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Fire adds *richness* to the land

The Jemez FHiRE Project

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T. J. Ferguson

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Cover image: Geoarchaeologists taking a core sample from an explosion pit on Banco Bonito, a lava flow from the Valles Caldera. Cores collected by the team provided soil records of fire going back thousands of years. Geoarchaeology was but one component of the multidisciplinary Jemez FHiRE Project. Image: Anastasia Steffen.

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Subscription inquiries: 520-882-6946, ext. 26.

The Jemez FHiRE Project: An Introduction

CHRISTOPHER I. ROOS, SOUTHERN METHODIST UNIVERSITY
THOMAS W. SWETNAM, UNIVERSITY OF ARIZONA

Each year, media coverage reinforces the idea that we have a major fire problem in the western United States. The National Interagency Fire Center reports that 2015 was the largest fire year in many decades, with more than 10 million acres burned and more than $2 billion expended on firefighting.

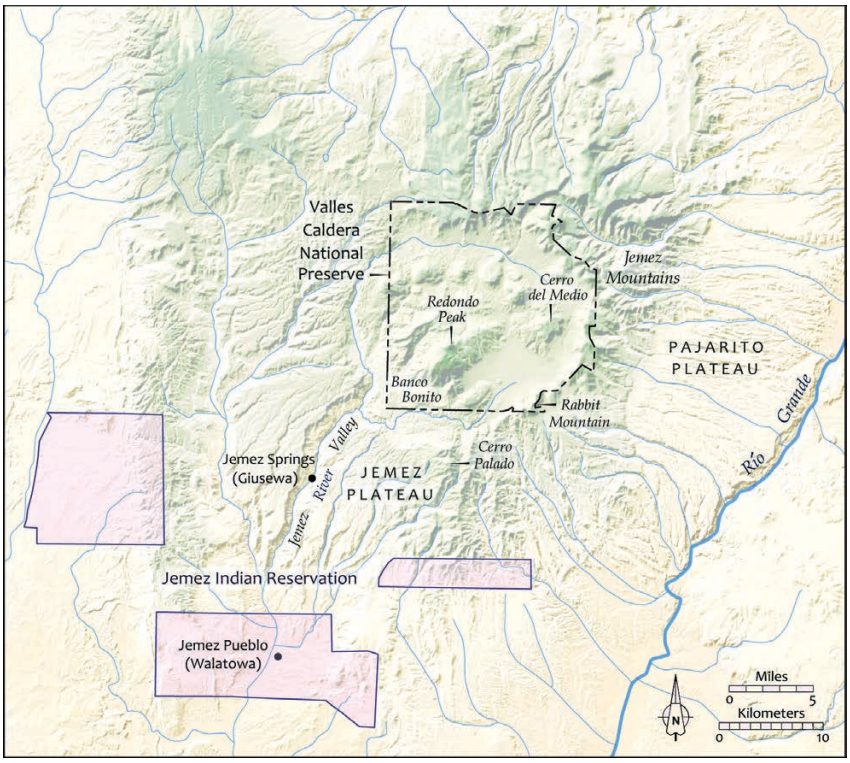
The current situation has been shaped by recent history and by social and natural processes. Fire seasons are longer and more dangerous because global warming has given us earlier springs and hotter summers. Many forests have more fuel, due to more than a century of fire suppression. Many more homes and lives are at risk because of the growth of exurban communities into attractive forested settings. This is the Wildland–Urban Interface (WUI), an area of fire management that poses particularly vexing problems.

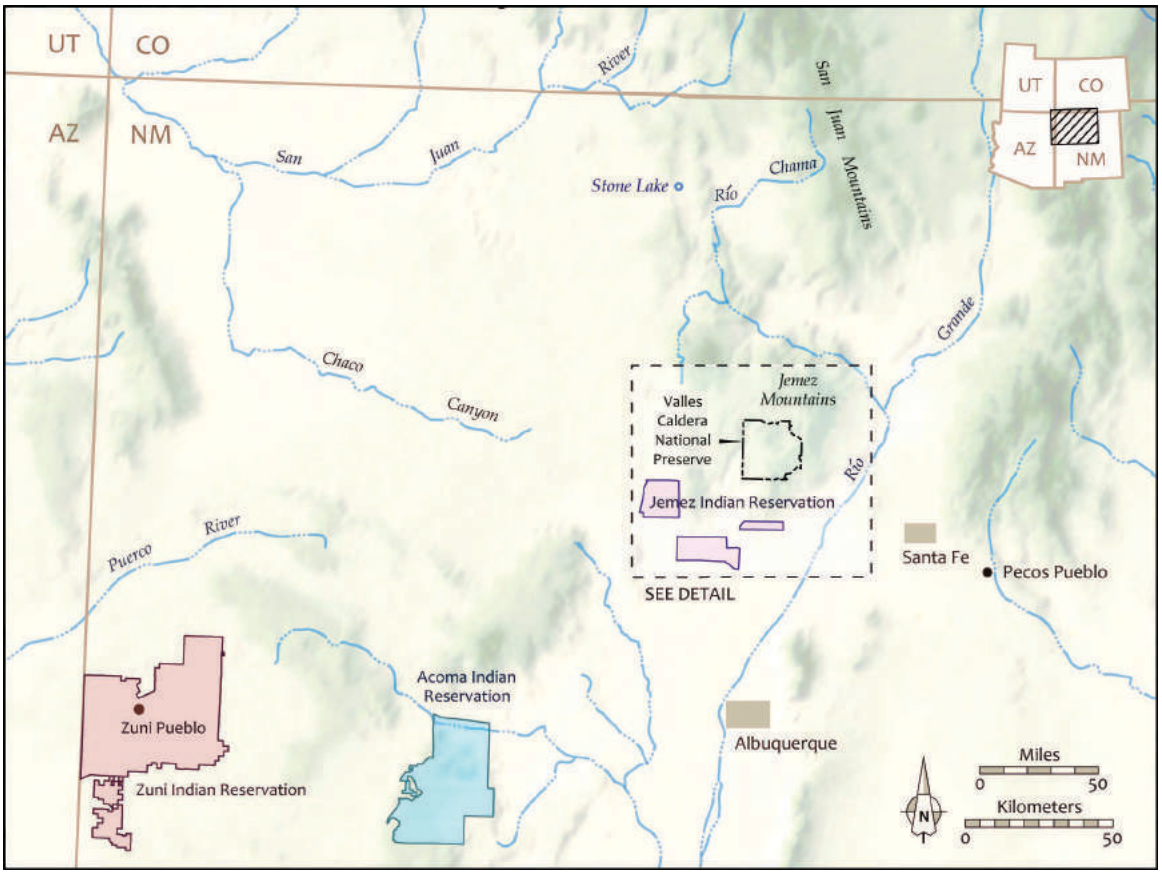
Although the surge of exurban communities into fire-prone settings makes these problems seem exclusively modern, many of these same forests—especially in the Southwestern U.S.—were inhabited by American Indian populations for centuries. Rather than treating today's WUI as modern and ahistorical, we think there is great value in learning from centuries of human experience in these same settings.

FHiRE team members Michael Aiuvalasit, T. J. Ferguson, Tom Swetnam, and John Welch conversing in a Southwestern ponderosa pine forest on the Jemez Plateau. IMAGE: CHRIS ROOS

Northern New Mexico's Jemez Plateau offers a singular opportunity to investigate the relationship between human communities and landscape fires at an ancient WUI. Situated in the southern Jemez Mountains, the Jemez Plateau includes a series of north–south oriented mesa tops that are mostly covered in dry ponderosa pine forests. Ancestors of the people of Jemez Pueblo lived in large villages on these mesa tops since at least 1300. By the time of their first contact with Spaniards in the 1500s, ancestral Jemez people numbered at least 5,000. At that density, and in their forested setting, this was indeed an ancient Wildland–Urban Interface—one that persisted for more than 400 years.

In 2012, funded by a National Science Foundation award (GEO-1114898), we assembled an interdisciplinary research team comprising tree-ring scientists, anthropologists, archaeologists, ecological modelers, and education and outreach





Maps of the Jemez Plateau in the southern Jemez Mountains of northern New Mexico. MAPS: CATHERINE GILMAN

specialists to study the dynamic history of human communities in the Jemez Mountains. We focused our work on documenting Native use of and attitudes toward wood (at home) and fire (on the landscape); on archaeological reconstructions of human population dynamics; and on paleoecological reconstructions of fire activity before, during, and after Jemez people lived on the forested mesas. Importantly, we also partnered with the Pueblo of Jemez charter school and other schools to integrate our research with community goals.

Simply put, this work would not have been possible without the involvement of tribal members from the Pueblo of Jemez, as well as our tribal collaborators from the Hopi Tribe, White Mountain Apache Tribe, and the Pueblo of Zuni. To all of our partners, and especially the Hemish people, we offer our heartfelt thanks.

In this issue of *Archaeology Southwest Magazine*, our team describes many components of the **Jemez Fire & Humans in Resilient Ecosystems (FHiRE) Project**, as well as the context and implications of what we have learned. In addition to close collaboration with our tribal partners, our program has offered research and training opportunities to graduate students at the University of Arizona, Southern Methodist University, and Harvard University. Although our work is ongoing, the articles in this issue share some of the insights we have gained by taking advantage of the exceptional opportunity provided by the human and environmental histories of the Jemez Plateau.

Fire Adds Richness to the Land: Ethnographic Knowledge about Forests and Fire

BENRITA "MAE" BURNETTE, WHITE MOUNTAIN APACHE TRIBE
RONNIE CACHINI, PUEBLO OF ZUNI
T. J. FERGUSON, UNIVERSITY OF ARIZONA
SHARLOT HART, UNIVERSITY OF ARIZONA
STEWART B. KOYIYUMPTEWA, HOPI TRIBE
OCTAVIUS SEOWTEWA, PUEBLO OF ZUNI
PAUL TOSA, PUEBLO OF JEMEZ
JOHN R. WELCH, SIMON FRASER UNIVERSITY

"Fire adds richness to the land," Jemez tribal member Paul Tosa said, pointing out the bright green shoots of new plants growing in an area previously burned by an intense forest fire. Later, Hopi tribal member Lawrence Talaswaima expressed a similar idea, telling us, "People think of fire as being real destructive, but when Hopi think about it, fire is something that is also a blessing. It will clear off all your underbrush. It might burn some trees, but the following two years, it's going to be new growth, new seeds that have been kind of buried underneath, they come up, new trees come up to rejuvenate the land."

Paul Tosa in the middle of an ancient reservoir at Boletukwa (known to archaeologists as Boletsakwa) in the Jemez Mountains. Hopi researchers stand at the edges of the reservoir while Barry Price Steinbrecher records a video. IMAGE: T. J. FERGUSON, MAY 21, 2014

We designed the ethnographic research component of the Jemez FHiRE Project to document these and other insights indigenous people have regarding ecological and historical variables in scientific models of land use and forest fires. We structured our research to collect two kinds of information. First, we sought specific historical information from Jemez tribal members about how their ancestors lived for centuries in the forested uplands of the Jemez Plateau. Second, we sought generalizable information about cultural and behavioral factors associated with fire ignition and suppression from the Jemez people and from three other tribes—the Hopi, Zuni, and White Mountain Apache—whose ancestors lived in forested environments.

During interviews and fieldwork, we collected ethnographic information about the use of fire in agriculture, grazing, and cultural practices, and about the harvesting of forest products used for fuel, construction, and cultural practices. Many research participants also shared their personal experiences as firefighters for federal agencies.

