

Global Environmental Change and Potential Impacts on California Agriculture

Laurent Ahiablame, PhD
Hydrologist, UCANR San Diego

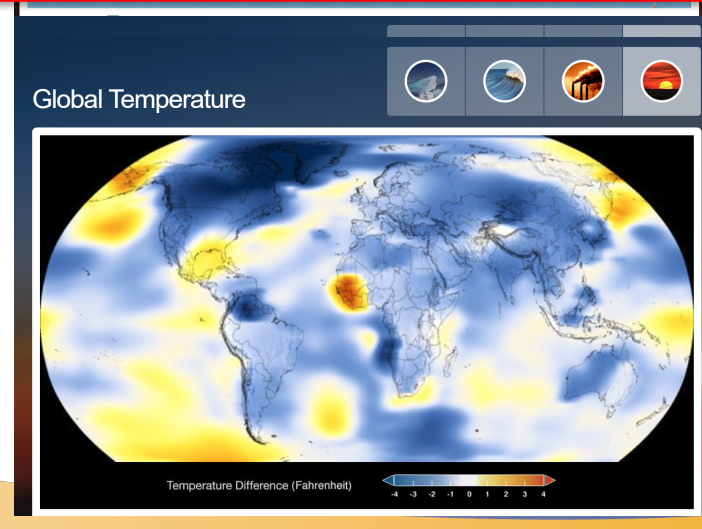
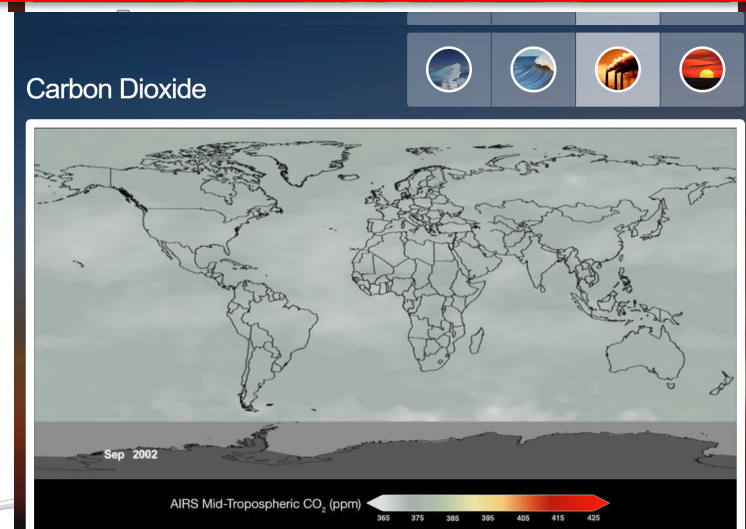
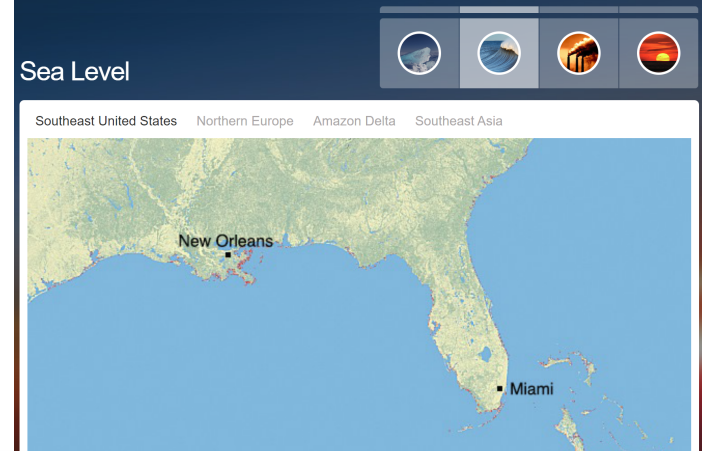
Climate Action and Agriculture Symposium
May 30, 2019

