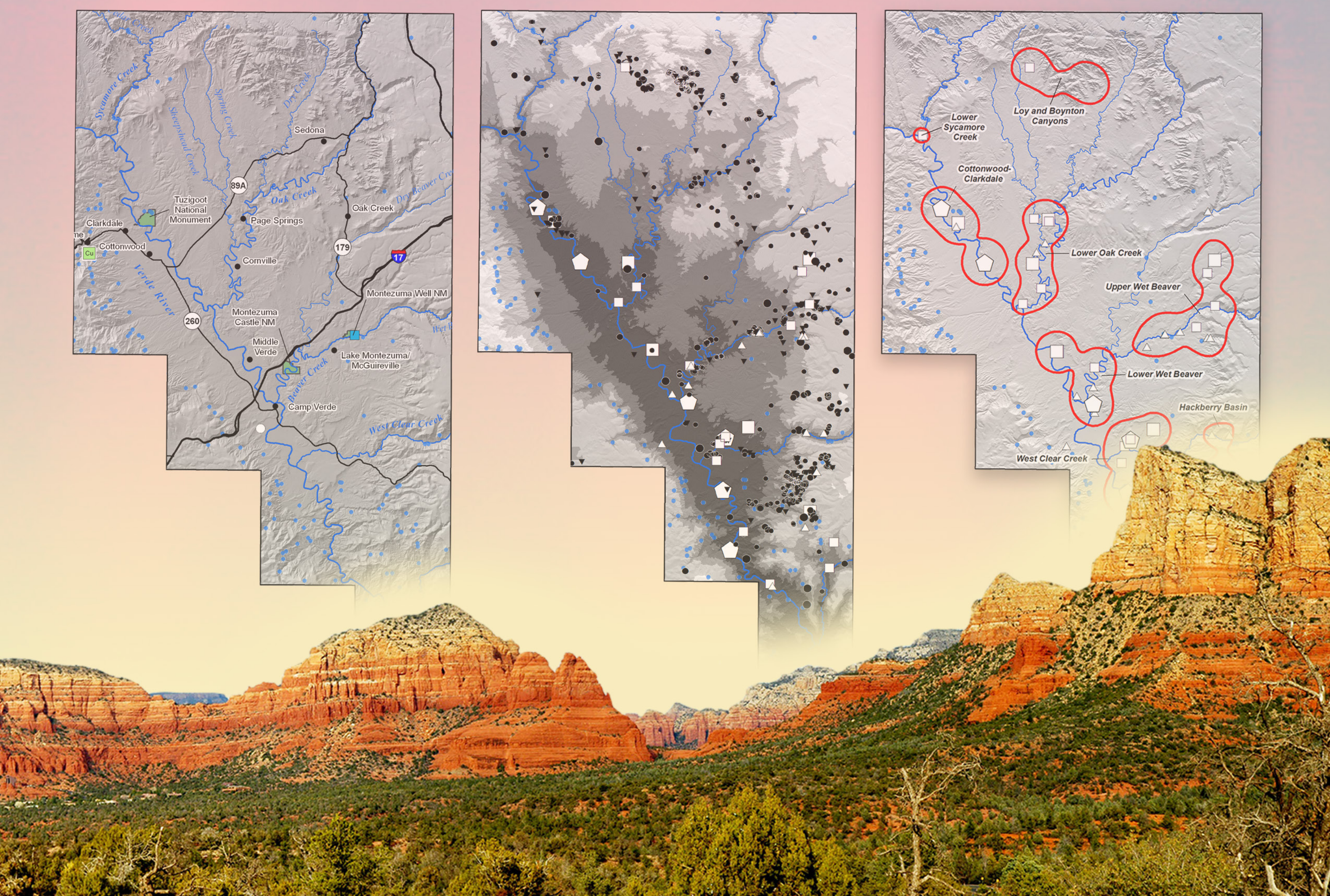
The Lower Oak Creek Archaeological Project

Archaeological Data Recovery along State Route 89A: Cottonwood to Sedona, Yavapai County, Arizona

Volume 3: Synthetic Studies and Conclusions

Edited by
Rein Vanderpot and Carla R. Van West

Technical Series 85
Statistical Research, Inc.
Tucson, Arizona



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Edited by
Rein Vanderpot and Carla R. Van West

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LIST OF ABBREVIATIONS AND ACRONYMS

ADOT	Arizona Department of Transportation
AM	archaeomagnetic
AMS	accelerator mass spectrometry
AMSL	above mean sea level
APE	area of potential effects
ARS	Archaeological Research Services, Inc.
ASM	Arizona State Museum
ASU	Arizona State University
CD_{68}	1σ ceramic date
CD_{95}	2σ ceramic date
cheno-ams	plants in the *Chenopodium-Amaranthus* group
CIV	climatic-intensity value
CNF	Coconino National Forest
DAI	Desert Archaeology, Inc.
DEM	digital elevation model
DHRSP	Dead Horse Ranch State Park
EDXRF	energy-dispersive X-ray fluorescence
FCR	fire-cracked rock
FR	frost ring
GIS	geographic information systems
GPS	Global Positioning System
GRR	Groseta Ranch Road
I-17	U.S. Interstate Highway 17
IO	isolated occurrence
LOCAP	Lower Oak Creek Archaeological Project
MGS	modern ground surface
MNA	Museum of Northern Arizona
MOCA	Montezuma Castle National Monument
MVRV	middle Verde River valley
NAGPRA	Native American Graves Protection and Repatriation Act
NAU	Northern Arizona University
NHPA	National Historic Preservation Act of 1966, as amended
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSAS	nonsite artifact scatter
PGS	prehistoric ground surface

PMDR	Plateau Mountain Desert Research
PNF	Prescott National Forest
ROW	right-of-way
SEC	Southwestern Environmental Consultants, Inc.
SFPB	San Francisco Peaks Bristlecone Pine (tree-ring chronology)
SR	State Route
SRI	Statistical Research, Inc.
SSI	Soil Systems, Inc.
SWCA	SWCA Environmental Consultants
TES	Terrestrial Ecosystem Survey
TL	thermoluminescence
USFS	U.S. Forest Service
USGS	U.S. Geological Society
UTM	Universal Transverse Mercator
VERDE	Don-Verde (tree-ring chronology)
VGP	virtual geomagnetic pole
VVAS	Verde Valley Chapter of the Arizona Archaeological Society
YEAP	Yavapai Ethnoarchaeological Project

CHAPTER 1

Introduction

Rein Vanderpot and Carla R. Van West

This document is the third of three volumes reporting the results of the Lower Oak Creek Archaeological Project (LOCAP) conducted by Statistical Research, Inc. (SRI). This project was a two-phase data-recovery effort associated with the improvement of a portion of alternate State Route (SR) 89A between Cottonwood and Sedona, Yavapai County, Arizona (Figure 1). The project was funded by the Arizona Department of Transportation (ADOT) and included testing and data recovery at 13 archaeological sites along and adjacent to the right-of-way (ROW) of SR 89A (Table 1). The archaeological work was part of a larger ADOT undertaking to reconstruct, widen, and upgrade the state highway and bridges in order to enhance safety and traffic flow along this busy transportation corridor.

Prior to these testing and data-recovery investigations, which were conducted in 1998 (see Chapter 1, Volume 1 of this report), ADOT had contracted with Archaeological Research Services, Inc. (ARS), to survey, record, and evaluate cultural resources within areas of potential effects (APEs) associated with the SR 89A highway-improvement project (Stone and Hathaway 1997). The APEs included the 600-foot-wide ROW along the 15.6 miles of SR 89A from Mileposts 355.30 to 370.90, a 300-foot-wide ROW along the approximately 1.8 miles of alternate alignment of SR 89A between Mileposts 361.69 and 363.46 (the Dry Creek Bypass Alignment), and a 500-foot-wide ROW along the approximately 3.5 miles of a potential bypass loop between Mileposts 365.15 and 367.83 (Alternate N-4). ARS archaeologists identified 28 archaeological sites within or adjacent to these APEs, as well as 74 isolated occurrences (IOs) (Artifacts/Features I-1–I-74) and 21 nonsite artifact scatters (NSAS/A–NSAS/U). Of these 28 sites, 18 were assessed as eligible for listing in the National Register of Historic Places (NRHP). Of the 18 NRHP-eligible sites, 15 were within and adjacent to the final ROW for the LOCAP and warranted data recovery. In each of 2 cases, 2 adjacent NRHP-eligible sites were combined into 1 site during fieldwork and are reported under the site number of the larger and more complex of the two cultural resources. AZ O:1:50/AR-03-04-06-901 (ASM/CNF) was subsumed into the surrounding AZ O:1:104/AR-03-04-06-902 (ASM/CNF) (Site 104/902). Similarly, AR-03-04-06-187 (CNF) was combined with the adjacent AZ O:1:134/AR-03-04-06-189 (ASM/CNF) (Site 134/189). Thus, 13 sites were investigated by SRI (see Table 1), representing 15 of the 18 sites recommended for data recovery by Stone and Hathaway (1997).