The traditional knowledge our tribal partners imparted is valuable for understanding how to think about human use of forests and fire. During the project, we worked with 50 tribal research participants, including 18

Above left: *Farm fields, such as this contemporary field in Jemez Pueblo, provide firebreaks that suppress the spread of forest fires.* IMAGE: T. J. FERGUSON, JUNE 2, 2014 ***Above right:*** *Mae Burnette discusses a dog-hair thicket on White Mountain Apache lands while John Welch records a video.* IMAGE: T. J. FERGUSON, JUNE 6, 2012 ***Below:*** *Paul Tosa (Jemez Pueblo) shows Marvin Lalo, Lawrence Talaswaima, and Paul Talawepi (Hopi) an area in the Valles Caldera burned in the 2013 Thompson Ridge Fire.* IMAGE: T. J. FERGUSON, MAY 22, 2014

members of the Pueblo of Jemez. We did not collect esoteric or secret cultural information: tribal participants decided what information they wanted to contribute. Consequently, we obtained consent to use general information about cultural practices, forest uses, and fire in scientific research and educational publications.

Our discussions covered many topics, including how burning of farm fields and grazing areas rejuvenates the land, restores fertility, and leads to new growth. We also learned some of the many ways fire is associated with farming, including clearing fields and ditches, and in heating the subterranean corn-roasting pits commonly associated with cornfields. Livestock owners traditionally used fire as a range-management practice, occasionally burning grassland.

We discussed how people who lived in the Jemez Mountains harvested thousands of roof beams to construct their villages. This, along with fuelwood collection, maintained cleared areas that served as firebreaks around villages. Field houses, farm fields, and a network of trails in the Jemez Mountains also acted as firebreaks that would have suppressed the ignition and spread of forest fires in the past.

Many tribal members think that recent fire suppression has led to unhealthy forest structures. Dog-hair thickets, where trees grow crowded and small, now appear in the Jemez Mountains and other forested areas. These provide fuel for large, destructive forest fires unlike any fires known in the past, when Pueblo people encouraged low-intensity fires that protected trees and promoted fertility.

As we continue our research, we expect the traditional knowledge shared by our tribal research participants will help scientists better understand the complex interaction between human behavior and forest fires.

The Hemish Footprint

PAUL TOSA, PUEBLO OF JEMEZ
BARRY PRICE STEINBRECHER, UNIVERSITY OF ARIZONA

For the Hemish people of Jemez Pueblo, land use and resource use are both secular and religious in nature. Land use is steeped in traditions that stem from long-term observation of and interaction with the environment. In order to model the land use and resource use of the Hemish people and their ancestors, and understand how that use has affected fire regimes over time, it is important to consider underlying values people hold toward the land. These values are reflected in tangible and intangible elements of a cultural landscape, and they have been passed down through generations of Hemish ancestors.

We refer to this cultural landscape as the "Hemish Footprint," reflecting the imprint of Hemish history and religion upon a vast swath of the Southwest. The Hemish Footprint encompasses all places where Hemish ancestors, or *quasho-taash,* traveled during their migrations, including places where they lived and established cultural and historical ties. These places include geographic landmarks associated with significant figures or events, natural features such as springs, and built environments such as villages, agricultural structures, and trails. Some of these places bear physical evidence of Hemish presence, and many are commemorated through place names, songs and histories, and ceremonies.

According to traditional teachings, the Hemish people emerged into this world near Stone Lake in northwestern New Mexico. Upon emergence, the *quasho-taash* were told by their Creator to travel across the land until they reached the Place of the Eagle, their destined home. Thus, they followed migration routes in all directions, establishing clans and societies. They built villages, buried their dead, established shrines, and recorded significant information in rock art during their travels. Places associated with Hemish migration traditions extend through parts of what are now Utah, Colorado, Arizona, and New Mexico.

The *quasho-taash* reached their destined home upon arriving in the vicinity of *Sey-tokkanu*, commonly known as Redondo Peak, in the Valles Caldera. Here, the image of an eagle is created by the pattern of vegetation and open meadows on the southwestern slope. The *quasho-taash* brought knowledge and traditions about how to be stewards of the land while taking what they needed to sustain themselves.

Like their ancestors, Hemish people travel well beyond their village to fields, springs, hunting camps, resource-collection locales, and ceremonial places. These places are committed to social memory, and their connections may be regenerated through such practices as pilgrimages to make offerings—for example, people make pilgrimages to Redondo Peak, Cerro Pelado, Cerro Negro, and many other, more distant locations as part of the ceremonial calendar. During these pilgrimages, people collect important resources to bring home. A network of trails, roads, and route markers connects places within the landscape, helping us appreciate the high degree of mobility ancestral people had that might not be readily apparent in the archaeological record.

Ancestral villages, artifacts, and other archaeological remains are an important part of the Hemish cultural landscape. Hemish interpretations of their history and impact on the landscape are guided, however, by a cultural logic that relates evidence of past lifeways with ongoing cultural traditions and knowledge. By considering this way of knowing the land, we are reminded that ancestral sites are not confined to the boundaries of architecture and artifact scatters, but are part of a network of places within a living landscape. Using this knowledge, we are better able to conceive of how the *quasho-taash* lived in and moved through the landscape, ultimately shaping their environment.

Food for Thought...

Over nearly five centuries, many writings have referenced the people of Jemez Pueblo and their ancestors, from military and parochial records of the Spanish colonial period to anthropological literature. These references have taken on a variety of spellings and pronunciations; for example, Hemes, Xemez, and Ameges. The orthographic variants often reflect Spanish derivatives of the term Hemish, used by the ancestors of the people of Jemez Pueblo to self-identify in their native Towa language. Jémez became widely used during the 1600s, and eventually the tribe adopted this as the name for their sovereign nation. Today, many members of the Pueblo use Jemez and Hemish nearly synonymously in casual speech and literature. Hemish may be considered more traditional, however, and is used when speaking in Towa. In the context of the Hemish Footprint, the term helps reflect the ongoing linguistic and cultural relationships between ancestral people represented by the archaeological record and their descendants at Jemez Pueblo today.

Jemez Archaeology and History

MATTHEW LIEBMANN, HARVARD UNIVERSITY
CHRIS TOYA, PUEBLO OF JEMEZ NATURAL RESOURCES DEPARTMENT

People have wandered among the vast canyons and sprawling mesas of the Jemez Plateau for more than 12,000 years. For most of this time, humans appeared in the region intermittently, enticed by quarries of inky-black obsidian and the simmering waters of hot springs.

Beginning in the 1200s, however, ancestral Jemez people began to crowd onto the southwestern flanks of the dormant volcano known today as the Valles Caldera (pages 9–12). Between 1300 and 1700, the Jemez Plateau emerged as a primary center of Ancestral Pueblo settlement in the American Southwest. During this 500-year period, Towa-speaking people constructed more than 40 villages of multistoried stone masonry architecture, ranging in size from 50 to 1,000 rooms. They also built more than 3,500 one- to four-room field houses—seasonally inhabited settlements located beyond large villages, amid agricultural fields.

Daily life varied considerably among the villages' ancestral Jemez residents. Some enjoyed a quiet existence, dwelling in pastoral hamlets of 25 people or fewer. Others chose to settle in sprawling pueblos teeming with as many as 1,500 inhabitants. Some villages had no kivas, whereas others display evidence for a dozen or more. The people who lived on the Jemez Plateau during this period shared characteristic pottery, however, favoring black designs painted on a chalky, oyster-white slip. Known as Jemez Black-on-white, this distinctive ceramic tradition endured, seemingly invariably, for nearly 400 years.

In 1541, a member of the Coronado expedition stumbled into the Jemez region, marking the Jemez people's first discovery of Europeans. Following this brief encounter, the Jemez pueblos hosted occasional foreign visitors for the next six decades. With Don Juan de Oñate's 1598 colonization of New Mexico, though, came the first European to live among the Jemez for an extended period—the Franciscan priest Fray Alonso de Lugo. Fray Alonso established a temporary two-room mission at Giusewa (Jemez Historic Site in present-day Jemez Springs), but his tenure among the Jemez lasted less than three years.

The rugged territory of the Jemez Plateau, combined with the reputed belligerence and recalcitrance of its inhabitants, colluded to keep the Spaniards at bay. In the 1620s, an enterprising young missionary named Fray Gerónimo Zárate Salmerón arrived in what the Spaniards called the Jemez Province. Zárate Salmerón built a massive, fortress-like mission church at Giusewa—the walls of which remain standing today—and founded a new settlement at the southern

View of the Jemez River valley. IMAGE: MATTHEW LIEBMANN

end of the valley. Called Walatowa by the Jemez, the remains of this second mission village lie beneath the modern architecture of Jemez Pueblo.

From the earliest days of Spanish occupation, the Jemez chafed at the bonds of colonialism. They burned the missions at Walatowa and Giusewa in 1623, in apparent protest against the Franciscans' persecution of their traditional religious practices. Over the next five decades, the Jemez suffered from famine, colonial violence, and repeated waves of pestilence. When word spread among the Pueblos of the planned Revolt in 1680, the Jemez seized the opportunity with relish. They burned their mission village once again, with the Jemez Province serving as a principal refuge and central cauldron of resistance over the next 14 years. Even Don Diego de Vargas's siege of the Jemez in 1694 could not break their spirit of resistance, and in 1696 they rose up once again, with many scattering to take refuge among their Diné (Navajo) and Hopi brethren.

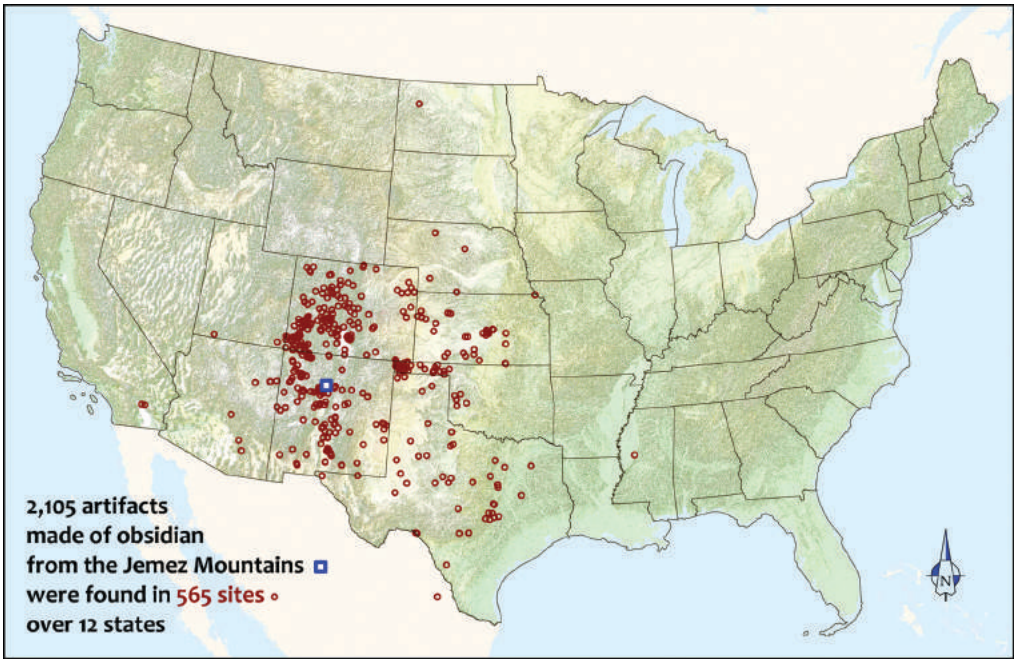
By 1703, the Jemez began to gather in the southern end of the Jemez region once again, where they have remained for the past three centuries. In 1838, the remnant population of Pecos Pueblo, a group of fewer than 30 people, migrated to Jemez Pueblo, where they joined their Towa-speaking relatives. Today, nearly 2,000 tribal members proudly claim Walatowa (Jemez Pueblo) as their home.

