Sudden Death In The Southwest

WILL INSECTS, RECORD HEAT, AND DROUGHT SPELL AN END TO LANDMARK PINYON PINE?

STORY & PHOTOS BY GARY LANTZ

Paint a picture of the American Southwest and certain colors seem essential. Ultramarine blue for skies that tend to stay sunlight drenched, a khaki tan for adobe earth and architecture, dark green for a fragrant forest so typically Southwestern—the junipers and pinyon pines that separate grassland, sagebrush and desert from high country forest of ponderosa and fir.

Especially in the Four Corners region of Utah, Arizona, Colorado, and New Mexico, pinyon/juniper forest appears to be the definitive landscape, or at least one often featured in travel brochures. The aroma from the woodland conjures images of small Hispanic villages, Indian pueblos, rugged red buttes and mesas, salsa and pinto beans. Or did, before the pinyon trees experienced a startling weather- and insect-induced assault, during what some researchers have called the Southwest's "perfect storm."

When this dryland storm ended, as much as 90 percent of pinyon trees were either dead or on the verge. Researchers estimate the kill at nearly 2.5 million acres, an ecological event of catastrophic proportions. Some scientists, accessing the results of this climatic "death spiral," believe the southwestern United States witnessed its first regional-scale environmental disaster associated with temperature extremes linked to global warming.

The drought and consequent die-off of pinyons was documented by researchers on the ground and even from space, as satellite photographs recorded the transition of vast landscapes from green to brown. Drought in the Southwest is a matter of fact, and the characteristic flora and fauna of the region are well adapted. Records show that extreme drought during the mid-20th century resulted in a patchy loss of pinyon forest, but nothing to equal the scale witnessed during the latest dry spell.

The species bearing the brunt of this plague of dry weather exacerbated by an outbreak of bark beetles was *Pinus edulis*—the Colorado pinyon, two-leafed pinyon, or two-needle pinyon—the most common pinyon pine of the Four Corners area. It's a tree accustomed to the Southwest's weather moods, getting by on as little as 10 inches of rainfall at lower elevations or soaking up as many as 22 inches annually at the extremes of its upper range.

Some estimates place the pinyon/juniper forest cover at approximately 37 million acres overall, now minus the amount exterminated during the drought. Generally the Colorado pinyon is associated with *Juniperus monosperma* or one-seed juniper, another tree well adapted to the Southwest's periodic dry spells. Together they occupy mostly rugged country, generally rocky plateaus, mesas, and lower slopes of mountains. Pinyon/ juniper forest comprises a transitional ecotone, occurring between desert grassland or sagebrush steppe and the Ponderosa pine/ Douglas-fir of higher, wetter, cooler elevations.

Healthy pinyons, like those at left, have been replaced by dying trees, like the one above.

Pinyons are slow growing, maturing at 75-200 years. Larger trees in a stand often approach 400 years old and may obtain a height of 50 feet or more, with some of these southwestern specialists on record as reaching truly old age at up to 1,000 years. Usually though, a pinyon/juniper stand is made up of trees closer to the average of 18 inches in diameter and maybe 35 feet tall.

Donald Culross Peattie, in his 1950 classic *A Natural History of Western Trees*, wrote "When the traveler from the East first looks out of the train window upon the sun baked hillsides of New Mexico, he sees a landscape of turquoise blue sky, silvery glint of snow-capped far off ranges, red, desert earth molded into conical hills and hundreds of crooked little pine trees. These are pinyons, the state tree of New Mexico, and the hundreds soon become thousands and, after a few hours, the traveler realizes they are reckoned by the millions."

What Peattie's travelers might have missed as they sped past was the pinyon's not-so-obvious genetic treasure: the universally acclaimed pinyon or pine nut, a gourmet morsel to both man and beast, praised for nutritional values, health benefits, and flavor, centerpiece of a multi-million dollar industry and vital fare for a variety of wildlife.

Pinyon cones contain from 10 to 20 large nuts. Unfortunately the trees bear at irregular intervals, yet often enough that pine nuts can be found somewhere in an area during most years. The seeds have no dispersal scheme other than their own unique nutritional value.

Several members of the crow family, including Clark's nutcrackers, Steller's jays, scrub jays, and pinyon jays, all cache pinyon nuts as a vital winter commissary. But it's the pinyon jay in particular that truly earns a living by gathering and storing the precious seeds.

These powder-blue members of the corvid species travel in vast flocks that may number up to 500 birds, each exhibiting co-adaptive traits especially suited for feasting on pinyon fare. Pinyon jays have a specialized esophagus capable of carrying up to 56 seeds, which they bury approximately an inch deep, root end down, as many as seven miles from their foraging site.

And while fellow corvids tend to gather nuts from open cones, the pinyon jay hammers open green cones as well. Some biologists estimate that a single flock of pinyon jays may cache as many as 4.5 million nuts during a good seed-bearing year.

