



IN SEARCH OF

The traditional role of agaves in pre-Columbian cultures has been known for centuries – the desert plants were a critical source of food, medicine and building materials. In recent years, however, botanists have discovered that ancient societies were actually cultivating agaves in Central and Southern Arizona. Some of those prehistoric farms are still out there, and researchers from Desert Botanical Garden are determined to find them.

BY ANNETTE MCGIVNEY ■ PHOTOGRAPHS BY EIRINI PAJAK

A tall, slender agave plant with a central stalk topped by a cluster of yellow flowers stands prominently in the foreground. Two people, a woman in a wide-brimmed hat and a man in a cap, are looking at the plant. The background shows a vast desert valley with rolling hills and mountains under a cloudy sky.

ANCIENT AGAVES

Desert Botanical Garden botanists Wendy Hodgson and Andrew Salywon examine a blooming agave in the Sedona area. When the botanists are out searching for domesticated agave species, they often encounter new, scientifically undescribed native agaves such as this one.

THE JOB DESCRIPTION FOR an agave researcher should read something like this: Must be willing to shed blood and expose oneself to blister-inducing juices while obtaining specimens. Most field days are spent hiking off-trail, up steep rocky slopes, in triple-digit temperatures. Encountering Africanized bees, rattlesnakes or crazy humans is a constant possibility. Being able to identify and follow obscure clues across large swaths of desert is a plus.

Although scientists have always roamed rugged landscapes in search of new information, few can match the challenging working conditions faced by Arizona botanists Wendy Hodgson and Andrew Salywon. Their groundbreaking agave research takes “suffering for science” to a whole new level, but the payoff is big: In recent years, they’ve discovered five Arizona agave species that previously were unknown to science, and in the process, they’re rewriting history on how the plant was used by pre-Columbian cultures in the Southwest.

“There is no one else doing this research,” Salywon says, laughing, as he slathers his face and neck with sunscreen before we set out on a scramble up a steep hill west of Sedona. “Who would be this crazy?”

It’s late June, and an excessive-heat warning is in effect. But it’s also when the agaves bloom in Central Arizona, so Hodgson and Salywon aren’t about to pass up the possibility of a new discovery just because the forecast calls for a record-breaking 110 degrees. Salywon stuffs a plant press into his daypack and grabs a 10-foot aluminum “snatch pole,” and he, Hodgson, photographer Eirini Pajak and I head toward the place Hodgson has named Angel Hill.

The saguaro may be Arizona’s most iconic plant, and its blossom is the official state flower, but the agave most embodies Arizona’s rich cultural history. There are more species of agave — at least 21, including varieties and subspecies — in Arizona than in any other U.S. state. The agave was a staple food for Arizona’s pre-Columbian cultures, as well as a critical source of medicine, cordage, textiles and building materials. And it’s long been utilized by the indigenous cultures of northern and central Mexico. People living in the Yucatán still have 40 different uses for it, and anthropologists estimate that number was far higher in pre-Columbian times. Archaeobotanist Phil Dering calls the agave the “buffalo of the region” to convey how indigenous cultures in Mexico and the Southwest depended on the plant for countless purposes, much as the Plains Indian tribes depended on bison.

The traditional role of agaves in pre-Columbian cultures has been known for centuries. But what’s been realized in just the past three decades, thanks to the work of Hodgson and Salywon, is how these ancient societies domesticated and farmed agaves throughout Central and Southern Arizona — and even in the Grand Canyon. As senior research botanist and curator of the herbarium at Desert Botanical Garden in Phoenix, Hodgson has been on the hunt for domesticated agave species in Arizona since the mid-1980s. Her colleague Salywon, a research botanist and assistant herbarium curator, joined the search a decade ago.

“People have underestimated how important the agave was to ancient cultures,” Salywon says as we pick our way up Angel Hill. “Arizona was possibly the center for domestication of the plant.”





LEFT: Parry's agaves (*Agave parryi*) thrive near an archaeological site. While not a domesticated species, Parry's agaves were among the native agaves cultivated by Arizona's early inhabitants.

ABOVE: An unusual dwarf form of an agave — possibly Sacred Mountain agave (*Agave verdensis*) — grows near an archaeological site in the Sedona area.

Hodgson, who's leading us on the scree-filled route, adds that the discoveries of domesticated "heirloom" species across the state help document "the bio-cultural landscape" of Arizona. "We're learning how people adapted to their environment," she says as I grab a juniper branch to keep from tumbling downhill. "There's not enough time in the day to discover all the new domesticated species — they're right under our noses."



