LEGACIES ON THE LAND

To fully understand the prehistoric cultures of the Southwest, ASU scientists study how the landscape influenced societal and economic changes. They want to know how these changes, in turn, transformed the landscape.

by ADELHEID FISCHER
In 2001, Hoski Schaafsma proposed a study of several acres of land in a riverine area north of Phoenix. The Arizona State University graduate student’s goal was to investigate the effects of ancient Hohokam farmers on the soils. He wanted to determine whether their activities influenced the kinds of plants that grow there today. His advisor, John Briggs, was skeptical. Briggs pointed out that the site had been abandoned by the Hohokam nearly 1,000 years ago. Besides, he reasoned, a century of cattle grazing and more than a decade of soil-churning ATV traffic probably had altered the place beyond recognition. Nevertheless intrigued by Schaafsma’s idea, he gave him a green light to proceed.

To their mutual surprise, Schaafsma discovered that the Hohokam’s silt-trapping dams had altered the soils in their riverside fields. To this day, only a monoculture of creosote bushes has managed to take root. By comparison, the surrounding landscape that was largely untouched by the indigenous farmers hosted an average of 28 plant species.

“It’s mind-boggling to me that a prehistoric human culture planting corn with a stick still has an impact on modern-day vegetation,” says Briggs, a grassland ecologist with ASU’s department of ecology, evolution and environmental science.

Briggs wasn’t the only professor at ASU intrigued by the idea that prehistoric land uses could influence modern-day ecosystems. Scientists refer to such phenomena as “legacy effects.” For more than a year, ASU anthropologists Keith Kintigh and Katherine Spielmann attended informal meetings with their colleagues. Their discussion focused on the interplay between landscapes and the ancient cultures that inhabited them. They had ideas to test. Spielmann suggested a research project at the little-known pueblos of Agua Fria National Monument in central Arizona.

The monument area provided the perfect test site. Located 40 miles north of downtown Phoenix, it is within easy driving distance for the researchers and their students. However, unlike other major prehistoric sites in the Southwest, the archaeological features at Agua Fria have barely been documented. Some sketchy information does exist. That information raises a number of tantalizing questions for researchers.

Sometime between the late 1200s to about 1400, a group of prehistoric people occupied pueblos on a cluster of mesas at the monument. No one knows who they were or where they came from. No one knows why they chose to set up their homes and farm fields in these arid, high-elevation grasslands with their drying winds and thin, rock-studded soils. And no one knows, why, after less than 200 years of occupation, they disappeared from the site.

“It’s our Easter Island,” Kintigh says.
The site’s greatest appeal was the availability of land — 1,000 acres, to be exact. The Agua Fria National Monument was formally dedicated in 2000. Former U.S. Secretary of the Interior Bruce Babbitt drew the boundaries to include 10 major pueblos, agricultural fields, and hundreds of tiny field houses.

This greater inclusiveness marks a new era in the preservation of archaeological sites, Kintigh says. Until recently, the preservation of prehistoric ruins often entailed drawing tight boundaries around existing structures. Much of the research was limited to these postage-stamp sites. But archaeologists knew that the land needed to support its occupants may have ranged tens of square miles beyond the boundaries of their excavation pits.

Archaeologists can’t understand ancient Egypt simply by studying the pyramids. Using that logic, Kintigh says that researchers can’t hope to fully understand the prehistoric cultures of the Southwest without studying how the landscape influenced societal and economic changes. They need to know how these changes, in turn, transformed the landscape.

The ASU researchers are taking a more landscape-focused approach to studying the indigenous people at Agua Fria. The archaeologists need the expertise of scientists like Briggs—not just as consultants, but as collaborators.

Kintigh says that such integrated research is almost unprecedented in both anthropology and ecology. For example, in the past, archaeologists routinely called upon other specialists for help. Mammologists can identify animal remains found in prehistoric garbage dumps known as middens. Palynologists can pinpoint the kinds of crops grown in ancient agricultural fields by analyzing residual pollen grains found in the soil. But on the Agua Fria project, the scientists shared the same research question and charted research plans in tandem.

