John H. Madsen

Cultural Resources of the Santa Rita Experimental Range

Abstract: The Santa Rita Experimental Range is a vast open space with few signs of houses or human habitation, but at one time it was quite the opposite scene. Archaeological surface inspections reveal heavy use of the Range dating back hundreds of years. This paper will review the history of cultural resource management on the Range and provide a timeline of local cultural history pertinent to understanding the cultural landscape on the west flank of the Santa Rita Mountains. An archaeological site inventory done by Cynthia Buttery in 1985 and 1986 will be the central focus of this paper. Buttery's work provides an important picture of land use on the Range over 800 years ago by Hohokam farmers. The paper will conclude with comments on cultural resource management and research opportunities on the Santa Rita Experimental Range.

Introduction

This paper will address the history of cultural resource management on the Santa Rita Experimental Range (SRER or the Range) and will provide a summary of how the land was used by American Indians prior to European contact in the late 1690s. The paper will conclude with a summary of potential strategies to protect and preserve cultural resources on the Range and a view of how we might blend the environmental information found in prehistoric sites with more traditional range-oriented research themes.

Historic Preservation Policy Applicable to Santa Rita

Two Federal laws set the stage for cultural resource management on the Santa Rita Experimental Range. The Archaeological and Historic Preservation Act of 1960 (AHPA) (Public Law 86-523, 16 U.S.C. 468–469c-2) was adopted to further improve the intent of the Historic Sites Act of 1935 (16 USC 461–467). The intent of AHPA is to preserve historic American sites, buildings, objects, and antiquities of national significance. The Act provides for the protection of historical and archaeological data (including relics and specimens), which might be irreparably lost or destroyed as a result of alterations to the land caused by a Federal agency or a Federally licensed construction project.

The second law of importance was the National Historic Preservation Act (16 USC 470 *et seq.*). Enacted in 1966, this Act provides for a National Register of Historic Places, and has broad authority over national, State, and local historic preservation programs. Section 110 of the Act has had the most significant impact on the Range.

Section 110 directs the heads of Federal agencies to assume responsibility for the preservation of National Register listed or eligible historic properties owned or controlled by their agency. Agencies are directed to locate, inventory, and nominate properties to the National Register, to exercise caution to protect such properties, and to use such properties to the maximum extent feasible. Other major provisions of Section 110 include documentation of properties adversely affected by Federal undertakings and the establishment of trained Federal preservation officers in each agency.

After the passage of the National Historic Preservation Act, Federal agencies with land managing responsibilities began to fill their ranks with cultural resource managers. The Santa Rita Experimental Forest, as it was called in the 1960s, fell into a unique Federal land category. Because the land was not within the boundaries of a National Forest, it was identified as "other Federal lands" and was administered by the Bureau of Land Management (BLM). The USDA Forest Service Rocky Mountain Forest and Range Experiment Station managed the surface of the land through an interagency agreement with the BLM.

Management of cultural resources on the experimental range was shared between the Coronado National Forest and the Rocky Mountain Forest and Range Experiment Station. Little was known about the cultural resources before 1974. The Coronado National Forest employed its first Forest Archaeologist by 1975. Personnel at the Station, in cooperation with the

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In: McClaran, Mitchel P.; Ffolliott, Peter F.; Edminster, Carleton B., tech. coords. Santa Rita Experimental Range: 100 years (1903 to 2003) of accomplishments and contributions; conference proceedings; 2003 October 30–November 1; Tucson, AZ. Proc. RMRS-P-30. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Forest Archaeologist, conducted cultural resource inspection on SRER in advance of ground alterations related to fence installations, buried pipelines to livestock water supplies, and road maintenance.

In the 1980s opportunities arose to place large blocks of sensitive habitat in south-central Pima County under the jurisdiction of the U.S. Fish and Wildlife Service. In an elaborate exchange that involved land from several agencies including the U.S. Forest Service, BLM, and U.S. Fish and Wildlife Service, the Range was transferred to the State of Arizona in 1990. Today the Santa Rita Experimental Range is administered by the Arizona State Land Department and leased to the University of Arizona for ecological and ranch lands research.

Land management responsibilities for SRER now fall to the Arizona State Land Department and their lessee, the University of Arizona. National historic preservation policy applies to SRER when Federally funded or licensed projects or Federally funded grants are used in a way that might impact cultural resources. In such instances the Arizona State Historic Preservation Office in consultation with the funding or licensing agencies, the recipient of the funds or license, and other interested parties, such as Arizona Tribes, assure compliance with Federal legislation.

Two State laws now serve to protect and preserve the prehistoric, historic, and paleontological resources within the boundaries of the Experimental Range during the normal course of daily operations and management, and during State and privately financed research. The first of these laws is the Arizona State Historic Preservation Act of 1982 (Title 41, Chapter 4.2 Historic Preservation, Article 4, General Provisions, A.R.S. Sec. 41-861 through 864). This State law and its associated policies are administered in part by the Arizona State Historic Preservation Office and guide land-managing agencies and institutions like the University of Arizona through their responsibilities to protect and preserve cultural resources on lands they own or control.

The second State law pertaining to SRER is often referred to as the Arizona Antiquities Act, but in actuality is Title 41, Chapter 4.1 Article 4, Archaeological Discoveries (A.R.S. Sec. 41–841 *et seq*.). The University of Arizona has a long and honored role in the implementation of this law. In 1927, the Arizona Eight Legislature enacted the first law to regulate excavation of prehistoric ruins on State and Federal lands in Arizona through a permit system. The legislature assigned the task of administering this statute to the University of Arizona, Department of Anthropology. The Department administered the Act until 1960 when amendments placed administration of the law under the Arizona Board of Regents and the Director of the Arizona State Museum, University of Arizona (ASM).

The intent of the Arizona Antiquities Act is to protect the information contained in historic and prehistoric ruins, and paleontological deposits by controlling access to sites on State lands through a permit program administered by the ASM. The Act has been amended six times to keep pace with national and State historic preservation policy and is one of the strongest preservation and grave protection laws in the nation.

The University of Arizona has a consistent record of compliance with the State Historic Preservation Act and the Arizona Antiquities Act. New information about the cultural resources on SRER is slowly but steadily gathered as archaeological surveys required by State law are conducted in advance of range management and range research projects.

