

Volatile weather changing how California farmers grow food

By Mark Shapiro, California Watch

Ten miles outside of Modesto, in the farming town of Hughson just off Highway 99, the Duarte Nursery is at the front line of dramatic changes now under way in California's immense agriculture industry.

The family-run nursery, founded in 1976, is one of the largest in the United States, and there's a good chance the berries, nuts and citrus fruits eaten across the West began their journey to market as seedlings in Duarte's 30 acres of greenhouses, labs and breeding stations.

The nursery's owners have built a thriving business using state-of-the-art techniques to develop varieties adapted to the particular conditions and pests California farmers face.

These days, according to John Duarte, president of the nursery, that means breeding for elevated levels of heat and salt, which researchers say are symptoms of climate change – even if Duarte doesn't necessarily see it that way.

“Whether it's carbon built up in the atmosphere or just friggin' bad luck,” he said, “the conditions are straining us.”

The cause of Duarte's woes might be in dispute among farmers in California's \$31 billion agriculture industry. But the symptoms are clear. From the vast fields of fruits and nuts in the Central Valley to the wineries of Napa and Sonoma, the increasingly volatile weather is altering the fundamental conditions for growing food, California's largest industry.

Farmers are in many ways at the front line of climate change.

They conjure food from soil, sunlight and water – all of which are profoundly affected, scientists say, by climate change. Stresses have emerged across the state as water supplies tighten. Rain is coming at unexpected times. Winters aren't getting cold enough. And salt from the rising ocean is making its way into Central Valley water.

Climate change already has cost farmers money. In the Central Valley, some growers are paying more for seeds designed to withstand the new extremes.

At the nurseries and colleges in what Duarte calls “the Silicon Valley of agricultural innovation,” these changing conditions have forced botanists to look for varieties of almond, pepper, citrus, cherry and other crops resistant to drought and salt.

Other interests also are bracing for dramatic change. The crop insurance industry is calculating potential billion-dollar losses from extreme weather conditions, as well as the floods and fires that occur in their wake. Climate change could join the ranks of earthquake and hurricane insurance as a special – and hugely expensive – problem for insurers.

Over the past 20 years, there has been more than \$500 million in crop losses from heat waves, floods and ill-timed rainstorms in the heavily agricultural counties of San Joaquin, Merced, Kings, Kern, Napa and Sonoma, according to a study last year by a team of Stanford University researchers.

“Compared to 20 or 30 years ago, farmers are recognizing a lot more risk factors in climate events,” said Jeff Yasui, director of the U.S. Department of Agriculture's Risk Management Agency office in California, which handles crop insurance in the state.

Climate and agriculture scientists predicted much of this. Charles Kolstad, an environmental economist at UC Santa Barbara, said California agriculture is being hit with a

trifecta of converging forces prompted by climate change: longer seasons of extreme heat, shorter cold seasons and dwindling water supplies.

Yields of key crops are expected to drop significantly over the coming decades as climate change alters these growing conditions, according to a report Kolstad co-wrote for the state Environmental Protection Agency and Energy Commission and published last fall in the peer-reviewed journal *Climatic Change*.

Climate scientists believe the Earth's average temperature will rise at least 2 degrees in the next four decades – their most conservative estimate. Along the way, the yields of citrus crops in the San Joaquin Valley are expected to drop about 18 percent, grapes about 6 percent, and cherries and other orchard crops about 9 percent.

Those crops – accustomed to the cooler edges of California's climate – are showing declining yields already, according to the USDA's National Agricultural Statistics Service. That could mean higher prices for consumers as the supply shrinks. This summer's record droughts in the Midwest also prompted the USDA to predict a similar rise in prices driven by devastated yields for corn and soybeans, the primary food for chicken and cattle nationwide.

Kolstad and other scientists have focused on tree-based perennial crops because they are fixed in 25- to 30-year cycles and cannot easily be adapted to changing conditions. Switching a tree orchard from cherries, for example, to more heat-tolerant pistachios, avocados or tangerines can cost millions of dollars before the trees start bearing marketable fruit.

If California's water crisis persists, seasonal vegetables and fruits also will be dramatically affected. Some already are.

Much of the southern Central Valley, spreading along either

side of Interstate 5, is now a patchwork of fallow fields, according to Gayle Holman with the Westlands Water District in Fresno. Thousands of acres that once grew onions, tomatoes, melons and other crops have been set aside by farmers because they can no longer obtain, or afford, water – a scarcity, scientists say, that is significantly due to the dramatic shifts in the timing of rainfalls in the state.

Those grower cutbacks are felt most acutely in Central Valley towns like Mendota, where farm workers can no longer find the seasonal fieldwork upon which they once relied. Official unemployment in the area ranges between 15 and 20 percent. Studies by the state's Employment Development Department show an inverse correlation between water allocations and unemployment in the valley: The water supply goes down, and the unemployment rate goes up.