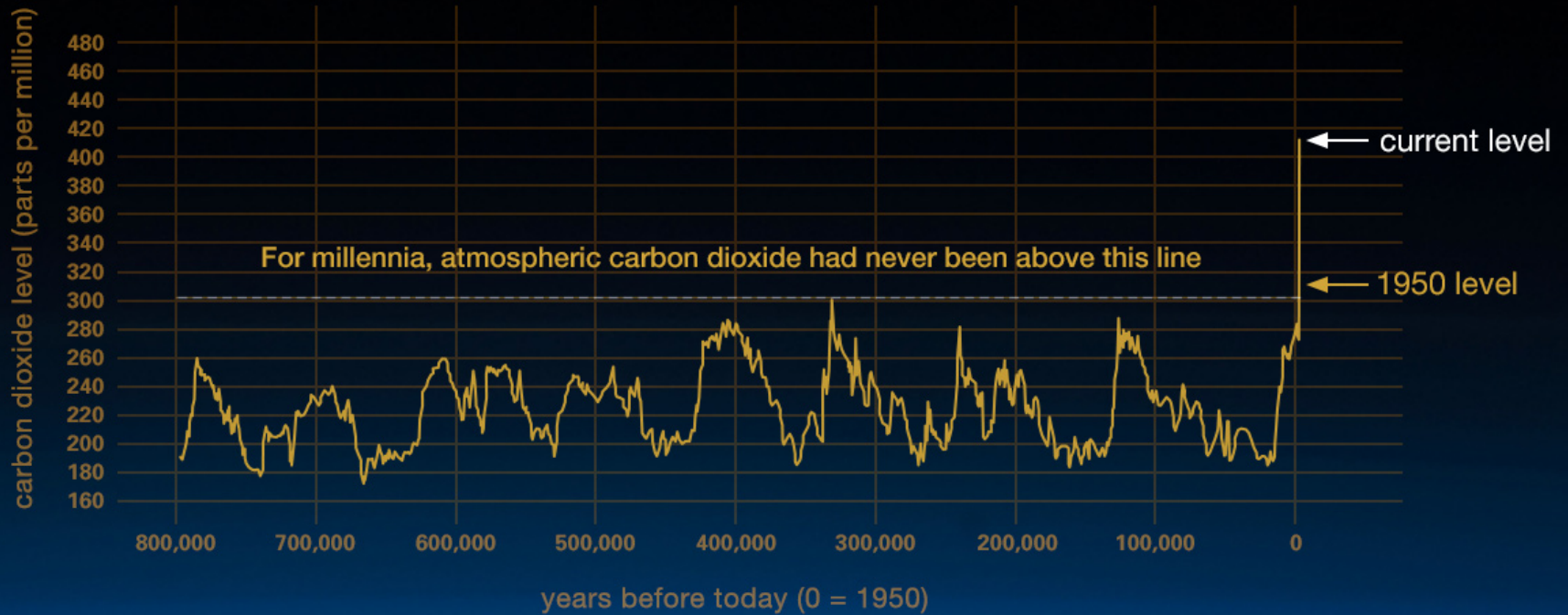
Climate Change

- Global warming and climate change
- Global warming- the long-term warming of the planet
- Climate change- encompasses global warming, but refers to the broader range of changes that are happening to our planet
 - rising sea levels
 - shrinking mountain glaciers
 - accelerating ice melt in Greenland, Antarctica and the Arctic
 - shifts in flower/plant blooming times

Climate Change

Notes from the National Aeronautics and Space Administration

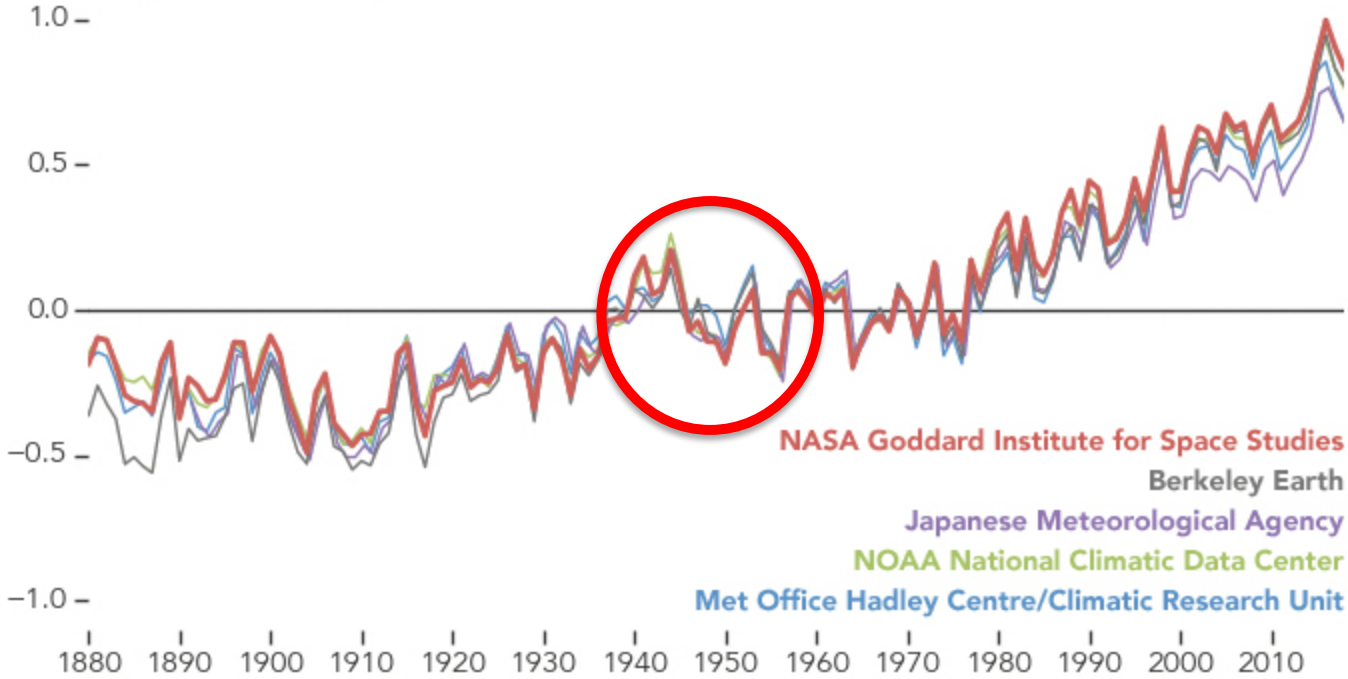




Scientific Consensus: Earth's Climate is Warming

A World of Agreement: Temperatures are Rising

Global Temperature Anomaly (°C)



