California Farms Adjust to Drought

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During droughts, California farms shift scarce irrigation water to crops with higher payoffs such as vegetables or to orchards and vineyards to maintain asset values. With less forage available from pasture or hay and silage, livestock producers cull herds and shift livestock out of state.

As we learned in the first article of this issue, the 2020–21 drought has been uniquely severe and has affected regions of California differently. Precipitation shortfalls were worse in Northern California and affected livestock pasture areas of the North Coast, as well as the snowpack of the Sierra Nevada mountains. Surface water deliveries were cut drastically, including those for the Russian River basin and some of the most senior water rights holders in the Central Valley. Nonetheless, some important regions, such as the Central Coast, did not have to cut irrigation quite as severely as the Central Valley and the North Coast.

This article reviews farm responses to lack of precipitation and irrigation water supply reductions. We focus on cropping patterns and livestock numbers. The drought is a major focus of California agriculture in 2021, but other vital issues did not fade away when this drought entered the picture. Commodity prices and national and global market conditions, environmental regulations, labor market concerns, continuing pandemic influences, and much more continue to have major impacts on farm prospects in California.

This article uses the best available data and informed judgments to draw the most accurate picture about farm responses to the 2020–21 drought. However, data are not yet fully available, and some farm responses are not yet reported. Therefore, our assessment is necessarily preliminary.

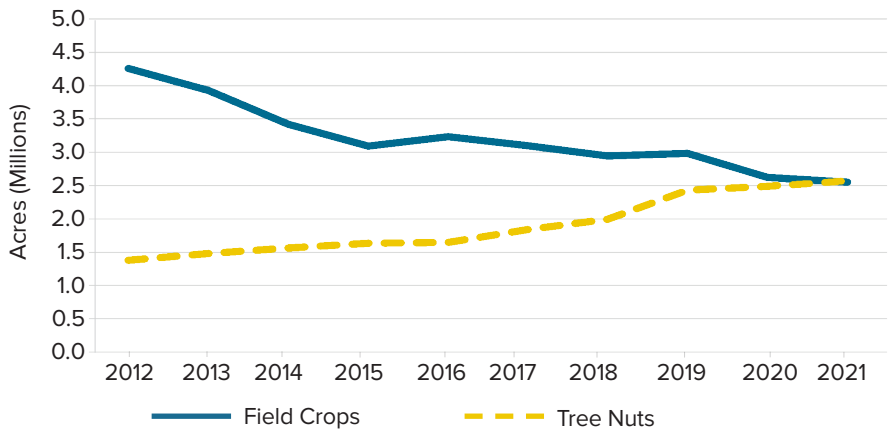
Economic Water Pressures

Crop farms facing increased irrigation water scarcity adjust in several ways, including how much land to plant to which crops and how much land, if any, to leave unplanted. Farms also adjust how much irrigation water to use per acre. Many plans and decisions are based on projected water availability, as well as projected crop prices and costs.

Many farms can adjust spring planting based on considerable, if imperfect, information about water availability (and cost), as well as projections for commodity prices, yields, labor availability, and other input costs. Farms may also consider the opportunity to sell water to willing buyers. At one extreme, farms may leave some fields unplanted, while diverting water to other acreage on the same farm, to other farms, or to non-farm buyers. In some cases, crop insurance provisions pay indemnities for "prevented planting" when below-normal water deliveries are projected. In general, farm managers estimate their expected payoff for each potential water use for each potential water scenario and select options with the greatest net benefit.

Given the need to keep their trees and vines healthy and productive for many years, growers with orchards or vineyards often have less flexibility about their water usage. Nonetheless, in order to economize on water use during a drought, growers may remove some older trees or vines a few years earlier than normal. If growers expect water availability and costs to soon return to normal, these fields may be replanted immediately with young trees or vines, which use little water in the first few years. If water or commodity market uncertainty is severe or delays in access to planting materials prevail, this land may remain unplanted for a season or two. Drought may also occasion a reconsideration of land use, such that some less suitable orchards or vineyards may shift to less water-intensive annual

Figure 1. A Decade of California Field Crop and Tree Nut Acreages



Source: USDA National Agricultural Statistics Service data on "principal crop" (i.e., field crop) and tree nut acreage, with other sources and extrapolations for 2021 non-bearing acres for tree nuts.

crops or be left idle if no profitable options are available.