Previous Archaeological Investigations

In the northeast corner of SRER lies Huerfano Butte. This rocky outcrop contains many archaeological features and will be described later on in this paper. In 1958 William Lindsay reported a bedrock seed-processing location on the Butte, and the ASM gave it a State site number. In 1965 the Butte gained public notoriety when a young girl discovered a prehistoric jewelry cache while on a picnic. This discovery resulted in the first and only scientific journal article about the archaeology of SRER (Bahti 1970).

In 1974 the U.S. Forest Service began to require surveys on the range in response to the passage of the National Historic Preservation Act. The Forest Service recorded eight small sites between 1974 and 1985.

Cynthia Buttery (1987) accomplished the first systematic archaeological inventory on the Range. Over a 2-year period from 1985 to 1986, Buttery recorded 46 Hohokam sites. This research was accomplished in partial fulfillment of her master's degree in anthropology at Texas Tech University and provided information for U.S. Forest Service and Research Station personnel to better manage and protect the cultural resources under their care.

From 1987 to present, five compliance surveys have been completed on the Santa Rita Experimental Range and were related to the placement of water pipelines, soil testing, and road improvement projects (Lange 1999; Lascaux 2000; Madsen 1991; Stone 2001; Swartz 2002). The most recent work by Swartz (2002) was in response to proposed carbon sequestration studies funded in part by NASA. The School of Natural Resources, University of Arizona contracted for archaeological assistance from Desert Archaeology, Inc., to meet Federal requirements for funding. Swartz examined the surface of six parcels prior to the excavation of trenches related to this study. The archaeological inspection resulted in the discovery, recordation, and avoidance of one small prehistoric site. Swartz also found historic features related to early research on the range. Swartz (2002: 17) found it interesting that: "Taken as a whole, across the entire 53,000-acre Range, ... markers and other remains from studies [conducted] in the first half of the twentieth century may meet eligibility requirements for inclusion in the National Register of Historic Places." These artifacts of past research on the Range may contribute to our understanding of the history of range research in the Unites States beyond the written record. By virtue of being an experimental station with 100 years of continuous operation and contributing significantly to range research, SRER today may warrant national recognition as an historic landmark.

Southern Arizona Prehistory

A short summary of southern Arizona prehistory is provided so that the reader can better understand the prehistoric cultural resources of the SRER. Some findings, particularly

those from Buttery (1987), are incorporated into the body of this summary, but most of the detailed information from her work on Hohokam resources will follow this summary.

Big Game Hunters

From archaeological and paleontological investigations a picture has emerged regarding life in the Western Hemisphere from 10,000 to 8,500 B.C. The term "Paleoindian" is used to identify the earliest inhabitants of North America. The origin and ethnicity of these people continues to be debated, but it is sufficient to say they moved about in small groups, lived in temporary camps, and hunted megafauna. Butchering sites with stone tools found in association with the remains of mammoth have characterized these people as big game hunters. In southern Arizona, known butchering sites are located in the San Pedro River Valley and Sulphur Spring Valley. A spear point type referred to as the Clovis Point (first discovered near Clovis, NM) has been found embedded in the bone of mammoth at the site of Naco, AZ (Haury 1953), and at the nearby sites of Lehner (Haury and others 1959), and Murray Springs (Hemmings 1970).

Mammoth remains have been found in the Santa Cruz River watershed. Within the boundaries of SRER a mammoth tusk was found in an eroding arroyo bank (Buttery 1987: 12). The discovery of Clovis points (Agenbroad 1967; Ayers 1970; Doelle 1985; Huckell 1982) and a later style of point called the Plainview Point (Agenbroad 1970; Hewitt and Stephen 1981; Huckell 1984a) indicate a presence of big game hunters in the Santa Cruz River Valley before 8500 B.C. However, archaeological sites with mammoth remains and Clovis or Plainview points have yet to be discovered in the Tucson Basin.

Archaic Hunter Gatherers

Mass extinction of mammoths, mastodons, camels, horses, giant ground sloths, and other large Pleistocene mammals is attributed to climatic change and excessive hunting. By 8500 B.C. the door closed on the big game hunter era, and for the next 7,000 years American Indians adapted to changing environments and landscapes. People focused on mixed subsistence strategies of hunting smaller game, fishing, and eating wild plant resources. Data on social organization, economy, and ritual behavior are severely limited, but there is evidence to show increased sedentism between the early and late periods. Across North America this period of 7,000 years has been separated into the Early, Middle, and Late Archaic periods. These periods are not chronologically similar from region to region. In Arizona, Archaic hunter-gatherer sites are assigned to one of three periods within the Southwest Archaic Tradition: the Early Archaic (ca.7500 to 5000 B.C.), the Middle Archaic (ca. 5000 to 1700 B.C.), and Late Archaic (ca.1700 B.C. to A.D. 150). The term Late Archaic is also synonymous with Huckell's Early Agricultural Period (Huckell and others 1995).

Transition to Agriculture

The term Early Agricultural best reflects the cultural setting between 1700 B.C. and A.D. 150. During this period farmers irrigated fields of maize on the flood plain of the Santa Cruz River and farmed at the mouths of watered canyons. They supplemented their diet with deer and other small game and wild plant foods (Diehl 1997; Ezzo and Deaver 1998; Gregory 1999; Huckell and Huckell 1984; Huckell and others 1995; Mabry 1998; Roth 1989). Sedentism is expressed in the archaeological record by discoveries in recent years that include dozens of houses per village, irrigation ditches, and the byproducts of food processing such as carbonized or burned maize and animal bone. With people spending more time in one location, trash accumulated, as objects were discarded or cached away. The resulting material culture of the early agriculture period includes diverse flaked stone and ground stone tool assemblages, carved stone pipes, clay figurines, and crude pottery vessels. Seashell and other nonlocal resources indicate involvement in trade. Data on social organization and ritual behavior are speculative. Larger than normal oval structures found in village settings might be social or ritual places or perhaps the homes of influential people.

Huckell (1984b) excavated 10 sites at Rosemont on the eastern slopes of the Santa Rita Mountains immediately east of SRER; these sites span the later portion of the Southwest Archaic Tradition through the Early Agricultural Period. No such sites are recorded yet on SRER, but 10 diagnostic arrow points of Archaic and Early Agricultural origin have been found on the Range.

