

Arizona's future climate includes temps rising, water disappearing

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A red pinyon pine is a dead pinyon pine: Drought stress and higher temperatures already have resulted in massive tree die-offs along the western parts of North America. Credit: Craig D. Allen/USGS

(Phys.org) —The southwestern United States is facing an increasingly stressful future with unabated population growth, oversubscribed water resources and a hotter and drier climate. This, in a nutshell, was the message delivered by a panel of three environmental experts discussing how climate change is already affecting and will impact the Southwest's

environment during a panel discussion on the University of Arizona campus during the Tucson Festival of Books.

The presenters did leave the audience of almost 250 with some reason for optimism, pointing out that small but committed groups working with nongovernmental organizations and tribal communities plus efforts on behalf of the private sector have started and will continue to make a difference.

Population in the six Southwestern states – Arizona, Nevada, California, Colorado, Utah and New Mexico – is expected to grow from currently 56 million to 94 million by the middle of this century, according to the report *Assessment of Climate Change in the Southwest United States*, to which three of the UA panelists contributed. At the same time, water from the Colorado River already is over-allocated by about 2 million acre-feet, which is. The panelists pointed to a study by the Bureau of Reclamation, which estimated the gap between projected future demand and supply of Colorado River water to be 3 million acre-feet – more than three quarters of a cubic mile.

"Increasing all this consumption by 50 percent is just not going to work," said Karletta Chief, an assistant professor and assistant specialist in the Department of Soil, Water, and Environmental Sciences in the UA College of Agriculture and Life Sciences. Chief contributed to the report, furnished under the National Climate Assessment, which is prepared every four years to inform the U.S. president and Congress on the status of climate change research and its impacts.

Panelist Gregg Garfin, an assistant professor and assistant specialist in climate, natural resources and policy in the UA's School of Natural Resources and the Environment, and the main editor of the report, presented data showing that the annual minimum and maximum temperatures have been increasing across all six Southwestern states and

will continue to do so, resulting in a possible increase by 8 degrees Fahrenheit by the year 2099.

"The implication is that somewhere between the middle and the end of the century, Tucson's annual average temperatures will be more like Yuma," Garfin said. "Also, we'll see longer heat waves, more days over 100 degrees, and fewer cool nights, in addition to a decrease in spring precipitation, all under the assumption of continued high greenhouse gas emissions."

Rising temperatures, decreased snowfall and earlier spring snowmelt, combined with episodic droughts, already have shown their impact, as massive swaths of conifer forests have died across the Western U.S., from northern Mexico to Alaska.

"It's a one-two punch of drought and increased temperatures," Garfin said. "It depletes soil moisture, trees are wobbly from drought stress, then insects come in and take down the trees."

Wildfires, too, are thought to have some connection to the changes in climate. Between the early 1980s and the early 2000s, scientists have observed a tripling in the number of acres burned in the Southwest. While some of that may be due to forest management, "there is a strong correlation with increasing temperatures," Garfin said.

Garfin also mentioned the less obvious consequences of how climate change may affect the nation indirectly through shifts affecting the Southwest, given that Southwestern states produce more than half of specialty fruit, nuts and vegetables for the U.S., and more than half of the nation's shipping container traffic comes in through the ports of Los Angeles and Long Beach, Calif.

"Walnuts, pistachios and pecans won't be able to grow in places where

they currently grow," Garfin said. "Sea-level rise, while not much of a concern in our perception here in Arizona, can be highly disruptive in California. The San Francisco and Oakland airports will be inundated if California doesn't take action, and with storm surges on top of higher sea level, that would have implications for port facilities that bring in all those goods in to the U.S."

Chief shed light on how climate change would affect the 170 Native American tribes in the Southwest.

"Native Americans have a unique relationship to the natural [environment](#)," she said, "because many of their practices and cultures are connected to that environment. Climate change impacts their cultural identities and practices."

Because poverty is more widespread among Native Americans compared with the average U.S. citizen, and unemployment rates are higher, Native people have more trouble mitigating environmental impacts, Chief explained.

"For example, the existing infrastructure will not be able to handle the deteriorating water quality and deliver good water to residents," she said.

Chief reminded the audience "while many tribes do not have much access to electricity or urban activities, their contributions to climate change are not significant in that way, but the consequences will be more devastating for them."

The panelists agreed that lack of awareness stands in the way of taking measures to mitigate the impacts of climate change on the Southwest.

"The fact that the Colorado today almost never reaches the Gulf of California anymore – we don't hear much about that because it's south of

the border," Garfin said. "If the Potomac River didn't reach its mouth, we'd hear a lot about it."

Flushing toilets only once a day, as one member of the audience suggested, certainly does help, the panelists agreed, but efforts to cut back on residential water use only go so far given that "agriculture consumes almost 80 percent of the water in our region."

"The cities will have water but agriculture will go first," predicted panelist Alan Weisman, former UA journalism professor and author of "Countdown: The Last, Best Hope for a Future on Earth?" and the international bestseller "The World Without Us."

"That's something to think about when we look at what is happening in the food growing areas of California," Weisman said. "As [climate change](#) follows those projections, food will become more scarce. How can we be adding people while running out of water and having reduction in food production all at once?"

Provided by University of Arizona

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