The High-Elevation Archaeological Record of the Valles Caldera

ANASTASIA STEFFEN
VALLES CALDERA NATIONAL PRESERVE

The Valles Caldera is an inviting oasis at the top of the Jemez Volcanic Field, a lush landscape of expansive meadows and forested volcanic domes. Created by a catastrophic eruption 1.2 million years ago, the caldera was subsequently shaped into its current landforms by a series of eruptions that now form a ring of extrusive intra-caldera domes. This ring surrounds a single, very large intrusive resurgent dome in the center.

Throughout this million-year sequence, lakes have come and gone inside the caldera, further softening the profiles of the domes and meadows and contributing sediment layers. Today, these layers are covered by deep, well-developed soils that contain the caldera's archaeological record. The volcano is quiet: dormant, but not extinct, with magma below the surface shallow enough to heat the hot springs that have been delighting visitors for millennia.



Locations of known archaeological sites with obsidian artifacts geochemically sourced to the Jemez Mountains. MAP: CATHERINE GILMAN, BASED ON A MAP BY ANASTASIA STEFFEN AND PHIL LETOURNEAU

An obsidian quarry on Cerro del Medio with archaeologist Chris Turnbow for scale. IMAGE: ANASTASIA STEFFEN

Previously known as the Baca Location No. 1, the Valles Caldera was acquired by the federal government in 2000 to create the Valles Caldera National Preserve. Archaeological inventory began immediately, and to date archaeologists have surveyed nearly 30 percent of the caldera and recorded more than 680 archaeological sites. These sites are mostly scatters of obsidian artifacts that reflect the high quality and great abundance of volcanic glass here.

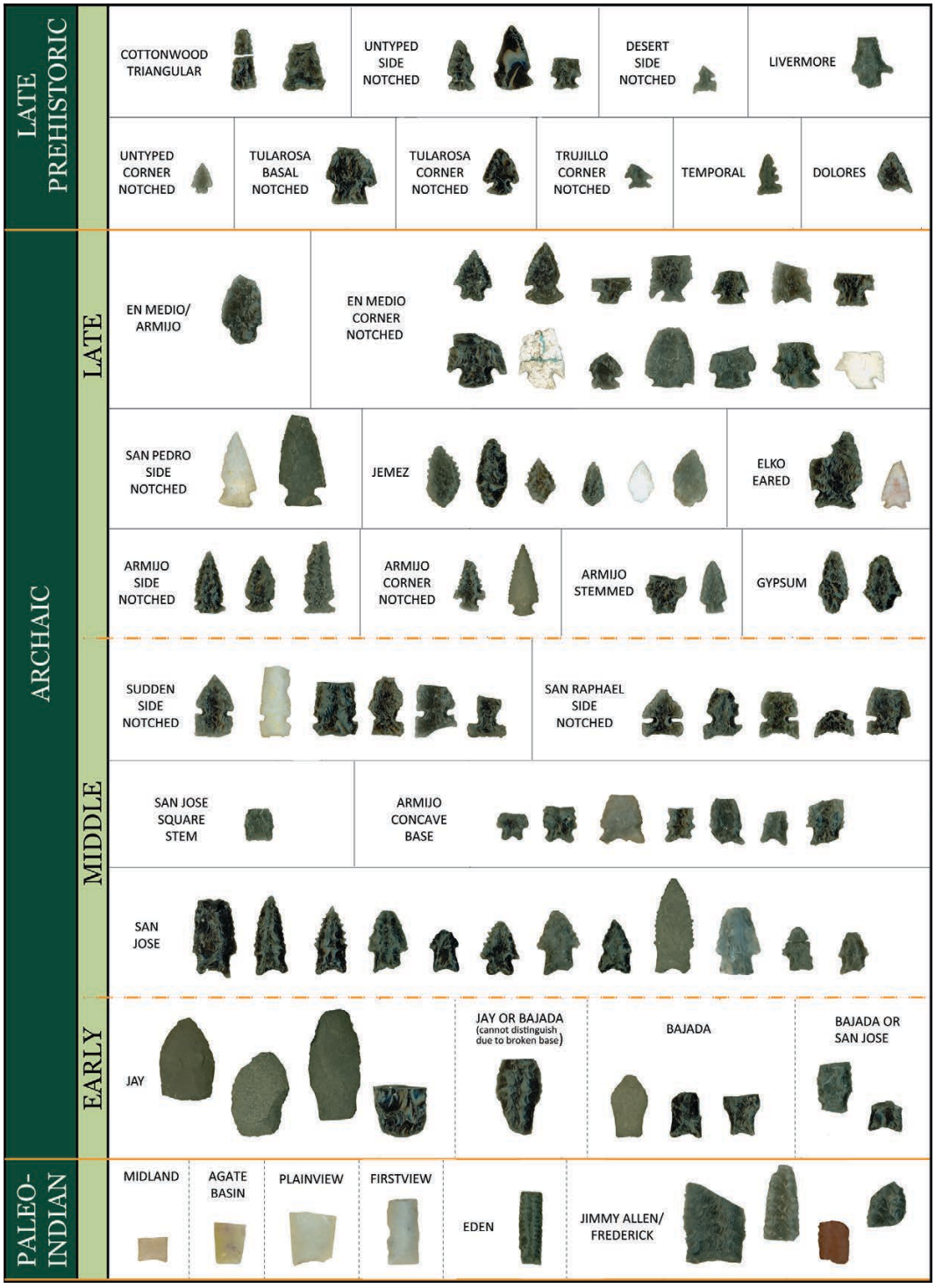
The obsidian quarries are large, up to 30 acres in size, and are dazzling composites of many millennia of knapping at the rich obsidian outcrops. Inside the preserve, these quarries are found primarily at the Cerro del Medio dome and on the slopes of Rabbit Mountain on the south caldera rim. Because obsidian artifacts can be "sourced" via geochemical analyses, we know that obsidians from the Jemez Mountains are found at archae-

Lush landscapes of the Valles Caldera. IMAGE: ROURKE MCDERMOTT

ological sites across central North America and at sites of all time periods over the past 10,000 years. Although it is difficult to determine whether individual obsidian artifacts recovered in faraway locations such as western Mississippi or North Dakota arrived there as the result of direct transport or down-the-line trade, this broad distribution demonstrates that diverse cultural groups consistently valued Jemez Mountains obsidians.

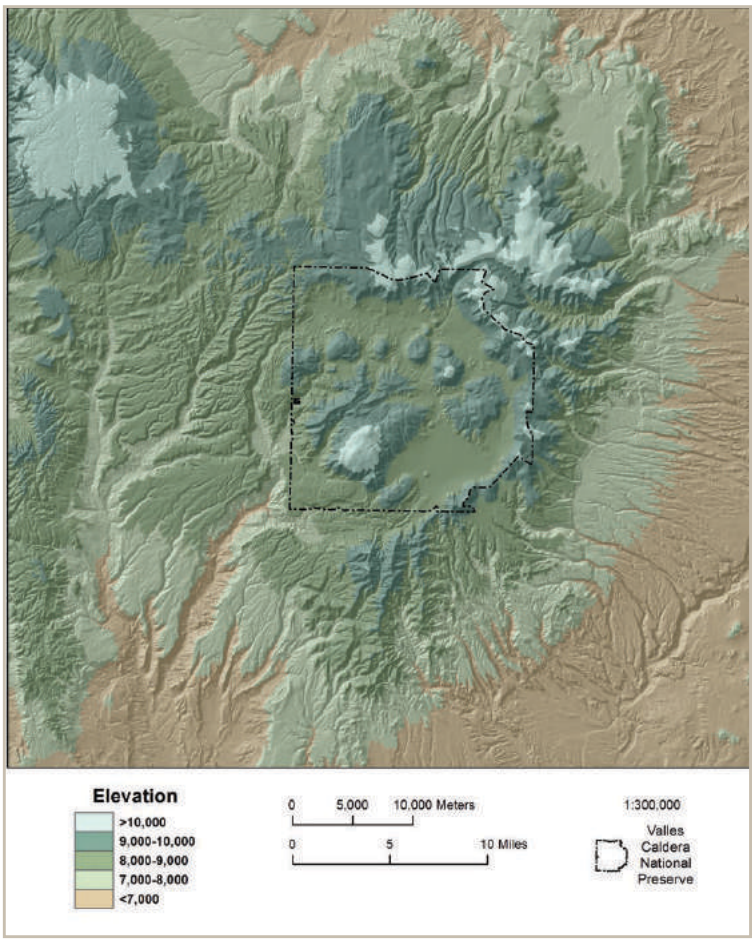
There is notable variation within obsidian scatters on the preserve. Some resulted from people procuring, testing, and "high-grading" raw obsidian that was then carried off for further reduction elsewhere. Others indicate that people were undertaking finer reduction of bifaces, making tools, and sharpening tools; these scatters probably represent residential encampments and resource-processing areas.

Our 15-year experiment in distributional or nonsite surface archaeology has been coupled with a commitment to in-depth analysis of resulting artifacts and data. We identify all diagnostic projectile points ("diagnostic" meaning they have physical attributes that we can tie to time periods and lifeways) in order to build a localized point chronology. We have thus far combined the latter with X-ray fluorescence geochemical sourcing and with obsidian hydration analysis for more than 150 of these diagnostic points. We have also identified formal types for the relatively rare yet diverse pottery sherds we have encountered.



Array of Valles Caldera projectile points by time period. TYPE ASSIGNMENTS AND ILLUSTRATION: JEREMY DECKER, ADAPTED BY CATHERINE GILMAN

The emerging picture of deep human history in the Valles Caldera is that of an Archaic landscape where human



Shaded relief map of the caldera and the surrounding Jemez Mountains. MAP: VALLES CALDERA NATIONAL PRESERVE

activities focused on hunting, gathering, and procuring diverse resources. The caldera records this gentle, sustainable use of resources that caused only minimal transformation of the landscape throughout the Archaic period (from about 9,000 years ago to perhaps 1,500 years ago). Although this is an extraordinarily preserved record of the Archaic period, it also documents use by more recent Ancestral Pueblo peoples. Although the caldera's elevation is too high for farming—except in the far southwest corner on Banco Bonito—agrarian peoples would have come to the caldera to hunt and trap large and small game, to gather abundant berries, grasses, and mushrooms, to collect specific ceremonial or medicinal plants, and maybe even to fish.

Indeed, people probably enjoyed the caldera in the past in many of the same ways we do today—for hunting and fishing, for clean waters, for scenic vistas, and for spiritual replenishment. The Valles Caldera might provide inspiration to us as we consider the consequences of modern unsustainable land use and transformation.

Terminus Ante Quem Dating of the Depopulation of Jemez Ancestral Villages

JOSH FARELLA AND THOMAS W. SWETNAM
UNIVERSITY OF ARIZONA

Tree-ring dating methods were first developed and applied to archaeological questions in the American Southwest in the 1920s. Almost all the thousands of construction dates for ancient Pueblo dwellings have been based on crossdating the ring-width patterns of ancient vigas (roof beams) and other wooden structural supports.

Thomas Jefferson used an even older application of tree-ring dating, namely *terminus ante quem* ("limit before which") dating of living trees growing within the ruins of old dwellings. The idea was that when one counted the annual rings of trees growing within what was once a roof-covered structure, the age of the tree would provide a minimum estimate of years since people had used the dwelling. This method—which we call TAQ, for short—has been little used in Southwestern archaeology (or elsewhere), however. Our work shows that the TAQ tree-ring method holds promise for application in the Southwest—and,

for that matter, any place where tree-ring datable trees are found growing within ancient settlements.