Early Ceramic Period

The Early Ceramic Period (A.D. 150 to 650) is a relatively new concept within the Tucson Basin (Heidke and Ferg 2001; Heidke and others 1998). Although ceramic artifacts, including clay figurines and crude plain pottery, were made during the Early Agricultural period, pottery containers revolutionized life after A.D. 150. Over this 500-year period, pottery was refined into nicely made plain ware and red ware vessels. A variety of new pit house styles are found—basically shallow rectangular pits protected by a framework of posts and beams supporting a coat of matted grass, brush, and mud. Overall a less homogenous culture is seen. As people become less mobile, more time is available to experiment and to adopt ideas from distant lands to make life easier. It is not known if these changes are a step in the evolution of the local sedentary population or reflect the influence of new people. Cultigens, including maize, beans, squash, and cotton, wild plants, and hunting were important parts of the subsistence economy. Greater quantities of imported materials such as turquoise, obsidian, and shell suggest a greater investment in a sedentary life. Data on social organization and ritual behavior remain speculative. The cultural setting by A.D. 650 sets the stage for the emerging Hohokam tradition.

Hohokam

Hohokam is the English pronunciation of Hu Hu Kam, a word used in the Piman language to mean "those who are gone." O'odham ancestral roots are deeply embedded in the ancient cultures of the Sonoran Desert.

The geographic extent of the Hohokam tradition coincides closely with the basic and persistent patterns of settlement

and subsistence seen in the Sonoran Desert before the sixth century A.D. By A.D. 650 new cultural traits such as pottery with red decoration, public architecture, and extensive irrigation systems are identifying characteristics of the Hohokam. These new cultural elements were so innovative that renowned archaeologists Harold Gladwin (1948) and Emil Haury (1976) postulated a Mesoamerican migration into the fertile Salt River and Gila River valleys. In recent years new archaeological data suggest that the traits that uniquely identify the Hohokam are products of internal experimentation as well as the external influences of the Anasazi and Mogollon cultures and the northern cultures of Mesoamerica.

Hohokam Community—For purposes of this discussion, Hohokam history is divided into the Preclassic period (A.D. 650 to 1150) and the Classic period (A.D. 1150 to 1450). The Hohokam aggregated into cohesive agricultural communities that occupied every hospitable niche within the Sonoran Desert. The term "community" refers to clusters of sites dominated by villages of different size and social complexity that maintained farmsteads, multifaceted agricultural systems, and smaller sites located strategically to acquire natural resources (Fish and others 1992).

Each community had a central village supporting one or more forms of public architecture. In the Preclassic period, clay-capped ceremonial mounds and ball courts identified the religious, economic, and social centers of a community (Gladwin and others 1937; Wilcox and others 1981; Wilcox and Sternberg 1983). A shift in Hohokam ideology eventually caused the decline and eventual abandonment of ball court centers and the rise of Classic-period platform mound communities reflecting the emergence of new positions of authority. O'odham oral history suggests that platform mounds may have been built for the Hohokam elite (Teague 1993).

Hohokam community organization speaks to a high order of cooperation and social interaction that reaches beyond community boundaries. These same organizational skills are also seen at the village level with remarkable consistency through time. During the Preclassic period, families organized into cohesive courtyard groups. Each courtyard group contained clusters of rectangular pit houses, cooking ovens, cemeteries, and trash disposal areas positioned around the edge of a common open space (or courtyard). In some larger villages, multiple courtyard groups were positioned around larger central plazas (Doyel 1991).

By the Classic period the courtyard group takes on a pueblo design because of innovations in architectural materials, particularly adobe block construction. Villages contain from one to as many as 20 compounds, each defining the living and working space of a related social group. Within compound walls, groupings of houses and ramadas face common yards containing workspace and cemeteries. Trash mounds and large cooking ovens lie on the exteriors of compound walls.

Hohokam Farming—By the sixth century A.D., the people of the Sonoran Desert had had nearly 2,000 years to hone their agricultural strategies. In the broadest river valleys like the Phoenix Basin, Preclassic and Classic-period Hohokam communities were organized to maintain one or more river-fed irrigation systems. Villages and farms were strategically positioned along miles of arterial aqueducts, canals, and ditches that provided water to croplands.

In narrow river basins like the Santa Cruz and San Pedro, mountains squeeze the flood plains into narrow stripes of fertile land. During the Preclassic and Classic period, Hohokam communities organized along the edges of these flood plains and successfully used river water to irrigate crops. The narrowness of valleys also offered the same communities an opportunity to diversify their agricultural strategies by farming the alluvial fans of nearby mountains. Here the Hohokam planted the lower limits of fans where a combination of direct rainfall and the construction of diversion dams directed water from swollen washes to adjacent fields.

In basins with no perennial waters alluvial-fan farming was supplemented with other faming techniques including diverting rainwater into deeply excavated storage reservoirs for domestic use and pot irrigation, blocking gullies with rock terraces to capture flowing water and sediments, and planting crops in gardens bordered on all sides by rock walls that captured rainwater, prevented runoff, and caused soil saturation. Specialized crops like agave were grown in piles of soil and rock that caused a mulching effect and minimized evaporation.

Hohokam Craft Specialization—Part of the diverse material culture of the Hohokam—craft specialization—emerges from the early ceramic period and takes on a strong Mesoamerican orientation. Seashell, minerals and rock, animal bone, plant fiber, and clay were transformed into utilitarian, status, and ritual objects with diverse form and function. The common person possessed the skill to make plain ware pottery and flaked stone tools for hunting, harvesting, and processing food, but skilled craft specialists were spread throughout communities and were actively involved in repetitive manufacture of products and their subsequent trade. People specialized in making jewelry, ritual objects of stone and clay, textiles, and decorative pottery.

Pottery such as bowls, jars, ladles, and effigy forms, with painted red designs was the signature of the Hohokam people. The earliest decorated pottery was a gray ware with simple incised exterior lines and red painted designs. By A.D. 800 brown pottery with red designs dominated southeastern Arizona while buff-colored pottery with red designs dominated the central basins of the Salt and Gila Rivers. By A.D. 1300 the introduction of distinctive red, black, and white polychrome pottery provides intriguing questions about cultural influences, suggesting, perhaps, the acceptance of outside ideology and/or religion (Crown 1994).

The momentum of the Hohokam culture wanes by A.D. 1350, and their descendants reorganize themselves over the landscape. Pima oral histories tell of social and political upheaval and of environmental factors that profoundly alter the cultural landscape of the Sonoran Desert (Teague 1993).