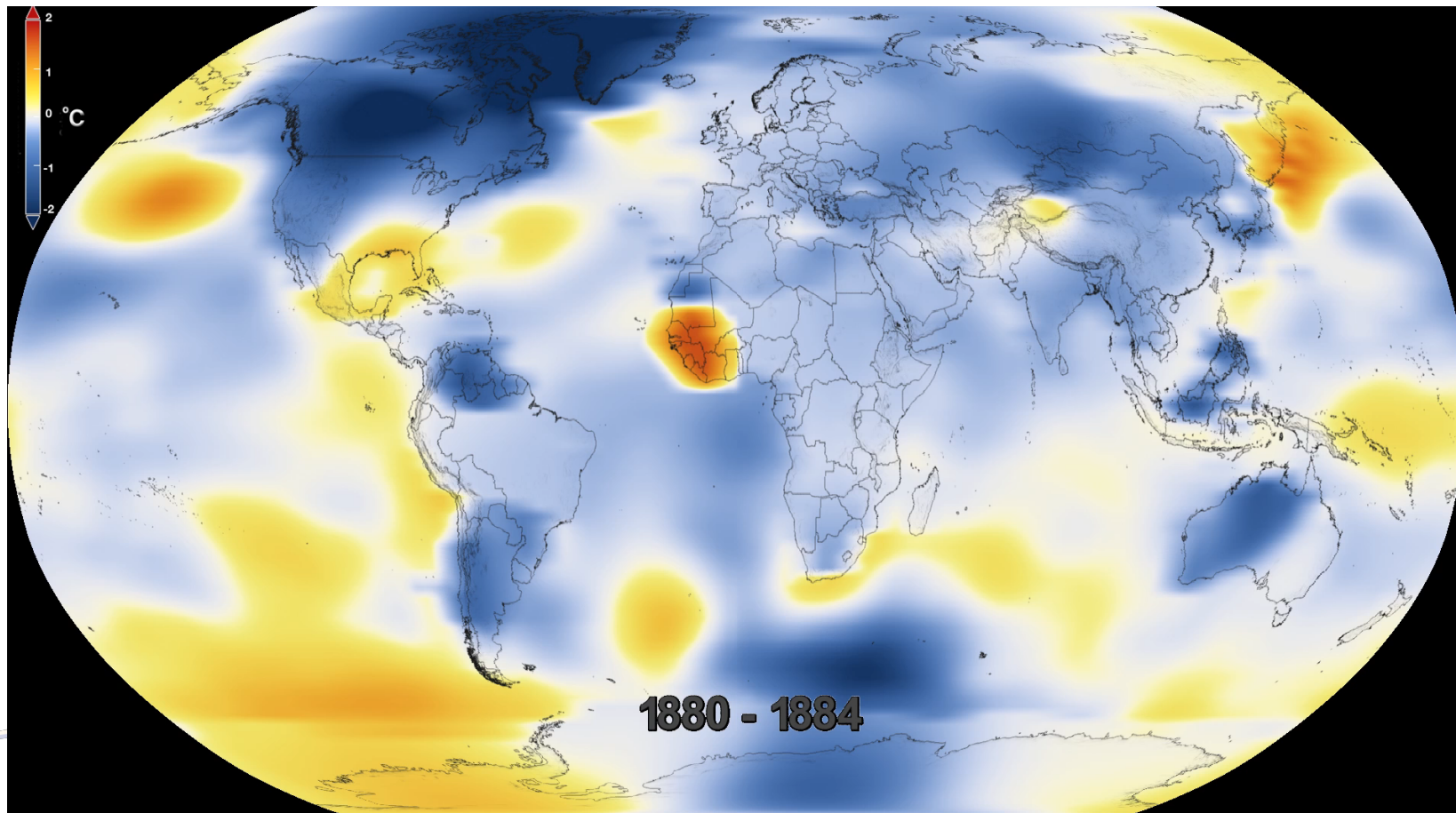
NASA Goddard Institute for Space Studies
Berkeley Earth
Japanese Meteorological Agency
NOAA National Climatic Data Center
Met Office Hadley Centre/Climatic Research Unit



NEWS | January 18, 2018

Long-term warming trend continued in 2017: NASA, NOAA

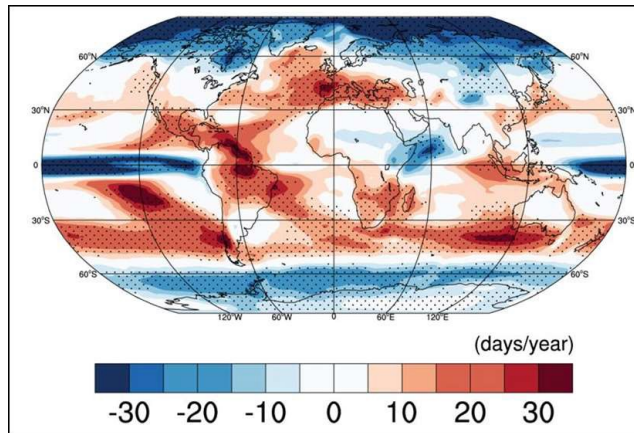
From NASA



Agriculture and Natural Resources

A Wetter and Drier Future Globally?