The mutualism between tree and jay is underscored by traits including large, thin-coated seeds with exceptional energy values, variable coloration that helps the jays determine between viable and aborted seeds, and the retention of seeds in open cones. On the other hand, the pinyon nut is so essential to the pinyon jay that hormonal activity not only increases with lengthening daylight, but with the appearance of pine cones and a diet of nuts as well. Pine nuts that aren't recovered by the jays become the source of new pinyon seedlings, and the forest begins anew.

Historically the pinyon nut has been an important crop for native peoples as well as roaming troupes of pinyon jays, and it remains a multi-million dollar crop across the United States. Haniel Long, author of another southwestern classic called *Pinon*

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The pinyon jay is among the species relying on nuts from pinyon cones.

Country, published in 1941, had the following to say about the autumn pine nut harvest: "The pinyon is a good nut, quite small, higher in protein and carbohydrates than pecans but lower in fat . . . It takes an old Indian or native to show what can be done (in cracking the shells with their teeth). Pinyons go in one corner of the mouth and shells come out the other. Sitting against a warm wall in the winter sun, people can keep it up for hours."

The importance of pinyon nuts as a food crop was addressed by a recent University of Missouri study. They found the pine nut industry in America worth around $100 million annually, with some 80 percent of the nuts consumed in the United States presently imported from other countries.

As an integral part of southwestern culture, wildlife habitat, and esthetics, the sudden loss of up to 90 percent of the region's pinyon trees was shocking to say the least. In an article appearing in the Santa Fe *New Mexican* in January 2004, Melissa Savage of the Four Corners Institute, Santa Fe, and William Rommer, Colorado State University, pointed out that the loss of so many trees resulted not only from a decade of drought coupled with unusually high temperatures, but also the unusually wet period that preceded the onset of the dry years.

The researchers said that during the wet period, large numbers of young trees proliferated and existing trees grew larger, developing more biomass than could be supported even during average conditions. Then, instead of returning to an average weather cycle, the region went straight into severe drought. As a consequence trees were left even more vulnerable to moisture stress and insect attack.

Nor did it help that the drought was linked to unusually high temperatures. Records show major drought years in the 1950s were as dry or possibly even drier than those during the recent episode.

A major difference between the 50s' dry spell and the recent one was the heat. High temperatures exacerbated water stress and proved to be an ally of the final pinyon executioners, the Pinyon Ips beetle.

Pinyon Ips kill by boring through the outer bark, laying eggs that hatch into larvae that tunnel through the cambium layer, eventually girdling the tree if circumstances allow. Heat- and moisture-stressed pinyons were unable to manufacture the sap flows needed to counteract the beetle attacks, and the die-off began.

Foresters have few means of fighting bark beetle infestations other than allowing nature to take its course. Generally, populations are kept in check by severe winter cold. But the unusually warm temperatures accompanying the recent drought allowed for three or four beetle generations a season rather than the customary one or two. At the same time, low winter mortality resulted in massive beetle numbers that eventually overwhelmed even healthy pinyon trees.

Craig Allen, with the U.S. Geological Survey field study station at Los Alamos, New Mexico, noted climate stress so severe that plants from cactus and shrubs to native grasses succumbed to the one/two punch of drought and high temperatures. Study plots at Bandelier National Monument lost all pinyon pines greater than five centimeters in diameter and two meters tall.

Overall, the Jemez Mountains region experienced a dieback of around 90 percent, and Allen says escalating numbers of beetles became available to attack increasingly weak trees, resulting in population irruptions that could fly to adjoining areas and successfully infest relatively robust trees.

David Breshears, a researcher with the University of Arizona at Tucson, reported that soil water content in months preceding the onset of mortality was sufficiently low to halt transpiration and photosynthesis in the pinyon pines he studied. At the same time he noted trees were dying at altitudes where precipitation and moisture availability generally precludes drought fatality.

Breshears felt the drought's severity underscored global warming's potential to disturb natural balances ranging from carbon stores and dynamics to the future production of pinyon nuts. The Arizona scientist recorded a 50 percent reduction in grama grass ground cover and a 26 percent loss of drought-resistant junipers at his study sites. His assessment: the recent episode could be a harbinger of future global change-type drought across North America.

At the same time some found a silver lining in the death of millions of pinyon pines. Colorado State's Bill Rommer, quoted in an article written by the *Denver Post's* Jeremy Myer, said "It's possible the insects are doing the forest thinning we would never be able to afford."

His observations agree with those of Reese Halter, botany professor at Humbolt State University in California. Halter believes that a decades-long history of fire suppression "created an enormous food supply for these insects," and blamed the loss on antiquated management policies.