Reorganization Period

By A.D. 1450 warfare, drought, floods, disease, or some combination of these factors caused change in the structure of Hohokam society. Desert people did not vanish from the landscape—they simply reorganized. In 1697, Captain Juan

Mateo Manje and Father Eusebio Kino explored the valleys of the San Pedro, Gila, and Santa Cruz Rivers. In the Gila River Valley these explorers noted the abandoned Casa Grande Ruin and other burned out Hohokam towns. Yet the Spanish encountered fertile irrigated croplands and many villages, where often hundreds of people would come out to welcome them. People were still living a sedentary lifestyle, but it was seemingly on a different scale than 250 years prior and analogous to that of people living a thousand years earlier. Villages were nothing more than clusters of small oval huts built of sticks and mats (Burrus 1971; Karns 1954). The people encountered by Kino were the descendants of the Hohokam and are the ancestors of the O'odham-Piman people.

Southern Arizona History

Hispanic Arizona—Hispanic Arizona is separated into the Spanish Colonial period (1536 to 1821) and the era of Mexican Independence (1821 to 1856). Most of the major river valleys of present-day Arizona were explored, and a pattern of European settlement was established over this 320-year span. Life on the northern frontier of New Spain was dangerous, and for the Spanish, and for the later Mexican citizen, being able to safely and permanently settle in any one location was never easy.

Franciscan priests attempted a permanent secular presence with the Hopi Tribe from 1629 to 1730 but met with little success. In southern Arizona the Jesuits similarly placed priests at the Indian settlements of Guevavi and Bac on the upper Santa Cruz River between 1701 and 1732. It was not until 1736, when silver was discovered south of present-day Nogales, that miners and ranchers hurried to the borderland of New Spain. The stage was now set for a permanent Hispanic presence in what is now Arizona, and the Santa Cruz River drainage attracted the highest density of Hispanic people. Thereafter, conflict with Indian communities, particularly the conflict between the Apache and Spanish colonists, impeded permanent political and social stability. Even the stationing of garrisoned troops and the building of four presidios, including one at Tubac (established 1751) and one at Tucson (established 1776), did little to protect missionaries, miners, ranchers, and Indian allies. A brief negotiated peace between the Apache Indians and the Spaniards brought calm to the region around 1790, but the success of the Mexican Independence Movement culminated in the end of Spanish rule in 1821, bringing new political problems and instability between the Hispanic population and American Indian.

During the Mexican period (1821 to 1854), conflict with the Apache people intensified in the borderlands, and settlers again retreated to the safety of the presidio forts. Only the courageous dared to face the isolation of the mining camps and ranches of the hinterlands. The instability of the period is exemplified by the failure of land grants. The San Ignacio De La Canoa Land Grant is of particular interest because of its proximity to SRER. In 1821 brothers Tomás and Ignacio Ortiz gained title to 42,000 ha (17,000 acres) along the Santa Cruz River, extending from the western edge of SRER south to present-day Amado. The southern boundary of the land grant was just a few miles north of the presidio of Tubac, yet by 1835 repeated Apache raids forced the brothers to abandon their ranch and to tend their herds from the safety of the Tubac Presidio.

United States Annexation—Mexico's refusal to sell lands to the United States or to resolve land disputes in Texas resulted in the Mexican War of 1846. The Treaty of Guadalupe Hidalgo in 1847 ended Mexican control over a vast region, including Texas, as well as portions of New Mexico, northern Sonora, and upper California. Under the Compromise of 1850, the U.S. Congress created the New Mexico Territory, including present-day Arizona north of the Gila River, Southwest Colorado, southern Utah, and Southern Nevada. The Treaty of La Mesilla, also known as the Gadsden Purchase, finally clarified international boundaries in 1854 when the United States purchased 30,000 square miles south of the Gila River.

The period of annexation was a time of transition in the Santa Cruz River Valley. To paraphrase Sheridan (1995), most Anglo Americans viewed southern Arizona as an obstacle and a wasteland on their way to better lands. In 1846 the Mormon Battalion passed through Tucson while mapping a route to California. On their heels came scores of miners, merchants, and stockmen lured west by the discovery of gold in California in 1848. Through the 1850s and 1860s, Anglo attempts at ranching and mining in the Santa Cruz River Basin were marginal and paid few dividends. The Civil War created new problems as Union forces left the region, opening it to Apache reprisals. For example, between 1855 and 1862 cattle ranching continued on the San Ignacio De La Canoa Land Grant; by 1859 a lumber mill, hotel, and tavern were build just southwest of SRER at La Canoa. Apache raiders burned the newly constructed buildings in 1861 (Willey 1979). In 1862 the Civil War reached Tucson when a brief tug-of-war over occupation ended with Union Troops in possession and Confederate Troops retreating to Texas.

The U.S. military, like their Spanish and Mexican predecessors, could do little to calm old and new ethic conflicts throughout the period of annexation. During this period, however, Mexican and Mexican-American residents established the foundation of later successes in southern Arizona.

Arizona Territory (1863 to 1912)—In 1863 the Arizona Territory was carved out of the Territory of New Mexico. The land once considered an obstacle to westward expansion was rediscovered. From 1863 forward, Arizona's gold, silver, and copper resources lured an aggressive rush of miners to the territory, and with each new discovery mercantile centers thrived. The cattle boom of the 1880s paralleled the growth of mining; and, finally, the arrival of the railroad through southern and northern Arizona culminated in the end of the frontier. Throughout the entire era, a growing U.S. military presence broadened warfare, leading to suppression and confinement of Arizona's Indian tribes.

Santa Cruz River Valley—In the 1860s and 1870s, Tucson thrived as a center of commerce and was the territorial capital from 1867 to 1877. Mexican and Mexican-American businessmen dominated the economic markets and provided the majority of services to settlers, ranches, mines, farms, and above all military posts. Networks of freight wagons delivered produce from Mexico, as well as hardware and other goods from the east and west coasts. By 1881 the

Southern Pacific Rail Road offset the balance of power in Hispanic Arizona. Easterners rolled into the region and successfully outbid the established frontier merchants for local markets.

South of present-day Tucson, SRER was in the shadow of the ranching and mining booms. Frederick Maish and Thomas Driscoll ran cattle on the San Ignacio De La Canoa Land Grant in the late 1860s and purchased the land from founder Tomás Ortiz in 1879. By 1899 they had acquired title to the Grant from the U.S. Government. Copper was discovered at the north end of SRER in 1875. Here the mining town of Helvetia had ups and downs with some mining successes until it was abandoned in 1911. The Narragansett Copper Mine was established on the eastern edge of SRER in 1879. Thereafter, a community of 150 people worked the Rosemont Copper Mill and Smelter from 1894 to 1910.