Project Setting and Sites

The SR 89A road-widening and improvement project links the Verde River valley near the modern town of Cottonwood with the red rock formations of Sedona. As such, it provides a transect across one of Arizona's more rugged, environmentally diverse, and visually spectacular physical landscapes. At its southern end, the project area began in the upper portion of the middle Verde River valley (MVRV) (Figure 2), in the desert riparian setting of Cottonwood (994 m [3,260 feet] above mean sea level [AMSL]). It continued through some 11 miles of semidesert grasslands, rose through another 4.5 miles of conifer woodland, and ended in West Sedona (1,341 m [4,400 feet] AMSL), surrounded by the photogenic red rock formations that demarcate the receding edge of the Colorado Plateau.

The 13 project sites formed two clusters, a southern one and a northern one. All 13 sites were completely surface collected and tested in Phase 1, and 3 sites were selected for Phase 2 data recovery.

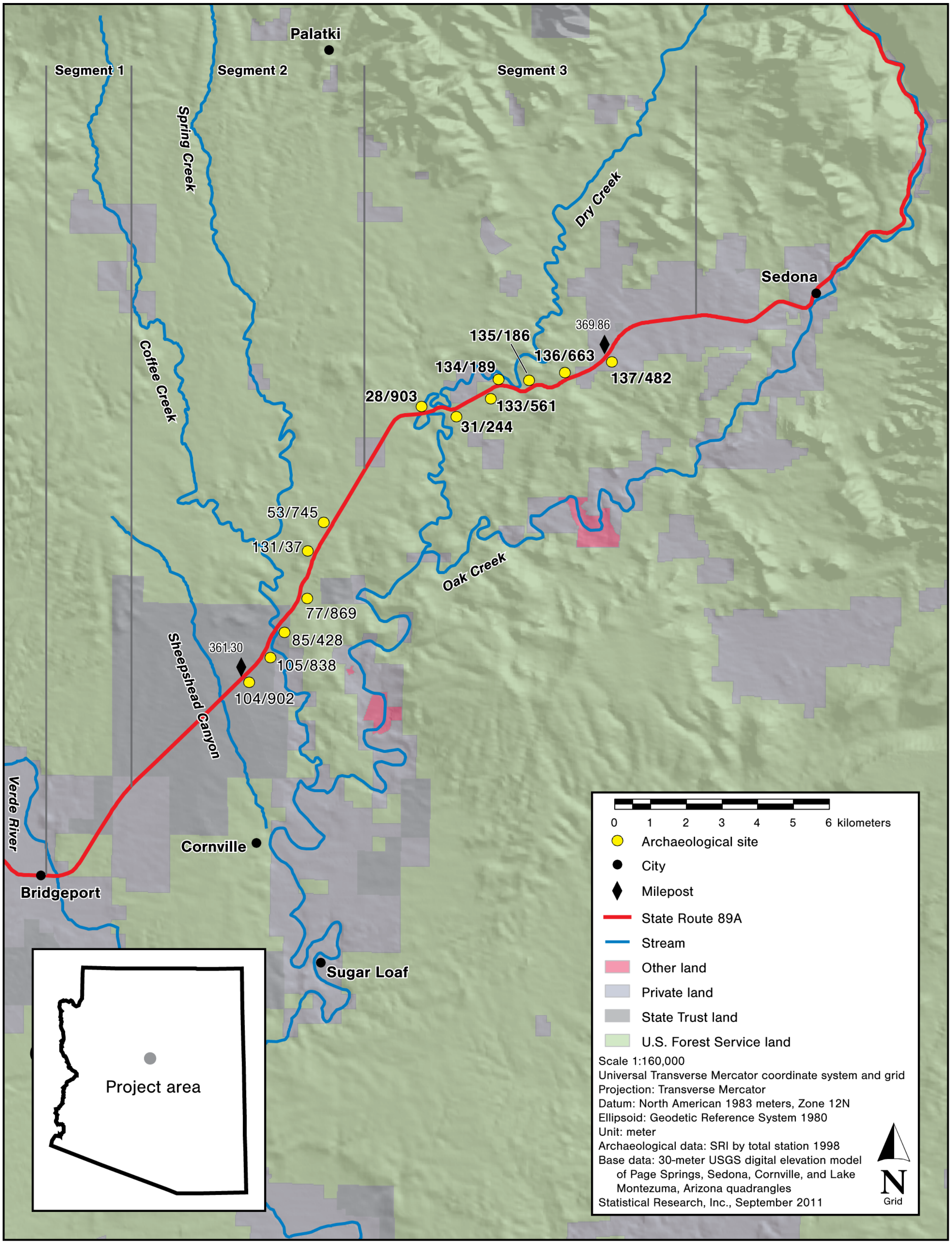

Figure 1. Map showing the locations of the sites along State Route 89A investigated by SRI.

Table 1. Sites Investigated by Statistical Research, Inc., as Part of the Lower Oak Creek Archaeological Project

Site No. (ASM/CNF)	Site Description	Site Function	Site Age	Comments
28/903	lithic scatter and subsurface thermal feature	**Locus A:** base camp; **Locus C:** hunting overlook?	**Locus A:** Late Archaic period; **Locus C:** Archaic and Formative periods	A Late Archaic period thermal feature and an associated activity area were excavated in Locus A.
31/244	lithic scatter	lithic procurement; plant and animal processing	Middle and Late Archaic period hunting and plant-procurement camp; Formative period hunting camp	
53/745	multilocus site including 7 historical-period cobble piles, 2 probable masonry structures, 7 cleared areas interpreted as possible wickiup clearings, 1 slab-lined pit, 1 thermal pit, 1 bedrock metate, 1 possible retaining wall, and a series of possible agricultural terraces	hunting camp; farmsteads/field houses; food-processing camps; possible agricultural area	Middle and Late Archaic period; Middle to Late Formative period (A.D. 640–1425); possibly protohistoric period	More than 8,000 surface artifacts were point-located; 13 features were tested during the Coconino National Forest volunteer project.
77/869	artifact scatter with two rock berms (agricultural?)	food processing	Archaic period; Formative period (A.D. 1075–1180)	No features were excavated.
85/428	four thermal features and an artifact scatter	hunting camp; food processing	Middle Archaic period; Formative period (Squaw Peak phase?)	All four features were excavated.
104/902	**Locus A:** artifact scatter with masonry structure and rock cluster of unknown function; **Locus B:** artifact scatter; **Locus C:** historical-period rock alignment with associated artifacts	hunting camp (Archaic period); field house (Formative period); temporary habitation (historical-period component)	Archaic period; Formative period (A.D. 1350–1400); **Locus C:** 1930s	The Locus A rock cluster was excavated.
105/838	**Locus A:** 3 pit structures and 8 thermal features; **Locus B:** 2 definite and 2 probable masonry structures and 11 rock features of uncertain function; **Locus C:** masonry structure	farmstead or field house in each locus	**Overall site:** ca. A.D. 1–1450, pre-1900; **Locus A:** Squaw Peak phase (A.D. 1–650) (Feature 37), Camp Verde phase (A.D. 900–1150); **Loci B and C:** Tuzigoot phase (A.D. 1300–1400/1425); possibly protohistoric period??	Locus A was entirely excavated; Locus B masonry structures and 2 rock clusters were excavated by volunteers.
131/37	artifact scatter and basalt quarry	lithic procurement, food processing	Formative period (A.D. 800–1200)	
133/561	**Locus A:** lithic scatter; **Locus B:** artifact concentration with possible subsurface midden; **Locus C:** roasting pit with artifact scatter	**Overall site:** lithic procurement; **Locus A:** hunting and plant-procurement and plant-processing camp; **Locus B:** possible habitation; **Locus C:** plant roasting.	**Locus A:** Middle and Late Archaic period; **Loci B and C:** Formative period; roasting pit in Locus C may date to the protohistoric period	Only Locus A was tested by Statistical Research, Inc.; a possible pit structure in Locus B found during geophysical subsurface survey was tested by volunteers and determined to be a midden or activity area.

continued on next page

Site No. (ASM/CNF)	Site Description	Site Function	Site Age	Comments
134/189	artifact scatter (primarily lithics) and 4 rock features (including 2 possible structures)	hunting camp; possible habitation (field houses)	Middle and Late Archaic period; Formative period (A.D. 1075–1125)	No features were excavated.
135/186	lithic scatter	food procurement and processing	Late Archaic period	
136/663	artifact scatter	hunting/gathering camp	Late Camp Verde or early Honanki phase (A.D. 1075–1200), based on 2 sherds and 1 projectile point	
137/482	flaked stone scatter	hunting/gathering camp	Middle Archaic period	The site was badly disturbed; it was in-completely documented because of its location on private land.