UCLA

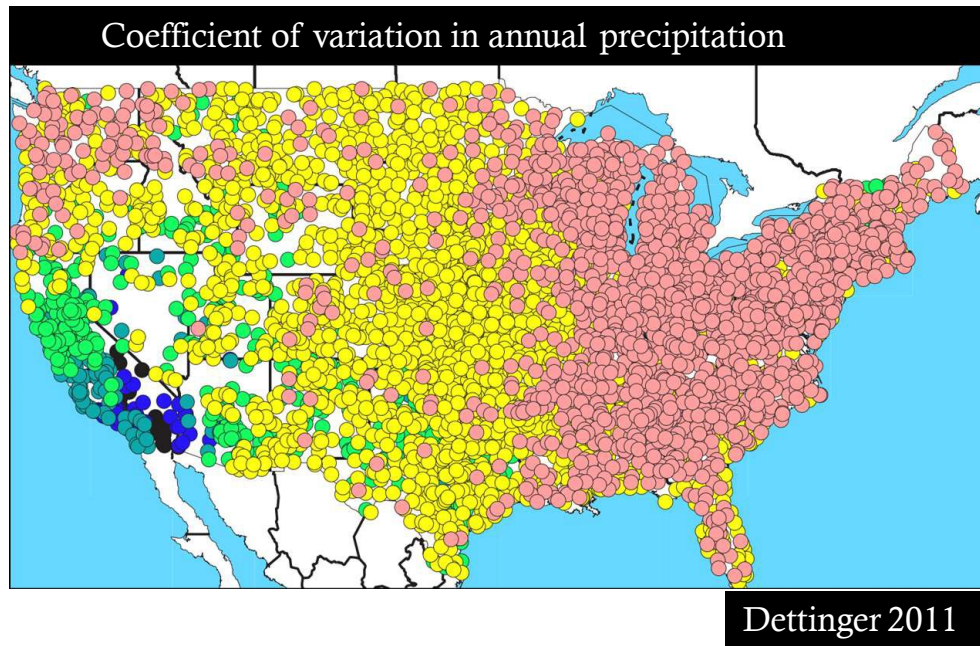


- Changing character of precipitation in a warming world
 - Largest increase in the most intense precipitation
 - Change in “dry day” frequency
 - More dry days, esp. where people live
- Increasing wet extremes compensated by decreases in non-extreme precip. and increased frequency of dry periods. Net effect: more frequent wet-dry swings
- **The “rich get richer” ...but in time, rather than space**

Daniel Swain
dswain@ucla.edu
[@Weather_West](https://twitter.com/Weather_West)
www.weatherwest.com

California's Climate Context

UCLA



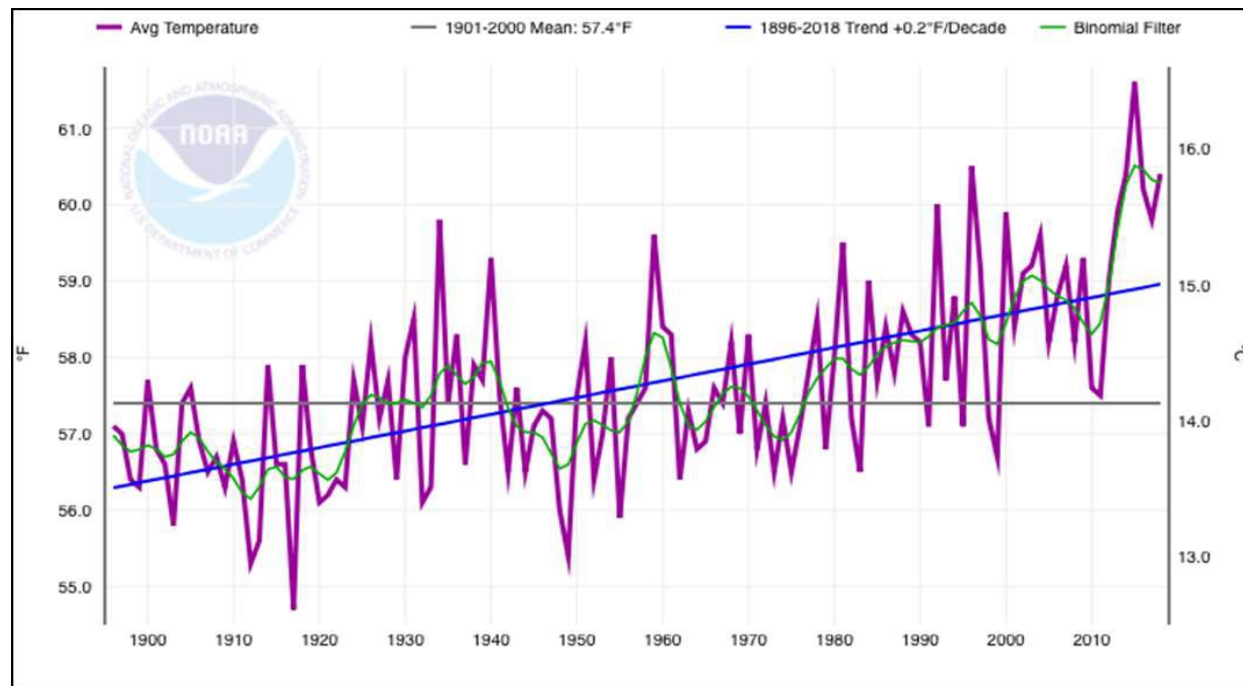
- Strong seasonal cycle of precipitation and latitudinal gradient
- Uniquely high year-to-year variation in precipitation; drought susceptibility