Buttery (1987) notes the presence of at least three historic-period ruins on SRER, and Swartz (2001) notes evidence of past range experimental plots that may date to the Territorial and Statehood periods. Little information exists to fully describe these historic resources. Nathan Sayre (this proceeding) provides an overview of the history of the SRER, and his data will provide a glimpse of what historic resources may lie untapped and awaiting anthropological/archaeological study.

At this point I return to a more indepth look at the Hohokam culture and the patterns of Hohokam use of land within the Santa Rita Experimental Range.

Cultural Resources on the Range

The work by Buttery (1987) provides the primary source of information about Range cultural resources. The principal reason for Buttery's research was to examine how specific environmental factors such as landform, soil, hydrology, and to a broader extent vegetation, influenced how people organized themselves over the landscape in the prehistoric past.

Buttery conducted a systematic surface inspection of the Range with a crew of two to three people spaced 20 m apart. This team walked north-south transects along U.S. Geological Survey (USGS) topographic section lines and half-section lines. These parallel transects at half-mile intervals were chosen to give an evenly spaced, systematic sample covering of all biotic zones on the Range. Based on transect width and length, Buttery indicates that approximately 19,700 ha (8,000 acres), or a 15-percent sample of the 146,000-ha (53,000-acre) range was inspected for archaeological resources. Buttery found 46 prehistoric sites during her study (fig. 1). Sites were plotted on USGS 7.5-minute topographic maps and on to Mylar™ sheets covering 1:24,000-scale aerial photographs. The surface characteristics of each site were recorded on U.S. Forest Service site forms, and sketch maps were made. All site forms are on file at the Supervisor's Office of the Coronado National Forest in Tucson, AZ. Site information is now available to qualified researchers through the State AZSITE Geographic Information System.

Criteria for designating sites were based on the standards of the Coronado National Forest in 1985. Archaeological sites were defined by the U.S. Forest Service as the presence of six or more artifacts in proximity to each other on the surface, or by the presence of obvious prehistoric features on the landscape, such as seed-processing sites with mortar holes in bedrock outcrops.

In 1985 considerable data were available from adjacent regions to seriate Hohokam sites by time periods, and to classify sites into functional groups based on surface artifact assemblages and visible surface features. Borrowing from a site classification system used during Phase B of the Central Arizona Project (Czaplicki and Mayberry 1983: 27–29), Buttery sorted SRER sites into five categories: (1) Lithic Scatters, (2) Garden Sites, (3) Limited Activity Sites, (4) Habitation Sites, and (5) Specialized Activity Sites.

Lithic Scatters (Places Where Stone Tools Were Made)

The Hohokam and their predecessors were expedient toolmakers. If a task required the use of cutting, scraping, or piercing tools, the nearest source of fine-grained rock was used to make the needed implement. The import of exotic stone tools and raw material from outside southern Arizona occurred but was not in any way necessary or extensive.

The Santa Rita Mountains provide a wide range of rock types suitable for making stone tools. On the Range, fine-grained black to gray porphyritic andesite is found in abundant quantities on cobble terraces overlooking the Santa Cruz Floodplain (Jones and others 1998). The same material is plentiful in streambeds on the upper bajada.

Buttery identified six lithic scatters where someone split porphyritic andesite cobbles to make tools. Lithic scatters are characterized by the presence of cores, flakes, and waste debris. Stone cores are cobbles with flakes removed; the resulting flakes are sharp and can be used for cutting, or can be flaked further into other tools. Debris is the byproduct of toolmaking. Three lithic scatters were found in the upper reaches of Sawmill Canyon, and three others at the lower reaches of this drainage. These sites range from 80 to 270 m^2 in size.

Garden Sites

Prehistoric agricultural fields marked by rock piles and low stone alignments cover hundreds of hectares along the edge of the flood plain of the Santa Cruz River from the international border to locations 80 miles downstream at Marana (Fish and others 1992). Interdisciplinary study of these prehistoric agricultural complexes has detailed the nature and extent of agave cultivation during the later portion of the Hohokam sequence. Rock piles and stone terraces enhance the planting environment of the agave plant. The uneven, porous surface of a rock pile allows penetration of rainfall, and the rock acts as mulch, slowing evaporation of soil moisture. Agave pups gathered from a high-elevation habitat in the Santa Rita Mountains were transplanted into rock piles at lower elevation. Agave (or century plant) has been a source of food and fiber for most aboriginal groups of North America living within the distributional range of these drought-adapted perennial succulents.