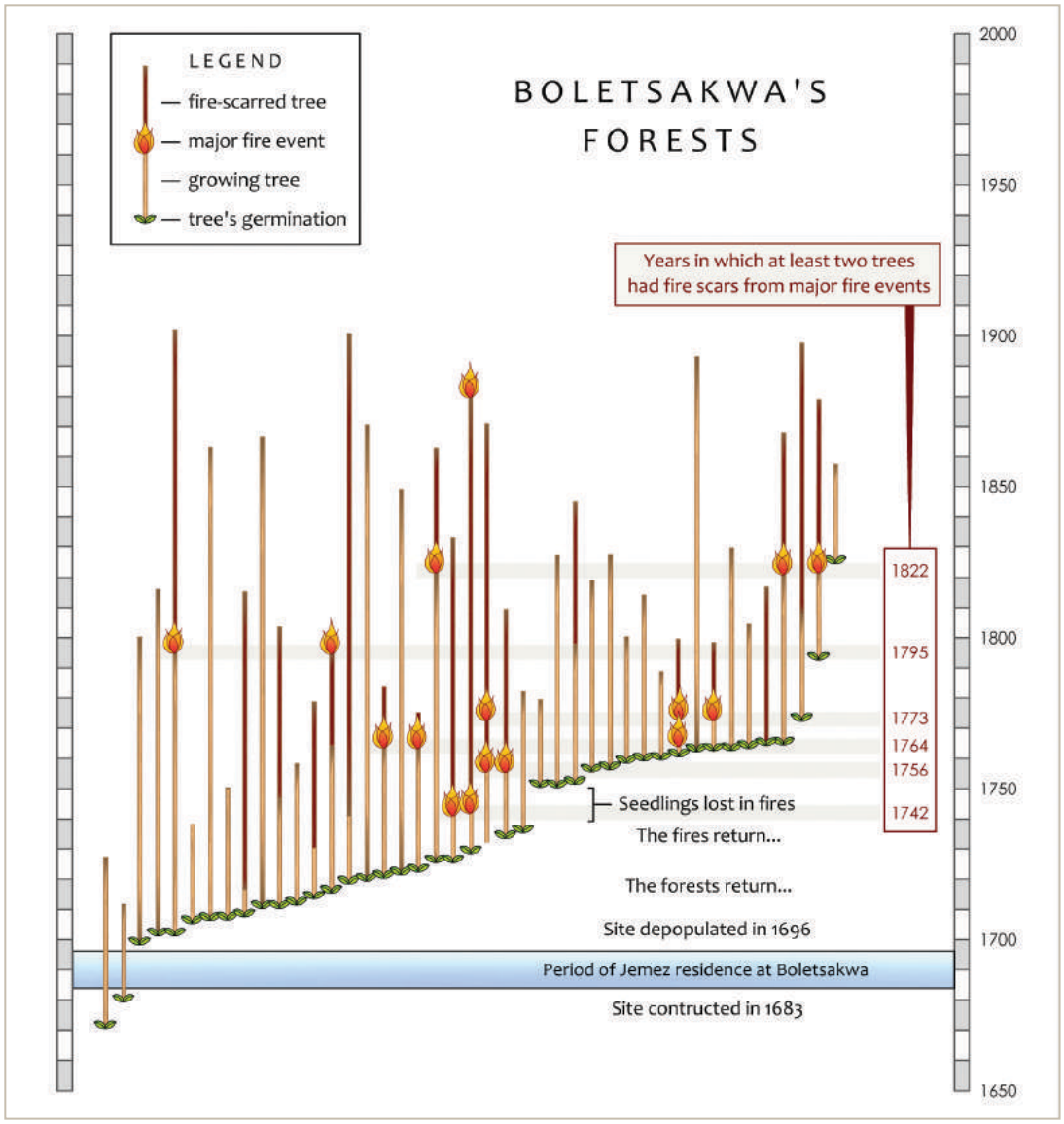
As we began our studies of ancestral Jemez villages, the surrounding forests, and their fire histories, we noticed that trees had occasionally grown up within and near the mounds that marked the remains of dwellings. In some cases, the trees had long since died, but their stumps or logs were present within and near the structures. Researchers have sampled and dated vigas (roof beams), latillas (ceiling pieces), lintels, and other wooden structural supports from some ancestral Jemez villages and field houses over the past 80 years, but in general, it is quite rare to find architectural wood on the surfaces of most sites. Fires and decay have destroyed most structural elements on the surface, and only a few large Jemez villages have been excavated.

Therefore, we made extensive use of the TAQ approach in our recent investigations of Jemez ancestral villages. Specifically, we sought to compare with and corroborate the residential and likely depopulation chronologies of the largest villages using analyses of pottery found on the surface. Rather than simple ring-counting as Jefferson suggested, we used the crossdating method to precisely date inner- and outermost tree-ring dates of living and dead trees.

In general, this approach worked very well, in that the timing of depopulation as indicated by the establishment of trees within and near village structures matched known dates from historical documents—for example, at Boletsakwa, a refugee village established after the Pueblo Revolt of 1680. Dating was also supported by the relatively coarse dates inferred from ceramic analyses.

Overall, our TAQ dating of four large villages, combined with analyses of pottery from site surfaces and the documentary record, contributed substantially to our interpretations of Jemez

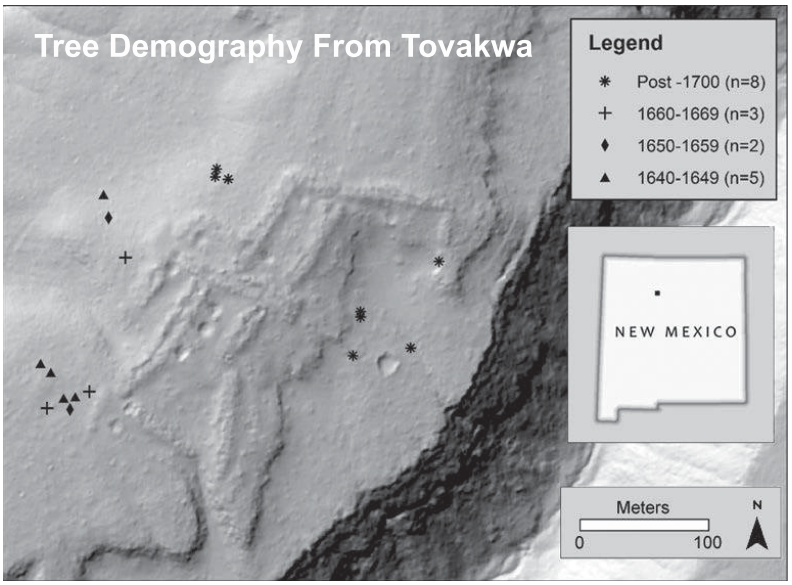
Left: *A large ponderosa pine tree growing within the remains of a field house. Age of the tree (pith date) provides a minimum number of years since the structure was inhabited.* ***Above and below:*** *Josh Farella using a chainsaw to collect a cross section sample from a dead tree near the site of Wabakwa.* IMAGES: TOM SWETNAM



Tree-ring chronologies of individual trees sampled near the pueblo of Boletsakwa, which is known from Spanish archival documents as a village constructed and inhabited after the 1680 Pueblo Revolt, then depopulated in the mid-1690s following the Reconquista. *The vertical lines show the spans of time that the trees lived, with innermost dates (piths) marked as horizontal green leaves at the bottom of the lines. All but two sampled trees established after the 1692 Reconquest. The fire icons mark the dates of fires that resumed burning around the village after depopulation and the accumulation of sufficient surface fuels to carry fire.* GRAPHIC: CATHERINE GILMAN, ADAPTED FROM A FIGURE BY FARELLA AND SWETNAM

demographic patterns. Most large villages lost residents during the early to middle 1600s, coinciding with the tragic loss of more than 80 percent of the Jemez population due to diseases, warfare, and other social stresses (pages 15–16). Contemporaneous depopulation of villages in the uplands coincided with the Spaniards' *Congregación* policies (pages 18–20), through which people were voluntarily or forcibly gathered near mission churches in canyons and valleys.

As we searched for potential wood samples on the surfaces of ancestral Jemez villages, we found dozens of fragments that we suspect might be the last remains of structural supports at these sites. We are currently analyzing these to determine whether a subset of



LiDAR map of the Tovakwa village site showing locations of sampled trees within and near the walls. The earliest establishing trees around the village date to the early 1640s, corresponding with the likely depopulation period.

these specimens might also be crossdated, thereby providing additional chronological information. In any case, it is clear that old wood existing on the surfaces of archaeological residential sites in the Southwest should be considered a potential source of information—certainly, these materials should be collected and analyzed before they are lost to decay and wildfires.

Modeling Jemez Population

MATTHEW LIEBMANN
HARVARD UNIVERSITY

How many people lived on the Jemez Plateau in the 1500s and 1600s? Historians, archaeologists, and casual observers have pondered this question ever since the first *conquistador* set his boot heels into the sands of the Jemez valley in 1541.

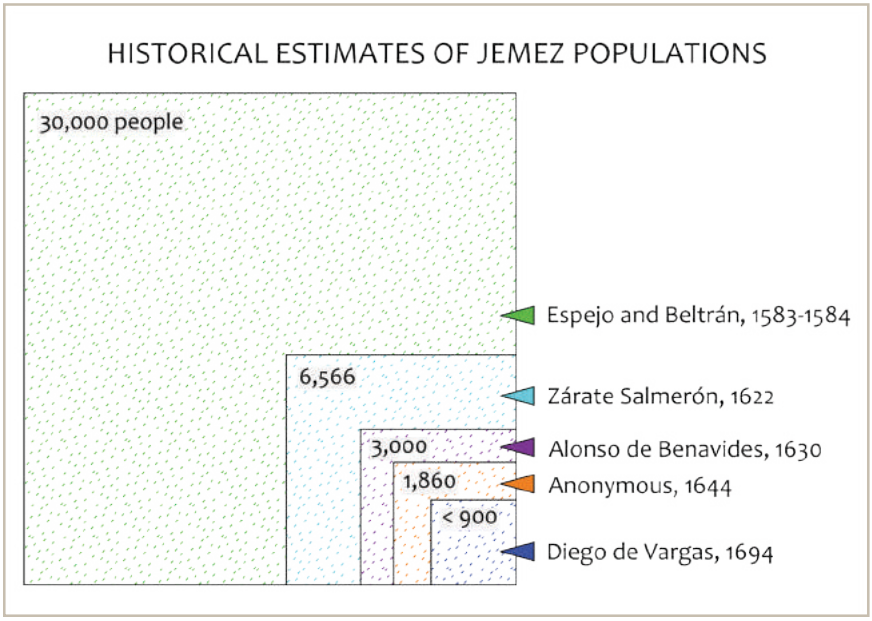
Over the course of the subsequent century, Spanish explorers and Franciscan priests penned widely varying population estimates for the region. In 1583, Antonio de Espejo wrote that "as many as 30,000" Jemez people lived in the area. Nearly four decades later, Franciscan friar Fray Gerónimo Zárate Salmerón claimed that he baptized 6,566 "souls" among the Jemez. By the early 1640s, other Franciscans wrote that just 1,860 people remained in the Jemez valley. Then there is the confusing chronicle of Fray Augustín de Vetancurt, written in the 1690s. Vetancurt logs 5,000 residents at the Jemez missions, but appears to refer to a period seven decades prior. (Consider that the 2010 census documented 1,788 people living at Walatowa—Jemez Pueblo.)

At first glance, these historical documents suggest a massive population at the moment of first contact with Europeans, with a steady reduction over the course of the following century. Based on reports such as Espejo's, some historians think waves of epidemic diseases swept through New Mexico in advance of Spanish colonists, beginning in the 1500s. Other scholars doubt the historical estimates of vast populations. They point to incentives for priests and Spanish officials to inflate the numbers of Pueblo "subjects" they reported to the Crown.

