MEMORY SNAGS

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Source: *The North American Review*, SUMMER 2021, Vol. 306, No. 2 (SUMMER 2021), pp. 48-49

Published by: University of Northern Iowa

Stable URL: https://www.jstor.org/stable/10.2307/27152946

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Once, a rainstorm brought a tumble of mud and seed to rest against the protective feet of this boulder. A baby alligator juniper, *Juniperus deppeana*, dug roots under gravel in the boulder's shadow. Decades passed, a century. The alligator juniper grew thick, stretching perhaps twenty feet tall. Its bark scaled like the skin of an old reptile; its branches sprouted webs of bright green foliage.

Now here we are, on a warm November afternoon. Or at least, here I am. All that remains of the alligator juniper is a snag squatting under a bower of white sotol flowers. As the Santa Catalina Mountains in southern Arizona grow warmer and drier, the lower range of alligator junipers is contracting up in elevation. This tree grew at what used to be the lower elevational end of the species' range, in the grasslands nearly four thousand feet above sea level, where the heat and dryness must have become too much.

The snag is wide as a telephone pole; it points up-trail with a broken branch. I step next to the old snag, measuring it against my body. My heart pounds from the steep ascent. The jagged crown reaches my waist. Its gray surface, which appeared knobbed and cracked from far away, is finely grooved all over in thin repeating lines and delicate swirls like fingertips.

Different species live at different time scales—alligator junipers live on tree time, I live on human time. This tree germinated before the Santa Catalina Highway that I drove to reach this place existed. When this tree was young, trails had been the only way to travel the Santa Catalina Mountains for thousands of years. More recently in tree time—only a century ago—a rutted road reached Mount Lemmon, its last seven miles too narrow for two-way traffic. Even more recently, World War II internment camp prisoners built the Santa Catalina Highway. I would have thought that a century from now, long after I was gone, this tree still would be growing. But climate change is blurring tree time and human time. I peer into the hollow stump of this alligator juniper that dried out when I was a child and I feel time collapsing.

I expect to find a bird's nest in the hollow of the snag. Instead I find a pile of rusty nails and a thumb-sized plastic skull that grins at me when I pick it up. Hidden arthropods moan, buzz, creak against the backdrop of distant traffic's shush and flow, shush and flow.

I move every few years for work, school, connection. I don't have an intimate read on this landscape, a deep knowledge of this place. I could easily pass through the Sonoran Desert and its mountains with no clear sense of ecology or of history. But thousands of alligator juniper snags like this one dot these hillsides, bleached and splintered, memorializing the changing climate of the Southwest. In the Santa Catalinas, memory snags gather time in their broken fingers for me to see.

I'd been tipped off by an invertebrate zoologist at the University of Arizona, who called the dead alligator junipers on the grassy slopes of the Santa Catalina Mountains the ghosts of climate past. In the desert's desiccating air, plants tell stories, pose riddles, with what they leave behind: saguaros with their ribs, wildflowers with their seeds, alligator junipers with their standing dead.

Each sun-dried stump is a primer on what happens to the plants cloaking a desert mountain as their world becomes hotter and drier. The Santa Catalinas reach just over nine thousand feet high. Alligator junipers higher up keep living, while those lower down die out, their habitat shrinking into an ever-narrower band. Scientists have been surprised by how quickly plant ranges in the Santa Catalinas are contracting and shifting—alligator junipers as a species have lost more than one thousand feet in elevation in less than five decades, as their lower reaches have gotten too hot and too dry for them to survive.

The snags are instructive in another way. The mountains I hike through on weekends, though wild, can never be considered untouched. I hike for emotional release, sure—but not, as the standing dead remind me, to walk into a place that's escaping the effects of climate change. Of me.

Junipers evolved tens of millions of years ago. Today, alligator junipers grow as far north as Oregon and eastward onto limestone outcrops in Arkansas, and as far south as northern Guatemala. The center of alligator juniper genetic diversity lies in north-central Mexico. In the highlands of northern Chiapas and of Guatemala lives a unique variety of alligator juniper with seeds small enough to travel in the bodies of birds. Most alligator junipers have seeds too big for birds; they move in the jaws of hungry animals such as racoons, squirrels, or opossums, or they wash downhill in rain.

I search for the standing dead on which to snag my memory, to tack the truth in place.

Alligator junipers throughout the American Southwest and into central Mexico are very closely related, although they grow on isolated mountains and their seeds do not travel far. During the Wisconsin Glacial Episode—the most recent ice age—piñon juniper woodlands grew across this region, including in isolated mountains and the surrounding lowlands. As the lowlands dried and warmed into desert, alligator junipers retreated into the mountains where they live today. Those migrations took thousands of years.

Birds and insects seek out snags, burrowing into old alligator junipers for food and shelter. As for me, I seek out those snags to tack in place a baseline that keeps shifting.

The idea of shifting baselines comes from marine fisheries research, but it's relevant to any ecosystem. In 1995, fisheries expert Daniel Pauly wrote about what he called "shifting baseline syndrome" among fisheries scientists. Researchers were trying to get a handle on the worldwide collapse of marine fisheries, but the research kept resetting when new people got to work—each new scientist measured the fisheries' collapse against the stock size at the start of her own career.

Similarly, when I drive the switchbacks up the Santa Catalina Highway to elevations where healthy alligator junipers still thrive, I am tempted to measure what is normal against what I've experienced. Where I see live alligator junipers is where they belong: above five thousand feet. But on my drive up I pass gray-white dead alligator junipers, some below four thousand feet. Here, the snags say. When you were a child, we grew *right here*. History in tree form, confronting my assumptions from sunlit mountainside.

It's no coincidence that most of these standing dead, these memories, are framed by the windows of my car. My car, even more than the sharp smell of junipers, possibly even more than the view of tawny cliffs stretching above canyons, or trails under puffed out pines, symbolizes outdoor escape to me. I've tried to leave small towns without a car—or simply to get around my sprawling southwestern city without a car—and it is not easy. Still, for the purposes of recreation, the foolishness of trying to escape from a built world in the vehicle for which it was built somehow did not occur to me until I saw, on the side of a hiking trail, the smoothed wood of a weathered alligator juniper snag.

I used to prefer alligator junipers that found themselves in difficult situations, splitting the idea of inhospitable with the finest comb: gripped tight to cliffsides. Tangled among boulders. Wiggling roots into sandy soil where other plants struggled to find purchase. I liked best alligator junipers flourishing in sunstruck places where my body wilted; or on snow-swept mesas of northern New Mexico, the alligator junipers growing with their trunks twisted round like snakes. I thought of those trees as having adapted to extreme conditions. I admired their sheer persistence, their obdurate endurance. Because I think of all alligator junipers as survivors now, I no longer have favorites.

In the Santa Catalinas, living alligator junipers remain among the most common trees below 8,500 feet. On hiking trips in the mountain, I easily could pretend I didn't believe in ghosts; sliding my eyes away from complicated sights on the drive up, I could choose, instead, to admire thriving alligator junipers in campgrounds at higher elevations.

But I search for the standing dead on which to snag my memory, to tack the truth in place. Standing dead alligator junipers in the Santa Catalina Mountains help me keep track of a quickly changing world. They are the stories that I wish I knew better, that I wish I knew better how to tell—about climate change; about what's happened and what's coming next; about cause and effect; tree and sky; memory and mountain; time and place. I don't want to look away. ●