

Impact of the Drought in the San Joaquin Valley of California

A Study Funded by Wells Fargo Foundation
California State University, Fresno
July 2015



Overgrown Boat Ramp

Lake Success: Sierra Reservoir, Eastern San Joaquin Valley

Wildflowers grow where water should be. A recent rain has greened the hillsides and the lakebed but has done little to reverse the dwindling water level. The boat ramp is a full 100 yards shy of the current water level.

Geographic Area: Town of Porterville which has run out of water.

Photoaraph: Neil Chowdhury

Principal Investigator

Dr. Lynnette Zelezny, Provost

Co-Principal Investigator, Project Director

Dr. Xuanning Fu, Associate Dean of College of Social Sciences

Editor

Dr. Gillisann Harootunian, Director, University Initiatives

Co-Project Director

David Drexler, Henry Madden Library

Faculty/Staff Researchers

Dr. Antonio Avalos, Department of Economics

Neil Chowdhury, MFA, Department of Art and Design

Dr. Fayzul Pasha, Department of Civil and Geomatics Engineering

Dr. Samendra Sherchan, Department of Public Health

Jes Therkelsen, MFA, Department of Mass Communication and Journalism

Dr. Chih-Hao Wang, Department of Geography and City and Regional Planning

Dr. David Zoldoske, California Water Institute

Sargeant Green, California Water Institute

Photographer

Cary Edmondson, University Communications Department

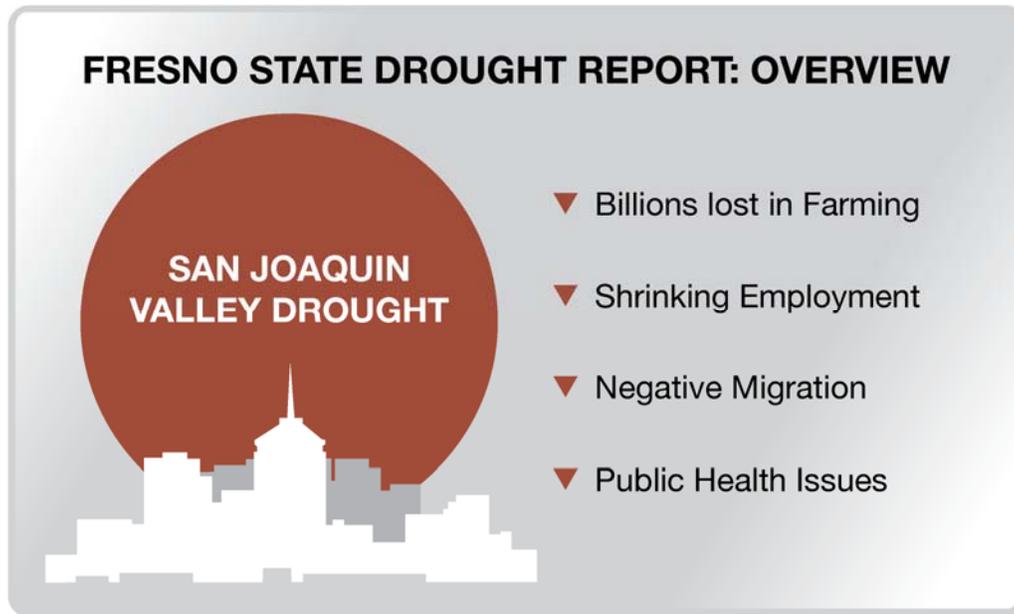
EXECUTIVE SUMMARY

For the past three years (2012–2014), California has experienced the most severe drought conditions in its recorded history. The rainy season of 2014–15 has resulted in disappointment for the fourth straight year: the drought has deepened.

