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AN OTHERWORLDLY SPECIES: JOSHUA TREES AND THE
CONSERVATION-CLIMATE DILEMMA

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About 210 km east of Los Angeles, along the boundary of the Mojave and Colorado Deserts, stands a national park dedicated to the American Southwest's most threatened botanical icon: the Joshua tree. With their shaggy bark, clusters of spiked leaves, and gnarled limbs reaching over 30 feet high, these trees (actually, they are succulents related to yuccas: *Yucca brevifolia*) reminded nineteenth-century Mormons of the biblical prophet Joshua with his arms stretched out in supplication—a gesture that befits these whimsical-looking and imperiled plants.¹ Unlike the coastal redwoods and mountain sequoias that inspired the American preservationist John Muir's advocacy in the early 1900s, Joshua trees had largely escaped the lumbering and habitat losses that devastated their more famous cousins to the north when this area became a national monument in 1936.² "It's something that you don't even imagine could live on Earth and here it is," says the ecologist Cameron Barrows, "It's something very alien . . . like a Dr. Seuss book."³ The biggest trees may be 1000 years old, adapted to brutal conditions in which summer temperatures soar above 40° C and annual rainfall measures a meager 228 mm.



Photo by Cedric Letsch on [Unsplash](#).

The Joshua Tree National Park, established in 1994, still contains hundreds of thousands of these otherworldly trees. What worries Barrows and his team, though, is the dearth of juveniles in the park's lower elevations. Their absence is a sign that seedlings are not surviving, in large part due to the high temperatures, drought conditions, and devastating wildfires associated with global warming. "They're well adapted to what we have now," Barrows remarks, "But you turn up the temperature a couple of degrees and that would be the end of most of these plants."⁴ The 2020 Cima Dome fire in the nearby Mojave National Preserve offers a glimpse of this superheated future.

It burned through over 43000 acres of old-growth Joshua tree forest, incinerating more than a million trees. Barrows has estimated that the tree habitat available in these two protected areas will decrease by as much as 90 percent by 2100. The NPS is doing what it can to shield “climate refugia” from wildfires and invasive species. Such proactive measures are becoming more routine as agency directors acknowledge that historical baselines for ecological protection and restoration have become outdated. Indeed, the NPS’s “Resist-Accept-Direct (RAD)” framework calls on rangers to assist endangered species in their search for a more suitable home, even though “managed relocation” remains ecologically uncertain and, for some, ethically questionable.

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Assistance inside protected zones is no salvation, however. Over 40 percent of Joshua tree territory lies in private hands, including many prized refugia. These lands remain vulnerable to pollution, mining development, and exurban sprawl. Given these threats, Joshua trees may soon become the first species to be protected under both the US Federal and the California Endangered Species Act (ESA) due to climate change. In September 2020, the California Fish and Game Commission voted to accept an emergency petition from the Tucson-based Center for Biological Diversity (CBD) that named the western Joshua tree a “candidate species” for one year while the state conducted a study to determine whether to give it “threatened” or “endangered” status. The move could not stop all Mojave development, but it did make it illegal to remove trees without a permit. Then, in September 2021, a federal court overturned a Trump-era U.S. Fish and Wildlife Service decision not to list the species as threatened, with the presiding judge directing the agency to reconsider *Yucca brevifolia* for protection under the ESA.

The ESA listing is only a stopgap, but a vital one. Neither the CBD petition nor the court injunction can halt the planetary threat of climate change to Joshua trees. As human activities shift the planet from a geological epoch that was supposed to last over a million years (the Holocene) into a new one (the Anthropocene), the speed of planetary changes in biotic and abiotic conditions has altered the species’ evolutionary trajectory. Since Joshua trees take decades to reach reproductive age, they cannot hope to migrate, let alone evolve, quickly enough to outpace a projected 3.5–4.0°C warming. Yet ESA listing can shield the trees’ habitats in the near term while conservationists investigate recovery options—assuming, of course, that Paris Agreement signatories can curb greenhouse gas (GHG) emissions fast enough to avoid catastrophic global warming.

