

Baltimore Sun:

Southwest's pinyons are being decimated

Beetles, drought blamed as scientists watch for ecological effects

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A massive die-off that turned millions of Southwestern pinyon pine trees into bare sticks has provided what scientists call a glimpse of how quickly some plant species can be decimated by climate change.

In less than two years, prolonged drought, extreme heat and an "explosion" of pinyon bark beetle populations combined to kill 40 percent to 80 percent of the pinyons in study sites in Arizona, New Mexico, Colorado and Utah, according to a study in the online edition of Proceedings of the National Academy of Sciences.

Across the region's 60,000 square miles of pinyon woodlands, the mortality rates ranged as high as 100 percent.

"We cannot say, for an individual event, that this drought was [caused by] global warming. But we do know this is consistent with the types of predictions that have been made about global warming," said David D. Breshears, a professor at the University of Arizona's School of Natural Resources in Tucson and an author of the paper.

"It's the type of drought we're concerned about having more of under different global change-type scenarios," he said.

Pinyon pines are egg-shaped evergreens that can reach 6 feet to 12 feet in height. They're the dominant tree species in the region, producing pinecones and tasty, pea-size nuts.

The die-off is expected to alter the character of the pinyon-juniper forest in unpredictable ways, and affect birds, such as the pinyon jay, as well as mice, deer, elk and other mammals that eat pinyon nuts.

The Southwestern drought first got a foothold in 1999, Breshears said. Winter precipitation and the normal summer "monsoons" in 2000 failed to produce the usual rainfall, and soil moisture declined.

After a little relief in the winter of 2000-2001, the rains dried up again, and the region entered a prolonged period of dry and very hot weather.

Annual average temperatures have been rising for a century in the region. The years 2000 to 2003 each ranked among the 12 hottest in more than a century of record-keeping in New Mexico, according to University of Arizona climatologist Gregg Garfín, who was not involved in the study. The year 2003 was the hottest on record, and the fifth driest.

"From a tree's perspective, they can handle shorter periods of water stress," Breshears said. "But they go into these longer periods and things start changing. The trees are gonna take a hit."

Breshears was tracking the drought's impacts on plant life in an experimental forest plot at the Los Alamos National Laboratory, where he worked at the time. But the effects were evident to everyone in the region.

The pinyon is the dominant tree on the landscape, "so people notice when the trees are dying," he said. "The trees start out a pretty vibrant green. With time, they became more and more pale. Then they pretty much started turning brown."

When the brown needles fell off, Breshears said, the woodlands turned gray, and "we were left with a lot of dead pinyon sticks."

"It looks like this was worse in some ways than the last big drought," he said. While the current weather has not been as dry as it was in the drought of the 1950s, maximum June and July temperatures from 2000 to 2003 averaged 3 degrees hotter.

"This might sound like a small difference, but it could translate into substantial physiological impacts for plants," Breshears added.

"If global warming progresses," he said, "we ought to have warmer droughts that will also be more intense. So this kind of large, fast die-off across a region is something the ecological community is increasingly concerned about."

The die-off also demonstrated that the impact of changes in temperature and rainfall on vegetation can be amplified by biological agents.

Beetles increasing

Although drought and high temperatures weakened the Southwest's pinyons, what ultimately killed them in such numbers was the pinyon bark beetle.

The beetles are always present in the pinyon forest, boring into the trees' bark to lay their eggs. Normally, the trees' sap, or pitch, oozes into the wound, providing sufficient protection. But with soil moisture reduced by drought, the trees can't make as much pitch, leaving them more vulnerable. That's especially true when the insects' populations are as high as they were.

"Bark beetles can have multiple generations per year, and in warmer years, they can have more generations," said entomologist Neil S. Cobb, director of the Merriam-Powell Center for Environmental Research at Northern Arizona University, in Flagstaff and another of the study's 13 co-authors.

Beetle populations in the Southwest had begun building as early as 1996. By 1998, scientists noted up to 2 percent tree mortality in parts of the pinyons' range. That "doesn't seem like very much, which is the reason why people didn't think about it very much," Cobb said.

But it gave the beetles a foothold. And when the big drought struck in 2002 and 2003, their populations exploded, he said. "It really took us by surprise."

Where bark beetle populations never became a problem, pinyon mortality during the drought was about 10 percent, Cobb said. Where the populations were higher, so was pinyon mortality.

The more drought-tolerant juniper trees, meanwhile, appear to have come through with much lower mortality rates.

Grasses watched

Scientists aren't sure what will happen to the woodlands with so many pinyons wiped out. A pinyon recovery, if it occurs, will require ample rainfall, and it will take decades.

"It's hard to imagine, if we continue on this trajectory of increased temperatures, that the woodlands we see today will be there in the same way by the middle of the century," Cobb said.

Some cattlemen are hoping that useful grasses will now move in to replace the woody pinyons, which have encroached on former grasslands in some locations. But scientists say some unwanted weedy species, such as cheat grass, might invade instead.

Cheat grass offers little nutrition for cattle. It also consumes soil moisture early in the year, increasing fire risk later. And fire opens the landscape to still more cheat grass invasions.

If the pinyons' demise opens more acreage to erosion, it becomes more difficult for grass or trees to get re-established, leaving more open desert.

"One of the things that we need to be concerned about is, no matter what the land is used for, it's getting changed in big ways very quickly, very dramatically," Breshears said.