Rainfed pasture allows little adjustment other than reducing animal stocking rates. With a lack of winter rain or snow, each acre of pasture provides less forage during the spring and summer. Lower stocking density may apply to lower elevation pastures that provide winter forage, as well as to mountain pastures that provide ample summer forage in non-drought years. In the North Coast region of California, organic dairy herds use some of the rainfed pastures that have been hit severely by the 2021 drought. However, most pasture in California serves beef cows with their calves, along with yearling feeder cattle. When there is less pasture forage, calves are weaned early and sold out of state younger than usual, mature cows are culled, and more feeder cattle are shipped out of California.

A Decade of Crop Acreage Patterns

Figure 1 shows the decade-long downward trend in field crops and the accompanying rise in tree nut acreage in California. While these trends have been ongoing for decades, the ten years since 2012 illustrate interesting patterns. In 2012, California had about 4.26 million acres of field crops (the USDA designation of "principal crops") and about 1.38 million acres of tree nuts (almonds, pistachios, and walnuts) for a total of 5.64 million acres. During the 2012–2015 drought, field crop acreage reached a temporary low of about 3.09 million acres in 2015, while tree nut acreage climbed to 1.63 million acres. The combined total was only 4.72 million acres, leaving about 0.9 million acres in other crops or left unplanted in that severe drought. Drought did not seem to affect the steady increase in tree nut acreage but drove a rapid decline in field crop planting.

Between 2015 and 2019, field crop acreage bounced up and down, but ended these four years only 0.11 million acres lower. Meanwhile, tree nut acreage rose by another 0.8 million acres for a total of 2.43 million acres, regaining a combined total of about 5.4 million acres. While field crop acreage held its own, tree nuts captured land that had been left unplanted in 2015, or had been planted to other crops. Finally, in the two years of the current drought, field crops fell to 2.55 million acres and tree nuts rose to 2.57 million acres, now exceeding field crop acreage for the first time. Notice that the combined acreage has fallen again, to about 5.12 million acres, leaving some land left unplanted or available for other crops.

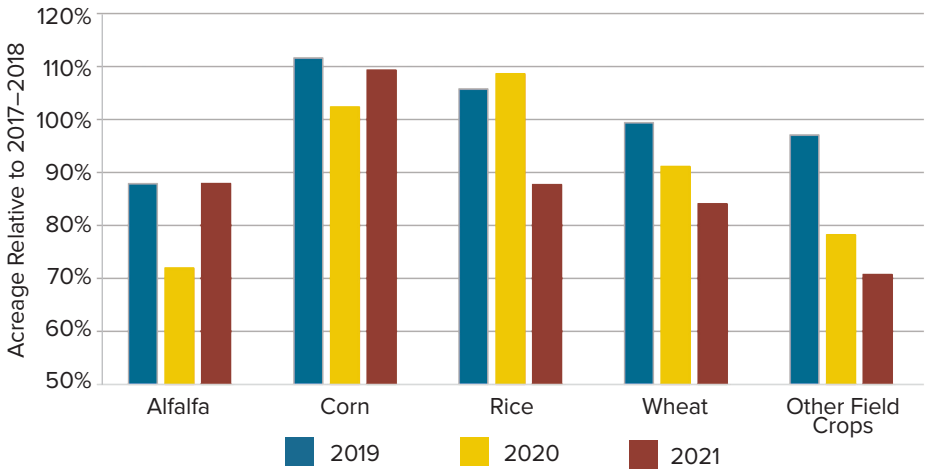
One implication of this shift to more orchards is that California is now less flexible in response to water cuts than it was in 2012 when we entered the previous severe drought. Then, farms had 67% more field crop acreage from which water could shift to keep the trees and vines healthy and the berry, melon, and vegetable crops productive. Now in 2021, the Central Valley alone has about 2.6 million acres of mostly young tree nut orchards and 1.4 million acres of other trees and vines.

Field Crop Acreage Shifts in the Current Drought

Patterns of field crop acreage adjustments in the current drought are displayed in Figure 2. The vertical axis shows acreage relative to the 2017–18 average. The horizontal axis has bars for four important field crops and an aggregate of other field crops. In these USDA data, other field crops include cotton, grains such as sorghum, oilseeds such as safflower, peas, beans, and finally, a few other crops such as sugar beets and potatoes. Compared to 2019, acreage in 2020 was down substantially for all categories of California field crops except rice, which was up slightly in 2020.