Archaeology adds wrinkles of its own to this narrative. Jeremy Kulisheck's study of field houses—seasonally-inhabited agricultural structures of one to four rooms—suggests relative population stability among Jemez groups from the 1500s through the 1650s.

So, was the Jemez Province (the Spaniards' official designation for the region) home to a huge population that experienced a step-like decline between the 1500s and early 1600s? Or are the historical accounts unreliable, and more moderate ancestral Jemez populations remained relatively stable from pre-Hispanic through early colonial times?

To answer these questions, we first determined where Jemez people were living immediately prior to their earliest contacts with Europeans. Then we calculated how many people lived at each of those villages. Based on previous studies, the Jemez FHiRE Project identified 18 archaeological sites that were inhabited between 1480 and 1520 in the Jemez Province. To figure out how many people lived in these 18 villages, we measured the volume of the architectural rubble at each site—in other



Historical estimates of Jemez population sizes. GRAPHIC: CATHERINE GILMAN

Map of contact-era Jemez villages. MAP: CATHERINE GILMAN

words, we estimated how big people's houses were, and how many people lived in each of those houses. Aiding us in this process was a series of maps generated using airborne LiDAR data, a process in which an airplane maps terrain using lasers that can "see" through trees down to the ground surface (see *archaeologysouthwest.org/asw30-4* for a link to this research).

Using these techniques, we calculated that the Jemez region housed approximately 5,000 to 8,000 people at the turn of the sixteenth century. Judging from these archaeological calculations, it appears that Fray Zárate Salmerón did not exaggerate when reporting his estimate of 6,566 neophytes in the early 1620s. It seems that Jemez populations remained relatively stable from 1492 until the establishment of large Franciscan missions in the 1620s, as suggested by Kulisheck's field-house studies.

Following the founding of the missions, however, Jemez villages appear to have suffered devastating population losses. Josh Farella's investigations of tree establishment at these sites (pages 12–15) indicate that residents left in droves by the 1640s and 1650s, allowing ponderosa pines to take root across these sites. So, although the Jemez did suffer devastating population losses due to disease, warfare, and famine, these plagues did not strike until eight decades after initial contacts with the Spaniards. By the time of the Pueblo Revolt of 1680, fewer than 900 Jemez people remained in the valley, a population decline of 87 percent in 60 years.

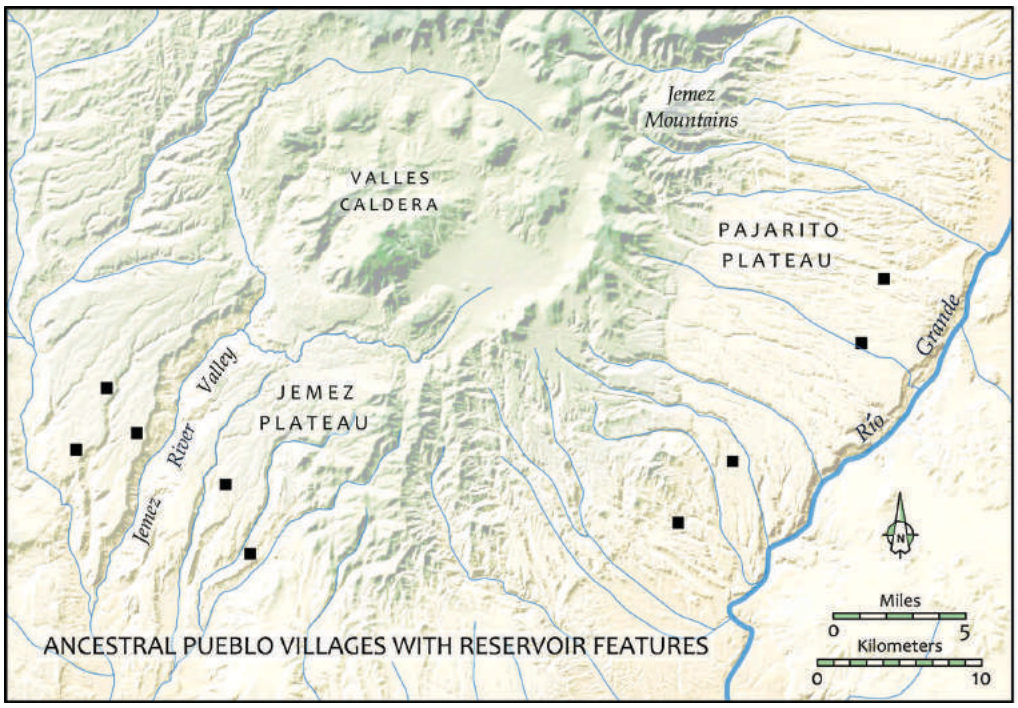
Ultimately, the archaeological evidence collected by the Jemez FHiRE Project shows that European colonialism unleashed forces that destroyed a staggering number of Jemez lives. Now that we have this information, we can begin to formulate a more accurate picture of how ancestral Jemez people managed to survive and thrive in fire-prone forests for the preceding 300 years. In the process, we hope that the lessons they pass down through the centuries will be useful to tribal and federal land managers in the twenty-first century.

Through Fire and Water: Ancestral Jemez Water Management

MICHAEL AIUVALASIT
SOUTHERN METHODIST UNIVERSITY

Ancestral Pueblo inhabitants of the Jemez Mountains developed sustainable water-management strategies to complement their forest-, wood-, and fire-management practices. By 1300, many of the region's residents were living in large villages on mesa tops, which presented challenges for meeting domestic water needs. Permanent water sources, such as springs and perennial streams, are often located in canyon bottoms far below the mesa tops, and droughts make such water sources unreliable.

To buffer against the risk of water scarcity, people living on the Pajarito Plateau (Keres and Tewa peoples) built small



Ancestral Pueblo sites with water reservoir features tested in this study. MAP: CATHERINE GILMAN

water-catchment basins at all the large mesa-top villages, and people living on the Jemez Plateau (Towa people) did the same. Residents built these reservoirs to capture surface runoff from the mesa tops. Water was impounded by horseshoe-shaped earthen and stone-lined berms from one to five feet high, and stored in basins 30 to 100 feet in diameter that had been dug down to bedrock.

Such features are examples of "common-pool resources." Due to their proximity to a village, these features stored water that was accessible to everyone; but each dip into the basin meant that less water was available to others. Ethnographic observations of reservoir use at mesa-top communities at Acoma and Hopi provide examples of how social norms, rules, and institutions surrounding common-pool resources operated, and they support the view that these archaeological features may serve as proxies for understanding how communities managed domestic water in the past.

We conducted multidisciplinary geoarchaeological investigations of reservoir features in order to determine when and how water was stored in relationship to residential histories and drought episodes. We cored 15 features at nine sites. Accelerator Mass Spectrometry (AMS) dates of short-lived charred tissues buried in basin sediments and paleosols (fossil soils) beneath the berms date the use-life histories of these features. Preliminary results suggest there were significant differences in the ways Pajarito and Jemez groups managed water.

On the Jemez Plateau, people typically built reservoir features before the founding of large villages, from about 1100 to 1300. Most of the Jemez features show evidence of being partially cleaned out and reused into the historic period. In some cases, people used them even until the Pueblo Revolt of 1680.

1910 photograph of the reservoir feature at Amoxiumqua (LA481). This is one of the largest reservoir features in the Jemez Mountains. When dug out down to bedrock (about 1.5 feet below basin surface), it could store up to approximately 44,500 cubic feet of water. COURTESY OF THE BRAUN RESEARCH LIBRARY COLLECTION, AUTRY NATIONAL CENTER, LOS ANGELES, P.24544

By contrast, the beginning of reservoir use at large villages of the southern Pajarito Plateau clusters around 1300, and people's use of these features ends abruptly around 1450. This is at least 50 to 100 years before these large villages were completely

depopulated, and coincident with a mega-drought in the 1400s. Reservoirs on the Pajarito show no evidence of being cleaned out. They stored less water than those of Jemez, and they are typically breached, as well as undersized for the potential runoff of their catchment areas.

These differences help us to identify resource-management decisions in the archaeological record. Some communities seemingly maintained robust water-management strategies during droughts, whereas other communities facing droughts found their water insecurity compounded. Broadly, this work demonstrates the continuity of Pueblo peoples' water-management practices to the present day, and the potential for these features to address questions of archaeological and contemporary significance.

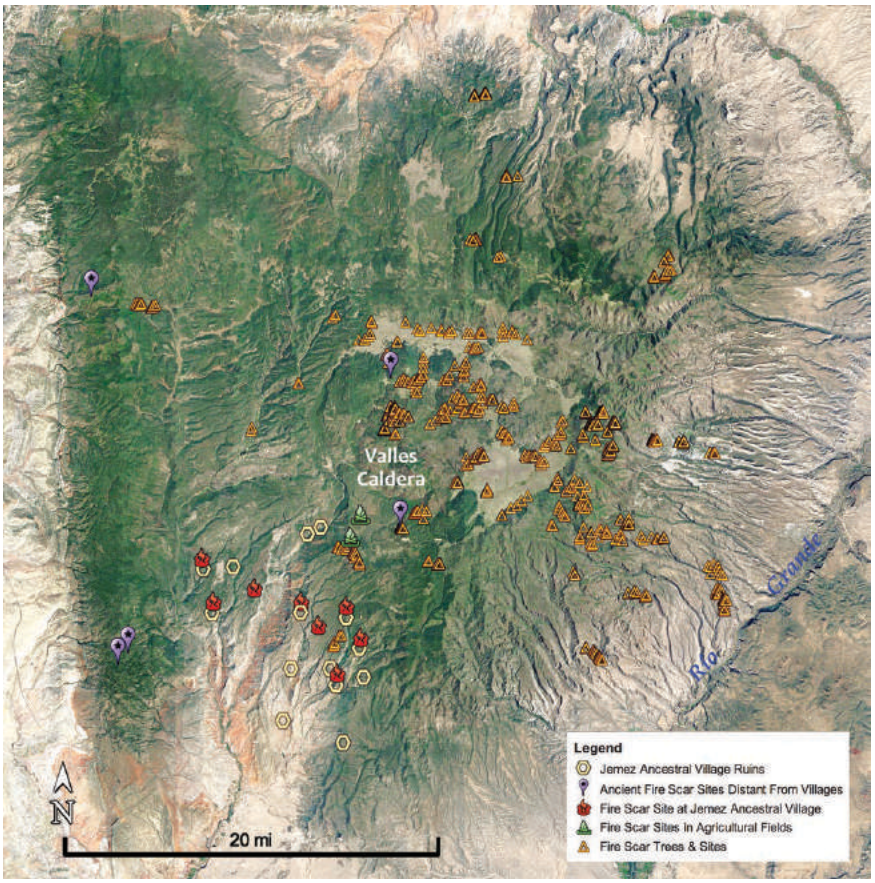
Tree-Ring Records of Forests, People, and Fire in the Jemez Mountains

THOMAS W. SWETNAM
UNIVERSITY OF ARIZONA

The Jemez Mountains have sustained forests, people, and fire for many centuries. Ponderosa pine forests and pinyon-juniper woodlands blanket the mesas and canyons surrounding the ancient Valles Caldera (pages 9–12). This landscape shows abundant evidence of human habitation and recurrent fires over a long period of time.

The remains of at least a dozen villages of more than 500 rooms each are nestled within the forests and woodlands on the southern plateau of the Jemez. People built these multistory pueblos beginning in the 1300s and resided in them until the early to middle 1600s (see pages 8–9). In addition to many large and small villages, Jemez families also built and seasonally inhabited thousands of "field houses" (page 15). They lived in these shelters when they tended crops in the lands surrounding the villages. The juxtaposition of numerous ancestral Jemez villages, field houses, farm fields, and trails within ponderosa pine forests well into the historic period provides a rare opportunity to reconstruct the history and interactions of people in fire-prone forests.