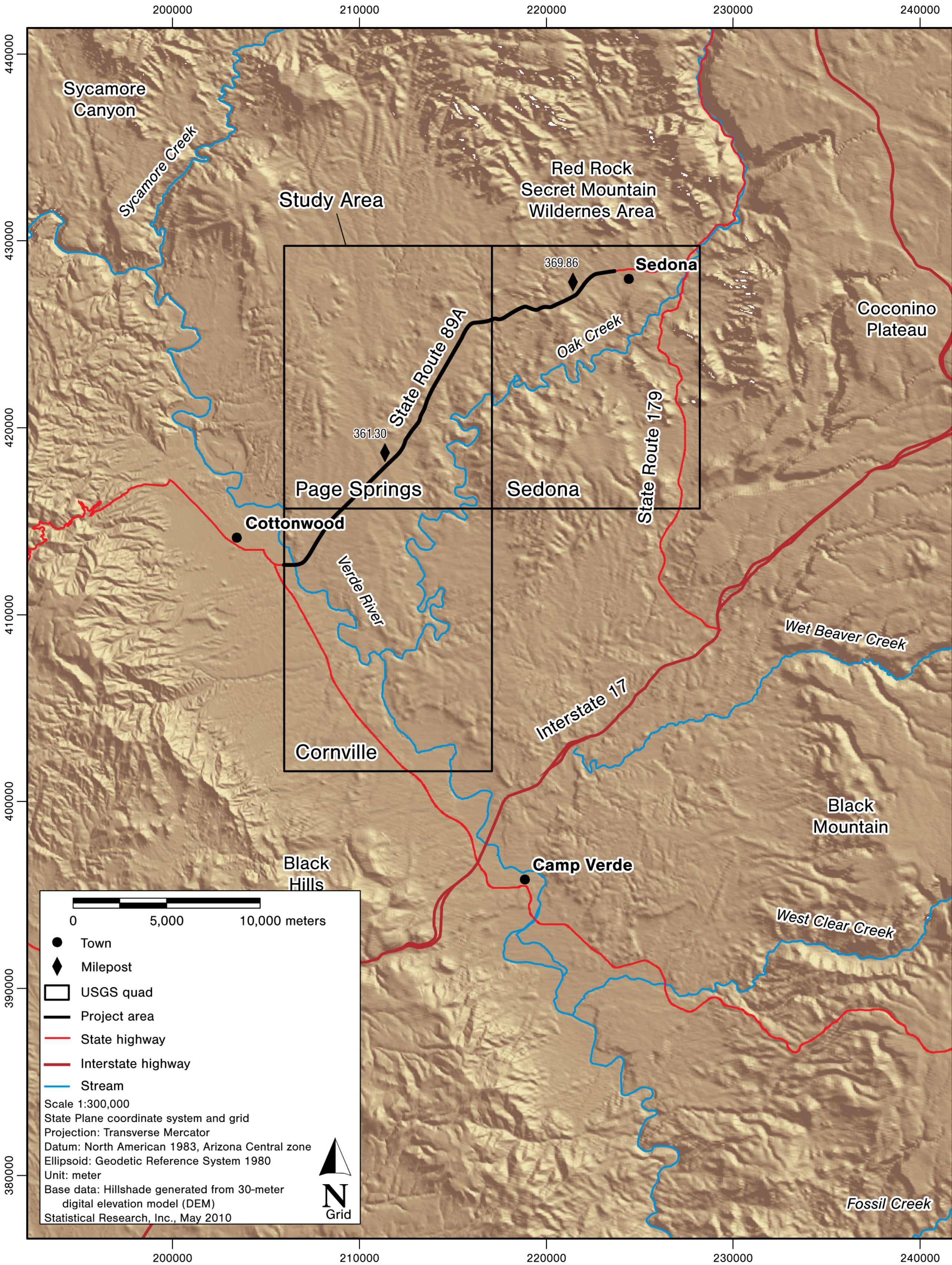

Figure 2. Map of the Verde River valley of central Arizona.

Southern Half

Beginning at Milepost 355.3, in the community of Cottonwood, the SR 89A project corridor crossed the Verde River at Bridgeport. The project corridor continued northeastward through approximately 5 miles of lowland plains before the terrain began to undulate as hills and tablelands. At that point, where juniper and agave appear within the assemblage of plant species, SRI encountered the first project sites. Six of the 13 project sites were located within the first 2.65 miles of this elevated terrain, in the vicinity of Spring Creek, between Mileposts 361.30 and 363.95: Site 104/902, AZ O:1:105/AR-03-04-06-838 (ASM/CNF) (Site 105/838), AZ O:1:85/AR-03-04-06-428 (ASM/CNF) (Site 85/428), AZ O:1:77/AR-03-04-06-869 (ASM/CNF) (Site 77/869), AZ O:1:131/AR-03-04-06-37 (ASM/CNF), and AZ O:1:53/AR-03-04-06-745 (ASM/CNF) (Site 53/745). These sites formed the southern cluster reported by Vanderpot in Chapters 5–10 of Volume 1 of this report. Two of these sites—Sites 105/838 and 85/428—were selected for further data recovery in Phase 2. Site 105/838 was a multicomponent farmstead along Spring Creek dating to the Early Formative period (Squaw Peak phase) (A.D. 1–650/700) and the Camp Verde (A.D. 900–1125/1150) and Honanki (A.D. 1150–1300) and/or Tuzigoot (A.D. 1300–1400/1425) phases. Three pit structures and several extramural features within the ADOT ROW were excavated. Additional structures and other features dating to the later Honanki/Tuzigoot phase were documented outside the ROW, and several of them were investigated after Phase 2 by amateur archaeologists from the Verde Valley Chapter of the Arizona Archaeological Society (VVAS), under SRI supervision. Site 85/428 was a multicomponent hunting camp and food-processing locale dating to the Middle Archaic and Early Formative periods and located along the ephemeral upper reaches of Spring Creek. It contained four thermal features, all of which were located within the ROW. All four were excavated. The features included the remains of a multiple-use roasting area and its clean-out debris, a rock-walled roasting pit with clean-out debris, and a slab-lined hearth. During and after completion of the Phase 2 fieldwork, VVAS-volunteer-aided investigations (under the supervision of Coconino National Forest [CNF] Archaeologist Dr. Peter Pilles) were also conducted outside the ADOT ROW at Site 53/745. Most of the work concentrated on the presumed Yavapai dwellings (wickiups, or *u-wá*) at this site. No conclusive information was obtained to support the inference that they were indeed structures. The results of the volunteer work at Site 53/745 were incorporated into the site description in Volume 1 of this report.

Northern Half

By Milepost 366, the project area had gained sufficient altitude that scattered pinyon, scrub oak, and a more diverse vegetative understory joined the mix of plant species. Seven of the 13 project sites were located in the hilly woodland terrain drained by Oak Creek and its tributary, Dry Creek: AZ O:1:28/AR-03-04-06-903 (ASM/CNF) (Site 28/903), AZ O:1:31/AR-03-04-06-244 (ASM/CNF), AZ O:1:133/AR-03-04-06-561 (ASM/CNF) (Site 133/561), Site 134/189, AZ O:1:135/AR-03-04-06-186 (ASM/CNF) (Site 135/186), AZ O:1:136/AR-03-04-06-663 (ASM/CNF), and AZ O:1:137/AR-03-04-06-482 (ASM/CNF) (Site 137/482). These sites were distributed along a 3.2-mile stretch between Mileposts 366.65 and 369.86, from the Dry Creek Bridge to Grasshopper Flat, in West Sedona. They formed the northern cluster of sites that are reported by Wegener and Vanderpot in Chapters 11–17 of Volume 1 of this report. One of these sites, Site 28/903, was selected for excavation during Phase 2. Site 28/903 was a base camp dating to the Late Archaic period and located along Dry Creek, adjacent to the Dry Creek Bridge. It contained a thermal feature and an extensive lithic scatter. The thermal feature (a subsurface hearth) was within the ROW, and it was excavated. During and after completion of the Phase 2 fieldwork, we conducted additional, VVAS-volunteer-aided investigations outside the ADOT ROW at Site 133/561. A possible feature in Locus B encountered during the subsurface geophysical survey at the site was tested but did not result in a positive feature designation.