"Global warming has increased the annual temperature in New Mexico only two degrees F., yet just enough to push the pinyon pines over the edge with a helping hand from the bark beetles," he wrote. "When trees die in the semi-arid woodland ecosystems of the Southwest they are not likely to return soon. Rising temperatures are depleting the moisture necessary for their regrowth."

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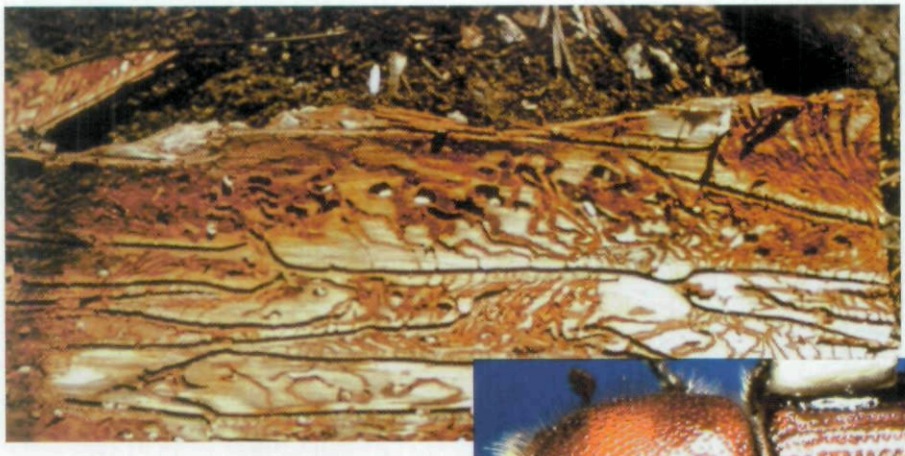

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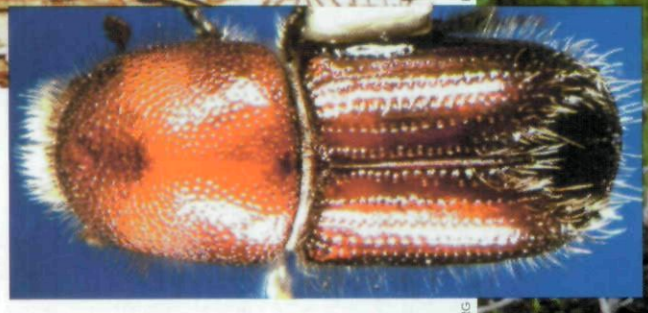