Daniel Swain
dswain@ucla.edu
@Weather_West
www.weatherwest.com

California Changes So Far: Warmer, Less Snow, More Flammable

UCLA

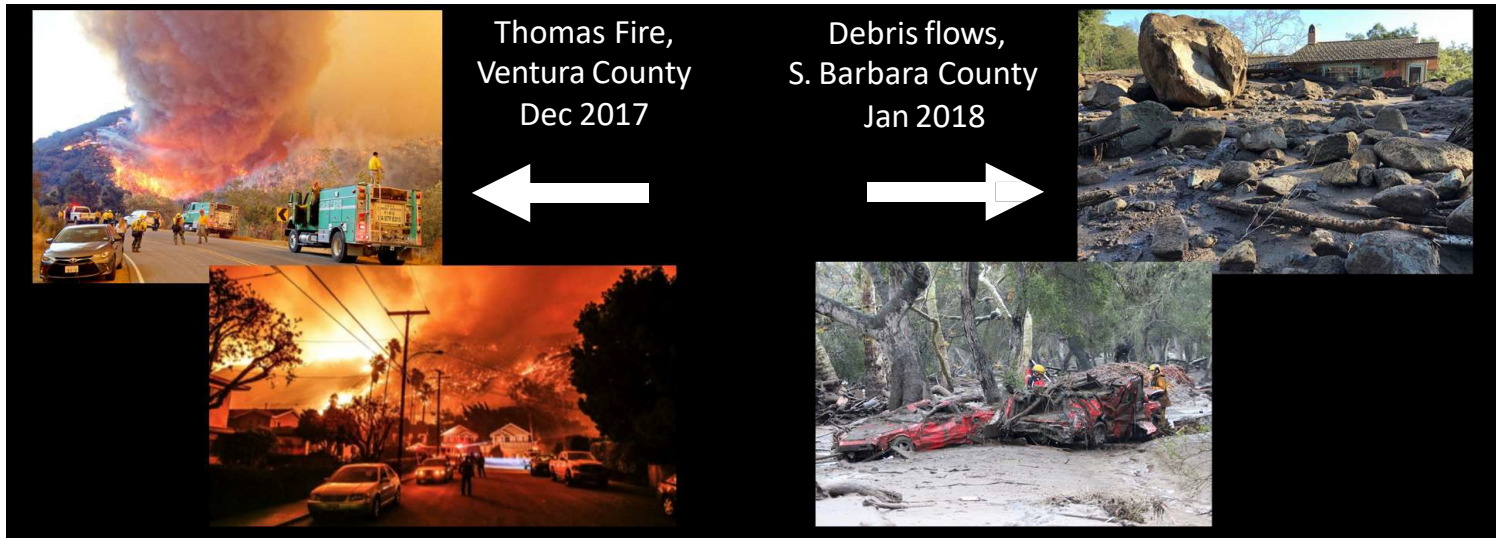
California annual average temperature (NOAA)



Daniel Swain
dswain@ucla.edu
[@Weather_West](https://twitter.com/Weather_West)
www.weatherwest.com

California Changes So Far: Warmer, Less Snow, More Flammable

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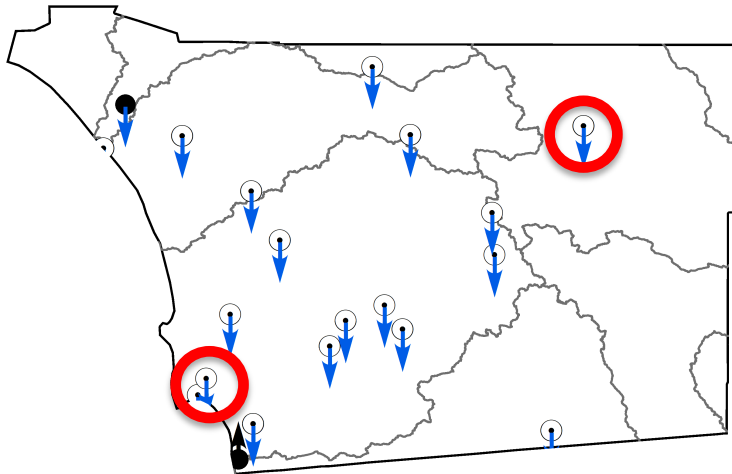


“If we only consider changes in average climate, then we’re largely missing the point” Dr. Swain