The ADOT road-widening and -improvement project terminated at Milepost 370.9, near the intersection of SR 89A and Juniper Road, where the stunning red rock country begins. Deep in this country, a series of canyons carving Munds Mountain and the Secret Mountain Wilderness area—which mark the northern boundary of the LOCAP study area—sheltered cliff dwellings, such as Honanki and Palatki, that were built in late prehistoric times.

Research Domains

Volume 1 of this report contains the project’s introductory and background information, field and analytic methods, and descriptions of the 13 sites, along with a LOCAP site summary. Volume 2 sets forth the material-culture analyses; studies of faunal, pollen, and macrobotanical data; and geomorphological data and environmental studies associated with the 13 investigated sites. In Volume 3—the present document—we place the project sites and analysis results within the archaeological context of the MVRV. These chapters represent the synthetic and interpretive studies undertaken for the LOCAP, and each concludes with a research summary. The chapters directly address the research domains identified in Chapter 3, Volume 1 of this report (and summarized below) as most relevant for the project.

Cultural Landscapes

Our overarching research theme was the identification of cultural landscapes—the modified physical and biological environments created by cultural perceptions, beliefs, and interactions. Within this theme, we delineated four research domains. The first research domain was the archaeology of mobile forager-farmer peoples: discovering solutions to the methodological and interpretive challenges presented by small sites used for farming, resource procurement, and other specific purposes. We were particularly interested in how archaeologists can identify ephemeral surface sites, such as the camps of the historical-period Yavapai peoples who occupied the study area and the aceramic locales used by Archaic period hunters and gatherers. Incorporated into this research domain were questions about chronology, data-recovery methods, and cultural affiliation.

Land-Use Practices

The second research domain covered land-use practices. The LOCAP provided an excellent opportunity to study changes and consistency in land use over an extremely long interval of human occupation: *What resources were used? To what degree were ancient populations dependent on cultivated plant foods? Can we determine the seasons when sites were used and the sites' functions?* We were interested in assessing the sustainability of each group's land-use strategy and in comparing and contrasting the effectiveness of different strategies. Ancillary tasks included reconstructing ancient environments and studying the effects, positive or negative, of human interactions with the land and resources.

Early Agriculture

Related to land-use practices was the third research domain, that of early agriculture: *When were cultigens and agriculture introduced to the MVRV region? How does the date of introduction compare to those of other regions of the U.S. Southwest? What effects did agriculture have on the established lifestyles of the Archaic period occupants of the region, particularly in terms of mobility vs. sedentism?*

Native American History

The fourth research domain was Native American history. The Northeastern Yavapai and Northern Tonto Apache peoples used the LOCAP study area in historical-period times. They view Montezuma Well in the Verde River valley as their place of origin (Stein 1981). Furthermore, Hopi clan-migration stories place Palatkwapi, the Place of the Red Rocks, somewhere in the red rock country of the region. Fleeing the eventual destruction of Palatkwapi, Hopi peoples traveled northward along the route that Byrkit (1988) called the Palatkwapi Trail. The San Francisco Peaks, so integral to the Hopi sacred landscape, can be seen rising high above the Verde River valley.

Survey data suggested that some LOCAP sites may have been Yavapai or Apache campsites in the historical period. We were interested, therefore, in assessing archaeological evidence of occupation by these peoples and determining, if possible, their settlement and subsistence practices, evidence of interactions among these groups and with their nonnative neighbors, and the material characteristics of their lifestyles: *When did these groups enter the region, and what was the nature of their overlap, if any, with established prehistoric peoples?*

Project/Study Areas Defined

The following terms are used in this report to identify the different physical areas discussed in relation to this project. SRI refers to the entire data-recovery project as the LOCAP. We refer to ADOT's SR 89A road-improvement-project corridor as the "project corridor." Our specific "project area" (the LOCAP area) was the segment of the project corridor that contained the 13 sites investigated by SRI as well as portions of sites located outside the ADOT ROW that were also investigated by SRI (see Figure 1). Because our sites were not representative of all periods or site types known to exist in the Verde River valley, we also chose to examine—through archival means—a larger geographic area that included a greater range of variation and allowed us to understand our sites in a larger spatial and temporal framework. To allow for a two-level hierarchy of detail, we defined two larger analytic units. The first was our "immediate study area" (referred to as the study area), which included the northwestern portion of the MVRV; it is depicted on the three 7.5-minute USGS quadrangle maps (Page Springs, Sedona, and Cornville) encompassing the project area (see Figure 2). The second was the "expanded study area," and it is referred to as the MVRV. The MVRV is equivalent to the middle Verde River basin, beginning at the confluence of the Verde River with Sycamore Creek to the northwest and ending at the confluence of the Verde River with Fossil Creek to the southeast. The MVRV, as defined, is depicted on 18 7.5-minute USGS quadrangle maps (Sycamore Basin, Loy Butte, Wilson Mountain, Munds Park, Clarkdale, Page Springs, Sedona, Munds Mountain, Cottonwood, Cornville, Lake Montezuma, Casner Butter, Middle Verde, Camp Verde, Walker Mountain, Horner Mountain, Hackberry Mountain, and Verde Hot Springs), including the three maps that define the LOCAP study area (see Figure 3, Chapter 2, Volume 1 of this report).

A Note on Site Designations

All project sites carry multiple site designations. These include registration numbers conforming to systems managed by the Arizona State Museum (ASM), CNF, and, in some cases, the Museum of Northern Arizona (MNA) (e.g., NA5005). Throughout this report, we identify the project sites by composite numbers incorporating both their ASM and CNF designations but not those used by the MNA (for the MNA site numbers, the reader is referred to Table 1, Volume 1 of this report). The project area lies in a single survey quadrangle map used by the ASM (AZ O:1), and all project sites are located in the Sedona Ranger District of the CNF (AR-03-04-06). Therefore, in chapter headings and in the initial reference to a site within any chapter, we provide the full composite number, which includes the complete ASM site designation followed by the complete CNF site designation, concluding with the "ASM/CNF" suffix in parentheses (e.g., AZ O:1:137/AR-03-04-06-482 [ASM/CNF]). We have chosen to abbreviate the official designations assigned to a site by using only its site-specific number (e.g., Site 137/482) in the text, figure captions, and table titles; only the numbers (e.g., 137/482) are used in the tables and figures.

Volume Organization

The remainder of this volume is divided into seven chapters. Following this introduction, Stacey Lengyel presents a detailed overview of the project chronology. After a summary of the various methods used to place the LOCAP sites in time, she discusses the extant phase sequence for the MVRV and reviews the chronometric and archaeological data used to identify the temporal components at each site. These data are then compared to the regional phase sequence, to see how well they agree and how they add to our knowledge of the area's prehistory. In Chapter 3, Kerry Sagebiel and Stephanie Whittlesey tackle the difficult issue of affiliating Yavapai with certain pottery types—in particular, Tizon Wiped and Orme Ranch plain. The chapter examines how these types came to be associated with the Yavapai; what their defining attributes are; how they compare to ethnographically described Yavapai ceramics or those made by other, closely related groups, such as the Western Apache; and what the chronometric dates associated with these types contribute to this study.

Chapter 4 provides a dendroclimatic reconstruction for the MVRV. The goal of this chapter is to identify climatic episodes that initiated changes in water availability and thereby influenced sustainable settlement. Author Carla Van West identifies archaeological correlates for precipitation and temperature patterns from the final years of the Squaw Peak phase through the historical period. In Chapter 5, Van West integrates the dendroclimatic reconstruction with other sources of paleoenvironmental information (i.e., stream-flow reconstruction, flood history, faunal and botanical use, and palynological data) to narrate a history of environmental change in the MVRV. In Chapter 6, Van West presents an exhaustive overview of prehistoric settlement and land use in the MVRV. Using 18 USGS topographic maps covering the MVRV, Van West created a geographic information systems– (GIS-) compatible archaeological landscape database to discern patterns of settlement and land use through time, to compare temporal patterns of land use to the distributions of important environmental variables, and to correlate contemporary trends and extremes within the reconstructed local climate and stream flow presented in Chapters 4 and 5.

Chapter 7 introduces Native American perspectives on historical-period land use. The chapter consists of three parts. First, former Director of the Cultural Preservation Office of the Hopi Tribe, Leigh Kuwanwisiwma, discusses the importance of the Verde River valley in Hopi history. Integrating scholarly research with the Hopi world view, Kuwanwisiwma weaves a compelling story of Sakwaskyavi, the Place of the Blue-Green Valley. Next, Yavapai-Apache Elder David Sine presents a Yavapai oral history of life in the Verde River valley, mixing family stories with tribal memory. Third, Vincent Randall describes what it was (and is) like to be a Tonto Apache living in the Verde River valley. Finally, Chapter 8 recaps the project results, highlighting its major contributions to Verde River valley archaeology. The original research design is revisited, and the various research themes and domains that were most adequately addressed by the investigations are identified and reassessed.