Historically, the state of California has faced many droughts, and several studies have been completed to assess the impacts on different sectors. These studies have considered the entire state, and not focused on the San Joaquin Valley, the center of agriculture in the state. The impact of late 1980s drought in California on the societal and environmental costs was assessed by Gleick and Nash (1991). The Institute for Water Resources (IWR) of the U.S. Army Corps of Engineers also published a report on the 1987–1992 drought, focusing on all of California. The lessons that were learned from this study were published in Dziegielewski, Garbharran & Langowski, 1993. The Pacific Institute published a report on the drought from 2007 to 2009. The report analyzed the impacts on California’s economy and environment (Christian-Smith, Levy, & Gleick, 2011). Recently the Center for Watershed Science, University of California Davis (UC Davis) published “Economic Analysis of the 2014 Drought on for California Agriculture,” a report also focusing on the current drought’s impact throughout the entire state, with a focus on agriculture (Howitt, Medellín-Azuara, MacEwan, Lund, & Sumner, 2014). This was followed on May 31, 2015 by “Preliminary Analysis: 2015 Drought Economic Impact Study.” Also issued was the “Preliminary 2014 Drought Economic Impact Estimates in Central Valley Agriculture” (Howitt, Medellín-Azuara, MacEwan, & Lund, 2014) that studied all 25 counties of the Central Valley.

None of the reports however specifically focused on the San Joaquin Valley’s agriculture, and none focused on a comprehensive assessment of many impacts. The need is compelling: as one example only, the UC, Davis study for the entire state (2014) notes, “70% of the statewide crop revenue losses and most of the dairy losses are likely to occur in the San Joaquin Valley” (pg. iii). The San Joaquin Valley produces a significant portion of total US agricultural production, the main kinds including nuts, vegetables, cotton, and fruits, particularly grapes and citrus. Despite such agricultural importance, this research area remained a gap. This report fills that gap, and does so by analyzing both the economic impact and other serious impacts such as public health impacts in the San Joaquin Valley.

The Central Valley of California studied in the research noted above encompasses all or parts of 25 counties. This study concentrates on the southern portion of the Valley known as the San Joaquin Valley. The San Joaquin Valley consists of eight counties: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare. Geographically, it extends from the San Joaquin river delta at the northern end to the Tehachapi Mountains in the south, and from the Coastal Ranges on the west to the Sierra Nevada mountain range on the east. This region is the ‘geographic core’ of farming, of the Central Valley, and indeed of the state.



Fresno State conducted this drought impact study in spring 2015, funded by the Wells Fargo Foundation. A selected group of faculty and staff members at Fresno State agreed upon the goal of delivering widely useful information for public officials, private officials, and the general public. After consultation, the project team arrived at four areas warranting inclusion:

1. The impact on agricultural revenue from elevated costs for energy use (pumping water up from the increasing aquifer depth).
2. The economic impact, with an emphasis on San Joaquin Valley Disadvantaged Communities.
3. The factors involved in residential water consumption that should inform water policy and planning.
4. The public health implications from potential increased infection rates of target diseases.

The findings from each of these four chapters are summarized immediately below. These findings also led to the recommendations presented in the conclusion to this report.

To increase public usability of this report, appendices are included that contain the following:

1. A set of maps (including interactive online) representing the San Joaquin Valley's hydrology and the effects of the drought over time.
2. An annotated bibliography
3. A list of stakeholder organizations with a synopsis of their role and contact information
4. A set of URL links to data sources of value such as data sets (e.g., hydrologic, agricultural, populations).

Finally, this report also aims to *tell the story* of the San Joaquin Valley, arguably the heart of U.S. agriculture. As the study proceeds through the chapters outlined above, a thread in-between those chapters and so throughout the report are editorial snapshots depicting other “drought” conditions in the San Joaquin Valley (e.g., financial, medical, employment). The question is posed: when a

water drought occurs, how thick or thin is the margin of absorption in the area? The demographics given in response to these questions point to the need for sensitivity to vulnerable populations (e.g., undocumented workers; limited resource minority farmers) and for sensitivity to the capacity to respond to their immediate needs. Photographs and video vignettes also allow readers to see and hear the people who are experiencing right now the impacts of the drought in the San Joaquin Valley.

Findings

Chapter 1: Severity of the Drought and its Impact on Agriculture and Use of Energy

This chapter studies the impact on agricultural revenue in the San Joaquin Valley. The drought exacerbates the heavy dependence of San Joaquin Valley agriculture on groundwater which needs to be pumped from an increasing depth, causing escalating costs from high energy consumption. Due to the significant extent that agriculture contributes towards the San Joaquin Valley's economy, adverse events in agriculture will result in multiple adverse effects in the region's economy. Impacts will occur in employment, population migration, and wage levels and food prices, which the most vulnerable residents can experience in a direct and harsh manner.