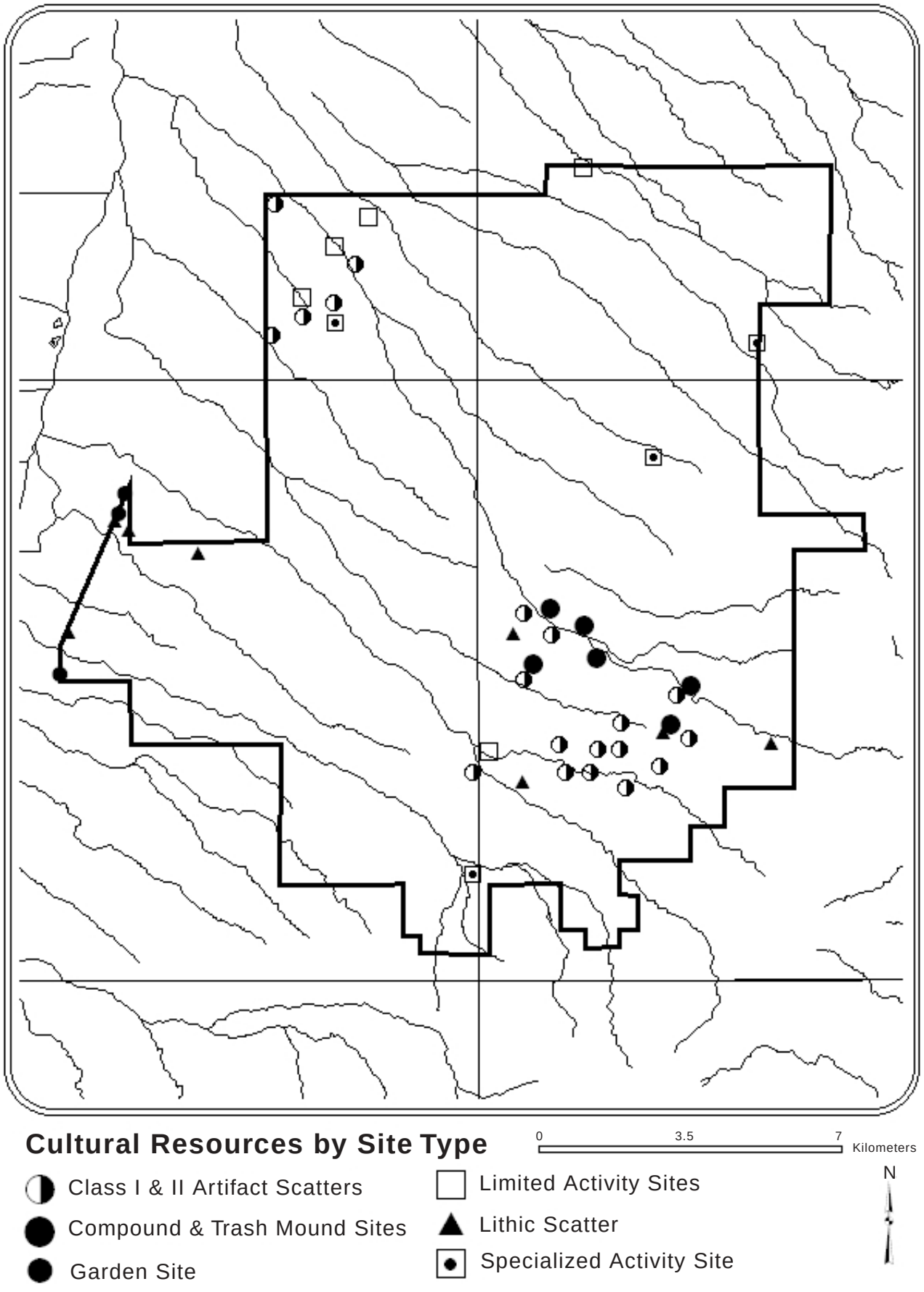

Figure 1—Archaeological site locations on the Santa Rita Experimental Range.

Four agave fields were recorded on the lower bajada of SRER below 945 m (3,100 ft) elevation. Fields range from 391 to 10,000 m^2 in size with four to 18 rock piles per site. One agricultural site has a 60-m-long rock terrace. Buttery found no habitation sites near these fields and postulated that people living on or near the flood plain maintained them. Recent work on the western periphery of SRER (Jones and others 1998) shows that villages dating to the late pre-Classic and early Classic periods are within a mile of Buttery's agave fields.

Limited Activity Sites

Seven Hohokam sites, each with fewer then 25 artifacts, were scattered between the upper and lower bajada. These sites range from 12 m^2 to 6,360 m^2 in size and contain plain ware pottery and flaked stone artifacts. One of the sites has three unidentified decorated pot sherds. From this limited information no particular function can be assigned to these sites.

Habitation Sites

Over half of the sites recorded by Buttery on SRER (25 of the 46 sites) are identified as habitation sites. As the word implies, these are places where people built houses and lived seasonally or year round. To determine seasonal versus year-round habitation requires a multidisciplinary approach to many lines of excavated archaeological data, but habitation in the broadest sense is easily recognized without excavation from specific indices of artifacts and features seen on the surface. Buttery separated habitation sites into four categories based on the types of artifacts and feature exposed on the surface.

Compound Sites—By A.D. 1150 the Hohokam were building their houses within walled compounds. Compounds were made from solid adobe blocks or from upright posts intertwined with sticks and brush and bound together with adobe mud. Evidence of both construction methods are expressed archaeologically by remnant stone footings on the surface.

Two habitation sites on the upper bajada of SRER are classified as compound sites. One site has two small rock compounds with interior spaces of 48 m^2 and 108 m^2. Thirteen other segments of wall footing were also recorded including one footing 25 m long. The larger compound site has a rock footing nearly 40 m long with three attached perpendicular walls about 10 m long each. Two rectangular rooms are attached to the interior of this enclosure.

Besides hundreds of broken pieces of plain utilitarian pottery and a few decorated pieces, the artifacts on the surface of both sites include food-grinding tools and flaked-stone cutting, scraping, and piercing tools. The dates of occupation are tentatively placed after A.D. 1150 based on the Classic period compound architecture. A few pieces of Rincon Red-on-brown pottery, dated to between A.D. 950 and 1150, were found on both sites. Another pottery type called Tanque Verde Red-on-brown dated between A.D. 1150 and 1300 was found on one of the sites. Site area is based on the distribution of artifacts on the surface. The first site covers an area of 14,000 m^2, and the second, larger site covers an area of 105,340 m^2. The potential for buried cultural features on both sites is certain.

Trash Mound Sites—Villages occupied year round or seasonally over many years have locations set aside for trash disposal. After repeated dumping episodes in one location, trash accumulates into mounds, and if conditions are favorable, these mounds remain visible for centuries. On the upper bajada of SRER four villages were occupied for extended periods of times as suggested by the presence of trash mounds. Two villages have four trash mounds, and the two others each have one mound. Most of the mounds are only a few centimeters high and are identified by the presence of artifact concentrations, but the largest known trash mound on SRER covers 72 m^2 and is mounded 50 cm high.

Based on the distribution of surface artifacts, the four villages range from 70,000 to 200,000 m^2 in size. Artifacts scattered across these sites include plain utilitarian pottery, flaked-stone cutting, scraping, and piercing tools, and waste flakes and debris from toolmaking. Seed-grinding tools (manos and metates) and jewelry made from seashells are present. Three of the four villages have datable decorated pottery including Rincon Red, and Rincon Red-on-brown, as well as Sacaton Red-on-buff, indicating occupation between A.D. 900 and 1150. The earliest of the four sites has one trash mound with Santa Cruz Red-on-buff pottery placing its occupation between A.D. 875 and 950. With little doubt, these sites have archaeological deposits that include many buried houses and features.

Class I Artifact Scatters—Buttery used the term "Class I Artifact Scatter" to describe sites with three or more types of artifacts. These sites have no surface evidence of trash mounds, but a few have heavy concentrations of artifacts that may represent locations of trash disposal. The absence of trash mounds may have to do with the length of occupation, the intensity and type of use, or the rate of deflation. It is certain that some of these sites represent permanent villages with several houses, while others in this group may be small seasonal farmsteads with a few houses or ramadas. The surface areas of these sites range from 8,000 m^2 to as large as 306,000 m^2.

Plain utilitarian pottery, flaked-stone cutting, scraping, and piercing tools, waste flakes, and debris from toolmaking are present on most of these sites. Twelve sites have food-grinding implements (manos and metates). Dispersed unevenly among the 14 sites are seashell artifacts, carved stone jewelry, tabular agave knives, a stone axe, pottery spindle whorls, a quartz crystal, evidence of a cemetery, and rock pile clusters protruding through the surface.