This volume also includes three appendixes. Appendix A summarizes the extant data for the dendroclimatic reconstruction presented in Chapter 4. Appendix B is associated with Chapter 6 and consists of a series of look-up tables summarizing data for the Terrestrial Ecosystem Survey (TES) units of the CNF and Prescott National Forest (PNF) and for those TES units whose soils were mapped by the Natural Resources Conservation Service (NRCS), Soil Survey Office, in Flagstaff. Appendix C provides descriptions of the sites and site components, by time period, serving as a second companion to Chapter 6.

Recommended Reading

The eight chapters presented in this third and final volume of the SR 89A report were drafted at various times between 2005 and 2011, with edits made to final drafts in 2018 and

2019. We sincerely wish that the information contained in this volume could have been made available to interested readers many years ago; some data presented herein should be updated by more-recent efforts. Publications are often delayed because of lack of funding, higher priority efforts, a dearth of staff to conduct the work, delayed but necessary peer reviews, and sometimes a combination of some or all of these. We experienced most of these common problems with the production of this volume. Nevertheless, we believe the data and interpretations contained in this report remain solid, well-reasoned contributions to our understanding of the precontact history of the middle Verde River valley and will be useful to future researchers.

The references that we minimally would have incorporated had we access to them prior to our contract deadline are included in a "Recommended Reading" list at the end of the volume. We acknowledge the important contributions made by both professional archaeologists and dedicated amateurs, many of whom we now consider professional colleagues and collaborators.

CHAPTER 2

Project Chronology

Stacey Lengyel

Time is an intrinsic element of the archaeological record and must be considered in any synthesis of archaeological data. Whether the primary interest is in diachronic change or synchronic comparisons, the time element must be accounted for. This is particularly important for such projects as the current one, which draws on data that span 4,000 years or more of prehistory. How one characterizes the time element, however, depends in part on the preference of the researcher and the goals of the project. Many researchers have found it useful to categorize data, collections, and sites within the artificial divisions of the cultural-phase sequence (e.g., Breternitz 1960a; Pilles 1981a, 1996a). Other researchers, myself included, find it more useful to discuss data with reference to the Christian calendar and within broad developmental periods (e.g., Weaver 2000).

One of the goals of this analysis was to use archaeological data recovered from the LOCAP to refine the extant phase systematics for the MVRV (Van West et al. 2018:62). In part, this was to be accomplished by developing a refined and chronometrically based chronology for the LOCAP sites. To this end, every effort was made to identify good archaeological contexts for chronometric dating (Van West et al. 2018:62); unfortunately, few such contexts were encountered at the LOCAP sites. Instead, much of the project had to be dated via data from temporally diagnostic artifacts. In an effort to avoid the blatant circularity of using artifact data to both date a context and place it within a specific phase, this analysis focused on the primary agenda of placing LOCAP contexts in time. Once a context was dated, contemporary phases were identified so that collections could be compared. In the end, this analysis illustrated some of the problems associated with the MVRV phase system and with phase systematics, in general.

This chapter first presents a summary of the chronometric and archaeological methods used to place the individual LOCAP sites in time. Next, an overview of the extant phase sequence for the MVRV is presented. This is followed by an overview of the chronometric and archaeological data used to identify temporal components at each site. Finally, the LOCAP chronometric and archaeological data are compared to the regional phase sequence to ascertain how well they agree and to determine how the LOCAP findings augment our knowledge of prehistory in this area.

Methods

A variety of chronometric- and archaeological-dating techniques were used to develop the LOCAP site chronologies and to assess the existing phase sequence. The individual chronometric methods and results are discussed in Volumes 1 and 2 and are only briefly recapped here. Whenever possible, I utilized chronometric data to assess the temporal component(s) of a particular site. The primary chronometric techniques employed in this study include archaeomagnetic (AM), radiocarbon, and thermoluminescence dating. The use of these techniques, however, was severely restricted by the paucity of appropriate archaeological contexts encountered in the project area. In many cases, I was forced to rely on archaeological-dating techniques to determine when a site or context may have been used.

The techniques employed in this study differ in resolution, in their abilities to date certain materials, and in their relevance to particular questions of archaeological interest. For all techniques, it was necessary to ascertain the relationship between the event dated by the technique (dated event) and the archaeological event of interest (target event). In all cases, it is fairly easy to link the dated event to some archaeologically significant event, but such an event may not be the same as the target event. Both AM and radiocarbon data can be related to the use or abandonment of specific features, which may be the target event, in many cases. Thermoluminescence data from pottery, on the other hand, relate to the production of specific ceramic artifacts rather than to the discard behavior that added them to the archaeological record. Although this technique provides a means for directly dating specific artifacts, it does not necessarily answer the question of how or when those artifacts were deposited in the locations from which they were recovered. Ceramic artifacts can be curated or collected and deposited by later groups, in which case the date of manufacture would have no relevance to on-site use.

It must be recognized that artifact dating is the most problematic of the methods employed in this study. Several assumptions and bridging arguments must be made to link the target event (e.g., site or feature use) with the dated event (e.g., manufacture and use of the artifact). Artifact styles are only temporally sensitive in that they are manufactured within a particular social environment at a particular point in time. A style in question is encoded with information that is socially meaningful within that environment. What we date is the time during which that information had a social meaning or the time that a particular style was in vogue. How and when an artifact bearing that style ended up within a particular depositional context are questions that need to be addressed through other archaeological information. It cannot be assumed, although it often is, that the artifact in question was used and deposited during the time associated with its style. Many behavioral and natural processes can lead to redepositional episodes, such as recycling of projectile points or ceramic sherds or erosion and transport of deposits to new areas. Therefore, the artifact dates presented in this chapter are supplied as additional chronological information for their respective sites or site components. They are not meant to imply that the artifacts were deposited in the recovery locales during the periods of time indicated. The inference that a group of sherds, for instance, originated in a localized pot bust is strengthened when a large number of sherds of the same type are recovered from a single locale. However, the temporal relationship between the manufacture of the pot and its breakage and deposition in the recovery locale is unknown. Realistically, a given artifact could have been deposited at any point after it was created. The associated production dates are offered as guidelines and hypotheses for when activities may have taken place at a given locale.

AM Dating

AM dating is a regional pattern-matching technique in which magnetic directions recovered from contexts of unknown age are matched against temporally calibrated records of change (Sternberg 1997). The principles of archaeomagnetism are outlined in Eighmy and Sternberg (1990), and the analytical procedures employed for this data set are discussed in Appendix E of Volume 1. Briefly, archaeomagnetism depends on two related phenomena. First, the earth's magnetic field changes in direction and strength through time. This is known as secular variation and is usually conceptualized as changes in the position of the north magnetic pole. Second, soils contain magnetic particles that can record the direction of the magnetic field under certain circumstances and thereby provide records of past directions of the geomagnetic field. In the Southwest, we are primarily interested in the magnetic signals acquired by archaeological materials during heating. When such materials are heated above several hundred degrees centigrade, the ferromagnetic minerals become remagnetized parallel with the extant magnetic field. After cooling, this realignment is locked into place until the feature is reheated. Thus, the direction of magnetic remanence that is measured in the laboratory is related to the last time the feature was heated to sufficiently high temperatures. This is usually conceptualized as the last use of the feature.

Nine AM samples were collected from six features at two sites in the project area (see Appendix E, Volume 1). Eight samples were collected from features at AZ O:1:105/AR-03-04-06-838 (ASM/CNF) (Site 105/838), and the ninth was collected from an *horno* (Feature 4) at AZ O:1:85/AR-03-04-06-428 (ASM/CNF) (Site 85/428) (Table 2). The samples were measured at the University of Arizona Paleomagnetic Laboratory, and the data were analyzed by SRI. Appendix E of Volume 1 details the measurement, analysis, and interpretive techniques used and provides the dating report for each sample. Typically, each sample consisted of between 8 and 12 individually oriented specimens that represented the same archaeological event (e.g., the last firing of a sampled hearth). Each specimen was measured, and the measurements from the specimens were averaged to obtain the sample mean. Each mean was then converted to a virtual geomagnetic pole (VGP), which is simply the location of the magnetic pole that would have created the sample mean.