For this reason, the study of the drought's impact on agriculture revenue sets the stage for this report. The chapter is structured as follows:

1. The impact of drought on surface water availability and groundwater storage.
2. The impact of the decreased surface water availability and groundwater storage on agriculture and energy consumption.
3. The impact of increased energy consumption on agricultural revenue.

The calculated losses to agricultural revenue from the drought (represented by low precipitation) are as follows:

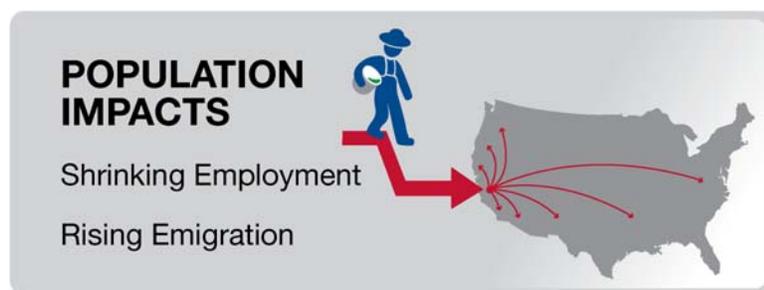
- 5 inches of precipitation (annual): \$2.564 billion loss in agricultural revenue
- 4 inches of precipitation (annual): \$2.827 billion loss in agricultural revenue
- 3 inches of precipitation (annual): \$3.098 billion loss in agricultural revenue
- 2 inches of precipitation (annual): \$3.35 billion loss in agricultural revenue.



Chapter 2: The Economic Impact of the Drought in the San Joaquin Valley

The generalized economic distress in the San Joaquin Valley is more acute in some agricultural communities, particularly in those most affected by reductions in surface water, and among those, the distress is particularly felt in Disadvantaged Communities. This chapter focuses on three economic areas—unemployment, population migration, and food prices—that directly impact the population, with a focus on the low income population. The findings include the following:

1. Though the unemployment rate is declining, an observed fall in Median Household Income is clear in some counties, particularly in most Disadvantaged Communities. A combination of job loss, lower hourly wage, lower annual wages paid to farm workers, as well as working fewer days per year, can partially explain the fall in MHI despite the declining unemployment rate, particularly in those Disadvantaged Communities that heavily depend on agriculture.
2. Some workers have decided to migrate to locations outside the San Joaquin Valley, possibly in pursuit of better working and living conditions. In most of the counties the balance between net domestic migration and net foreign migration is negative, which means a decrease in the county population. The population decrease due to immigration is relatively small in some counties (like in Fresno, San Joaquin, and Stanislaus counties) and relatively large in others (such as Kings and Tulare counties) that are more dependent on the agricultural industry.
3. Although it is not totally clear at what extent overall food prices will go up as a consequence of the drought, the data indicates that the price of some food items has increased during the dry years. This is relevant from the consumer perspective since a food price surge can impact disposable income, particularly for low-income households that spend a larger share of their income on food.



Chapter 3: Water Usage and Residential Water Consumption in the California San Joaquin Valley

Coping with municipal water scarcity has become a new research focus in city and regional planning. From 2000 to 2010, California's population increased by 10%, and the San Joaquin Valley's population doubled that rate at 20%. Population growth as well as continued drought exacerbates water scarcity. Less and less water can be used to support all uses of water (agriculture, residential, and industrial) for the increased population. Therefore, improving residential water use efficiency helps to prepare for a potential long-term drought. A small water consumption survey was conducted, with multiple findings, including a few that are very interesting.

Findings related to outdoor physical conditions:

1. Houses facing south consumed more water in the summer.
2. Houses with sprinkler irrigation systems consumed more water, particularly in the summer.
3. Houses with a pool consume slightly more water than those without a pool in both summer and winter.

Findings related to indoor physical conditions:

1. More than any other factors, more water consumption was most strongly measured by the number of bathrooms, with a strong positive relationship found in both the winter and summer.

Findings related to non-physical conditions:

1. *Self-perception.* The majority of respondents ranked themselves as moderate water users. However, these moderate water users actually consume as much or more water than those who ranked themselves as heavy water users.
2. *Neighborhood social effects.* Water consumption of a given household is likely affected by its neighbors for winter water consumption (the time of the survey).

These findings indicate a need to conduct a large-scale residential summer water consumption survey to gather sufficient data for further analyses and to provide sufficient planning information for the potential long-term drought.



