Water & the California Farmer

A Steady Flow of Innovation, Conservation and Stewardship

California remains America's agricultural leader – with **nearly 78,000 farms and $42.6 billion in revenue**,[1] about 12% of the U.S. total, it is clear that the Golden State will continue to be a bellwether for global agricultural success and sustainability.[2] The state is responsible for roughly "16% of national cash receipts for crops and 7% of the U.S. revenue for livestock and livestock products."[3] Also, "California's agricultural abundance includes more than 400 commodities," and produces "nearly half of the fruits, nuts, and vegetables grown in the United States."[4] Export revenue reached $18 billion as recently as 2012, up from $6.5 billion the previous decade.[5] According to estimates, "$1 billion in agricultural exports supports roughly 8,400 jobs."[6]

California's Abundance: 400+ commodities & nearly half of U.S. fruits, nuts & veggies

Agriculture in California accounts for about 41% of the state's total applied water use.[7,8]

Most people understand that water is necessary to grow our food, but what they may not know is how integral water truly is. **Both surface and groundwater are essential for agricultural production** and, in times of drought, a greater reliance on groundwater is needed to produce the diversity of crops and products that consumers enjoy both locally and in a global market. The lettuce we buy each week at the grocery store is actually composed of over 90% water, and the same goes for tomatoes, strawberries, cucumbers, and many of our favorite fruits and vegetables.[9] The bottom line is that water isn't just used to make our food. Water *is* our food. And farmers in California continue to blaze a trail of innovation by using water as a tool for efficiency, conservation, and environmental stewardship as agriculture faces a myriad of water-related impediments in the 21st century.

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The Delta-Mendota Canal in Stanislaus County

Don Cameron, a member of California's State Board of Food and Agriculture and General Manager of Terranova Ranch, is on the cutting edge of irrigation. His wine grape vineyards stretch for 1,300 acres, so maximizing water is a top priority. Don has used drip irrigation on these vineyards since 1982, a time when drip was still uncommon. Making the switch to micro-irrigation has saved Terranova Ranch between 15% and 20% on water costs. When Don took over as General Manager, he recalls, "I was told we couldn't grow tomatoes. I was told the ground was too light." Processing tomatoes now occupy 2,300 acres at Terranova, due in large part to Don's implementation of drip systems. He contends, "We eliminate evaporation from the soil surface and provide uniform distribution of water and reduce fertilizer usage along with producing a 28% higher yield. We no longer have excess water accumulation at the end of fields as we did when we furrow irrigated."[10]

DRIP IRRIGATION

"We eliminate evaporation from the soil surface and provide uniform distribution of water and reduce fertilizer usage along with producing a 28% higher yield. We no longer have excess water accumulation at the end of fields as we did when we furrow irrigated."

Don Cameron
Terranova Ranch

But drip isn't the only practice that makes Don a pioneer in water use efficiency. During flood periods, which typically occur once every three or four years, Don captures flood flows from the Kings River and diverts them to his vineyards to recharge the groundwater supply. Don is currently working to expand this practice with a Flood Corridor Grant from the California Department of Water Resources. Terranova Ranch is also receiving bids for a 1-megawatt solar facility that will be built this summer to decrease dependence on conventional power for the farm's water pumps. Don's case is an example of how micro-irrigation coupled with strategic flooding and renewable energy investments can enhance water efficiency and responsible groundwater maintenance.[11]

Making the switch to micro-irrigation has saved Terranova Ranch between 15% and 20% on water costs.

Farms across the state continue to adapt as California endures its third dry year in the past five. California farmers have historically increased crop yields while reducing water use, as evidenced by the fact that "inflation-adjusted gross revenue for California agriculture increased about 88 percent between 1967 and 2010, from $19.9 billion to $37.5 billion. During that period, the total applied water use to crops in California was reduced by 20 percent, from 31.2 million acre-feet (MAF) to 24.9 MAF. As a result, **the 'economic efficiency' of agricultural water use in California has more than doubled in the same period,** from $638 per acre-foot in 1967 to $1,506 per acre-foot in 2010."[12]

In an average year, "agriculture will irrigate about 9.6 million acres with 34 MAF of water, or about one-third of the available surface water supplies."[13] Most of California's agricultural regions have experienced a sharp decline in rainfall levels in recent years, and climate change is diminishing the Sierra Nevada snowpack at an alarming rate.[14] These conditions suggest that the ability of farmers to increase water use efficiency will have far-reaching implications for the future of agriculture.