The LOCAP AM samples were dated by statistically comparing (Sternberg 1982; Sternberg and McGuire 1990) their calculated VGPs with the Southwest AM-dating curve, SWCV595 (LaBelle and Eighmy 1997). Six of the nine samples could be dated in this way (Figure 3; see Table 2). Three samples from Site 105/838 could not be dated against the curve. Two of these samples were collected from Features 31 and 40 at Site 105/838, and they could not be dated because they did not possess robust and reliable magnetic signatures. The third sample was collected from hearth Feature 23.05, and although this sample had a very strong and precise magnetic signature, its VGP was located too far from the dating curve to yield a statistical date, probably because of the imprecision of the curve and the tendency for the curve-building statistics to restrain the amplitude of looped segments of the curve (Lengyel and Eighmy 2002), such as in the A.D. 1050–1150 segment located near the Feature 23.05 VGP. In addition,

Table 2. Archaeomagnetic Results from Features

Feature No., by Site No. (ASM/CNF)	Feature Type	Alpha 95 (degrees)	Plat (degrees)	Plong (degrees)	K	Date-Range Options (A.D.)
105/838						
23	walls	1.50	79.93	208.53	652.86	1010–1040; 1185–1315
23.05	hearth	1.40	75.39	211.51	1,052.36	no date
23.39	hearth	8.30	75.47	182.58	39.33	935–1340
23	(composite)	1.40	78.32	210.43	330.66	1010–1040; 1235–1265
29.02	hearth	2.30	81.29	212.60	385.06	935–1040; 1185–1390
29.06	hearth	1.80	80.37	214.77	663.41	985–1040; 1235–1315; 1335–1365
29	(composite)	1.40	81.13	213.77	495.19	935–1040; 1235–1365
31	roasting pit	14.30	10.23	73.88	310.84	no date
37	floor	1.90	83.07	326.04	436.27	585–690; 1760–1815
40	horno	37.70	78.99	82.31	2.29	no date
85/428						
4	horno	5.50	80.92	338.38	101.14	585–690; 935–990; 1760–1890

Key: K = sample precision; Plat = VGP paleolatitude; Plong = VGP paleolongitude; VGP = virtual geomagnetic pole.

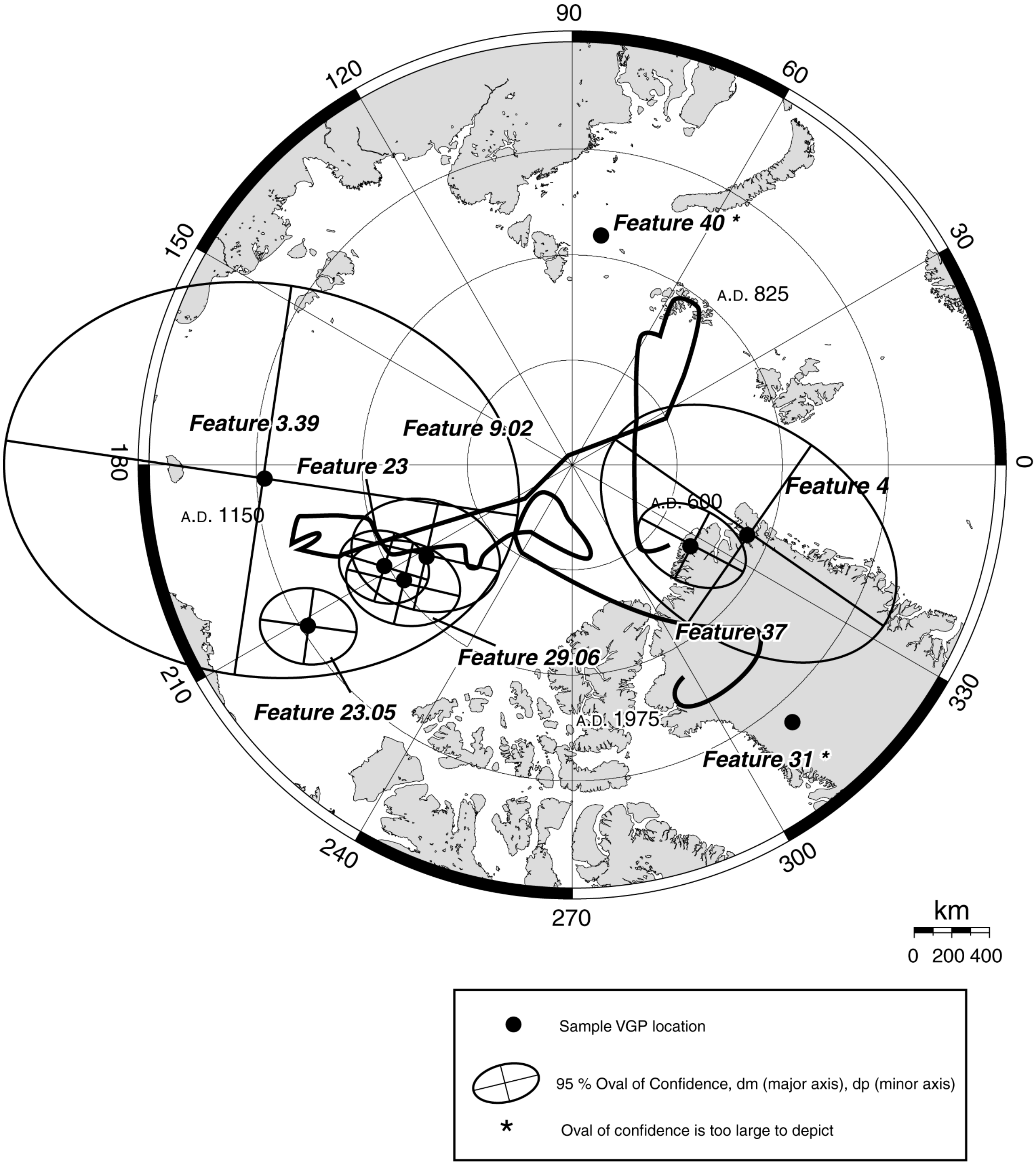

Figure 3. The location of the nine archaeomagnetic-sample virtual geomagnetic poles plotted against the Southwest dating curve, SWCV595. Note that the samples from Features 31 and 40 are too imprecise to be dated against the curve; their associated ovals of confidence are not depicted.

composite mean dates were calculated for the samples collected from Features 23 and 29 at Site 105/838. These composite means are based on the averaged data from all specimens collected from each structure, and they represent the mean abandonment date for each structure.

The meandering nature of secular variation, as reflected by loops in the curve, also can result in multiple dating options for some samples. There is no way to determine which option is correct for a particular archaeological context without referring to some other source of chronometric information (e.g., recovered artifacts, associated architectural style, or associated radiocarbon dates). Similarly, it is possible to obtain spurious dating options for contexts that predate the calibrated curve (i.e., pre-A.D. 600), again because of the tendency for secular variation to loop back on itself through time. This problem most likely does not affect the dating of the contexts included in this study.

Radiocarbon Dating

Seven botanical samples were submitted to Beta Analytic, Inc., for radiocarbon dating, but only five samples proved suitable for dating (Table 3). Laboratory reports are presented in Appendix F of Volume 1. Three of the dated samples were submitted for standard radiometric dating with extended counting, and two were submitted for accelerator mass spectrometry (AMS) dating. The $^{13}C/^{12}C$ stable-isotope ratio was measured in all four samples to control for fractionation of radiocarbon absorption by different plants. I used the 95 percent confidence calibration date ranges provided by Beta Analytic, Inc., for each sample. These calibrations were made using the Pretoria Calibration Procedures (Talma and Vogel 1993) and the atmospheric radiocarbon data set, IntCal98 (Stuiver et al. 1998).

Two of the dated samples were collected from a pit structure (Feature 23) at Site 105/838, one was recovered from a second pit structure (Feature 37) at Site 105/838, one was recovered from a roasting pit (Feature 2) at Site 85/428, and one was recovered from a roasting pit (Feature 1) at AZ O:1:133/AR-03-04-06-561 (ASM/CNF) (Site 133/561). Every attempt was made to collect samples from primary archaeological contexts that would date the archaeological events of interest most closely (e.g., burned structural debris from the floor of a pit house, charred annuals or fuel-wood from the base of a thermal feature, etc.). Care was given to the types of materials dated, as well, with preference given to annuals when available. In most cases, however, only fuelwood or structural wood was available for dating. The samples were submitted in two rounds: the first set was submitted soon after the main phase of fieldwork was completed, and the second was submitted after the analysis of macrobotanical specimens from bulk sediment samples was completed.

Two of the samples from Site 105/838 were collected from Feature 23, a pit structure. The internal consistency of the calibrated dates was tested using the procedures built into the calibration program, CALIB, Version 5.0.1 (Stuiver and Reimer 1993), and the sample dates were found to be statistically similar at the 95 percent confidence level. The results were then pooled and calibrated through the same program, using the calibration curve, IntCal04 (Reimer et al. 2004), and no smoothing, to obtain the mean 2σ calibrated date of A.D. 1037–1264 for the pit structure. This pooled date is a more precise, and presumably more accurate, measure of the age of this structure.