Tree-ring dating of fire-scarred trees found throughout the Jemez Mountains gives us a chronology of fire events spanning the past 700 years, including multiple centuries of intensive



Aerial view of the Jemez Mountains, with approximate locations of large ancestral Jemez villages and fire-scarred tree collections. MAP: THOMAS W. SWETNAM, ADAPTED BY CATHERINE GILMAN

human habitation in these areas. Ponderosa pine trees from the Jemez commonly contain a dozen or more fire scars in basal wounds. A few very ancient forest stands contain living and dead fire-scarred tree-ring material extending back into the 1300s. Patterns of synchrony and asynchrony of fire dates among the more than 1,300 trees we sampled across the Jemez Mountains reveal the following narrative of forest, human, and fire interactions.

Precolonial period (pre-1590)

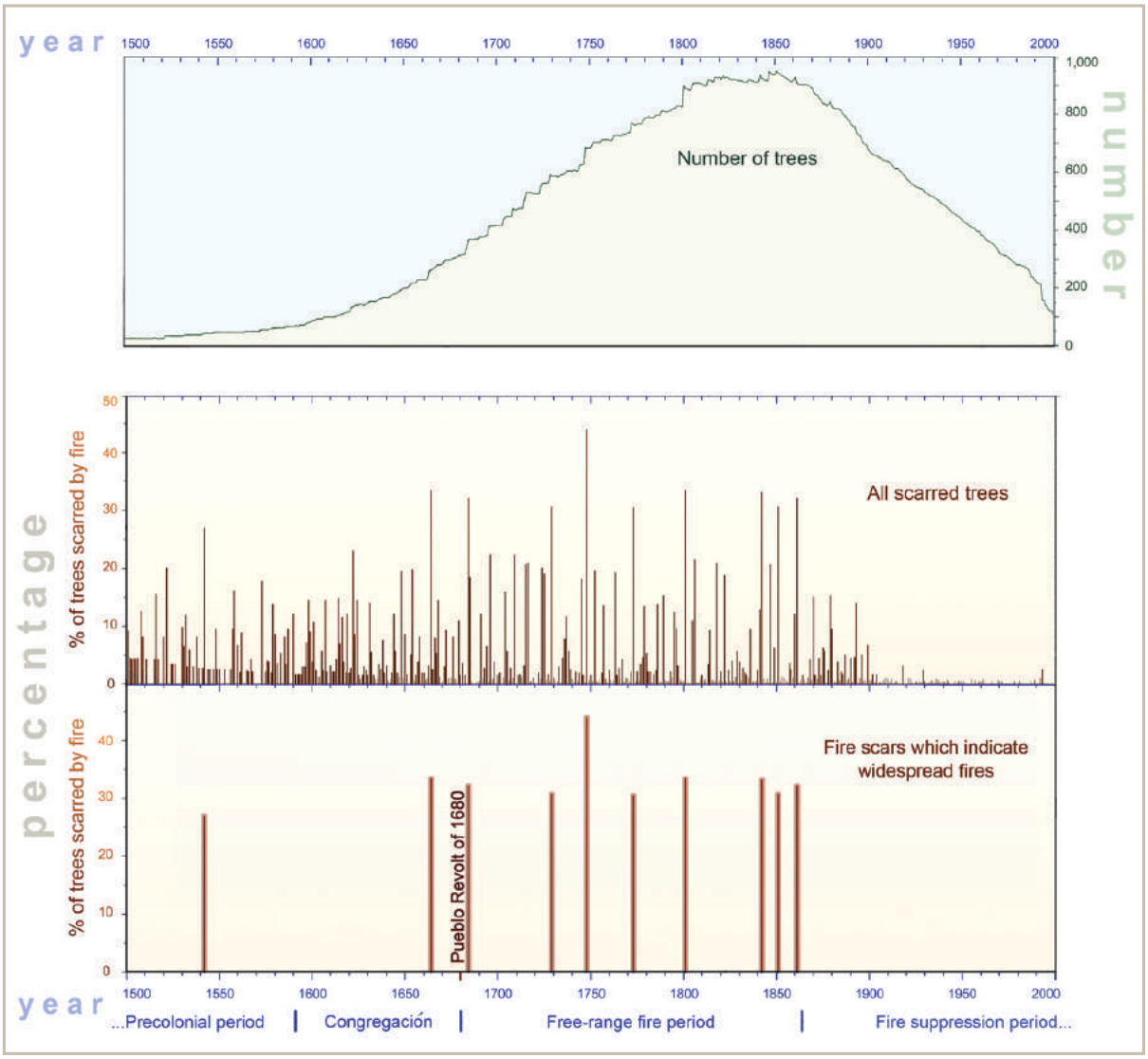
This period is characterized by relatively high human population densities in the uplands, as well as intensive land uses (fuelwood and timber harvesting, agriculture, and trails) that resulted in reduced fuel continuity. Although there were no spreading fires near villages, there were many small fires, as well as very few widespread fires in seasonal agricultural areas and other more distant areas. We found a weak association between fire events and interannual climate variations.

Congregación (1590–1680)

This period is characterized by depopulation of large village sites in the uplands; by recovery of forests on village sites; by increased mass and connectivity of fuels overall; and by a rise in the number of widespread fires in some areas. Again, we found a weak association of fire events with interannual climate variations.

Free-range fire period (1680s–1860s)

These centuries are characterized by open, ponderosa pine-dominant forests with free-ranging, widespread surface fires—wildfires not generally impeded by human actions—at ten-year (or fewer) intervals. We found strong interannual climate–fire associations, especially with wet and dry oscillations related to large fire years.



Fire-scar chronology from the entire Jemez Mountains set of 1,377 trees, showing all fire dates, and the subset of fire dates recorded by 25 percent or more of trees within the dataset (i.e., widespread fires). Many small fires were recorded prior to depopulation of the large Jemez villages in the uplands (pre-1650), but relatively few widespread fires occurred. After depopulation fewer small fires occurred, but widespread fires increased in frequency as continuous fuels accumulated across old trails, farm fields, and village ruins. GRAPHIC: CATHERINE GILMAN, BASED ON A FIGURE BY SWETNAM

Livestock grazing and fire suppression period (1860s–present)

This era is characterized by intensive livestock grazing, which has led to greatly reduced fine-fuel mass and continuity. Direct suppression of fires by government agents has led to near-elimination of widespread surface fires. Timber harvesting, road building, and lack of widespread fires have led to the establishment of multiple cohorts of trees, especially during wet periods. Moreover, many homes and other structures have been and are being built within forested areas (especially after World War II). Fuel accumulations of live and dead trees have increased, and thickets of small-diameter, stunted pines have become common. Large, high-severity wildfires occur during extreme drought years—especially after 1980, as temperatures have risen.

Taken together, our tree-ring, archaeological, and documentary histories point to a heavily used and inhabited forest environment on the southern Jemez Plateau prior to about 1700. Small forest fires set by people and by lightning were abundant. Intensive human use of this landscape created a very patchy mosaic of fuels that tended to reduce fire spread and severity. The modern landscape is essentially the opposite of this condition, with more-or-less continuous fuels, as well as many more homes built within these forests.

The past is not a perfect guide to managing today's landscapes, but useful lessons emerge. Among these is the conclusion that disrupting fuel continuity is a key to living sustainably within fire-prone forest environments over long periods of time.

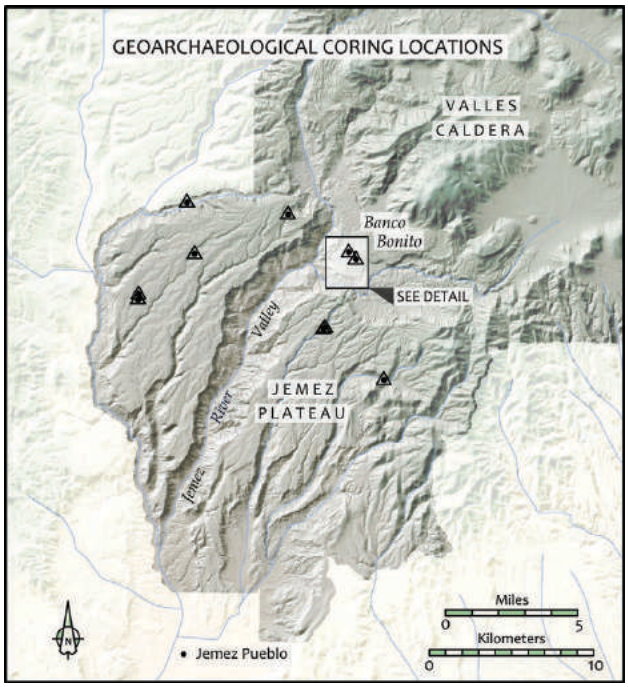
Left and above: *Fire-scarred tree sampling on Banco Bonito, near ancestral Jemez agricultural fields and field houses.* ***Below:*** *An example of a fire-scarred tree cross-section from an ancient log showing dates of fire-caused wounds in the 1300s and 1400s.* IMAGES: TOM SWETNAM

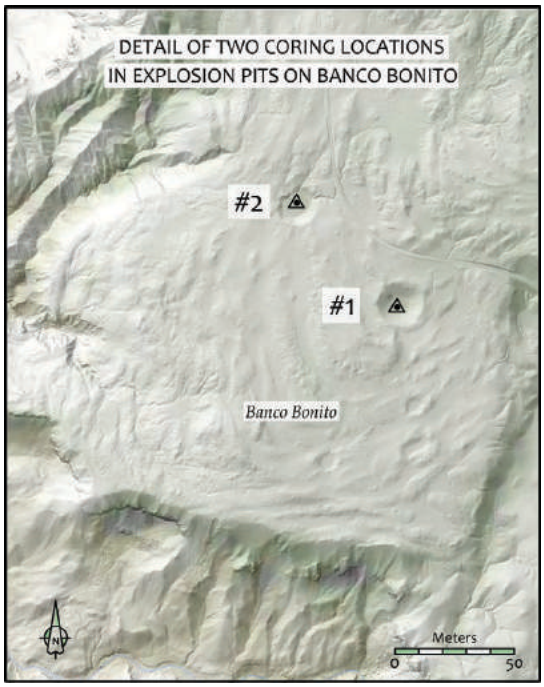
The Long-Term Context for Human–Fire Relationships on the Jemez Plateau