Daniel Swain
dswain@ucla.edu
@Weather_West
www.weatherwest.com

Case of San Diego

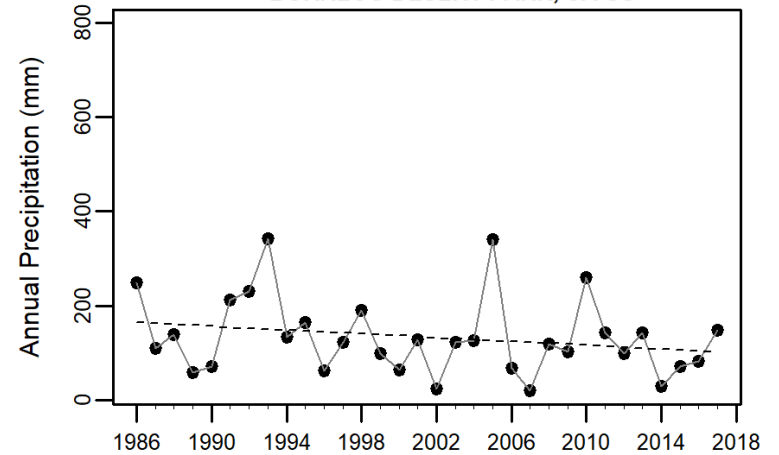
Annual



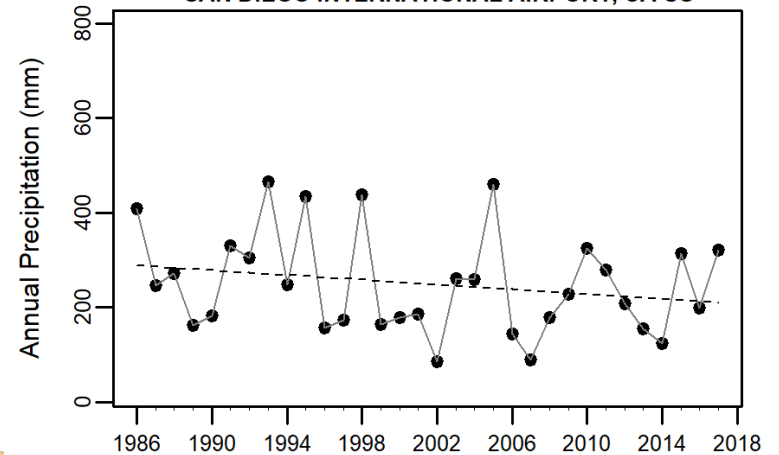
- ↑ Upward
- ↓ Downward
- Significant
- Non Significant
- HUC 8 Watershed
- San Diego County Boundary

1985-2017 annual rainfall

BORREGO DESERT PARK, CA US



SAN DIEGO INTERNATIONAL AIRPORT, CA US



Impacts on Agriculture



July 2018 heat will cut 2019 avocado production

Like 134 Tweet Share 3

Issue Date: December 19, 2018

By Kevin Hecteman



San Diego County's record heat may prove devastating to avocado crop

Posted: 4:48 PM, Jul 11, 2018 Updated: 7:19 PM, Jul 11, 2018
By: Jim Patton

AVOCADO HEAT DAMAGE FOLLOW-UP

AVOCADO HEAT DAMAGE FOLLOW-UP

On Friday July 6, 2018, the California avocado industry was hit by an unprecedented heatwave. For many growing areas the heat continued into July 7 and July 8. What made this event so different from previous heatwaves? First, it had been a very mild season up to this point — some growers reported that their groves were in the 70s on July 5 and hit with triple digit

f t e

Avocado Growers Slash Groves by One-Third to Save Thirsty Trees : Agriculture: Farmers across the county are thinning their orchards in response to the drought and water cuts.

By JONATHAN GAW
TIMES STAFF WRITER

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Impacts on Agriculture: Yolo County

TABLE 3. Projected changes in Yolo County crop acreage in actual acres and percentage, 2013–2050*

	Rice	Alfalfa	Wheat	Corn	Safflower	Pasture	Tomato	Prune	Grape	Almond	Walnut	Other fruit
Annual change in climate index	2.66	3.57	3.57	2.66	2.66	2.66	3.57	-1.96	-1.96	-1.96	-1.96	-1.96
Acreage in 2013 (acres)	38,432	41,030	33,276	19,368	7,808	11,500	34,558	1,746	13,030	17,737	14,400	1,699
Change, 2013–2050 (acres)	-866	6,036	-15,029	-1,504	2,386	7,130	4,833	-123	-92	237	-398	-154
Change, 2013–2050 (%)	-2%	15%	-45%	-8%	3%	6%	14%	-7%	-1%	1%	-3%	-9%

* Projections assume the long-term historical trend of local climate change continues, holding everything else constant. The climate index for each crop is the same as in table 2.

TABLE 4. Summary of projected changes in Yolo County crop acreage, 2013–2050*

	All crops	Field crops	Vegetables	Tree and vine crops
Change, 2013–2050 (acres)	-3,962	-8,264	4,833	-531
Change, 2013–2050 (%)	-1.69%	-5.46%	13.98%	-1.09%

* Projections assume the long-term trend of local climate change continues, holding everything else constant.

Hyunok Lee and Daniel Sumner, 2016

Research Article

Modeling the effects of local climate change on crop acreage

by Hyunok Lee and Daniel A. Sumner

The impacts of climate change on agriculture depend on local conditions and crops grown. For instance, warmer winter temperatures in a given area would reduce chill hours, potentially cutting yields for some crops but extending the growing season for others. Using a century of climate data and six decades of acreage data, we established quantitative economic relationships between the evolution of local climate and acreage of 12 important crops in Yolo County. We then used the historical trend in climate change to project future crop acreages in the county. Only marginal changes in acreage in 2050 were projected for tree and vine crops there, in part because chill hours, although lower, remained above critical values. Walnuts were the most vulnerable tree crop, and the projections indicated some cultivars might be marginal in 2050.

but agriculture, with its 368,000 acres of farmland, is significant to the county economy. Agriculture generated farm revenue of \$721 million in 2013, with crops accounting for 95% of that amount (fig. 1).