WHEREVER THEY GO IN ARIZONA, Hodgson and Salywon are pulling out binoculars and glassing distant ridges for the telltale agave stalk. Sometimes, they find an unusual species next to the interstate. More often, though, they stumble upon a discovery far off the beaten path. When Hodgson wandered to the top of Angel Hill on a hunch nearly 20 years ago, she hit the mother lode. The area contains an agave farm dating back at least 700 years, with three different domesticated species growing on a rocky perch high above Oak Creek. Of all the scenic places Hodgson has visited for her research, Angel Hill is her favorite.

"Hello, baby!" Hodgson says, as if she's greeting an old friend, to an *Agave phillipsiana* on top of the hill. Commonly called Grand Canyon agave for the place the species was discovered, *Agave phillipsiana* was later found by Hodgson in the Sedona area, then around Prescott and the Tonto Basin. Presumably, it was traded by ancient cultures in the region and maybe from as far away as central Mexico. The cluster of the

species on exposed Angel Hill has the good sense to grow in the shade of a large juniper.

Hodgson talks about her research the way a detective discusses an investigation. In 1990, a fellow botanist told Hodgson about an unusual-looking agave spotted in the Grand Canyon. "The Canyon flora list included [the wild native species] *Agave parryi*, which I knew would not be found there," Hodgson recalls. She and some friends found the strange agave near archaeological sites in the Canyon's Deer Creek drainage, but it wasn't flowering at the time. Another friend, the Canyon botanist, later sent Hodgson a sample of flowers from it. By then, Hodgson was convinced there was an unknown agave domesticate in the Grand Canyon. "It was a remnant of being farmed," she says. But she couldn't prove it until she got a fresh flower, which she and a friend finally did by

hiking into the Canyon's waterless Surprise Valley in triple-digit August heat. Hodgson named the species after the late botanist Arthur Phillips III, who gave her the original tip.

Agaves are sometimes mistaken for cactuses because of their spiny leaves, but they're in a different plant family. Calling them "century plants" is another common misnomer. In reality, most agave species mature and develop a tall stalk from their rosette of leaves after about 20 years. In the same year the stalk shoots up, flowers bloom on the top half, and then the plant dies. Instead of reproducing from seeds, domesticated agaves perpetuate through vegetative reproduction, where rhizomes from the mother plant produce "pups" that continue to grow after the mother plant dies. The portable little pups were ideal for trading and transplanting in Arizona's pre-Columbian agrarian communities.

Salywon pulls out a knife and carefully cuts a spiny *Agave phillipsiana* leaf to take back to Desert Botanical Garden's extensive herbarium. Hodgson estimates the herbarium has archived more than 3,000 agave specimens, representing more than 180 different species. Almost all of them were collected by Hodgson, and more recently by Hodgson and Salywon, over the past 30 years. While Salywon presses the leaf between newsprint, Hodgson makes notes in a journal wrapped in a bloodstained suede cover. In addition to having gnarly spines, the agave leaves contain a caustic juice that can be as irritating to human skin as poison ivy.

After visiting *Agave phillipsiana*, we walk across the hilltop to check on *Agave delamateri*, another domesticated species first discovered in the Tonto Basin and later found by Hodgson in the Verde Valley. She suspects this plant, like *Agave phillipsiana*, originated in northern Mexico but was widely traded in Central Arizona. We've arrived a year too late for this cluster: Dry, skeleton-like stalks rise from fading rosettes. The dying plants are surrounded by a few parched pups shriveling in the heat. Salywon pulls out what's left of his dwindling water supply

and sprinkles it on the baby agave.

“These plants are living archaeological artifacts,” Hodgson says. She explains that because of the agave’s vegetative reproduction process, the plants we see on Angel Hill today are genetically similar, if not identical, to what pre-Columbian people were cultivating here hundreds of years ago.

But the clock is ticking for these living legacies. Due to drought over the past two decades and lack of human tending, the rare domesticated agaves are quickly disappearing from Arizona’s wild landscapes. An untold number probably died off before Hodgson and Salywon could even get to them.

Nearby, we inspect a cluster of *Agave verdensis*, called Sacred Mountain agave in honor of where Hodgson first found it near Sedona’s Sacred Mountain archaeological site. “This is the cutest agave I know,” Hodgson says. The stalk of one plant is curved from the wind, and she cups the flowers in her hand as she takes a whiff of the sweet, musky scent. “When I first came up here,” she adds, “there were probably 100 stalks. The hillside was covered.”