The third sample from Site 105/838 was collected from pit structure Feature 37. The AM data and recovered artifacts suggested that this structure had been utilized during

Table 3. Radiocarbon Results from Features

Feature No., by Site No. (ASM/CNF)	Material	Sample Number	$\delta^{13}C$ (‰)	^{14}C Age (years B.P.)	Calibrated Age (2σ)
85/428					
2	*Zea mays*	Beta-208190[a]	-10.3	1,560 ± 40	cal. A.D. 410–600
105/838					
23	*Populus/Salix*	Beta-131270	-26.5	760 ± 100	cal. A.D. 1040–1410
23.24	*Populus/Salix*	Beta-131271	-26.5	960 ± 80	cal. A.D. 970–1260
29.24[b]	juniper charcoal				
37	*Zea mays*	Beta-209213[a]	-10.4	1,560 ± 40	cal. A.D. 410–600
133/561					
1	*Pinus* charcoal	Beta-208191	-21.8	270 ± 40	cal. A.D. 1510–1600, 1620–1670, 1780–1800
28/903					
Trench profile[b]	*Pinus* charcoal				

[a] Accelerator mass spectrometry assay.

[b] Sample contained too little carbon for dating.

the early part of the Formative period. If true, this would be one of the few excavated structures from this time period. The AM curve only extends back to A.D. 585, and it was unknown whether this structure could predate the curve. For that reason, several charred maize cupules that were recovered from the feature's fill were submitted for AMS dating. The 2σ calibrated date range that was returned for this sample confirmed the belief that this feature dated to the early Formative period and, therefore, predated the AM curve.

It was thought that roasting pit Feature 2 from Site 85/428 most likely dated to the early part of the Formative period, as well. Several charred maize cupules were recovered from the feature's fill and provided appropriate material for dating. Few radiocarbon dates have been obtained from this period for the MVRV, and we felt it was important to try to add to our understanding of this period. Furthermore, in dating a maize sample, we possibly could help to substantiate the few dates for the beginning of maize agriculture in this area. The 2σ calibrated date range that was returned for this sample confirmed the belief that this feature dated to the early Formative period. It also indicated that at least some maize agriculture was conducted in this area prior to A.D. 600, as suggested by Logan and Horton (1996:41–45).

The final sample was collected from Feature 1 of Site 133/561 in an attempt to verify that this roasting pit was protohistoric period in age, as suggested by nearby artifacts. Although we recognize the difficulties with obtaining precise radiocarbon dates from protohistoric period and historical-period contexts, our primary interest in dating this feature was to determine whether it was at least protohistoric period in age, rather than prehistoric. As discussed below, this feature was located outside the ROW and could not be excavated; however, charcoal was recovered from a rodent hole that tunneled into the base of the feature, and we are fairly confident that the submitted sample related to the use of the feature. The 2σ calibrated date range that was returned for this sample confirmed that this feature postdated A.D. 1500 and was either protohistoric or historical period in age.

Thermoluminescence Dating

Six sherds from AZ O:1:53/AR-03-04-06-745 (ASM/CNF) (Site 53/745) and one sherd from Site 133/561 (Table 4) were submitted to the University of Washington Luminescence Dating Laboratory for thermoluminescence- (TL-) dating analysis (see Appendix C, Volume 2, for details). The sherds and their associated sediments were collected from the modern surface of the two sites and consisted of two prehistoric wares, one prehistoric/protohistoric period ware, and two temporally uncertain wares (Orme Ranch Plain and Tizon Wiped). The objective of the analysis was to obtain age estimates for the two Orme Ranch Plain sherds and the two Tizon Wiped sherds in order to better assess how these wares fit into the use history of the two sites. Currently, the date range for Orme Ranch Plain is uncertain; some researchers have proposed that the type dates specifically to the historical period (Breternitz 1960b), and others have suggested that it could be prehistoric in origin (Pilles and McKie 1998; Whittlesey and Benaron 1998:159). The dating of Tizon Wiped is also somewhat uncertain, and it is thought to be primarily a protohistoric period and historical-period type that may have origins in prehistory (Dobyns and Euler 1958; Whittlesey and Benaron 1998:159). The TL analysis was undertaken to determine whether these four sherds were prehistoric (pre-A.D. 1450), protohistoric period (A.D. 1450–ca. 1540), or historical period (post-A.D. 1540) in age. The three well-dated sherds were submitted as controls for the TL method. It should be noted that our primary interest in dating these sherds was to obtain further temporal information on the two poorly dated types, rather than to try to date specific archaeological contexts. The returned TL-date ranges provided added temporal constraints on site use but may not have related directly to the processes that brought these sherds to the sites.

At first glance, the TL-date ranges resulting from this analysis appeared to be somewhat scattered (see Table 4). The date ranges of the two prehistoric sherds overlapped

Table 4. Ceramic Type, Age Range, and Thermoluminescence Age for Sherds Submitted for Thermoluminescence Dating

University of Washington Laboratory No.	Site No. (ASM/CNF)	Ceramic Type	Age Range	Thermoluminescence Age (A.D.) (1σ)
UW557	53/745	Deadmans Black-on-red	A.D. 900–1100	1041 ± 79
UW558	53/745	Black Mesa Black-on-white	A.D. 900–1160	1172 ± 61
UW559	53/745	Jeddito Corrugated	A.D. 1300–1625	1676 ± 30
UW560	53/745	Orme Ranch	unknown	1608 ± 51
UW561	53/745	Orme Ranch	unknown	1155 ± 99
UW562	53/745	Tizon Wiped	unknown	1128 ± 66
UW563	133/561	Tizon Wiped	unknown	1791 ± 29

with the accepted date ranges for their respective types; however, the date range for the Jeddito Corrugated sherd seemed to be somewhat later than expected (maximum age of A.D. 1646). The two Orme Ranch Plain sherds exhibited widely different date ranges separated by at least 300 years, although we expected them to have similar dates. Finally, although the Tizon Wiped sherds were recovered from different sites, they appear to represent prehistoric and historical-period occupations separated by at least 570 years. If these dates are correct, then this is clearly a very long-lived type.

Before accepting these TL dates as accurate estimates of the ages of the submitted sherds, I investigated potential sources of error that could have affected the returned date ranges. There was some concern that the use of surface artifacts for TL dating could have introduced some error. Conventional wisdom suggests that artifacts should be located at least 30 cm below the surface and within fairly homogenous soils (Aitken 1997:188–189). This practice is suggested to simplify the effects of background radiation absorbed from the surrounding matrix and from cosmic rays. However, Dunnell and Feathers (1994) argued convincingly that surface sherds provide excellent opportunities for TL dating and, in some cases, are to be preferred over sherds from buried contexts. They point out that because most buried contexts started off at the surface and were buried through subsequent depositional processes, buried contexts may actually be more complex than those on the modern-day surface (Dunnell and Feathers 1994:131–132). Recently, Seymour (2003) and Dykeman et al. (2002) have run a number of tests on the accuracy of TL dating of surface artifacts. Both of these studies indicated good agreement between the TL dates and the known or target dates or date ranges, and both studies emphasized the usefulness of employing TL dating with protohistoric period and historical-period sherds.

A second potential source of error comes from the variable contribution of radiation from the underlying soil matrix. The sherds from Site 53/745 were of particular concern, because basalt regoliths are located within 15–30 cm of the surface across most of this site. However, only the sheetwash gravels at the site's surface were collected for submission with associated sherds. It was thought that the difference between the mineralogy of the regoliths and the sheetwash could have led to a gross underestimate of the gamma-dose contribution to the total TL signal measured in each sherd. This, in turn, potentially could result in erroneously old TL dates. However, because the gamma contribution to the total dose rates was less than 10 percent for all of the sherds from Site 53/745, the effects of the basalt on sherd radiation was trivial (Feathers, personal communication 2005).

The final identified source of potential error was the presence of anomalous fading in two of the submitted sherds (UW559 and UW560). Anomalous fading refers to the inability of a crystalline material to retain the TL signal in the absence of a zeroing event, such as heating or illumination (Aitken 1997:210). Potassium feldspars are particularly prone to exhibiting anomalous fading, and it is usually recommended that quartz-grain inclusions be used for TL studies of younger specimens, because the latent TL signal is generally more stable in these minerals (Aitken 1974; Wintle 1973). Furthermore, by focusing on coarse quartz inclusions, one is able to increase the signal to noise ratio and to employ more-sensitive measurement techniques for recent samples (Feathers and Rhode 1998:289–290). Unfortunately, this technique was not used to analyze the seven sherds submitted for this project. Instead, these sherds were analyzed via the fine-grained technique, which has a higher likelihood of including feldspars in the analyzed sample (Aitken 1997:195). This is most likely the source of the anomalous fading noted for the Jeddito Corrugated (UW559) and one of the Orme Ranch Plain (UW560) sherds. Because sherds that exhibit anomalous fading may greatly underestimate the true age of firing, the TL ages for both of these sherds should be considered to be minimum estimates. They very well could be older than the seventeenth-century (A.D.) ages obtained from this study.