Working together in 2004, the ASU scientists began to unravel some of the mysteries posed by the pueblo people of Agua Fria. Their initial focus was at Pueblo La Plata. The site has an estimated 160 rooms. It is the biggest and the most accessible ruin in the monument.

To understand how the occupants may have impacted the landscape, the researchers’ plan called for setting up two transects. Each transect is a line of intensive study. One transect was located about 550 yards from the pueblo ruins in an area heavily used by humans. A second transect was known as the control transect. It was set up more than half a mile away. Foot traffic probably would have been far lighter in this area.

Ecology and archaeology students worked at regular intervals along each transect. They documented such things as rock cover—everything from gravel to boulders—as well as herbs, cacti, shrubs, and trees. They also took note of human debris. They charted broken bits of pottery and chipped stones left over from the tool-making process.

The site revealed some curious patterns. Surrounding the pueblo, the researchers discovered what they called a donut hole—an area of parched soils largely devoid of rocks. They think that pueblo builders chose material closest to the site for building their structures. As a result, rock cover was depleted in the immediate area surrounding the ruins.

Not surprisingly, the number of rocks increased as students moved away from the ruins. But as the number of rocks increased, so did the plant cover. To this day, the donut hole immediately surrounding the ruins supports far fewer plants than the rocky terrain.
on the pueblo’s periphery or in outlying areas. “The pueblo people moved rocks for a variety of purposes,” Briggs explains. “As a result, they continue to have an impact on today’s landscape.”

In early 2005, the ASU researchers started mapping the ancient agricultural fields near the pueblos. They want to know if the agricultural infrastructure built by early Agua Fria farmers also left discernable impacts on these cultivated areas.

Kintigh says that such legacies have been dramatic at other prehistoric landscapes. The fields surrounding the Zuni pueblos of New Mexico are just one example. Ancient farming practices there left soils so compacted and depleted of nutrients that they are incapable of supporting plants to this day.

The ASU scientists know that key questions can’t be answered without shared expertise. The archaeologists pointed out linear alignments, known as check dams, on the hillsides around Pueblo La Plata. Only then did Briggs see the work of human hands in what looked like a natural landscape.

Humans have impacted the environment in many ways during the Industrial Age. That is not new. “We’ve been impacting the environment ever since we became a society in human evolutionary times,” Briggs says. “It’s really changed my perspective of what ‘natural’ really means.”

Unlike ecologists, Spielmann says that archaeologists take for granted that there is “human modification of the landscape.”

“There’s not much out there that’s untouched,” she adds. “But we had no idea about the complexities of soil, or what you could read from plants. This project has made us more sophisticated thinkers about one another’s disciplines.”
Life at Pueblo La Plata  A short walk from the tumbled-down walls of Pueblo La Plata is a boulder-strewn field that offers uninterrupted views of some of Arizona’s most open and rugged country. On this blustery day in early March, the clouds cast shadows on the surrounding mountains. Their flanks appear purple and as deeply pleated as the bellows of an accordion.

Botanist Wendy Hodgson and her fellow researchers don’t break stride to take in the beautiful view. Littered with rocks and prickly pear cactus, this is ankle-twisting, shin-stabbing terrain. And when the weather warms up, you’re apt to bump into a rattlesnake or two. Take your eyes off your feet here and you do so at your peril.

Besides, this is no pleasure hike. Hodgson is on a mission. Clustered on a gentle rise are tall, woody flower stalks as thick as a man’s wrist. Hodgson makes lots of forays into Arizona’s back country. She scans hillsides and ridge tops for spikes just like these with their prominent peduncles, or stems, laddered against the sky. This corner of Perry Mesa is the kind of botanical find most likely to stop her in her tracks.

As we approach the ridge, the ground underfoot grows noticeably rockier. We have entered an ancient agave garden. More than 600 years ago, the occupants of Pueblo La Plata moved volcanic rocks ranging in size from cobbles to boulders to the edge of the mesa. They heaped the rocks into piles and then planted agaves among them.