Like Don Cameron, California growers and water suppliers have implemented "state-of-the-art design, delivery, and management practices to increase production efficiency and conserve water. As a result, they continue to make great strides in increasing the economic value and efficiency of their water use."[15] But individual growers like Don Cameron are not the only innovators.

One example of cooperative innovation is the Anderson-Cottonwood Irrigation District (ACID), whose members have implemented a program to replace water distribution ditches with new pipe systems.[16] ACID, located in Northern California, was created a century ago to provide irrigation assistance to farmers through its 100-mile water delivery system covering more than 30,000 acres.[17] **To date, over 22,000 feet of pipe have reached nearly 500 acres.**[18] According to ACID Director Stan Wangberg, "Individual growers who have participated in this program have reported that their irrigation cycles are much more efficient, with reduced irrigation times and overall water use. They have also reported that the improved systems have significantly reduced irrigation water losses."[19]

Innovation in water management has been coupled with a rise in micro-irrigation, which boasts an efficiency rate of between 80% and 90%.[20] **Drip irrigation has grown rapidly over the past 40 years and now threatens to replace gravity irrigation as the dominant method of irrigation in California.**[21] Between 1970 and 2010, low-volume techniques were used to irrigate

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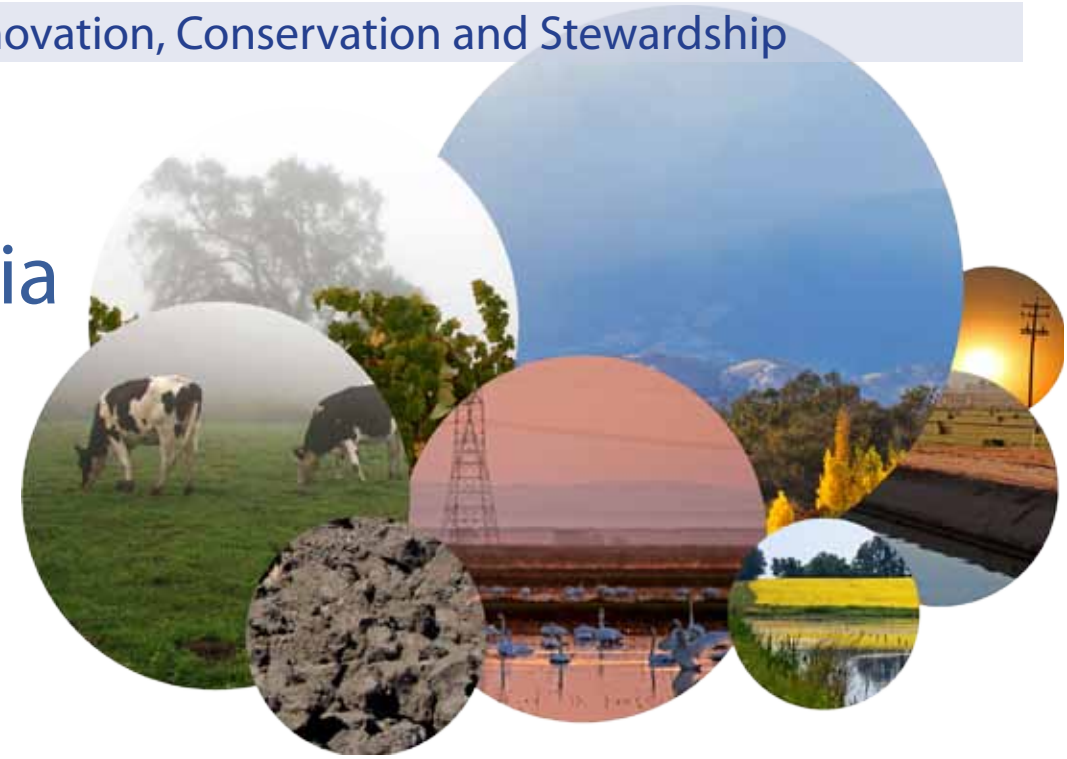

nearly 3 million acres, whereas the use of gravity irrigation fell substantially.[22] In 1991 gravity irrigation was used by 67% of farmers. By 2011 that number fell to 43%.[23]

Revenue for California agriculture increased about 88% between 1967 and 2010, from $19.9 billion to $37.5 billion.