As in many endangered species cases, the opposition to listing the Joshua tree emerged locally. Municipal leaders in the fast-growing towns of Lancaster and Victorville have argued against federal intrusion, citing local ordinances that already ban the trees’ removal and fuming about the costs of additional conservation measures. Yet the August 2020 public hearings about the CBD petition also confronted an unexpected foe: the solar industry. California’s ambitious plans for combatting climate change call for 100 percent clean electricity by 2045 and a cut in GHG emissions to 80 percent below 1990 levels by 2050. Achieving these targets requires an unprecedented expansion of solar energy and the industry has its eye on the Mojave to construct vast collection arrays. As Scott Kulkhe, the Project Manager for the enormous Big Beau solar farm in Kern County told *The Daily Beast*, “it’s a balancing act . . . We need to cite these projects somewhere, and in the process we try to invoke as little environmental damage as possible.”⁵ Big Beau’s developers persuaded the California regulators that listing the Joshua tree as endangered would spell the end of their project. Feeling trapped between conflicting climate and conservation mandates, the Fish and Game Commission found a compromise: it has allowed 15 San Bernardino and Kern County solar projects to move forward while ecologists monitor the effects on Joshua trees and their habitat.

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The controversies over the Joshua tree's future exemplify the "green-green dilemmas" that environmentalists face as they simultaneously rush to mitigate climate change and stem mass extinction. Building California's renewable energy capacity to help avert a *planetary* emergency conflicts with an equally passionate desire to save a beloved *regional* icon. Given the interlocking threats of rising temperatures, wildfires, and limited refugia, one might be tempted to resign these desert sentinels to posterity and focus on species with a greater chance of survival.

Peter Kareiva, the former director of the Nature Conservancy, would likely do so. He and his Breakthrough Institute colleagues have called for a more pragmatic, "human-centered" approach to species protection in which Muir's ethic of "fragility and solitude" has no place. "Conservation's continuing focus upon preserving islands of Holocene ecosystems in the age of the Anthropocene," Kareiva writes, "is both anachronistic and counterproductive."⁶ Echoing his utilitarian approach, a solar industry trade group has emphasized that Californians must accept trade-offs at the "climate-conservation nexus."⁷ My essay turns such prognoses on their head. "Nature-based" solutions for climate stabilization, I argue, are more effective in the near term than "engineering-based" ones. A cautious, species-centered approach to the conservation-climate dilemma requires an adaptive framework anchored in historical benchmarks of habitat size and variability—not a defeatist acceptance of species obsolescence or a perilous leap into novel ecosystems.

Seeking Refuge in a Super-Heated Desert

One reason that the ESA listing is critical to the western Joshua tree's imminent survival is the inability of the trees to sprout plantlets in higher and cooler elevations fast enough to outpace the Mojave's warming. In the Joshua trees' evolutionary history, things were not always so precarious. Paleoecologists have theorized that *Yucca brevifolia* once relied on giant sloth dung to disperse their seed, but the species went extinct more than 13000 years ago. According to a scientist for the US Geological Survey, the sloth resembled "a fuzzy Volkswagen Beetle" that consumed Joshua tree spines and then deposited seeds in their dung ten or more miles away.⁸ Such large-mammal dispersal allowed the succulents to migrate due to warming at the end of the last Ice Age. Now, however, the plants depend on rodents to carry their pods, dropping seeds a few hundred yards from the parent.

About a decade ago, many conservationists had hoped that "managed relocation" might save the species.⁹ More recent studies of the delicate relationship between Joshua trees and a symbiotic yucca moth have cast doubt on whether assisted colonization could work. Joshua trees do not have nectar to attract pollinators, so they rely exclusively on a moth with spectacular "tentacle-like" jaw appendages to collect pollen deep inside the flowers and deposit it on each flower's female parts. The moth then lays her eggs with a blade-shaped ovipositor on the flowers' seeds. When the yucca moth caterpillars hatch, they eat those seeds before crawling to the ground and forming cocoons. In this sense, the moths are "farming" the trees, entangled in an "evolutionary partnership" millions of years old.¹⁰ If NPS staff plant or move seedlings hundreds of kilometers away to avoid fires, the yucca moths may not thrive in the new upland locations. Muir put it aptly: "When we try to pick out anything by itself, we find it hitched to everything else in the universe."¹¹

The Joshua tree-yucca moth symbiosis is a wonder of co-evolution, but it is not the only "hitching" imperiled by Mojave development. Ecologists have described Joshua trees as the desert's "great canteen" since antelope ground squirrels, desert wood rats, and blacktail jack rabbits gnaw through their bark for moisture in the driest parts of the year. At the Big Beau project site, investigative reporters learned that workers have already cut down over 200 Joshua trees in anticipation of costly permitting for a threatened species removal—a move that has disrupted the desert's vegetative community. The chain reaction could be catastrophic: if rat and jack rabbit numbers decline, so too will predator populations of coyote, fox, and hawk.

