# NEWS IN FOCUS



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**Forests of ponderosa pine (*Pinus ponderosa*) may never recover from a megafire that burned through New Mexico's Jemez mountains in 2011.**

ENVIRONMENT

# Tree rings reveal wildfire risk for southwestern US

*Historical record points to climate patterns that prime the region for intense fire seasons.*

BY CALLY CARSWELL

Ellis Margolis's desk is covered in slices of wood. They're scattered around his computer, piled in cardboard boxes and stacked on shelves. The tree rings and burn scars imprinted in the wood help the ecologist and other scientists predict the potential for future fires in the southwestern United States by understanding the blazes of the past.

This year, as Margolis and his colleagues at the US Geological Survey (USGS) in Santa Fe, New Mexico, go into the field to expand their data set, the work feels like a race against time. Snowpack is dangerously low in many parts of Arizona and New Mexico, setting the stage for exceptionally dry conditions that fuel these conflagrations. The biggest wildfires in New Mexico's recorded history have erupted in just the past decade, torching hundreds of thousands of hectares across the state, including in the mountains Margolis studies. "The lack of snow is scary," he says. "We're set up for a big fire year if things don't change dramatically."

Storms that could deliver game-changing amounts of precipitation are unlikely, according to a 6 February federal water-supply forecast. And preliminary results from the network of sampling sites across two of New Mexico's mountain ranges suggest that future blazes — even as soon as this summer — could be even bigger than recent megafires.

Since the late 1970s, researchers have used tree rings and fire scars to reconstruct the fire history of an area and to understand how ▶

climate drives conflagrations. Tree growth rings vary in width with annual precipitation, providing a record of past climates. And when blazes burn a tree without killing it, they leave scars that can be dated along with the rings.

Initially, researchers tried to understand how frequently fires had burned individual stands of trees, says Tom Swetnam, a fire ecologist at the University of Arizona in Tucson who is now based in New Mexico. Land-management agencies such as the US National Park Service and the US Forest Service had followed strict fire-suppression policies for decades, but they were beginning to recognize fire's ecological benefits. The agencies wanted to know how fire had behaved historically, so they could use it as a tool to promote forest health.

As scientists built fire chronologies, patterns emerged. Forests in Arizona, New Mexico, western Texas and northern Mexico all tended to burn in the same years, for instance. And Swetnam eventually linked active fire years to La Niña phases, or periods of cooling in the Pacific Ocean's equatorial waters, that dried out the Southwest[1].

Multiple studies on mid-elevation forests of ponderosa pine (*Pinus ponderosa*) in Arizona and New Mexico found[2] that before widespread fire suppression, low-intensity fires had burned through these stands roughly every decade. Fire helped to maintain the open structure of ponderosa stands, and without it the forests grew thick with trees. This made them more vulnerable to big, hot fires.

One such blaze ignited in New Mexico's Jemez Mountains in June 2011, when a tree fell on a power line. Dubbed the Las Conchas fire, it torched about 63,000 hectares, making it the largest blaze in New Mexico's recorded history at the time. It burned incredibly hot, and killed so many trees in certain areas that scientists are unsure whether the forest will ever grow back.

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In some ways, the Las Conchas fire was an outlier. Its severe temperatures were unusual, says Craig Allen, a USGS fire ecologist based in the Jemez Mountains, especially in areas where ponderosa pines were totally incinerated.

Yet, in other ways, fires on the scale of Las Conchas may be consistent with historical norms. For instance, Margolis says, researchers don't have a good grasp of whether the size of the blaze was truly exceptional.

This is one of the questions that Margolis has pursued by systematically sampling trees across the Jemez Mountains, and in expanding a similar network in the Sangre de Cristo Mountains outside Santa Fe. "It's so basic," he says, "but it takes a lot of data to get there." Although his analysis of the Jemez data isn't complete, Margolis sees strong evidence that fires as big as Las Conchas, or even twice its size, have occurred for centuries. The implication: "We should be more freaked out that the fires can get even bigger," he says.

This year, it's the potential for fire in the Sangre de Cristo Mountains that really worries Margolis. Many of the area's forests haven't burned in more than 100 years, an unnaturally long dormant period, according to fire histories he's reconstructed. That means the mountains are stocked with fuel.

Widespread fires of the past burned on the heels of extremely dry winters that followed two to three wet winters. That's exactly the pattern New Mexico is currently experiencing, because 2016 and 2017 were relatively wet.

"If we had a Las Conchas fire outside of Santa Fe, it would be devastating," Margolis says. The fire itself could threaten life and property. The loss of vegetation would leave the area vulnerable to post-fire flooding that could wipe out roads and clog vital water infrastructure with debris. "We're sitting on this powder keg," he says. ■

1. Swetnam, T. W. & Betancourt, J. L. *Science* **249,** 1017–1020 (1990).
2. Margolis, E. Q., Huffman, D. W. & Iñiguez, J. M. Southwestern Mixed-Conifer Forests: Evaluating Reference Conditions to Guide Ecological Restoration Treatments. Ecological Restoration Institute Working Paper No. 28 (2013).

POLICY

# Trump budget underwhelms

*Many major science agencies would see flat funding.*

BY LAUREN MORELLO, GIORGIA GUGLIELMI, SARA REARDON, JEFF TOLLEFSON & ALEXANDRA WITZE

Confusion reigned on 12 February, as US President Donald Trump released his budget request for the 2019 fiscal year.

Just four days earlier, the Congress had lifted mandatory caps on government spending, sending the Trump administration scrambling at the last minute to revise its budget proposal. The White House abandoned its original plan to seek a 27% funding cut for the National Institutes of Health (NIH), a 29% decrease for the National Science Foundation (NSF) and a 22% reduction for the Department of Energy (DOE) Office of Science, holding their funding steady. But the details of Trump's vision for many agencies remain fuzzy, frustrating science advocates.

"The big headline is that at the eleventh hour, [the White House] backed away from their intention of dramatically scaling back on basic research," says Matt Hourihan, director of the research and development budget and policy programme at the American Association for the Advancement of Science in Washington DC. But science agencies aren't out of the woods yet, he warns. Even in a budget that seems to support basic science, "they're still going after programmes, like environmental programmes, that they believe fall outside the purview of government", Hourihan says.

Among other things, the Trump request would cut the US Environmental Protection Agency (EPA) budget to its lowest level since the early 1990s, gut climate-change research at the National Oceanic and Atmospheric Administration (NOAA) and axe five Earth-observing missions and instruments at NASA.

And although biomedical research holds steady under Trump's final 2019 plan, policy watchers remain sceptical of the president's intentions. The White House may have reversed course on potential cuts to the NIH and NSF, but Trump still opposes any funding increases for non-military programmes, says Jennifer Zeitzer, director of legislative relations for the Federation of American Societies for Experimental Biology (FASEB) in Bethesda, Maryland. "I think it'd be really generous to read that suddenly NIH and NSF are a priority for this administration," she says.

Trump is seeking US$34.8 billion for the NIH — roughly equal to the level in 2017, the last year for which Congress and the White House agreed on a final budget (see 'Roller-coaster ride'). But the White House wants that money to go further than it does now, by creating three new institutes within the NIH. Among them would be the National Institute for Research on Safety and Quality, which would replace the $324-million Agency for Healthcare Research and Quality within the Department of Health and Human Services.

The NSF would also see flat funding under the Trump plan, with a budget of $7.47 billion.