One problem, then another

Like just about everything having to do with climate change, the consequences unfold like a sequence of trapdoors. First, there's the temperature, a jagged progression over the past decade of unusual highs and lows occurring at times of the year that can debilitate growing crops.

Then there's the water. California's water sources are caught in a pincer: More water is needed at a time when less water is being delivered into the network of canals carrying it from the north to the agricultural regions in the south.

A precipitous drop in snowfall has led to declining water runoff in the San Joaquin and Sacramento rivers in the spring and summer months, when it's central to irrigation in the valley. Over the past century, the state Department of Water Resources has measured a steady 10 percent decline in runoff from April to July. In recent years, however, the rate has accelerated to as much as 20 percent during those critical months.

For the three years between 2006 and 2009, the runoff amounted to the equivalent of two “normal” years, according to John Leahigh, chief of operations planning for the California State Water Project.

In fact, such calculations appear to be the new normal. This year, Sacramento Delta water supplies are not expected to come anywhere close to filling the irrigation needs of Central Valley farmers.

In February, the Department of Water Resources cut the delivery of water to valley farmers from 60 to 50 percent of their allotment – a practically unprecedented reduction that late in the growing season, according to Leahigh.

Parts of the valley supplied by the federal water project have been cut even more severely, to 30 percent of their normal allotment.

Farmers in the valley generally blame the drop-off in water on the 2007 state Supreme Court decision affirming the need for water to preserve Pacific smelt and other endangered species.

A study by the Public Policy Institute of California, however, concludes that the roughly 300,000 acre-feet of water diverted to comply with the Endangered Species Act constitutes no more than 15 to 20 percent of the reduced water flow to the valley.

Rather, the overall pool of water is shrinking.

“There’s less water coming into the system,” said Francis Chung, chief of the Modeling Support Branch for the Department of Water Resources. “The water that used to exist is now coming earlier in the year. So there’s less water to distribute (to the valley) during the summer.”

Rising sea levels threaten water supply

Another growing problem has been rising sea levels associated with climate change. The San Francisco Bay, according to a

recent assessment by the National Academies of Sciences, is projected to rise by as much as 18 inches, and potentially triple that by the end of the century. Those inches translate into waves of new salt sources lapping into the delta.

Less water channeled into the delta from the Sierra means less available freshwater to dilute the onrush of salt, which has been pushing steadily eastward.

For each foot in sea level, 200,000 acre-feet of freshwater, known as "carriage water," is needed to hold the line on the saltwater. That amounts to one-fifth the volume of Folsom Lake each year, according to Chung, and the diversions will only increase as the sea level rises.

A study by UC Davis estimates that if salinity continues to rise at the current rate, by 2030, the financial costs to the Central Valley could be huge: as much as \$1 billion to \$1.5 billion a year in decreased agricultural activity, amounting to some 27,000 to 53,000 jobs lost.

Over the next 40 years, salinity is expected to increase by 4 to 26 percent, depending on the time of year, at the two water-pumping stations outside of Tracy. From there, most of the water destined for the valley is sent southward, according to a study by the Public Policy Institute of California and the Center for Watershed Sciences at UC Davis.

Ellen Hanak, senior policy fellow at the institute, explained that inside the delta, the network of waterways helps to dilute the salt content. But in the Central Valley, she said, there's not enough freshwater to reduce the salt's impact. That's partly the result of farmers using more targeted irrigation to reduce waste; they no longer have the excess spillover to mix with the salt.

"There's no drainage," she said. "They can't get rid of it."

As freshwater supplies decrease, the decisions over how to use

it are likely to become even more difficult.

“Water used to push the ocean back is water not used for agriculture,” said Tara Smith, an analyst and water modeling expert for the Department of Water Resources.

In other words, the liquid barricade needed to hold back the ocean is drawn from a dwindling amount of freshwater. The reduction in allocations issued by the water board in February means that more water is necessary to hold back the advancing Pacific Ocean and push the saltwater intrusion westward.

“We’re going to have to keep reducing the volume of exports from the delta because of the increased volume needed of carriage water,” said Chung at the Department of Water Resources.

Nevertheless, 40 railroad cars’ worth of salt – about 500,000 tons a year – flow daily out of the delta into the fields of the Central Valley. That adds extra salt to valley soils already made salty by the intensive pumping of groundwater from what millions of years ago was the ocean floor.

Daniel Cozad, executive director of the Central Valley Salinity Coalition, a group of local farmers, businessmen and government officials, said some farmers in the western valley are being forced to adapt by switching from salt-sensitive crops like strawberries and avocados to less sensitive – and less profitable – crops like alfalfa and wheat.

“Unfortunately,” Cozad said, “the higher the value of the crop, the more sensitive it is to salt.”