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Water management and innovation must also continue to be a collective effort. The Agricultural Water Management Council (AWMC) has so far united 78 "agricultural water suppliers and four environmental organizations to improve water use efficiency through the implementation of water management practices."[24, 25] These water suppliers "represent more than 4.6 million acres of retail irrigated acreage and a total of 5.86 million acres of agricultural land."[26] Nearly all of them have submitted and developed water management plans since the Council's formation in the early 1990s.[27]

Between 1970 and 2010, low-volume techniques were used to irrigate nearly 3 million acres, whereas the use of gravity irrigation fell substantially. **In 1991 gravity irrigation was used by 67% of farmers. By 2011 that number fell to 43%.**

But water efficiency is not the only concern for agricultural producers. Almond growers, who produce California's third biggest cash crop across more than 800,000 acres, have developed new strategies for implementing water saving practices that also provide environmental benefits.[28] Almond growers have undertaken measures that are responsible environmentally and economically, and are changing the norms for water, soil, and pest management for the future. For instance, **in the last twenty years almond growers have reduced their water use per pound of almond production by 33%.**[29] The improved water use efficiency is due largely to a gradual switch to micro-irrigation systems that improve both irrigation and nutrient management.[30]

Practices including integrated fertilization, demand-based irrigation, and using optimized irrigation infrastructure are just some of the ways that a majority of almond growers are already protecting the environment as well as their orchards.[31] New infrastructure allows growers to prevent over-irrigation and reduce leaching while transporting nitrogen from fertilizers into the root zone of the soil, resulting in reduced nitrate contamination.[32] However, new practices such as monitoring real-time crop evapotranspiration and regulated (managed) deficit irrigation are still on the rise and represent a promising future for the almond industry.[33] These practices will also have implications for California agriculture in general. **Environmental stewardship and economic innovation are not mutually exclusive,** and agriculture continues to be dedicated to investing in both for the future of California's well-being.

Citations

[1] U.S. Dept. of Agriculture (USDA) – *2012 Census of Agriculture,* 2014 (URL: http://agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/California/st06_1_001_001.pdf)

[2] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 3, Chapter 2: Agricultural Water Use Efficiency (p. 2-2) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol3_Ch02_AgWUE_%20PublicReviewDraft_Final_PDFed_co.pdf)

[3] ibid.

[4] ibid.

[5] California Dept. of Food and Agriculture (CDFA) – *Agriculture Statistics Review, 2013-2014* (p. 7) (URL: http://www.cdfa.ca.gov/Statistics/PDFs/ResourceDirectory_2013-2014.pdf)

[6] U.S. Senate Committee on Agriculture, Nutrition, and Forestry – News Release: "The Farm Bill is a Jobs Bill", 2014 (URL: http://www.ag.senate.gov/newsroom/press/release/the-farm-bill-is-a-jobs-bill)

[7] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 1, Chapter 3: California Water Today (Appendix: Table 3-2) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol1_Ch03_CA-Water-Today_PubReviewDraft_Final_JW.pdf)

[8] Applied water use is the official terminology used by DWR. "Applied water refers to the total amount of water that is diverted from any source to meet the demands of water users without adjusting for water that is used up, returned to the developed supply, or considered irrecoverable." (Source: Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 1, Chapter 3: California Water Today (Appendix: Box 3-5) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol1_Ch03_CA-Water-Today_PubReviewDraft_Final_JW.pdf)

[9] University of Kentucky Cooperative Extension Service – "Water Content Fact Sheet," 1997 (URL: http://www2.ca.uky.edu/enri/pubs/enri129.pdf)

[10] Don Cameron, Member – California State Board of Food and Agriculture, General Manager – Terranova Ranch, personal communication, April 15, 2014

[11] ibid.