CHRISTOPHER I. ROOS
SOUTHERN METHODIST UNIVERSITY

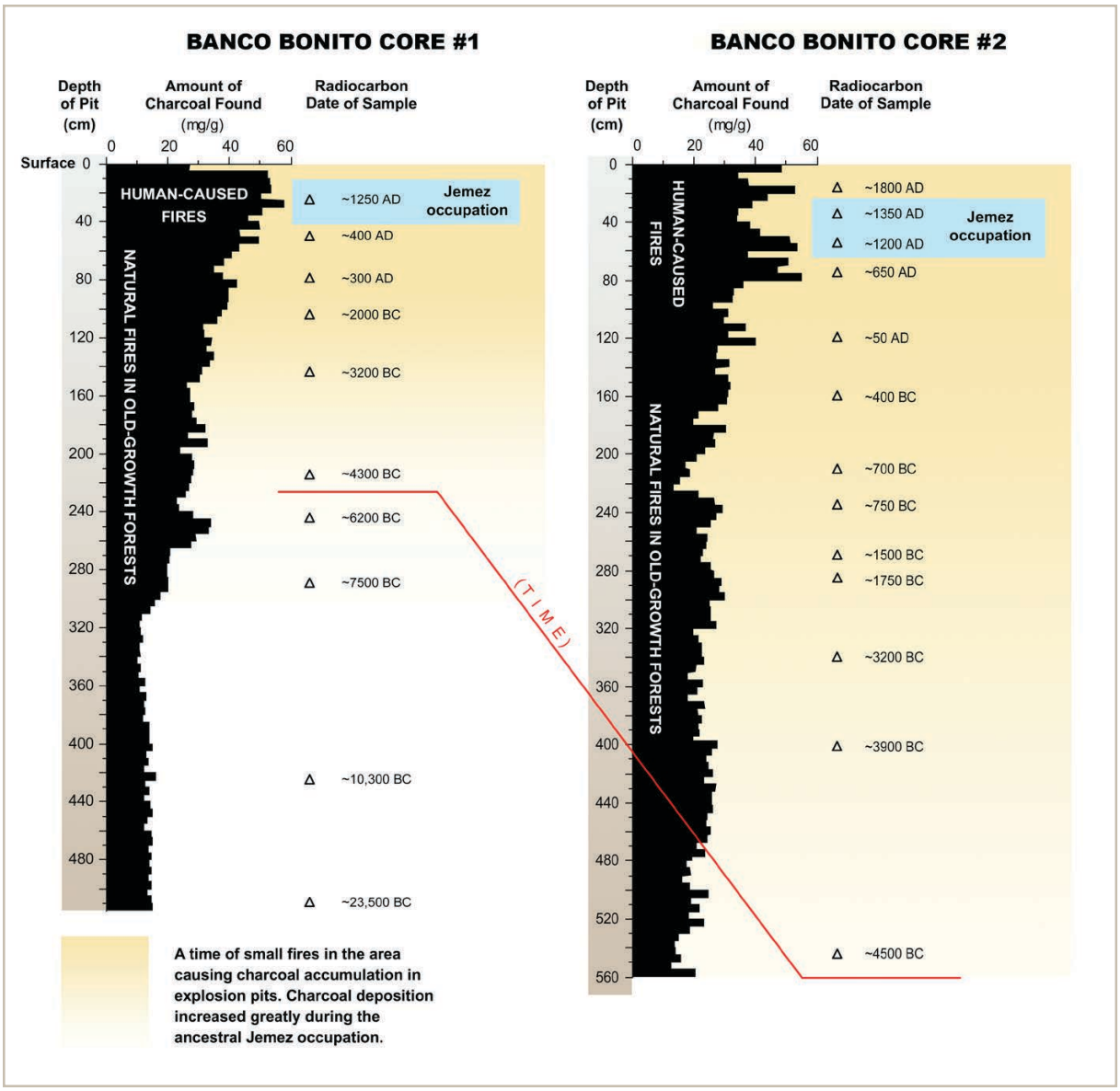
Ancestors of Jemez Pueblo began living on the Jemez Plateau around 1300. This means that very few tree-ring records from the area are old enough to extend before, during, and after the major period of human habitation in the dry pine forests on the mesa tops. In order to provide that long-term context and describe changes in fire activity over thousands of years, my students and I undertook a geoarchaeological coring program.

Our coring locations were situated in the ponderosa pine forests within the zone of agricultural land-use and settlement. At each location, we collected cores of soil and sediment that had accumulated episodically from flooding, wind-blown dust, and slope wash over the last few thousand years. These sediments and soils contain evidence of past fires (in the form of charcoal), as well





Above right: *Geoarchaeology research team coring the fill in an explosion pit on the Banco Bonito.* IMAGE: ANASTASIA STEFFEN ***Right:*** *Map of geoarchaeological coring locations in the southern Jemez Mountains.* ***Far right:*** *LiDAR image of the coring locations of "explosion pits" on the Banco Bonito rhyolite flow.* MAPS: CHRIS ROOS AND CATHERINE GILMAN



Stratigraphic plots of charcoal concentrations and radiocarbon dates from cores in two different explosion pits on the Banco Bonito. GRAPHIC: CATHERINE GILMAN, ADAPTED FROM A FIGURE BY ROOS

as evidence of the plant communities that were shaped by fire (represented by their pollen). By radiocarbon dating minuscule pieces of charcoal from these sediments and soils, we were able to build chronologies of changes in fire activity and plant communities at our coring locations.

The unique geology of the study area provided the long-term context for understanding fire activity during the period in which ancestral Jemez people were using and living in these dry pine forests. The Banco Bonito rhyolite formed more than 40,000 years ago as the most recent episode of volcanic activity for the Valles Caldera (pages 9–12) volcanic field. This lava flow created a distinctive ridge-and-swale topography with a number of features (called "explosion pits") that resulted from explosive degassing as the lava cooled. Cores from two of these explosion pits were more than 15 feet deep, providing 6,000- and 25,000-year-long records of fire. These records are represented in charcoal that eroded from surrounding slopes and was deposited in the deep sediments in the bottoms of the explosion pits.

We were surprised to learn that the amount of charcoal deposited in these soils was at its highest during the period of ancestral Jemez use of the Banco Bonito and its surroundings. Prior to the onset of warmer conditions after the last Ice Age, roughly 10,000 years ago, there were no local fires—but the period from about 1200 onward produced the highest charcoal concentrations in 25,000 years.

This suggests that although the fires used by ancestral Jemez people were relatively small (pages 18–20), the overall amount of burning was significant. This is an important insight, because it suggests that people overtook lightning as the primary source of ignition for landscape fires, and that people deliberately controlled and added a substantial amount of fire to their agricultural and hunting landscapes.

Modeling Ancient Land Use and Resilient Forests in the Jemez Mountains

RACHEL LOEHMAN
U.S. GEOLOGICAL SURVEY

Evidence from tree-rings and fire scars suggests that, prior to the twentieth century, ponderosa pine forests in the Jemez experienced frequent, low-severity surface fires that maintained open forest canopies. This pattern stands in marked contrast to today's ecological landscape.

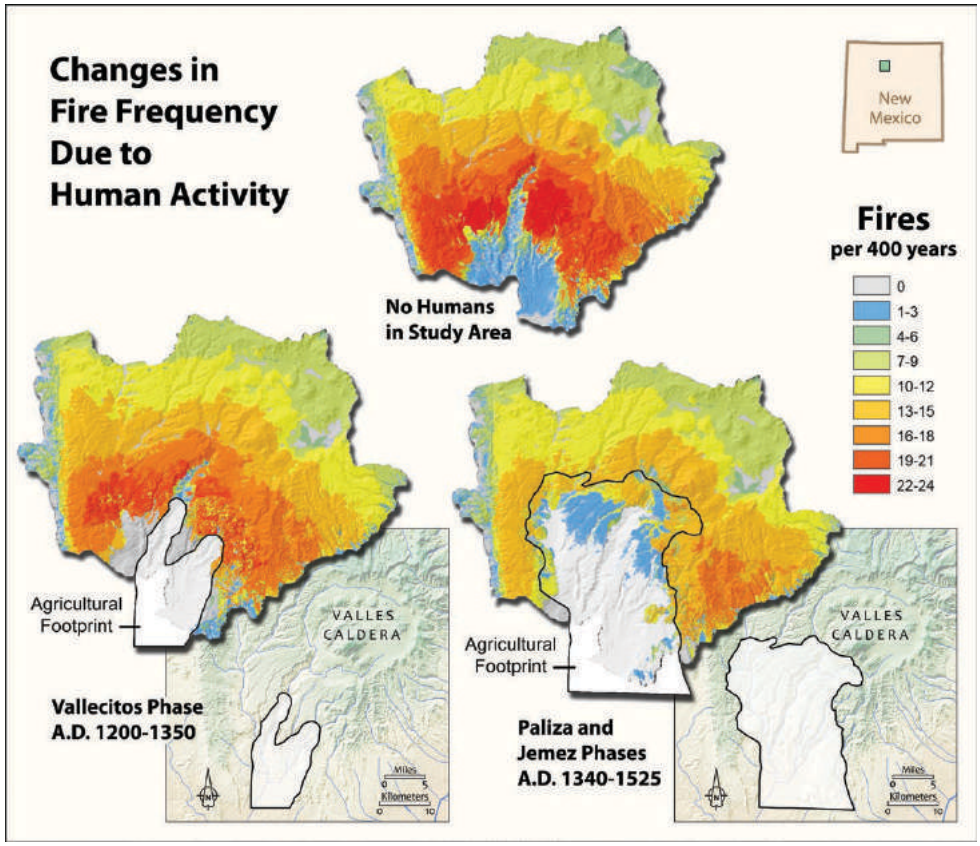
Human activities over the past 150 years have drastically altered forests and fires. In particular, fire exclusion—suppressing or limiting the presence of fire on the landscape—has increased surface fuel loads, tree densities, and ladder fuels. This, in turn, has led to fires that are larger and more intense than historical fires. Such fires also cause higher rates of tree mortality.

Combined with historical logging and grazing activities, fire exclusion has changed the composition of Jemez forests by increasing the number and density of small-diameter trees while nearly eliminating old-growth open ponderosa pine stands. We hypothesized that, in contrast to historical land use, ancestral Jemez land-use activities—although potentially intensive—did not markedly erode the long-term persistence of ponderosa pine forests, even through several major drought periods.

Ancestral Jemez groups needed wood for heating, cooking, firing pottery, and building. Harvesting wood to meet presumably significant demand would have altered forest structure and reduced the continuity and amount of surface fuels, thereby disrupting fire activity. Tree-ring evidence suggests that ancestral Jemez groups denuded 12- to 25-acre areas surrounding their villages. This would have modified fire behavior in much the same way that contemporary silvicultural treatments are used to slow the spread of fire and reduce its severity.

How much wood would it have taken to support ancestral Jemez populations? What were the effects of wood harvesting on fire activity and forests surrounding village sites? What were the effects across the broader Jemez landscape? We explored these and other questions using a spatial ecosystem and fire model called FireBGCv2, informed by rich archaeological, ethnographic, and dendrochronological data sets. We simulated several different time periods and spatial extents of habitation. Our results showed that human influence on vegetation and fire is density dependent.

In the early settlement period (1200–1325), when populations were small (around 500 people), reductions in fuelwood and decreased fire activity were limited to the immediate area



Changes in fire frequency and the footprint of human impact in simulated population and land-use histories. MAP: CATHERINE GILMAN, ADAPTED FROM A FIGURE BY LOEHMAN

of habitation. As populations increased (at least 5,000 people, around 1350–1525) and expanded outward from lower-elevation valleys and canyon bottoms to mesa tops, our simulations showed concomitant shifts in forest and fire patterns in the uninhabited landscape. Less frequent fires and limited fire spread from lower-elevation inhabited areas resulted in an increase in upper-elevation forest biomass. Middle-elevation ponderosa pine forests retained their open, park-like structure in part because people were intensively harvesting surface fuels and smaller-diameter trees—essentially serving as landscape-scale fuel treatments. It is likely that fuelwood collection compensated for any decrease in fire caused by fuel fragmentation by removing surface and ladder fuels, thus protecting landscapes from high-severity fire.

These results highlight the complexity of coupled natural–human systems and the long-term and extensive human footprint in the Jemez Mountains. They also provide an important counterpoint to current practices that favor fire exclusion as a method for sustaining forests. The historical-ecological perspective from the Jemez Mountains suggests that human populations must coexist with fire in order to maintain the resilience of fire-prone landscapes.

Lessons from Four Centuries of Local Management for Contemporary Fire Challenges

THOMAS W. SWETNAM, UNIVERSITY OF ARIZONA
CHRISTOPHER I. ROOS, SOUTHERN METHODIST UNIVERSITY

The remarkable abundance of ancestral Jemez villages and field houses distributed across the southern plateau of the Jemez Mountains tells us this landscape was densely settled and intensively used for a long time. We estimate that at least 5,000 residents were spread over the study area, putting the population density at more than 40 people per square kilometer. Because Wildland–Urban Interfaces (WUI) are defined as having densities of more than 25 people per square kilometer, we view the ancestral Jemez landscape as a WUI that persisted for more than three centuries.