Conservationists who have reviewed the solar industry's plans for Mojave expansion have also decried the companies' insistence that they lack siting alternatives. Environmentalists are pushing for alternatives to semi-natural desert lands for solar arrays, including rooftops, vacant parking lots, closed landfills, and abandoned shopping malls in Antelope Valley. There are also promising new technologies that will make solar cells far more efficient, requiring much less land for panels and transmission lines. Stalled protection measures, anticipatory removals, and the neglect of development alternatives hardly seem inconsistent with solar industry promises to provide power in "environmental . . . and socially responsible ways."¹²

Conservationists' calls to protect desert landscapes while scientists learn more about the Joshua trees' adaptability are paving the way for "ecosystem-based solutions" to the climate crisis. While cutting GHGs and expanding renewables are keys to decarbonizing the atmosphere, so are the "renovation" of degraded terrestrial carbon sinks such as forests, wetlands, and grasslands.¹³ By some estimates, these ecosystems—many of which are now imperiled by overdevelopment, invasive species, pollution, and overharvesting—could provide 30 percent of the carbon sequestration required under the Paris Agreement. Desert vegetation holds similar promise, as UC Davis researchers have shown that intermountain grasslands offer a robust alternative to forests as carbon impoundments in wildfire-prone California. As a result of these absorptive properties, conservationists have argued for 30% global terrestrial and aquatic biodiversity protection targets as buffers for a warming world—far higher than the current 17% of land and 10% of sea.¹⁴



A cluster of Joshua tree flowers. Photo by Jeffrey Eisen on [Unsplash](#).

The Endangered Species List: Triage in the Face of Shifting Baselines

Listing the Joshua tree as an endangered species does not mean that all solar expansion will cease. Barrows and his colleagues hope to use the candidacy periods to accelerate adaptation by replanting burned-over refugia with hardier seedlings, thus selecting for gene variants more likely to survive desert warming. They emphasize that California authorities should embrace community-based conservation based on Indigenous stewardship since Joshua trees serve as a “cultural keystone species” whose uses for food, basket-making, and storytelling on tribal lands.¹⁵

The 2021 federal court ruling may give scientists precious time to gather information during the two-to-three-decade window remaining before continued warming hits irreversible tipping points. US District Judge Otis Wright II lambasted the 2019 US Fish and Wildlife decision’s “unsupported, speculative, and irrational” evidence that Joshua trees could survive climate change, including antics such as placing a Joshua tree leaf in hot water to show the species’ tolerance for high temperatures. Wright summed up the green-green dilemma when he doubted that “a species that is historically ‘extremely limited’ in its ability to migrate will somehow save itself from the projected ‘massive declines’ in suitable habitat before the turn of the century.”¹⁶

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Though Joshua trees may require managed relocations to shield them from climate change, traditional habitat conservation targets are still necessary even as more and more carbon dioxide is emitted into the atmosphere. Despite the uncertainties about ecological prospects in 2050, 2080, or 2100, “natural and seminatural ecosystems are . . . the best starting place for immediate adaptation and mitigation.”¹⁷ Climate change has amplified the threat of drought and wildfires to Joshua trees, but it should not become a fatalistic excuse for neglecting near-term recovery efforts. The ESA—a 1970s piece of legislation anchored in Holocene assumptions about habitats—still provides a robust if imperfect instrument for improving ecosystem resilience in the here and now. The solar industry has presented Californians with a false choice between climate protection and conservation.

Notes

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- ¹² Modlin, “The Fight to Save the Joshua Tree.”
- ¹³ Michael D. Morecroft et al., “Measuring the Success of Climate Change Adaptation and Mitigation in Terrestrial Ecosystems,” *Science* 366, no. 6471 (13 December 2019): 2-3.
- ¹⁴ Kat Kerlin, “Grasslands More Reliable Carbon Sink Than Trees,” *UC Davis*, 9 July 2018, <https://climatechange.ucdavis.edu/climate/news/grasslands-more-reliable-carbon-sink-than-trees>.
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- ¹⁷ Michael Morecroft et al., “Measuring the Success of Climate Change Adaptation.”



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