For alfalfa hay and corn—most of which is used for silage—the main market is the dairy industry, which is concentrated in the San Joaquin Valley. Alfalfa hay and corn acreage declined precipitously in 2020, only to rise in 2021 back to the acreage of 2019. Alfalfa acreage, already low in 2019, remains at only 88% of its 2017–2018 average. Most grain and protein livestock feeds are shipped in from out of state. In contrast, most forage is produced within the state, because it is expensive to haul. The fluctuating pattern of forage acreage was caused

Figure 2. Acreage of California Field Crops in 2019, 2020, and 2021 Relative to the 2017–18 Average



Source: USDA National Agricultural Statistics Service data on "principal crop" acreage, which includes all field crops but does not include fruits and vegetables.

Table 1. Share of California Field Crop Acres Prevented from Planting, by Crop and Year

	2017	2018	2019	2020	2021
			Percent		
Corn	0.5	0.0	0.1	0.1	0.9
Cotton	3.6	10.6	3.6	26.2	37.4
Rice	19.9	1.4	9.1	6.4	21.0
Wheat	1.1	0.3	0.4	0.4	1.4
All Other Field Crops	0.6	0.4	0.5	0.9	2.1

Source: USDA FSA reported acreages on September 1 for 2017 through 2021.

partly by a pandemic-related collapse in milk prices in the spring of 2020, a subsequent rise in milk prices, and strong demand for forage for the rest of 2020. Milk prices were strong in early 2021, and hay and silage producers have experienced strong market demand, supported by dairy production remaining high in 2021. Even in drought periods, underlying economic forces have major roles in crop acreage patterns.

Field crop acreage in California has fallen substantially from the 2017–2019 average. Declines have been about 20% for rice (100,000 acres), about 15% for wheat (65,000 acres), and about 25% for the other field crops as a group (230,000 acres). Among the other field crops, cotton acreage alone fell by about 160,000 acres to only 110,000 acres in 2021. Overall, field crop acreage fell by about 360,000 acres from 2019 to 2020, and by another 70,000 in 2021.

Cropland Left Unplanted

No data tell us the motivation behind patterns of planted acres, and we have no data on total planted acreage or acreage of most individual crops grown in California in 2021. Nor are there definitive data on cropland left unplanted. We can, however, apply indirect evidence and inference. For example, recall that from 2015 to 2019, tree nut acreage rose faster than field crop acreage declined, indicating that tree nuts were replacing other crops too. But, since 2019, major field crop acreage has declined by 430,000 acres, and tree nut acreage rose by 140,000 acres, leaving a gap of almost 300,000 acres. This huge shortfall suggests that, although some of the land shifting away from field crops may have been planted to vegetables, fruits, or other crops, some of it was likely left unplanted.

One source of information may fill in part of the story. The USDA Farm Service Agency (FSA) requires farms that participate in its major field crop subsidy programs to regularly report how they use all the farmland on that farm. But, most California farmland is not on farms that participate in the covered subsidy programs, so this is only a part of the story. For example, in 2021, the FSA recorded only about 650,000 acres of California tree nuts compared to the more than 2.5 million acres in the state. Thus, the FSA data cannot provide direct information about California land use across its huge variety of crops, but are useful nonetheless.

Crops with large FSA subsidies—such as rice and cotton—have the bulk of their acreage included in the FSA records. Farms report acreage by crop, including acres planted and prevented from being planted. In California, about 85–90% of the "prevented planting" acreage is rice and cotton acreage. California cotton acreage reported to FSA fell from 279,000 acres in 2017 to 136,000 in 2020 and then rose to 170,000 acres in 2021. For cotton, the share of "prevented planting" acreage was about 3.6% in 2019 and about 37% (64,000 acres) in 2021. California rice acreage reported to FSA, including that reported as "prevented," ranged from 481,000 in 2018 to 529,000 in 2019 and was 488,500 in 2021. The amount "prevented" was 105,000 acres (about 20%) in 2017, 7,000 acres (1.4%) in 2018, and 102,000 acres (about 21%) in 2021. Rice acreage reported by FSA as planted in 2021 was 386,000 acres. This number compares to the total 2021 California rice acreage of 415,000 acres reported by the USDA National Agricultural Statistics Service.