Such large, dense human populations would have needed an extraordinary amount of wood for building, cooking, and other daily uses. From our ethnographic work, we know that cultural uses of wood are myriad and distributed variably across domestic, village, and landscape contexts. Additionally, large areas used as farm fields—together with networks of trails connecting villages, field houses, and farms—resulted in highly discontinuous surface and canopy fuels. Our modeling indicates that the demand for wood and the cleared areas for farm fields and trails would have cascaded outward from villages over time, greatly limiting the spread of fires across the landscape.

Although the landscape was highly fuel-limited during peak periods of ancestral Jemez population, our paleoecological work indicates that many fires still occurred. Lightning and people undoubtedly added fire via natural, accidental, and deliberate ignitions. Still, a general lack of synchrony of abundant fire-scar dates among trees living during this period indicates that most individual fires tended to be very small. After the massive population crash of the 1600s, widespread fires swept across the mesas, burning large areas, as indicated by highly synchronous fire-scar dates among sampled trees.

Soil charcoal records provide a long-term context for the small, patchy fires documented in the tree-ring record. Over the course of the last 10,000 years, soil charcoal concentrations were at their highest during ancestral Jemez times, suggesting that the small fires were not trivial, and might have added up to as much burning (in terms of total area burned) as at any other time since the end of the last Ice Age.

The resulting picture is of lots of small fires and lots of wood removed from the landscape for other uses. These activities may or may not have been explicitly framed as "fire management" by residents of the Jemez Plateau, but their effect was to manage fuels, ignitions, and forests in a manner that was apparently sustainable for more than 300 years. Interestingly, we have found no evidence that any Jemez villages were destroyed by fire.

Federal agencies recognize fire's important role in Southwestern forests. One lesson from our research is that regular and sustained use of small-diameter trees for cultural practices might be just as important in WUI settings. Promoting landscape diversity, or mosaics of vegetation with reduced fuel

amounts and connectivity overall, might be a key to long-term sustainability of forests and the WUI. In general, today's WUI areas are particularly hard to manage because of the complicated mosaic of homes and infrastructure existing within highly fuel-connected, flammable forests. Fire use in these settings can be risky and dangerous. Promoting judicious wood use—thereby reducing fuel connectivity—might be a low-risk alternative to using fire.

An overgrown Ponderosa pine forest before and after thinning treatments.
IMAGES: TOM SWETNAM

Another lesson from the FHiRE project is about fire size. Rather than trying to burn large areas at once, perhaps a better strategy for WUI settings is to light many small fires at a very high frequency. This certainly seems to be the case for our FHiRE study area, although it is important to note that this would have been invariably coupled with fairly intensive wood use, as well.

More than 300 years of intensive wood use—and wise fire use—on the Jemez Plateau created apparently sustainable human–fire relationships. We would do well to learn what lessons we can from centuries of experience in flammable forests, so that we can make the best decisions for the sustainability of these forests in the face of climate change.

FHiRE Outreach: Learning about Forest Fires Then and Now

SARA CHAVARRIA
UNIVERSITY OF ARIZONA

Every year, students see images about the devastating effects of wildfire that lead to evacuations, smoke pollution, and death. The FHiRE project realized it was important to reach out to teachers to help them learn about fire ecology. As part of our FHIRE project, researchers and I worked with teachers and students in Arizona and Jemez Pueblo to co-design lessons to help students learn about fire history and ecology. A fundamental goal of our effort was to disseminate important ecological knowledge to younger populations by making sure the topic was meaningful to the teachers and their students.

Based on our project, we offer the following suggestions for creating a fun and successful outreach program.

» ***Give careful thought*** to the content of the outreach as well as the language and vocabulary to use. Questions must be meaningful for local communities, and local settings must be used. Sharing local management concerns, such as watershed management or prescribed fire, with students and communities makes the science personal.

» ***Create opportunities*** for teachers and students to meet researchers and actively participate in field activities as students

Students from Walatowa (Jemez Pueblo) on a tour of a recently burned area with FHiRE team member Josh Farella. IMAGE: SARA CHAVARRIA

and summer interns. In the first year of a project, offer professional development workshops and invite teachers to co-design classroom lessons. Use field collections, sample preparation, and analyses as educational tools and, when possible, offer a summer camp for students. Hands-on activities and frequent interaction with scientists give students greater ownership of local management problems and needs.

» ***For subsequent years*** of the project, Year 1 teachers (the lesson co-designers) should lead additional teacher workshops in which they feature their own lessons and share the results. We suggest weeklong teacher workshops consisting of 1/3 presentations and tours by researchers, 1/3 hands-on lessons and activities, and 1/3 lesson redesign time.

» ***Supplemental activities*** for lessons we chose to pursue included creating one-minute-long informational videos to complement the teacher lessons. Add an additional two to four days for this component.

Our collaboration resulted in several tools that will help teachers and students understand forest fires today. For links to those resources, visit *archaeologysouthwest.org/asw30-4*.

Beyond Community Consent: Toward Sovereignty-Driven Academic Research

FRANCIS VIGIL, PUEBLO OF JEMEZ, PUEBLO OF ZIA
JOHN R. WELCH, SIMON FRASER UNIVERSITY

Our Jemez FHiRE project set out to apply best-practice tools and rules for community-engaged research partnerships. Specifically, we embraced the "Four Rs": Respect, Relevance, Reciprocity, and Responsibility.

From the start, the research team was committed to building relationships, listening closely to our Hemish colleagues, and keeping our eyes open for opportunities to boost the value of our work for the Pueblo of Jemez and other tribes participating in the project. Several team members had deep knowledge of Hemish land from years of research, training, and outreach (Liebmann, Loehman, Swetnam, and Vigil); others brought experience with successful research engagements with other communities (Chavarria, Ferguson, Roos, and Welch).

We embraced Hemish values, preferences, and collaborators wherever they surfaced. We addressed the mandate of the U.N. Declaration on the Rights of Indigenous Peoples for free, prior, informed consent (FPIC). We optimized opportunities for direct Hemish participation in research activities. We connected with educators, students, elders, elected officials, colleagues, and land and resource managers to listen, learn, teach, and think ahead. We hosted public events to share what we were learning.

Although the overall project was progressive, the question remained: Was the project likely to bring real, sustained benefits to the Hemish community or their lands? At a research team meeting in 2013, Vigil asked, "So, what are the benefits for the Pueblo of Jemez?" Already sensitized to the tensions between extractive, academically-driven research and community-driven research, leaving Jemez with scraps from an academic feast was the last thing we wanted.

Cognizant of these issues, subsequent deliberations among FHiRE team members and Pueblo of Jemez officials resulted in commitments to continue our collaborations. In 2015, the Tribal Council of the Pueblo of Jemez unanimously passed Resolution 2015-42. The resolution "authorizes the expansion of FHiRE collaborations to further enhance opportunities, capacities, and partnerships in education, career development, land and water resource management, fund raising, publication, research, and the interpretation and application of research results relating to the Ancestral Jemez Domain."

Moreover, the resolution "requests and respectfully requires all parties involved in FHiRE and related collaborations to maintain and strengthen commitments to (1) apply Hemish traditional knowledge in planning and implementing research and management activities affecting the Ancestral Jemez Domain; (2) create educational and career opportunities for Hemish people in land and resource management; (3) expand capacities within the Pueblo of Jemez and enable greater control by Hemish People over the Hemish Footprint; and (4) work toward the creation within Valles Caldera National Preserve of a center for the public interpretation and culturally appropriate management of the Jemez Ancestral Domain and Hemish Footprint."

Our research team is now charged with developing partnerships to serve Pueblo of Jemez interests in repairing damages from five centuries of colonial and extractive use of Hemish people and ecosystems. One way forward involves sovereignty-driven research—knowledge creation and mobilization to help govern, provide for, represent, and pursue desired futures on behalf of people and associated territory.

Sovereignty-driven research has origins in Indigenous ways of sustaining relationships, communities, and ecosystems. The approach may be useful for restoring what colonialism has degraded and usurped.

Beyond such generalities, we do not know what sovereignty-driven research will mean for ongoing inquiry, training, outreach, and management projects conducted on behalf of the Pueblo of Jemez. What we do know is that there is a lot to do. We invite our colleagues to help, and we encourage academic researchers to step beyond disciplinary thought by adopting community-based terms of reference for planning and implementing research programs.

We suggest that Indigenous sovereignty rests upon and is enacted through five interconnected "pillars" and pursuits:

- ***Self-sufficiency:*** creation and maintenance of sustainable supplies of the food, water, shelter, and human relationships essential for people to survive and thrive
- ***Self-determination:*** policies and practices that foster futures concordant with long-standing and emergent community values and interests
- ***Self-governance:*** internal capacities to pursue and sustain self-determination
- ***Self-representation:*** first-person portrayals of cultures, histories, and aspirations
- ***Peer recognition:*** establishment of government-to-government and other peer relationships based on legitimate authority over territory, citizens, and resources

FHiRE project scientists and tribal research partners meeting in Jemez Pueblo to review research results.
IMAGE: T. J. FERGUSON

Archaeology Southwest
300 North Ash Alley Tucson, Arizona 85701

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Lately, I have been struck by the varied roles this magazine plays in advancing our Preservation Archaeology mission, which has at its core the "community-engaged research partnerships" described by Vigil and Welch (pp. 26–27). The practice of Preservation Archaeology and the publication of this magazine may seem temporary and distant, but they are ultimately committed and direct.

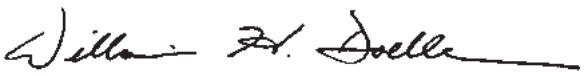
For this issue, as with every issue, we joined in an intense, temporary partnership with the FHiRE team. A case study in Preservation Archaeology at its finest, the FHiRE project was large-scale and interdisciplinary. It used low-impact methods, took advantage of new or enhanced technologies, and involved local community members. Moreover, it respected and learned from traditional practices. The team worked across a cultural landscape with rich archaeological and oral histories to gain new insights into the relationships among human demography, land-use strategies, and the effects of wildfire. Our editor and graphics team worked closely with the issue editors to communicate this complex scientific and ethnographic research for general audiences.

These publications helped share special places, initially. Now, they may help defend them.

Archaeology Southwest's promotion of the Bears Ears National Monument occurred through a partnership in which we acted mostly from a distance over a significant time span. We explicitly planned and published "Tortuous and Fantastic," the late 2014 edition of the magazine, to help to achieve national monument designation, which happened through President Obama's proclamation of December 28, 2016.

Much closer to our Tucson base has been our effort to amplify voices from 11 tribes who identify with the cultural landscape of the Great Bend of the Gila. Those 84,000 acres of federal land extend for nearly 80 miles along the Gila River downstream from the modern town of Buckeye, through Gila Bend, and westward almost to Dateland. We are proud of the magazine issue and two books we have published about the abundant petroglyphs, geoglyphs, trails, and ancient villages along that fertile ribbon of water in its commanding desert landscape—a world-class treasure even greater than the sum of its parts.

As with many things in life, true and lasting success requires earnest continued engagement. The success of the FHiRE project's collaboration with the Jemez community will be measured by its continuation. Bears Ears achieved national monument status, but the political clamor to diminish or rescind it is an imminent threat—one that I assure you Archaeology Southwest and other stakeholders are committed to overcoming. And although the Great Bend of the Gila has not yet achieved national monument designation, we will continue to build relationships among stakeholders who care about the protection, management, and interpretation of this landscape. The goal of Preservation Archaeology, or even the completion of an issue of this magazine, is never a static end point. It is a commitment, an ongoing conversation, an investment—a mission.



back sight (băk sīt) n. 1. a reading used by surveyors to check the accuracy of their work. 2. an opportunity to reflect on and evaluate Archaeology Southwest's mission.