Today, we walk across an agave graveyard. Some 20 to 30 dead stalks are strewn across the ground, and a handful of pups are trying to beat the odds. Salywon digs up one pup to take back and grow in the garden’s greenhouse, in case this Sacred Mountain clone’s descendants don’t make it.

Hodgson is wistful about Angel Hill as we hike back to the car in 107-degree heat. She knows the next time she comes here, there will be even fewer agaves. “I literally cried recently when I left a clone in Sycamore Canyon,” she says. “I knew I would never see it again.”

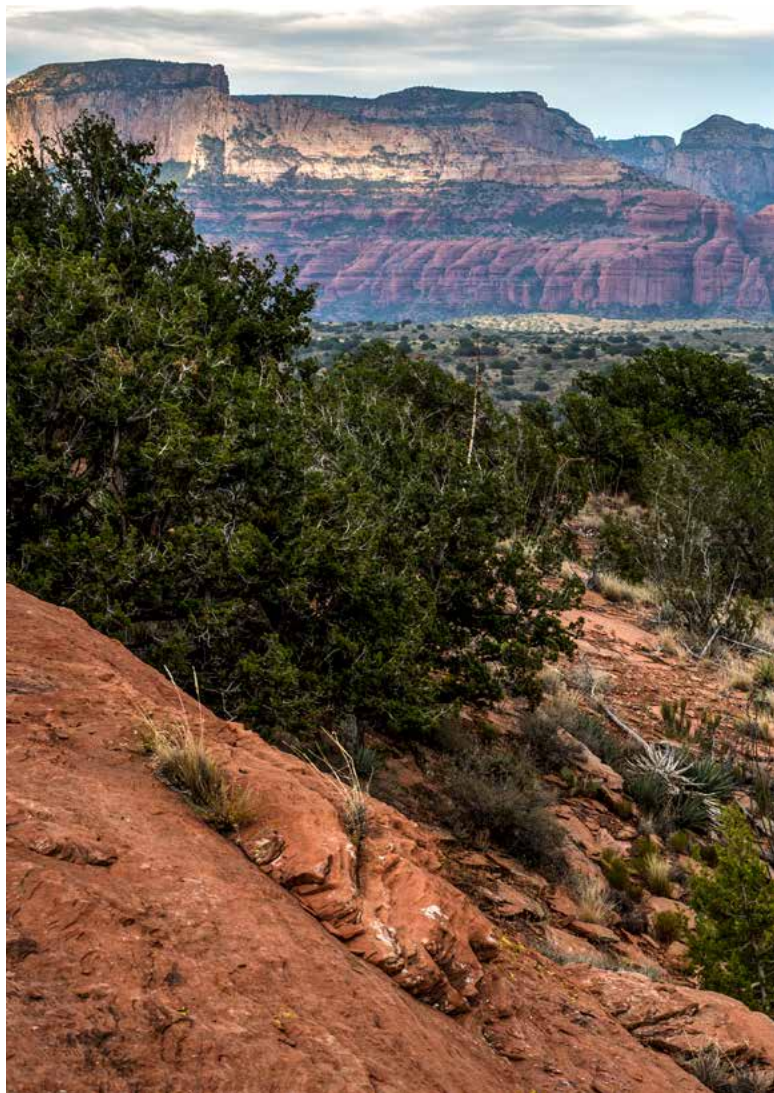


THE NEXT DAY, we scramble up to a remote ruins site off Red Canyon Road west of Sedona. Recent research into agave domesticates is not only expanding the scientific understanding of the plant, but also providing valuable information to archaeologists — because domesticated species are almost always found near archaeological sites.

“Sometimes I stumble upon the agave first. Sometimes it’s the ruins,” says Sedona resident Scott Newth, a regional coordinator for the Arizona Site Stewards Program. Newth is part of a group of citizen scientists whom Hodgson and Salywon have enlisted to help hunt for domesticated agave species. “It’s easy to tell a domesticate from a wild species once you learn how,” Newth says. “The leaves on the domesticates are not as stout.” Newth and his wife have discovered more than 20 clusters of domesticated agaves while hunting for archaeological sites over the past five years.