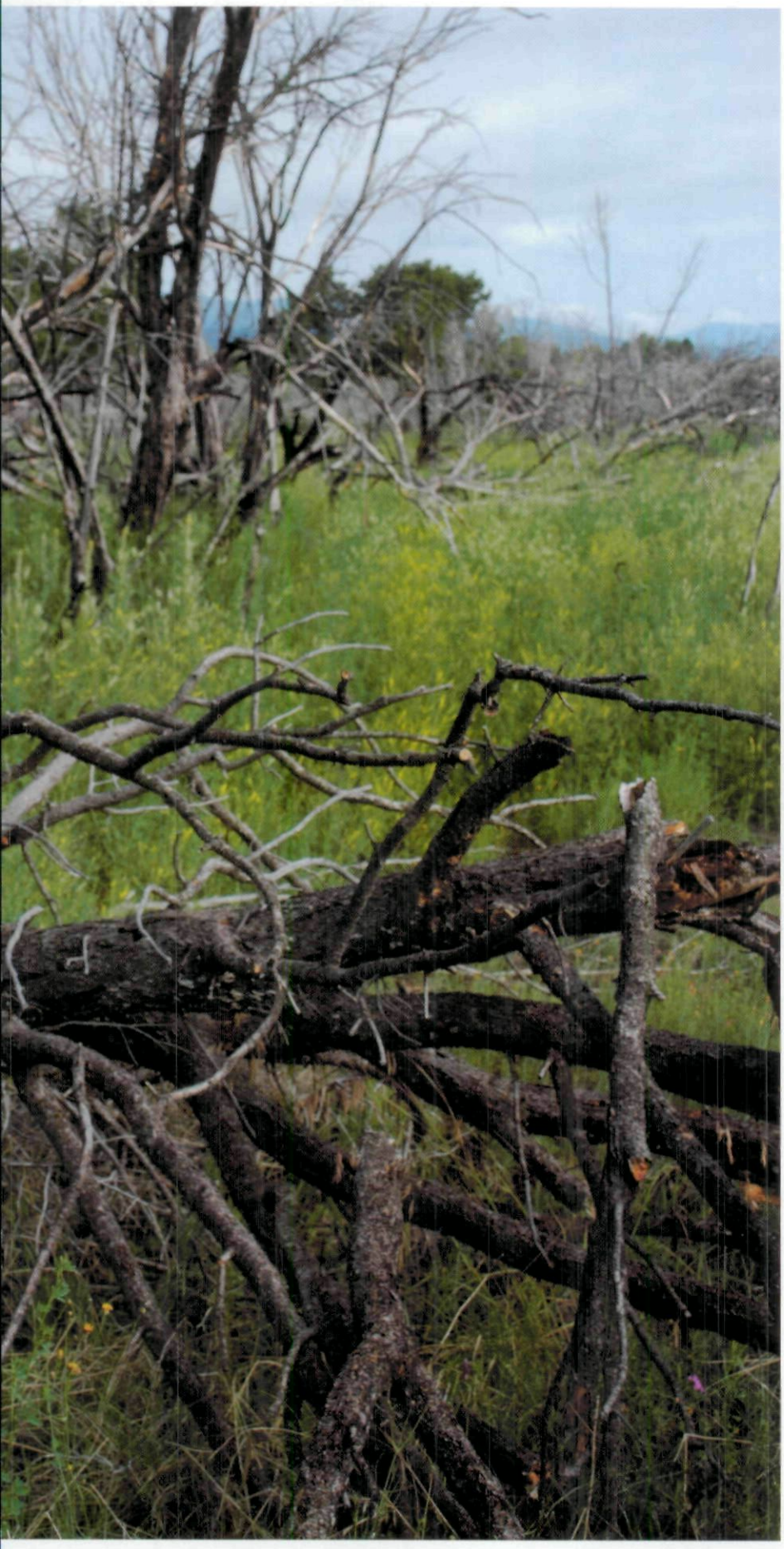
PINE BEETLE: JR BAKER & SB BAMBARA, NORTH CAROLINA ST. UNIV./BUGWOOD.ORG

Following environmental stress, bark beetles and the tunnels they burrow (above) eventually kill pinyons. In many cases decimated pinyon forest reverts to native grasses and wildflowers like penstemon (facing page, far right).

Others weren't quite predicting apocalypse. A team of 13 environmental professionals from institutions in Arizona, Utah, Colorado, Kansas, and New Mexico said that the fate of the pinyon/juniper forest was at the hands of the fickle weather patterns in the region. If it's wetter, they said, the trees could come back. If not, look for shifts to species from drier ecosystems.

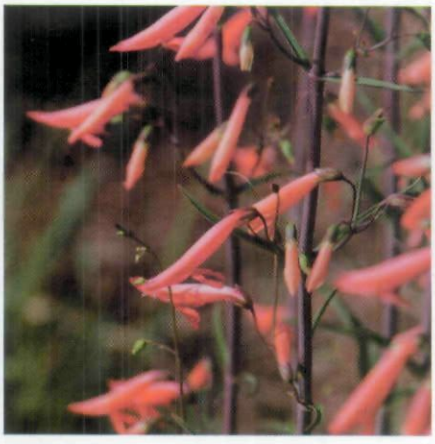
Mark Watson, habitat specialist for New Mexico Department of Game and Fish, said the loss of pinyon nuts during the 10-year drought has affected wildlife species including bears and turkeys as well as corvids. He's optimistic that surviving seedlings will in time result in a more open, grassy savannah-type pinyon/juniper woodland, which could actually be healthier and better able to withstand climatic fluctuations than tightly spaced woodlands resulting from years of overgrazing, abnormally high periods of rainfall, and fire suppression.

Such positive sentiments are shared by Bryan Bird, public lands director for the Forest Guardians environmental group



headquartered in Santa Fe. Bird is of the opinion that the regional scale disaster "wasn't necessarily unnatural," and that scientists don't yet totally understand the way that pinyon/juniper forests expand and contract according to weather moods. He hopes that groups presently studying the aftermath of the drought will be able to find better ways to manage regional forests in the future.

As for now, Forest Guardians and allies in the scientific community remain concerned about the plight of the pinyon jay, now deprived of much of its commissary. At the same time they're resisting planned salvage operations, more likely undertaken for aesthetics than for fire control, considering



that the danger was much more pronounced when the trees were still needle bearing and thus more volatile.

If the English poet Francis Thompson was correct in his assertion that one cannot pluck a flower without troubling a star, then the bright stars in the rarefied atmosphere over Santa Fe, Taos, Sedona, and Colorado Springs must have worried in recent years as they watched the Southwest endure a climatic and human-induced makeover.

But if it's any consolation, a return to more average conditions can be witnessed in new pinyon seedlings sprouting in the shadow of fallen elders, while the rich hues of native wildflowers flash amid grasses released by a dramatic reduction of forest canopy. Today the Southwest is far from dead, and change is obviously underway. Now for the patience to truly let nature take her course and see what tomorrow's weather may bring. **AF**

Gary Lantz writes on environmental topics from Norman, Oklahoma.