

# Scientists say slight climate changes will make South Texas' wild rainfall swings even more erratic

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Sitting on the edge of Seco Sinkhole in rural Medina County, watching runoff pour into the Edwards Aquifer, it is hard to imagine San Antonio running out of water.

The gaping hole some 60 feet wide is a unique conduit through the rocky limestone to the Edwards below. It's roughly 290 feet straight down to the fissures and pockets that make up the major water source for Central Texas.

On an overcast day in a record-wet spring that has prompted shrubs and plants to sprout from the normally barren sinkhole walls, water is flowing from Seco Creek into the massive opening. The spray of rushing water abounds and the landscape is lush. Most important, it is wet. Real wet.

But here's the rub. The creek flowing into the sinkhole was dry or nearly so for 14 months before torrential rainfalls this spring. The sinkhole's very name reflects the drought cycle: *Seco* is Spanish for dry.

As global warming continues to alter the climate, scientists agree that such boom and bust cycles will become more severe. Droughts will become more common as the area's already strained water supplies are further depleted by longer dry spells, evaporation and even the increased thirst of vegetation trying to survive in hotter climes. And the rain that does come is likely to arrive in more violent storms.

"It's paradoxical," said Andrew Dessler, professor at Texas A&M's Department of Atmospheric Sciences. "But you can expect both more drought and more flood."

South Texas' weather always has featured wild swings, especially when it comes to rainfall. San Antonio's average precipitation is more than 32 inches per year, but that average is anything but a norm.

The pattern over the past few years is a good example.

This year has been dominated by deluges that spawned flash floods and claimed 63 lives around the state. But those downpours broke a two-year drought that put San Antonians on harsh water restrictions and dried lawns to a crisp.

The numbers are telling. In 2006, slightly more than 21 inches of rain fell; the year before, about 17 inches fell.

But this year, San Antonio has had more than 46 inches of rain. A downpour in August spawned by Tropical Storm Erin accounted for 8 inches, or nearly half the amount of rain that fell in 2005.

With climate change making such swings more common, the looming increase in the weather's variability as much as any other potential change in the climate could change the way we live and how we farm in South Texas.

"Think about the difference in climate if you get all of those 32 (inches of rain) in one month or if you get a little bit every day," Dessler said. "It's the difference in living in a desert or a lush grassland."

### **Aquifer recharge**

The Edwards is one of the most prolific aquifers in the country, replenishing quickly after heavy rains because the porous landscape allows water to seep into the aquifer. Seco Sinkhole is probably the most notable illustration of this process.

But the limestone aquifer also drains nearly as quickly, losing water to springs and other seeps.

The aquifer's recharge averages about 711,600 acre-feet a year, which translates to about 232 billion gallons. The aquifer supplies farms, industry and 1.7 million people in South and Central Texas, and produces springs, rivers and streams.

Ideally, to keep the aquifer full, rain would come at regular intervals. But given the reality of the area's weather, the recharge can vary remarkably from year to year.

In 1992, recharge set a record, hitting nearly 2.5 million acre-feet. In 1956, in the midst of the worst drought in the state's recorded history, recharge didn't break the 44,000 acre-feet mark.

Turn up the heat a few degrees and the situation gets more volatile, especially if rainfall does diminish.

An analysis by Texas A&M agricultural economist Bruce McCarl found that an increase in temperature of just over 3 degrees and a decrease in rainfall of slightly more than 4 inches a year, about 12 percent of San Antonio's annual average, would reduce recharge by 20 percent to 24 percent a year.

Despite threatened shortages, the Edwards Aquifer Authority successfully lobbied the Legislature last session to raise the aquifer's pumping limit by 27 percent, from 450,000 acre-feet a year to 572,000 acre-feet a year.



When presented with the dichotomy of less water and more pumping, Robert Potts, who was the authority's general manager at the time, said it's the authority's job to administer water permits and the state's job to do the water-supply planning.

Potts said the authority orders limits during droughts. And those drought restrictions were strengthened at the same time the cap was lifted.

This has a significant effect, Potts said. For example, even under current recharge conditions, Comal and San Marcos Springs would be dry 81 percent of the time if maximum pumping were allowed.

"We've kept it from getting any worse," Potts said. "I don't think that's something people understand."

### **Growing thirst**

The various models used to predict climate are clear on one thing: South Texas is going to get hotter.

