967 there was \$651 (in 2010 dollars) of gross agricultural revenue produced for each acre-foot of water applied to our crops. By 2007 this measure of the economic efficiency of agricultural water use in California had risen to \$1,428/AF (in 2010 dollars). That represents a 119.3 percent increase in 40 years.

California's real gross agricultural revenue posted a very slight decline between 2007 and 2010, while our agricultural applied water use increased slightly. This resulted in a 2010 estimate of gross agricultural revenue per acre-foot of applied water that had fallen slightly, to \$1,280/AF. Either way, California agriculture is still producing a lot more real gross revenue, using less applied water, than in did during 1967.

Note also how this trend may be increasing: Real, inflation-adjusted California agricultural gross revenue (called "cash income from [agricultural] marketings" in the 2012 USDA/NASS report) increased 13.6 percent between 2010 and 2012. When crop water use figures become available for 2012, the first year of the continuing drought, new calculations may reveal that each AF of crop applied water in California in 2012 resulted in about \$1,500 in gross agricultural revenue (expressed in 2010 dollars). The shift out of lower-valued field crops, and into riskier, higher-valued truck, tree, and vine crops, continues. (Although such high-value crops may bring in more average gross revenue per acre, they are often subject to high costs, overproduction, and sharp market price swings, sometimes resulting in large net losses for the farmers who grow them.) California growers continue to adopt new, more efficient, irrigation technologies. The economic efficiency of California agricultural water use should continue to rise.

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