The cropland, almost all irrigated, is devoted to a wide variety of crops, including tree and vine crops such as almonds, grapes and walnuts, annual crops such as processing tomatoes, and field crops with differing seasonal cycles

Impacts on Agriculture: Yolo County



Review

Climate Change Trends and Impacts on California Agriculture: A Detailed Review

Tapan B. Pathak^{1,*}, Mahesh L. Maskey², Jeffery A. Dahlberg³, Faith Kearns⁴, Khaled M. Bali³ and Daniele Zaccaria²

- ¹ Division of Agriculture and Natural Resources, University of California, Merced, CA 95343, USA
- ² Department of Land, Air and Water Resources, University of California, Davis, CA 95616, USA; mmaskey@ucdavis.edu (M.L.M.); dzaccaria@ucdavis.edu (D.Z.)
- ³ Division of Agriculture and Natural Resources—Kearney Agricultural Research and Extension Center, University of California, Parlier, CA 93648, USA; jadahlberg@ucanr.edu (J.A.D.); kmbali@ucanr.edu (K.M.B.)
- ⁴ Division of Agriculture and Natural Resources California Institute for Water Resources, University of California, Oakland, CA 94607, USA; Faith.Kearns@ucop.edu
- * Correspondence: tpathak@ucmerced.edu; Tel.: +1-209-228-2520

Received: 9 November 2017; Accepted: 21 February 2018; Published: 26 February 2018

Abstract: California is a global leader in the agricultural sector and produces more than 400 types of commodities. The state produces over a third of the country's vegetables and two-thirds of its fruits and nuts. Despite being highly productive, current and future climate change poses many challenges to the agricultural sector. This paper provides a summary of the current state of knowledge on historical and future trends in climate and their impacts on California agriculture. We present

4 degree increase in temperature would lead to more than 5% yield reduction for most fruits, with 40% reduction potential in some important regions

Agronomy 2018, 8, 25

12 of 27

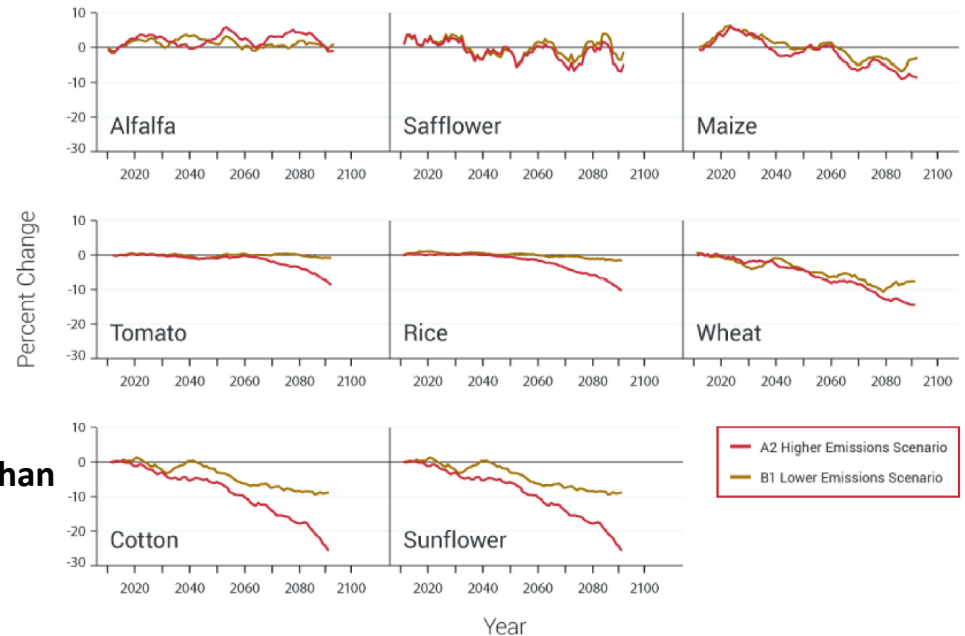
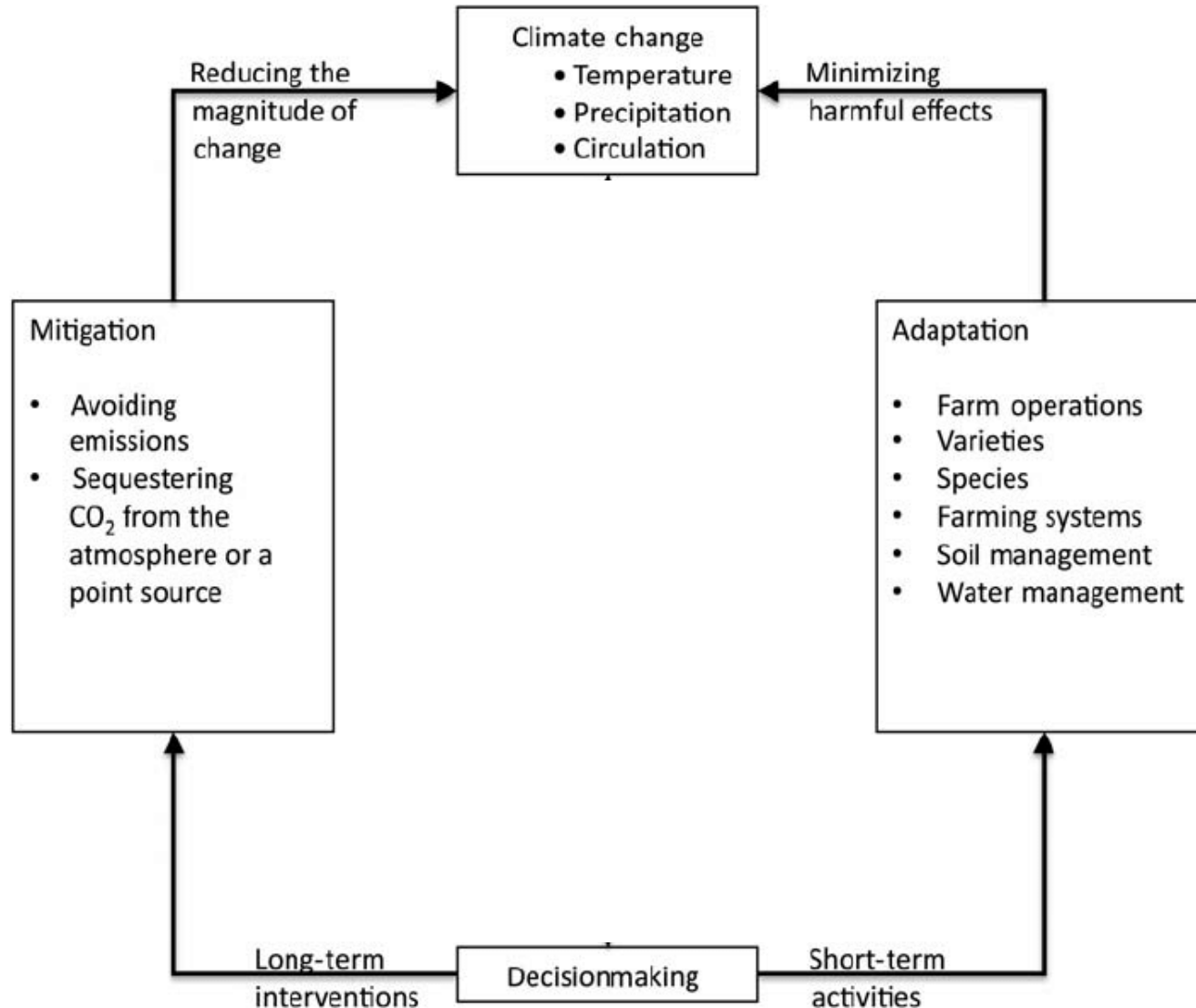