Five of the 14 sites have datable decorated pottery. Rincon Red-on-brown dating from A.D. 900 to 1150 is dominant, followed by Rillito Red-on-brown (A.D. 875 to 950), and unidentified buff ware sherds.

Class II Artifact Scatters—Buttery grouped these four sites together because the artifact assemblages are limited to broken pottery and flaked stone. Plain ware (utilitarian brown ware) is the dominant pottery type on the surface of these sites. Rincon Red-on-brown on three sites suggests an occupation between A.D. 900 and 1150. Flaked stone is limited to flakes and cores (cobbles with flakes removed), hammer stones (tools for removing flakes from cobbles), and

cutting tools. One site has a single small rock pile of indeterminate function. These sites range from 14,000 to 95,000 m^2 in size, and although they are large sites, the surface artifact assemblages lack the variety usually found at permanent habitation sites. The proximity of Class II sites to washes and fans may indicate they were seasonal habitation sites that functioned as farmsteads.

Special Activity Sites

These four sites are diverse in function. The first is a plant-processing site where four mortar holes and four grinding slicks (bedrock metates) were created on exposed bedrock near the mountain pediment. In these locations, food products like mesquite pods were milled or ground into flour with stone pestles and manos. Buttery notes that the largest mortar hole is 15 cm in diameter and 9 cm deep. The four nearby bedrock grinding slicks each measure about 70 cm long, 30 cm wide, and 18 cm deep.

The second special activity site is located at Huerfano Butte, a small rocky hill in the northeast quadrant of the Range. Buttery notes that shallow bedrock forces ground water to the surface in a wash on the south side of the Butte. Exposed outcrops of granite on either side of the wash have 50 bedrock mortar holes and numerous smaller cupules, further suggesting that the location may have been a reliable water source at times. Along the same wash is a vertical stone surface with pictographs painted in red hematite. The paintings include human and animal life forms as well as concentric circles. A few plain ware and unidentified decorated pottery sherds and flaked-stone artifacts were noted in the area. As mentioned earlier, Huerfano Butte gained notoriety in 1965 when a young girl discovered an extensive prehistoric jewelry cache while on a picnic. While exploring cracks and crevices on the butte the young girl discovered a prehistoric bowl filled with turquoise and shell beads, as wells as carved bird and frog pendants. This discovery resulted in the first and only scientific journal article about the archaeology of SRER (Bahti 1970). The cached offerings, the red paintings, and the numerous food-processing features may or may not be related, but one can imagine that a reliable water source near, or on the surface, is an element that could bind all of the site's features together.

The third special activity site is associated with food processing. It is located on the lower bajada in an area experiencing deflation. The site is 98,400 m^2 in size, and within its boundaries are 34 rock piles, most of which are check dams. Some of the other rock features are hearths and roasting pits filled with broken and fire-charred grinding implements. Buttery recorded 70 manos, 5 metates, and observed several pestles. The pottery at this site is dominated by mostly broken plain ware, but four broken decorated sherds were noted, including Snaketown Red-on-buff (A.D. 650 to 900), Rincon Red-on-brown (A.D. 900 to 1150), and Tanque Verde Red-on-brown (A.D. 1150 and 1300). Buttery noted a dozen modified sherds, some ground round into spindle whorls. Buttery noted that the flaked-stone tools made from black porphyritic rhyolite were abundant and include flakes, scraping and cutting tools, and cores.

The fourth special activity site is located in Florida Canyon and was identified as a source of black porphyritic cobbles. These cobbles were broken to test the quality of the stone for toolmaking. Some material was used on the spot to make tools, but it is also likely that cobbles were collected and taken elsewhere for use (see "Lithic Scatter" above). This site covers 70,000 m^2 of land. The discovery of an Archaic triangular biface tool along with plain ware Hohokam pottery suggest a long history of use. Every habitation site on SRER contains stone artifacts made from black porphyritic igneous rock, and as indicated earlier, Florida Canyon is not the only source for this material. Other drainages certainly have similar deposits of stone as do the lower bajada Holocene fans and ridges (Jones and others 1998).

Settlement Pattern

The pattern of Hohokam settlement on the northern slopes of the Santa Rita Mountains reflects both environmental risks and opportunities. Settlement will be examined in its relationship to the availability of resources on the upper bajada, middle bajada, and lower bajada of the Range.

Upper Bajada—Finding large numbers of Hohokam sites in upper bajada locations is a common pattern in the basin-range country of the Sonoran Desert, particularly where mountains rise above 1,219 m (4,000 ft) in elevation. The Santa Rita Mountains rise just over 2,881 m in elevation (9,453 ft), and the bajada slopes around the entire base provide many opportunities conducive to human settlement. Buttery indicates that 63 percent of the Hohokam sites on the Range are located on the upper bajada between 1,097 m (3,600 ft) and 1,341 m (4,400 ft) above sea level. Here, there is enhanced precipitation from orographic rainfall, sufficient elevation to lessen frost from cold air drainage, surface water, and bedrock water catchments. The bajada itself offers plant foods like mesquite pods and cacti fruit, and proximity to the mountain provides access to a rapid succession of plants and animals used for a variety of purposes, including food, clothing, and shelter.

The Hohokam living on the northern side of the Santa Rita Mountains depended on the relatively abundant local precipitation for domestic and agricultural use. The uplift of moisture-laden air passing over the Santa Rita Mountains delivers predictable precipitation to the mountain peaks, provides perennial surface water in canyons, and heightened chances for direct rainfall on the upper bajada in the winter and summer months, probably more so than on the valley floor. At the mountain front, Holocene sediments over bedrock are typically no deeper than a few meters; accessible water tables at the mouth of Box Canyon and Sawmill Canyon and in nearby ephemeral drainages were important factors in settlement location.

Upper bajada agriculture—Bottomlands with high agricultural potential are not evenly distributed along Box and Sawmill Canyons but vary with factors such as width and morphology of the flood plain, water-table depth, watershed size, and drainage gradient. The importance of such acreage for supporting relatively dense populations is indicated by the locations of large habitation sites along those stretches of Box Canyon and Sawmill Canyon suitable for flood plain fields. Buttery suggests that the water may have flowed in these canyons continuously in the prehistoric period.

The Holocene soils on the broad upper bajada terraces between major washes are also suitable for agriculture.