Chapter 4: Public Health Implications of the Drought

Drought leads to many environmental issues that affect human health and the ecosystem. Health-related issues that can arise from drought include infectious diseases, chronic diseases, and vector-borne diseases, themselves exacerbated by the sanitation and hygiene, food and nutrition, air and water quality, and water limitation issues also caused by the drought. Changes in air quality and water quality have a tendency to contribute to adverse public health, from direct impacts such as an increasing incidence of infections to an indirect impact through agricultural production (low crop yields can result in rising food prices and shortages, potentially leading to malnutrition). In addition, severe drought poses an immediate and severe threat to freshwater sources.

The analysis of current public health data led to these findings:

Coccidioidomycosis (Valley Fever)

1. The annual rates of Coccidioidomycosis (Valley Fever) in California increased by 67.7 percent from 2009 (6.5 per 100,000 population) to 2012 (10.9 per 100,000). The San Joaquin Valley is the major region of Coccidioidomycosis endemicity in California.
2. Five of those six counties with the highest average annual incidence rates from 2009–2012 are in the San Joaquin Valley: Kern (205.1 per 100,000), Kings (191.7 per 100,000), Fresno (64.5 per 100,000), San Luis Obispo (47.2 per 100,000), Tulare (39.2 per 100,000), and Madera (20.7 per 100,000) counties.

West Nile Virus

3. WNV was also detected at an all-time high in 44 counties in California, with 379 human cases reported (2013).
4. In 2013, the baseline incidence statewide for WNV Disease was 1.00 (1 case per 100,000 persons) though the incidence for WNV infection is 1.14.¹ The incidence for San Joaquin Valley counties were Stanislaus (3.25); Kern (2.90); Madera (1.97); San Joaquin (1.14); Tulare (1.10); Fresno (0.84); Kings (0.66); and Merced (0.00).
5. In 2013, WNV was detected in 2,528 mosquito pools from 27 counties (CDPH, 2013b). The baseline incidence Minimum Infection Rate statewide was 3.2. In the San Joaquin Valley, the rates were Madera (8.7), Kings (6.2), Kern (5.4), Tulare (4.8), San Joaquin (4.6), Stanislaus (3.2), Merced (3.0), and Fresno (2.2) counties.
6. Fresno County observed rate increases in West Nile Virus and Campylobacteriosis (Diarrheal Illness) infections.

Campylobacteriosis (Diarrheal Illness)

7. In 2012, Fresno County observed a significant increase in Campylobacteriosis cases with an incidence of 40.3 per 100,000 populations.
8. The Campylobacteriosis statewide incidence rate was 20.1 (per 100,000) in 2013. Seven out of the eight San Joaquin Valley counties had incidence rates higher than the statewide rate. The incidence rates in Fresno County (43.6) and Tulare County (42.3) were over twice the statewide rate (20.1). The incidence rate in Kern (39.7) was almost twice as high as the statewide rate. The incidence rates in the four remaining SJV counties were above the

¹ WNV infection identifies infections that are detected through blood bank screen, but no associated illness is reported.

statewide rate to varying degrees: Madera (33.3), San Joaquin (26.6), Merced (23.2), and Stanislaus (22.0). The eighth county, Kings, had a potentially unreliable rate.

PEOPLE COSTS

Public Health and Drought



Conclusion with Recommendations: Water Budgets

The findings from the San Joaquin Valley lead us to return these recommendations to all Californians. There has been much public discussion on how the previous rules allocating water to growers, cities, and the environment should be extended going forward. Given the reduction in water availability, it is imperative that the state determine the level of long-term sustainable water supply availability. This decision will impact all water users and all sectors, significantly. The water world going forward will most likely be one of water budgets for all concerned.

Recommendations:

- Spark deep political discussions about the future availability of water in California and how it is impacted by the current laws and policies on water. Emphasize four components:
 - Developing water budgets.
 - Creating a broad-based consensus on California's water future, with the appropriate leadership.
 - Understanding every single citizen should have and know his or her water budget and use it appropriately.
 - Understanding that groundwater, our largest water storage system and water savings account, is a finite resource.
- Increase funding in water education and technology at all levels to raise awareness of the role of water in our society, and inspire the next generation of water leaders.
- Avoid single uses of water.
- Explore non-conventional sources of water.
- Recognize the true value of water and price it accordingly.

THE FUTURE

Water Budgets and Water Pricing

