

# The Washington Post

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## Global warming threatens pine forests, forcing federal officials to shift strategy

By [Juliet Eilperin](#),

ROCKY MOUNTAIN NATIONAL PARK — A few modest features distinguish the trunk of the limber pine standing among the trees near abandoned beaver ponds: a white, plastic pouch attached by a removable staple, a numerical metal tag secured with an aluminum nail and a printed warning: “Pouches on trees to repel mountain pine beetles. Pouches contain chemicals. Do Not Touch-Do Not Remove.”

The conifer, with its accoutrements, represents a small salvo in the battle against a [beetle infestation](#), fueled partly by warmer temperatures. But it is also a larger symbol of how researchers from the [Forest Service](#) — in concert with National Park Service officials and other scientists — are working to steel [high-elevation pine forests](#) in the West against the onslaught of [climate change](#).

Scientists know that global warming will reshape these forests, which provide crucial habitat and food for key species, curb soil erosion and slow melting snow destined for local water supplies. What they don't yet understand is which trees are best poised to survive under these changed conditions and how they can help them adapt in the decades to come.

Although it's had its share of pests and pathogens, the pine forest here is in better shape than some nearby. Scientists are trying to figure out how to keep it that way.

“We're trying to stay ahead of the target,” said David Cleaves, [climate-change adviser](#) to the chief of the Forest Service. “The interior West, that's sort of ground zero for us.”

Global warming could affect everything from national forests' and grasslands' vegetation to their stream flows, and the agency has a comprehensive plan to deal with it. Managers must keep a [performance score card](#) on everything from how educated staff are on climate change to how much carbon is stored in trees and vegetation in their areas. They've started planting some species at higher elevations, such as yellow cedar in Alaska, and near river banks to lower stream temperatures. And they've launched a pilot project to assess the

vulnerability of watersheds in a dozen national forests.

At Virginia's George Washington and Jefferson National Forests, for example, managers are planning to construct stream crossings and bridges that can withstand major storm events, and to use fire more frequently to restore pine forests under pressure from the Southern pine beetle.

Out West, high-elevation five-needle pines — which include the species whitebark, limber, foxtail, Southwestern white, Rocky Mountain bristlecone and Great Basin bristlecone — are particularly vulnerable to climate change. Warmer temperatures have allowed native beetles to grow and feed on trees at a faster rate. Water deprivation and drought can also hurt them, and they can be crowded out by other tree species migrating to higher altitudes.

“We know the consequences of doing nothing,” said Forest Service research ecologist Anna Schoettle, looking out from Rainbow Curve at a vista boasting both healthy conifers and ones that had turned red and gray after beetle infestations. “We have a threat we can't ignore.”

Diana Tomback, a biology professor at the University of Colorado at Denver who directs the [Whitebark Pine Ecosystem Foundation](#), started studying whitebark as a graduate student in the 1970s. She was the first to discover that the tree depended on the diminutive Clark's nutcracker to disperse its seeds: the bird pries seeds from whitebark cones and transports them in its throat pouch, depositing as many as 35,000 seeds in 30,000 sites in a single season.

Now, some regions of the Northern Rockies have experienced an 80 percent die-off of [whitebark pines](#), and the [Natural Resource Defense Council](#) projects that between 80 and 100 percent of remaining trees in some areas will be killed by mountain pine beetles, whitepine blister rust or a combination of the two. The NRDC has petitioned to list the tree as an endangered species.

“Seeing what's happened to the whitebark pine really shakes you up,” Tomback said, adding that scientists and officials need to be “strategic” if they want to protect some of the remaining conifers growing near mountain tops. “There is certainly nothing that's going to work to protect millions of acres of these high-elevation trees.”

That is why federal officials are singling out trees such as the limber pine at the Beaver Ponds area, attaching a pouch filled with the chemical compound verbenone to ward off beetles. Verbenone mimics the scent of an insect pheromone, giving off a false signal that the tree has already suffered a mass attack, prompting the beetles to move on.

“It's like we draw them in and we tell them, ‘The hotel's full,’ ” said Jeff Witcosky, a Forest Service entomologist in Lakewood, Colo.

The West's beetle epidemic may be beginning to wane, federal officials said, giving

scientists the time they need to figure out how best to help the forest adapt to future changes. Mountain pine beetles killed 8.8 million acres of trees in 2009, 6.8 million acres in 2010 and 3.8 million in 2011, according to the Forest Service.

Since late 2009, the Forest Service has [collected seeds](#) from five high-elevation pines and placed them in long-term storage. Officials say it will likely take three to five years more to get the [genetic material](#) they need for each species.

“We don’t intend to use these seeds unless the horrible happens, and we have to reassemble these populations,” said Robert Mangold, the agency’s director of forest health protection.

Meanwhile, scientists including Schoettle and Richard Sniezko, a geneticist at the Forest Service’s Dorena Genetic Resource Center in Oregon, are growing thousands of saplings from collected seeds so they can test which ones show the greatest resistance to blister rust.

“Genetic diversity really is the core of life,” Sniezko said, adding that mastering the genetics of these species “gives us a tool” to help sustain them under specific threats.

Researchers are also testing how some of these pines fare at different elevations, in case the agency has to replant in the future and wants to shift the trees’ distribution to give them a better shot at withstanding global warming.

“We’re at the beginning,” said Jeff Connor, the park’s natural resource specialist.

Elsewhere in the West, the Forest Service is recommending thinning trees as part of its climate strategy, which some environmentalists charge is a way to justify commercial logging.

[John Muir Project](#) Director Chad Hanson, whose group opposes commercial logging in national forests, said these projects will kill five to 10 times the number of trees that would die from beetle infestations.

“There’s no scientific justification for it,” Hanson said, adding that standing dead trees provide critical habitats for many species. “It’s just economic opportunism.”

Cleaves said the plan is aimed more at maximizing the growth of older trees than addressing climate impacts.

[Wilderness Society](#) ecologist Greg Aplet praised the agency for its overall climate-change approach, saying it has “embraced” global warming “as a major risk factor for which it must plan.”

“But even where the issue is being dealt with head on, resources are a huge constraint,” he

added.

Schoettle said that in spite of those constraints, federal scientists and managers can still save many of the high-elevation pines, “if we can stay ahead of the curve, if we can manage for resilience.”

The Forest Service is spending between \$1 million and \$2 million a year to protect high-elevation pines.

“It’s not as if after these threats come through and climate change continues that these ecosystems will return to what they were,” Schoettle said, “but they will persist and will continue to function.”

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