Near ruins and rock-art sites, Newth also frequently finds roasting pits where ancient dwellers cut the leaves off the agaves to harvest the plant’s “heart.” Over a period of days, the plant’s coveted insides were slow-roasted in a pit until the sweet meat was ready for eating or storage. Arizona’s Apache tribes still conduct traditional agave roasts.

“We’re exchanging information with archaeologists all the time,” Hodgson says as our crew tops out on a slick-rock-covered mesa. Ruins of a multi-room dwelling sit at the edge of an escarpment. The mesa rises like an island amid a red-rock



sea. The inhabitants of this community — likely the Sinaguans, who lived in the area between A.D. 1150 and A.D. 1300 — surely chose this location for the view, whether for defensive reasons or aesthetic ones.

Just beyond the jumble of collapsed walls are the agaves we have come to see. The current theory is that these are not domesticated species, but what Hodgson calls a “cultivated” variety of native *Agave parryi*. The community of farmers who grew beans and squash along the creek below also tended clusters of agaves around their homes. It was what scientists call symbiosis: The humans helped the agaves, and the agaves sustained the humans. Before the days of grocery stores, symbiosis was key to survival.

Hodgson’s and Salywon’s research is documenting not only which agaves were farmed and how pre-Columbian cultures farmed them, but also how they cultivated various plants over centuries to create new “designer” species. Domesticates were developed by favoring specific desirable traits, such as leaves that were easy to cut, hearts that were large and sweet, or strong fibers for cordage. The most notorious modern example is the blue agave, which is grown in a specific region in central Mexico and produces the liquid that, when fermented and distilled, becomes tequila.

About 100 feet from the ruins site, agaves perched near the edge of the mesa are in bloom. Bulbous clumps of bright-yellow



Andrew Salywon and Wendy Hodgson collect specimens from the stalk of a mystery hybrid agave species near an archaeological site south of Sedona.

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flowers balance on tiny branches at the top of 20-foot stalks that resemble something from a Dr. Seuss book. These agaves look different from what Hodgson and Salywon have seen here before. It might be Sacred Mountain agave, or it might be something new.

“Could this have been an experimental agave garden? Maybe they knew how to hybridize,” Hodgson muses. “Part of the beauty of science is that you think things are known, but then you find out they’re not.” Hodgson and Salywon are determined to solve the mystery.

They use the snatch pole to get a sample of a flower to take back to the herbarium. They also take measurements of various plant parts and place the specimens between newspaper pages in the plant press. It’s the same methodical collection process botanists have used for at least a century. But what has revolutionized Hodgson’s and Salywon’s research — along with other aspects of botany — is the ability to examine plant DNA.

Five years ago, Desert Botanical Garden created a molecular lab to conduct a variety of research, including analysis of agave domesticates. Although Hodgson’s and Salywon’s blood-spilling fieldwork still constitutes most of the research, the work in the lab has become a key component. A small amount of agave leaf tissue is used to extract the plant’s DNA. The DNA is then sequenced, allowing an evolutionary tree to be constructed. This data offers additional evidence of whether a species is new to science.

“When we analyze the evolutionary tree of a specimen, it helps us answer anthropological questions about where the plant originated and how and where it was domesticated,” Salywon explains. “Plants are central to understanding human culture and the societies that utilized agriculture.”

Unfortunately for the domesticated agaves growing in the wilds of Arizona, there’s no formal way to preserve them, even as they increasingly vanish from the landscape. The federal Endangered Species Act protects only plants that are native to an area and have not been manipulated by humans. And the federal Archaeological Resources Protection Act does not extend to plants. Hodgson and Salywon hope protections for the species will come through some form of human tending, perhaps by bringing the domesticated agaves back into agriculture. “These agaves were grown here for a reason,” Salywon says. “Maybe they could become a new crop for this arid region.”

The intrepid botanists are also in a race to document as much as they can. “We don’t know where this research will lead,” Hodgson says. “We are collecting for the future. What scientist would have thought, 100 years ago, that the specimens they were preserving at the herbarium would one day be used for DNA analysis?”

But right now, as we huddle in the shade of a juniper and look out onto the sprawling greens and reds of the Verde Valley, time stands still. We’re just the latest in a long line of people who have enjoyed this view. Far below, the stream that once nourished ancient farmers’ crops still snakes through a ribbon of trees. Tiny clouds sneak across the blue sky, signaling the approach of the monsoon. And the stalwart agaves rise like totem poles from the slick-rock — just as they have for 700 years. **AH**