Figure 11. Crop yield response to warming in California's Central Valley based on higher emission scenario (A2) and lower emission scenario (B1) [40,41]. Copyright © 2006 Elsevier, Amsterdam, Netherlands.

Responding to Climate Change



Responding to Climate Change

OUTLOOK

Building climate change resilience in California through UC Cooperative Extension

A survey of UC ANR academics found opportunities for expanding the role of climate change in extension work.

Theodore Grantham, Assistant Cooperative Extension Specialist, Department of Environmental Science, Policy, and Management, University of California, Berkeley

Faith Kearns, Academic Coordinator, California Institute for Water Resources

Susie Koche, Forestry and Natural Resources Advisor, Central Sierra Cooperative Extension

Leslie Roche, Assistant Cooperative Extension Specialist, Department of Plant Sciences, University of California, Davis

Tapan Pathak, Assistant Cooperative Extension Specialist, Sierra Nevada Research Institute, University of California, Merced

Climate change is a global challenge. Yet, the impacts are local and already being felt in California. Rising summer temperatures and extreme events — including the recent swing from a 5-year drought to one of the wettest winters on record — are indicative of a warmer, more variable climate future. The changing climate has already begun to stress our social, economic and ecological systems. It is threatening crops, increasing catastrophic wildfires, harming fish and wildlife, limiting water supplies while also increasing flood risk, and ultimately impacting the health and quality of life for Californians.

The University of California's Division of Agriculture and Natural Resources (UC ANR) has worked with Californians for more than 100 years through its statewide network — which includes UC Cooperative Extension and the Agricultural Experiment Station campuses — to solve problems in agriculture, natural resources and food systems.

Climate change compounds these problems, making it more difficult for UC ANR to achieve its vision for "a thriving California in 2025 where healthy people and communities, healthy food systems, and healthy environments are strengthened through partnerships between UC and the people of the state."

UC ANR academics and staff are mobilizing to address the threat of climate change. In November 2013, UC President Janet Napolitano announced the Carbon Neutrality Initiative (CNI). The initiative committed UC to emitting net zero greenhouse gases from its buildings and vehicle fleet by 2025, the first commitment of its kind by any major university. Within UC ANR, the CNI provided small financial incentives for academics to develop climate change-related projects across many program areas, including agriculture, natural resources, nutrition and youth development.

Snowmelt fills the South Yuba River near Emigrant Gap in March 2016. Climate change is expected to reduce the Sierra snowpack, resulting in major shifts in the timing and magnitude of flows in rivers fed by snowmelt.

Esther Mosase
enmosase@ucanr.edu
(858) 282-6737

ANR NEWS RELEASES

News releases from the UC Division of Agriculture and Natural Resources

CDFA and UC ANR join forces to advance climate-smart agriculture in California

Author: Jeannette E. Warnert

Published on: October 24, 2018

California Secretary of Agriculture [Karen Ross](#) and UC Agriculture and Natural Resources vice president [Glenda Humiston](#) signed a memorandum of understanding in Sacramento Oct. 26 to initiate a new partnership to advance climate-smart agriculture in California.

This partnership will provide \$1.1 million to hire 10 UC Cooperative Extension community education specialists who will be deployed to 10 counties statewide to assist and encourage farmers to participate in CDFA programs aimed at increasing adoption of smart farming and ranching practices.



UC ANR vice president Glenda Humiston (left), and California Secretary of Agriculture Karen Ross sign a memorandum of understanding to initiate the new partnership to advance climate-smart agriculture.

Thank you!