> The surface runoff would have easily infiltrated the sandy Holocene soils and remained close to the surface because of the underlying Pleistocene clay soil. When the water reaches the clay soil, it would begin to move laterally. At the point where the sandy soil becomes shallow or pinched out, it is likely that there would have been free water on or near the surface, thus creating temporary seeps following above average winter precipitation…. (Buttery 1987: 92).

Between 1,097 m (3,600 ft) and the mountain pediment, Buttery noted locations where moist conditions near the surface caused lush growing condition for local gasses.

Middle Bajada—The middle reach of the Range's bajada was not a place of settlement because drinking water was inconveniently distant at either the Santa Cruz River below or at the mountain edge above. As Box Canyon and Sawmill Canyon drain downhill and cross into the mid-bajada, surface flow tends to diminish or disappear in channels through infiltration into increasingly deep valley fill. The lower limit of habitation sites on Box Canyon and Sawmill Canyon probably mark the downslope extent of significant surface flow from all but the largest precipitation events following major storms.

Many small drainages with bajada catchments are sufficiently shallow that farmers from upper and lower bajada settlements could have successfully farmed the middle bajada by diverting storm water into fields. However, water would have been available only in cases of storms directly over the watershed, a relatively unpredictable event compared to higher elevation precipitation triggered by uplift of air over the mountains. At this time there is no archaeological evidence suggesting agricultural use of this zone.

The vegetation regimes seen on the Range today probably mimic to some extent the Range around A.D. 1150, when the prehistoric population was at its highest. If there were any differences, it is in the frequency of native trees and plants seen today as opposed to the presence or absence of these species in the past. Within the Tucson Basin, analysis of charcoal from 21 roasting pits dating from A.D. 1150 to 1300 (Fish and others 1992) and from a single roasting pit dating from A.D. 894 and 1148 (Van Buren and others 1992) shows abundant fuel woods of mesquite, ironwood, and palo verde, all consistent with the vegetation seen in the same locations today. It is likely that exploitation of annual and perennial plants in the middle bajada was frequent and shared by the people living above and below this zone.

Lower Bajada—Buttery indicated that 37 percent of the sites on the Range are below 945 m (3,100 ft) and include small agave gardens, lithic scatters, a plant-processing site, and five habitation sites. Lower bajada habitation sites are linked to the flood-plain community. Here water in the Santa Cruz River, and at springs like those at Canoa, provides domestic water sources. Like elsewhere, mesquite, cactus, and other annual and perennial plants provided food resources. Hardy upland agave plants also were transplanted to lower elevation gardens, cultivated, and successfully propagated for food and fiber on the gravel ridges overlooking the flood plain.

Low bajada agriculture—Alluvial fans, composed of outwash sediments from the uplands, coalesce on the lower bajada north of Box Canyon. Gentle slopes provide an active depositional environment and controllable water flow. In these situations flood waters following storms provided both moisture and simultaneous enrichment for crops in the form of suspended nutrients and organic detritus. The clustering of habitation sites at the lower limits of alluvial fans on the Range mirrors similar patterns throughout the Santa Cruz watershed.

Hohokam Community

The archaeological survey conducted by Buttery covered approximately 19,700 ha (8,000 acres), or a 15-percent sample of the 146,000 ha (53,159 acres). Of the 46 archaeological sites recorded, 25 are habitation sites representing places of permanent or seasonal habitation by the Hohokam people. This sample of area and sites provides sufficient information to predict with some confidence that many more Hohokam sites are present on the Range. The majority of the recorded Hohokam habitation sites were occupied between A.D. 900 and 1150, and at least two were occupied until A.D. 1300. As indicated in the cultural history section of this paper, the Hohokam organized into communities with central sites with public architecture at their core. There is little doubt that the dense Preclassic population on the Range is part of one or more communities. This suggests that a central site with a ball court, a form of Hohokam public architecture associated with Preclassic communities, should be found somewhere on the Range probably in an upper bajada location. There is insufficient information on Hohokam Classic period sites, with only two recorded at this time, to understand their place and relationship to other sites.

Concluding Comments

Cultural Resource Management on the Range

Preservation of archaeological resources for scientific investigation outside the Range is not possible except in rare instances. Since 1987, over 29,600 ha (12,000 acres) of land has been inspected for archaeological sites on the western and northern periphery of the Range, mostly as the result of enforcement of the Pima County Cultural Resource Ordinance (Sec. 18.81.060,B.10). These inspections resulted in the recordation of over 400 archaeological sites, but unfortunately only a small portion of these sites will be set aside for preservation in perpetuity. Those sites not fully protected will be subjected to compliance-related archaeological investigations. Unfortunately, the cost of scientific study is very expensive, and all work is more often than not geared to collecting samples that never capture the full breadth and understanding of how people lived and survived in these arid lands.

This is why cultural resources inside areas like the Santa Rita Experimental Range are so important to protect. Within the Range lies important information about the prehistory of the region and the history of homesteading and ranching. Equally important is archaeological information about the history of range experimentation itself, and how early scientific research was carried out. A record of this scientific use

is embedded in the landscape and will not be found in the written or photographic history of the Range. Beyond the humanistic elements of archaeology, sites on the range contain vast amounts of information useful to studies of climate, plant and animal ecology, geology, and geomorphology.

We are rapidly approaching the time when the Santa Rita Experimental Range finally and forever will be enclosed on three sides by a dense urban landscape. High-density residential communities will create new challenges for the Range and will require an increased commitment on the part of the Arizona State Land Department, the Arizona Game and Fish Department, the Arizona Department of Agriculture, and the University of Arizona to manage and monitor the health of the Range.

A complete inventory of SRER cultural resources will facilitate the implementation of future range projects, to include improvements to the land needed in the normal course of use and during the selection of lands for scientific study related to the principal purposes of the experimental range. With the inevitable growth around the periphery of the Range, inventories of cultural resources are necessary for the sheer purpose of protecting them and for assessing impact from allowable public use within the current context of State law and State Trust lands policy.

Cultural resource inventory can coincide with the teaching mission of the University of Arizona. Opportunities for students to design and implement research on the scale of the work accomplished by Buttery (1987) and Fish and others (1992) abound on the Range, and can co-occur and even complement and contribute important information useful to the research objectives of the modern day range ecologist. With that said, the 100th Anniversary of the Santa Rita Experimental Range also presents an opportunity for constituents with common interests in the survival of the Range to develop a long range plan that binds public and scientific interest in this open space.

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