

**Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.**

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**Reading Tree Rings**

Droughts over the past two centuries in California have usually lasted several years at most, and there are lots of accounts of how the dry periods in the 1800s affected livestock, agriculture and the people. Until the last decade or so of the 1800s, however, there were no reservoirs to store winter runoff, so low rainfall years hit particularly hard on the early settlers. Were the last 200 years typical? That's an important question to try and answer.

Rainfall records in the state only go back about 150 years, but dendrochronology, or the study of tree rings, has allowed us to look much further back in time. Just like putting on a few extra pounds around your waist when you eat well on a vacation, trees suck up moisture when there is plenty to go around, and use that extra water to grow thicker rings.

History has been written in many places other than in books, and the job of a paleoclimatologist is to find where those climate records have been preserved. Tree rings, lake and seafloor sediments, corals, and ice are a few places where we have been successful in extracting climate records.

Bristlecone pines, which can live to be 4000-5000 years old, and survive in the White Mountains of southeastern California, are living history books in which the records of our pre-historic rainfall have been preserved. These ancient trees contain the evidence in the width of their annual rings that the last few thousand years have been characterized by alternating 50 to 90-year wet and dry periods, but also by droughts that have lasted 10-20 years.

These are mild events, however, compared to the period from about 900 to 1400 A.D., known globally as the Medieval Warm Period. Evidence from detailed tree ring studies indicates that during this period droughts as long as a century were common.

Is the present three-year period of well below average precipitation just another short-term drought, or is this the beginning of another megadrought, perhaps

intensified by global climate change? No one knows, yet. But most climate scientists would agree that the past century was unusually wet, and it has been during the past 100 years that the populations of the arid southwestern states literally exploded. Nevada went from 42,000 people in 1900 to 2.7 million today. Arizona grew from 123,000 to 6.4 million during the same period. And these states are both deserts.

California has 38 million people today, 25 times more than in 1900. And all this growth, whether farms, factories or cities, took place during what was very likely an unusually wet century.

For decades, Central Valley agriculture had everything- sunshine, fertile soils, and water. But that water was imported from elsewhere or pumped from aquifers that were being depleted year after year. This year, 430,000 acres of productive farmland in California were left fallow due to the drought. As of late August, 95% of the entire state was designated as being under severe drought conditions, and most of our largest reservoirs were at just  $\frac{1}{4}$  to  $\frac{1}{3}$  of their total capacity.

If we are entering a longer-term drought, the impacts and implications for California are enormous. It's hard to believe this is possible, but history tells us it has happened in the past. We have lived our entire lives in times of abundant water, but we need to begin facing the potential of a different future.

We need to become even more efficient in our use of water, especially in our agricultural practices, but also in our cities. While there are no technical difficulties with recycling our wastewater, there are still regulations that prohibit its usage except for certain types of irrigation. Without significant rainfall, it's difficult to capture additional runoff. So where does that leave us?