[12] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 3, Chapter 2: Agricultural Water Use Efficiency (p. 2-2) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol3_Ch02_AgWUE_%20PublicReviewDraft_Final_PDFed_co.pdf)

[13] ibid.

[14] U.S. Dept. of Agriculture (USDA) National Agricultural Statistics Service (NASS) – *California Agriculture Statistics Report,* 2012 Crop Year (p. 16) (URL: http://www.nass.usda.gov/Statistics_by_State/California/Publications/California_Ag_Statistics/Reports/2012cas-all.pdf)

[15] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 3, Chapter 2: Agricultural Water Use Efficiency (p. 2-2) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol3_Ch02_AgWUE_%20PublicReviewDraft_Final_PDFed_co.pdf)

[16] U.S. Dept. of Agriculture (USDA) Natural Resources Conservation Service (NRCS) – Online Newsroom: "California Conservation Success Stories", 2011 (URL: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/newsroom/stories/?cid=nrcs144p2_064143)

[17] ibid.

[18] Stan Wangberg, Director – Anderson-Cottonwood Irrigation District (ACID), personal communication, May 29, 2014; Robert Bailey, District Conservationist – United States Dept. of Agriculture (USDA), Natural Resources Conservation Service, personal communication, May 7, 2014

[19] Stan Wangberg, Director – Anderson-Cottonwood Irrigation District (ACID), personal communication, May 29, 2014

[20] Blaine Hanson, Professor – U.C. Davis – Presentation: "Irrigation of Agricultural Crops in California" (Slide #37) (URL: http://www.arb.ca.gov/fuels/lcfs/workgroups/lcfssustain/hanson.pdf)

[21] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 3, Chapter 2: Agricultural Water Use Efficiency (Appendix: Figures 2-2, 2-3) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013 prd/Vol3_Ch02_AgWUE_%20PublicReviewDraft_Final_PDFed_co.pdf)

[22] ibid.

[23] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 3, Chapter 2: Agricultural Water Use Efficiency (Appendix: Figure 2-4) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol3_Ch02_AgWUE_%20PublicReviewDraft_Final_PDFed_co.pdf)

[24] Agricultural Water Management Council (AWMC) – AWMC Website, 2014 (URL: http://www.agwatercouncil.org/index.php/about-us/signatories/8-about-us/signatories/16-group-one)

[25] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 3, Chapter 2: Agricultural Water Use Efficiency (p. 2-2) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol3_Ch02_AgWUE_%20PublicReviewDraft_Final_PDFed_co.pdf)

[26] California Dept. of Water Resources (DWR) – *Water Plan Update,* 2013 – Volume 3, Chapter 2: Agricultural Water Use Efficiency (p. 2-2 & 2-3) (URL: http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/Vol3_Ch02_AgWUE_%20PublicReviewDraft_Final_PDFed_co.pdf)

[27] ibid.

[28] Robert Curtis, Associate Director for Agricultural Affairs – Almond Board of California, Gabriele Ludwig, Associate Director for Environmental Affairs – Almond Board of California – *Almond Sustainability Report,* 2014 (p. 41)

[29] Robert Curtis, Associate Director for Agricultural Affairs – Almond Board of California – "Improved Almond Water Use Efficiency 1990-94 vs. 2010-14", 2014.

[30] ibid.

[31] Robert Curtis, Associate Director for Agricultural Affairs – Almond Board of California, Gabriele Ludwig, Associate Director for Environmental Affairs – Almond Board of California – *Almond Sustainability Report,* 2014 (p. 42)

[32] ibid.

[33] Robert Curtis, Associate Director for Agricultural Affairs – Almond Board of California, Gabriele Ludwig, Associate Director for Environmental Affairs – Almond Board of California – *Almond Sustainability Report,* 2014 (p. 43)

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