The United Nations Intergovernmental Panel on Climate Change in February reported that global temperatures will most likely increase 3 to 7 degrees by the end of the century.

Texas temperatures, according to the IPCC, will rise as much as 3 degrees as early as 2020. The South Texas average will rise by up to 9 degrees by the end of the century, said Claudia Tebaldi, a project scientist at the National Center for Atmospheric Research.

The heat will diminish the state's supply of water by increasing evaporation and the amount of water plants consume to survive in the warming environment.

Scientists are much more tentative when it comes to rainfall predictions. The models used by the IPCC showed a 10 percent to 20 percent decrease in Texas wintertime precipitation by the end of the century. The models varied too widely to make a forecast for summer rainfall.

The aquifer will be stretched either way. Water planners project that the region will need much more water during droughts than can be supplied by the Edwards and all other current water supplies by the end of the decade.

The statewide scenario outlined by the Texas Water Development Board is similarly daunting. Texas' population is expected to more than double by 2060, hitting a booming 46 million and creating demand that will far outstrip dwindling water supplies. To keep up with this boom, the state will have to develop 4,500 water projects and strategies estimated to cost about \$31 billion. If not, as much as 85 percent of the state's population could face water shortages in a drought.

The scenario described above doesn't even consider the impact of global warming. In fact, in its 2007 water plan, the state concluded "the effect of climate change on the state's water resources over the next 50 years is probably small enough that it is unnecessary to plan for it specifically."

The conclusion runs counter to the work of many experts who have studied the effect that more intense evaporation, which is a given with hotter weather, and a possible drop-off in rainfall would have on the rivers, reservoirs and aquifers throughout Texas. Some are becoming increasingly vocal about the need for Texas to start taking the threat seriously.

These are people like McCarl, the agricultural economist, who co-wrote the paper published in 2001 that found recharge to the Edwards Aquifer, San Antonio's primary source of water, could decrease 20 percent or more in less than three decades strictly because of a climate change.

Studies by George Ward, with the University of Texas Center for Research in Water Resources, showed a 3.6-degree increase in temperature and 5 percent reduction in rain could draw down the region's reservoirs drastically by as early as 2030 when coupled with population growth.

Ward also found that under the same scenario, runoff would decrease by 25 percent statewide and river flow to the coast would decrease by 35 percent. Ward believes the findings are significant, but after conducting the studies, he had very little luck energizing the bureaucracies responsible for water planning.

"For a while I was urging our state agencies to at least address these climate change issues," he said. "But I gave up a number of years ago."

### **Water planning**

The San Antonio Water System is looking at a number of projects to make up the looming shortfall. The largest is a \$2.1 billion proposal to capture floodwater from the Colorado River and pipe it roughly 170 miles to San Antonio.

SAWS and the Lower Colorado River Authority are partnering on the proposed pipeline. The two entities also are looking at the effect of global warming on water, SAWS water resource director Calvin Finch said.

The organizations already have produced a draft document outlining the state of the science. They are now trying to determine if the forecasts are solid enough to act on and what strategies to employ, Finch said.

"It sure looks to me that this is an issue we're going to have to respond to," Finch said.

Andrew Sansom, executive director of Texas State University's Rivers Systems Institute, said he's heard precious little other work being done by water planners around the state to prepare for climate change, and he's not shy about chastising the lack of action.

"This has huge implications for a state that has traditionally been dependent on over 200 reservoirs," Sansom said. "The issues are no longer with what is causing it, but what we should do about it and how we can adapt."

Water Development Board administrator Bill Mullican chafes under the characterization that the agency is ignoring or discounting a concern that could have a serious impact on the state's water supply. He said the issue simply hasn't risen to a level of prominence yet, particularly when compared with the uncertainty posed by population pressure and future water demand.

He said the state, which updates its plan every five years, is discussing how to integrate global warming into its 2012 water plan.

"The criticisms that we've received have not been from people who understood water-supply planning or the adaptive nature of water-supply planning," he said.

The state's 1997 water plan included examples of specific research, including Ward's, on the effect of global warming on Texas' water supply. But the issue disappeared in the 2002 report. And although it did resurface in the most recent report, there is little discussion of potential effects and none of strategies to adapt to the changing environment.

Sansom hopes that changes soon.

"If you want to sit down and let this stuff immobilize you, you can do it because the numbers are grim, but we can't afford to do that," he said.

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