Table 1 shows the range of shares reported to FSA as "prevented" for the five years from 2017 through 2021 for four major field crops and the category of all other field crops. Compared to the data in Figure 2, cotton acreage is shown separately and alfalfa is grouped with other field crops. Table 1 shows that the shares of "prevented planting" are very small for corn, wheat, and the category of all other field crops.

A substantial share of rice and cotton is enrolled in USDA-sponsored and subsidized crop insurance programs that pay indemnities for losses attributed to prevented planting claims. One of the approved "cause-of-loss" categories for prevented planting is expected failure of irrigation water supply during the insurance year, such as when local water agencies announce irrigation water delivery plans that are insufficient to produce the crop. The crop insurance indemnity for the prevented planting depends on local conditions during the planting period. Rice and cotton eligibility for "prevented planting" crop insurance indemnities differ year by year, but in a major drought year like 2021, both have high rates of prevented planting.

Satellites provide another source of information on land that is left unplanted. In 2021 satellites have taken multiple measurements that have been calibrated to distinguish between fields that have been planted to crops during the year and fields that have been left unplanted. Preliminary estimates from UC Merced researcher Nicholas Santos suggest a range of between 250,000 and 750,000 acres of land left unplanted in California's Central Valley in 2021. The large range reflects the uncertainty inherent in the careful interpretation of the satellite data.

The Sacramento Valley has about one-third of the projected unplanted cropland and the San Joaquin Valley has the other two-thirds. Unlike past droughts, the Sacramento Valley was unusually dry this year, and water districts there have curtailed deliveries much more severely than in past droughts. This is consistent with the satellite evidence of much more land left unplanted north of the Delta. The location of satellite-estimated unplanted land overlays fields that typically grow rice, other grains, and similar field crops; thus, these projections are consistent with the patterns seen in the prior drought years.

Drought Impacts on Pastures and Cattle Numbers

Much grazing land in California is used seasonally. Livestock, especially cattle, are placed on mountain pastures during the late spring through early fall and moved to valley and foothill pastures for the rest of the year. During 2021, precipitation on pastureland was low and, with less forage available, livestock producers adjusted grazing patterns. At the same time, hay production was reduced in California and other Western states, so forage feeds were more expensive. With less pasture forage available, operators reduced the number of livestock on pastures in California. We do not yet have the aggregate data to quantify this reduction.

Data on grazing livestock numbers are available by state in January of each year. On January 1, 2021, California had about 670,000 head of beef cows, the same as in 2018, but up almost 15% from the depths of the last drought in 2015. We will learn how the current drought has affected the size of the cow herd when the January 1, 2022 numbers are released.

An interim and partial assessment of the effects of the drought on cattle numbers may be gained from considering beef cow slaughter data, which are available monthly by region. Beef cow slaughter for April through July of 2021 in the Southwest region (of which California makes up 57%) was up by about 32% above the average of the previous three years. This represents an excess slaughter of about 2.2% of the regional cow herd. The slaughter rate was especially high in July and August compared to prior years. We note, however, that some other regions in the United States experienced equally large increases in cow slaughter over the same period, so we cannot definitively attribute the increased slaughter in our region to drought. Moreover, even if the excess slaughter is drought related, it amounts to around 2% of the cows, which is far from wholesale herd liquidation.

Finally, we note that the California dairy industry has continued to have relatively high quantities of milk production throughout the drought. With the exception of the 2% of production that is organic, California milk cows do not use pasture. Except for alfalfa and silage, most of the feed is either by-products, such as almond hulls, or shipped into California from other states. So far, California milk production has not fallen.

Conclusions

This article summarizes the direct responses of California crop and livestock producers to the current 2020–21 drought. Crop acreage has adjusted, and water has been reallocated to crops for which the payoff is highest. Some land has been left unplanted, and for some, crop insurance indemnity has been available. With less forage in California pastures, more beef cows have been culled, and there are reports of cattle being shipped to pastures out of state.

Suggested Citation:
Sumner, Daniel A., Carlyn Marsh, Quaid Moore, Scott Somerville and Josué Medellín-Azuara. 2021. "California Farms Adjust to Drought." *ARE Update* 25(1): 6–9. University of California Giannini Foundation of Agricultural Economics.

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Rodríguez-Flores, J.M., S.A. Cole, A. Guzman, J. Medellín-Azuara, J.R. Lund, and D.A. Sumner. 2021. "Lessons from Three Decades of Evolution of Cropland Use in the Central Valley." *California Water Blog*. Available at: https://bit.ly/3AFS7G5.