No one knows for sure what advantages were to be gained from such techniques. Hodgson suggests that the rock piles may have served to conserve precious moisture around the plants during the hot, dry summers or to provide a source of radiant heat during cold snaps in winter.

Hodgson completed her master’s degree in botany at ASU in 1982. Since that time, she has focused on the food plants of Arizona’s indigenous people, among them, agaves. She currently serves as a senior research botanist and director of the herbarium at the Desert Botanical Garden in Phoenix.

As part of her work at DBG, Hodgson has tracked agave gardens located near archaeological sites all over the central and northern part of the state. She’s trudged the slopes of Sonoran Desert mountains north of Phoenix and clambered up the hillsides of the Verde Valley. She’s also explored the narrow side canyons of the Grand Canyon.
Agaves are low-slung plants with fleshy lancets of leaves. Given that they were a staple of food and fiber, Hodgson isn’t surprised to find that early people farmed them.

But upon closer examination of the plants in these scattered agave fields, the botanical picture has grown far more complicated—and interesting. Arizona boasts 20 species of native agaves. In recent years, however, Hodgson and her colleagues have identified five additional species of non-native agaves. At least three of these may have originated in northwestern Mexico.

One thousand years ago or more, the offspring of these Mexican plants likely began to make their way northward in the packs of native people and into their agricultural fields. The agave plant’s main mode of reproduction is vegetative. Underground rhizomes spread out from the mother plant and sprout tiny plants known as pups. The plants that survive today are genetic copies of agaves that were planted and tended by prehistoric people. Hodgson calls them living archaeological features.

These imported agaves exhibit differences from their native cousins in ways that undoubt-edly were prized by early people. The thick fibrous leaves of these cultivars were more easily removed from the nutrient-laden heart of the plant. The hearts of the plants were roasted in covered pits and eaten. The leaves also generally have smaller teeth. This was a boon to harvesters who hacked them away from the plant’s center with crude stone tools, exposing themselves to serrated edges that could cut into human flesh like knives.

The non-native cultivars also mature at different intervals throughout the year. This ensured that fresh agaves would be available for longer periods of time, especially during lean seasons such as winter.

But these cultivars are not simply of interest to botanists alone. Agave pups can easily survive long-distance transport in a backpack. Researchers think that the plants probably were part of a vigorous network of trade in the Southwest. Agaves may be as reliable as styles of pottery in helping archaeologists to reconstruct the social structure and pattern of trade routes among prehistoric people.

Hodgson and her colleagues may get their first tangible clues soon. In a project funded by the National Science Foundation, botanists from the University of Georgia are analyzing snippets of plants from both native and non-native cultivars. The goal is to determine their molecular structure. These genetic markers may help researchers to match plants from the Grand Canyon, say, with their progenitors in Sonora, Mexico.

Molecular fingerprinting also may lend insight into the depth of agricultural knowledge of these early people. Hodgson says that some agaves appear to have been hybridized in order to breed desirable characteristics from one species into another. Non-native cultivars are susceptible to killing frosts and some insect pests such as the Agave snout-weevil. By hybridizing these plants with native species, native farmers may have given them greater abilities to cope with these environmental threats.

For example, the agave gardens at Agua Fria appear to contain the native *Agave chrysantha* and the non-native cultivar *Agave parryi*. But they also contain hybrids that exhibit features of both species. Hodgson wonders if these ancient farmers knew enough about the reproduction of plants to deliberately tinker with their genetic makeup. Or were these plants hybridized by the accidental forces of nature?

Asking tantalizing questions is the scientist’s job. “This work is part of a growing trend in field studies to observe plants in the cultural as well as ‘natural’ landscape,” the botanist says. “We are realizing that more plants than we had thought—particularly those useful to humans—have been influenced by human intentional or unintentional activities. We are now looking at the landscape in a different way.” Adelheid Fischer