

Why state's water woes could be just beginning

January 22 2014, by Steve Hockensmith



Ingram stands in front of an Arizona sinkhole known as the Montezuma Well. It served as a water source for the Sinagua people until they disappeared from the area around AD 1300.

As 2013 came to a close, the media dutifully reported that the year had been the driest in California since records began to be kept in the 1840s. UC Berkeley paleoclimatologist B. Lynn Ingram didn't think the news

stories captured the seriousness of the situation.

"This could potentially be the driest water year in 500 years," says Ingram, a professor of earth and planetary science and geography.

Ingram has an especially long-term perspective. As a paleoclimatologist—a scientist who studies changes in climate by teasing data out of rocks, sediments, shells, microfossils, trees and other sources—she's accustomed to looking back over eons. And according to the width of old tree rings (which can record the coming and going of wet or waterless stretches), California hasn't been so parched since 1580.

"These extremely dry years are very rare," she says.

But soon, perhaps, they won't be as rare as they used to be. The state is facing its third [drought](#) year in a row, and Ingram wouldn't be surprised if that dry stretch continues.

Given that possibility, the title of a recent book by Ingram seems grimly apropos. *The West Without Water: What Past Floods, Droughts, and Other Climatic Clues Tell Us About Tomorrow*, co-written with geographer and environmental biologist (and UC Berkeley visiting scholar) Frances Malamud-Roam, was released by the University of California Press last year. The NewsCenter spoke to Ingram about the lessons to be drawn from her research as California heads into what could be its worst drought in half a millennium.

Q: California is in its third dry year in a row. How long could that continue?

A: If you go back thousands of years, you see that droughts can go on for years if not decades, and there were some dry periods that lasted over

a century, like during the Medieval period and the middle Holocene. The 20th century was unusually mild here, in the sense that the droughts weren't as severe as in the past. It was a wetter century, and a lot of our development has been based on that.

The late 1930s to the early 1950s were when a lot of our dams and aqueducts were built, and those were wetter decades. I think there's an assumption that we'll go back to that, and that's not necessarily the case. We might be heading into a drier period now. It's hard for us to predict, but that's a possibility, especially with [global warming](#). When the climate's warmer, it tends to be drier in the West. The storms tend to hit further into the Pacific Northwest, like they are this year, and we don't experience as many storms in the winter season. We get only about seven a year, and it can take the deficit of just a few to create a drought.

You mentioned global warming. Is what we're seeing consistent with the predictions that have been made about how climate change could affect California?

Yes. We've already started having a decreased snow pack and increased wild fire frequency. And we've been warming, and it's gotten drier. With Pacific Decadal Oscillation [the ever-changing temperature of surface water in the North Pacific Ocean], every 20 or 30 years we go in and out of these positive and negative shifts that affect precipitation and temperature. But now we're entering a period where it looks like we're getting drier even though it doesn't necessarily correspond to that cycle. It looks like a trend. It's warming and drying, and that's definitely a big concern for Western states.

What originally sparked your interest in all this?

I grew up in Santa Barbara and personally experienced big floods

followed by droughts. In 1969, half our backyard was washed away from an atmospheric river during a wet year. Then the '76-77 drought made a big impression on me because there was almost literally no rain that year. So I was drawn to trying to understand what controls climate and why it's so variable. It's definitely very complex. We haven't explained it completely, but we're on our way.

What's an "atmospheric river"?

That's when corridors of moisture come up from the tropics, traveling across the Pacific Ocean for thousands of miles to the West Coast and bringing the equivalent of, say, 10 Mississippi Rivers of water. There's a lot of rain within two or three days. Almost all of our major floods in California correspond to these atmospheric river storms. The last one that was really major was the 1861-62 flood. It completely filled the Central Valley with something like 10 feet of water. Sacramento was underwater.

We don't know why, but we see evidence for these major mega-floods every one to two centuries over the past 2,000 years. It's been about 150 years now since the last one, and now there are all these major cities in the very places that were submerged. The U.S. Geological Survey created a scenario for this—the ARkStorm, it was called—and it showed that if we repeated the 1861 flood there would be something like \$725 billion in damage to the state. It would be a major disaster.

So on the one hand we should be worried about a drought, but on the other hand we should be worried about a flood?

Yes. If you look at the past, you realize that our climate is anything but reliable. We've seen these big fluctuations. Extreme droughts and

extreme floods. My co-author and I wrote a couple review papers about that, but those weren't going to be seen by the general public. They were for people in our field. And we thought we should try to bring this message out to the broader public. Because if you're going to buy a house in the Central Valley, I think you should know about these floods. And we have to start assuming that we could go into one of these longer droughts and maybe start doing some serious conservation and rethinking of agriculture here.

If you look at the archaeological record, you see that the Native American population in the West expanded in the wet years that preceded those long droughts in the Medieval period. Then during the droughts, they were pretty much wiped out. There was the so-called Anasazi collapse in the Southwest about 800 years ago. In some ways, I see that as an analogy to us today. We've had this wetter 150 years and we've expanded. Now we're using up all the available water, yet our population is still growing.

We're vulnerable just like they were, but on an even larger scale.

Provided by University of California - Berkeley

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