Overall, the validity of the TL dating for this project is supported by the dates returned for the two well-dated prehistoric sherds. Furthermore, the date returned for the Tizon Wiped sherd from Site 133/561 is in agreement with the historical-period age of other sherds of this type (Dobyns and Euler 1958). The Jeddito Corrugated date is slightly later than the accepted date range for this type, but when the affects of anomalous fading are taken into account, it appears likely that this sherd does, in fact, fall within the accepted age range. Likewise, the TL date returned for sample UW560 agrees with the hypothesized protohistoric period/historical-period age for Orme Ranch Plain. Because of anomalous fading, the true age of this sherd is probably somewhat older than the returned TL date, but it is likely that it still falls within the protohistoric or early historical period. The only sherds that appear to have returned surprising dates are the Tizon Wiped sherd from Site 53/745 and the second Orme Ranch Plain sherd. Both of these sherds returned TL dates that are somewhat earlier than the postulated date ranges. However, it has been hypothesized that both of these ceramic types originated in prehistoric times, and the TL dates seem to support this conjecture. It also should be noted that the only source of error that I could confidently identify would cause an underestimation of age rather than the overestimation that would account for the apparently early ages of these two sherds. Therefore, the TL dates for these two early sherds should be taken as accurate age estimates at this time.

Archaeological Dating

The archaeological-dating methods employed in this study rely on technological and stylistic changes in material culture to place objects in time. The potential resolution of these methods is variable and depends in part on how long particular styles persisted. Some styles changed rapidly and allow us to define relatively brief periods of use. Other styles persisted for hundreds or thousands of years and allow us to define only general periods of use. Because archaeological styles are not innately chronometric, the resolution of archaeological-dating methods also relies on how well archaeological studies have been able to date them. For instance, tree-ring-dated styles typically have a much more refined period of use than radiocarbon-dated styles. Of the artifact types recovered from the LOCAP, ceramics and projectile points proved to be the most useful for constructing the individual site chronologies.

Ceramics

Ceramic dating has had a long history of use in the Southwest. Years of archaeological investigations have provided a firm understanding of when particular styles were manufactured and used. In many cases, well-dated ceramic styles have formed the backbone of regional phase sequences and cultural periods. Furthermore, the presence of pottery is a key characteristic used to define the Formative period, or stage of cultural development, in the Southwest (Deaver and Ciolek-Torrello 1995).

The ceramic data for each site are reported in Chapter 2 of Volume 2, and the production-date ranges used in this analysis are listed in Table 10 of that chapter. Two methods were used to date the ceramic collections at LOCAP sites. For sites or site loci with few (<30) datable ceramic artifacts, a simple graphical method was used to ascertain the probable age(s) of a context or site (see McCartney et al. [1994:24–25] for a discussion). In this method, the researcher reviews the production ranges of the identified pottery types to determine whether one component or more than one component is represented in the collection. If all of the production ranges overlap, the collection is considered to be unmixed, and the overlap interval is thought to represent the best age estimate for the context or site. If nonoverlapping production ranges exist, the collection is considered to be mixed, and separate interval ranges are calculated for each set of overlapping types.

For sites and contexts with over 30 datable ceramics, a probability-dating method was used to deduce the most likely span within which pottery was used and discarded at the site. The probability method used here involved modeling the production ranges of the pottery types from a site or context as a composite probability curve. The individual production ranges were treated as flat, uniform probability curves. For the purposes of the analysis, it was assumed that there was a 100 percent probability that production occurred within the published interval and a 0 percent probability that it occurred outside this interval. The probability that a particular type was produced during any single year within the interval is then 1 divided by the total interval range. This approach has the advantage that long-lived or imprecisely dated types contribute less to the composite probability curve than shorter-lived and more-precisely dated types. Additionally, the sherd frequency for each type is taken into consideration by multiplying the probability for each year within the interval by the number of sherds from that type. Thus, the probability that 2 sherds from a ceramic type with a 50-year production range were used or deposited during any year within that interval is 1 divided by 50 times 2, or 0.04.

The composite probability curve generated for each site or context represents the sum of the individual probabilities of all the datable sherds from that site or context. It is standardized to 1 by dividing the total value for each year by the total area under the curve. The 1σ ceramic-date (CD_{68}) range and the 2σ ceramic-date (CD_{95}) range for the site or context include those intervals with pooled probabilities between 0.158 and 0.841 and between 0.025 and 0.975, respectively.

Flaked Stone

As with ceramics, regional sequences of flaked stone tools have long been used for chronology building. These regional sequences tend to be better developed in other areas of the United States (see Justice 1987) but can still provide useful temporal information for sites in the Southwest. Projectile point styles, in particular, have served as valuable markers for preceramic sites, and in some cases, they may be the only temporal indicators recovered from a site. Typically, projectile point styles changed slowly and had long periods of production and use. As a consequence, they primarily were used in this study to identify activity that took place within fairly broad cultural periods, namely the Middle Archaic, Late Archaic, and Formative periods.

Overview of Regional Chronology

The MVRV probably has been occupied since Paleoindian times (ca. 12,000–8000 B.C.), although not much is known about these early groups. The subsequent Archaic period (8000 B.C.–A.D. 1) is much better known. During this time, the region was populated by small, mobile groups that had a subsistence strategy focused on the gathering of wild plant foods and supplemented by hunting. By the Late

Archaic period, these groups were probably long-term, year-round residents of the area (Weaver 2000:231).

By A.D. 650, ceramic-bearing agriculturalists had appeared in the region (Breternitz 1960a; Fish and Fish 1977; Van West et al. 2018; Weaver 2000). It is probable that maize agriculture was practiced in this area prior to A.D. 650 (Logan and Horton 1996; Van West et al. 2018), but this earlier period is relatively unknown. The period between A.D. 800 and 1450 is much better understood (Pilles 1996a). A strong Hohokam influence is apparent in much of the region by A.D. 800 (Breternitz 1960a) but declines and disappears by A.D. 1150. Characteristics attributed to the Southern Sinagua were also present by A.D. 800 and persisted through the remainder of the prehistoric period (Pilles 1981a). By A.D. 1150, aboveground masonry structures were built in the area, and multistoried masonry pueblos appeared by A.D. 1300. The region appears to have been abandoned by Sinagua groups by A.D. 1450, although it was occupied by Yavapai groups into protohistoric period and historical-period times.

Obviously, the generalized culture-history overview presented above does little more than highlight sweeping changes in this region. A more detailed listing of the material-culture attributes associated with these blocks of time is presented in the existing regional phase sequences (Breternitz 1960a; Fish and Fish 1977; Pilles 1981a, 1996a; Tagg 1986). The named phases typically start in the Late Archaic period with the Dry Creek phase, followed by six phases in the Formative period: Squaw Peak, Hackberry, Cloverleaf, Camp Verde, Honanki, and Tuzigoot. Material culture and/or chronometric information from LOCAP sites indicate that all seven of these phases are represented within the project area to some extent and that Middle Archaic and protohistoric period site use may have occurred, as well. The material-culture traits that have been used to define these phases, as well as the associated chronology, are recapped below.

Late Archaic Period: Dry Creek Phase (2000 B.C.–A.D. 1)

The Dry Creek phase spans the Late Archaic period. As in other regions of the Southwest, it is characterized by a preceramic, preagricultural adaptation and by a suite of material-culture attributes that is frustratingly similar to those of later nomadic groups in the area. Lithic technology is primarily focused on core reduction, although some tools are also manufactured from flakes. Scrapers, choppers, flake knives, drills, bifaces, flaked hoes, gravers, scraper planes, hammerstones, grinding stones, basin metates, and oval, one-handed manos have been found at Dry Creek sites. Projectile points associated with the Late Archaic period and found at Dry Creek sites are typically thick and leaf shaped, and they may have serrated edges. Diagnostic types include Elko- and San Pedro-style projectile points. No structures have been encountered, but both shallow, basin-shaped, slab-lined roasting pits and fire-cracked-rock- (FCR-) filled hearths have been attributed to this phase. In at least three cases, east-facing, flexed burials have been recovered from contexts assigned to the Dry Creek phase (Weaver 2000).

Archaeologists have been frustrated by the lack of solid chronometric dates for contexts assigned to this phase (Dosh and Weaver 1979; Motsinger and Mitchell 1994a; Weaver 2000). Although a number of sites have been assigned to the Archaic period and/or the Dry Creek phase, few have been extensively tested or analyzed. Because many of the characteristics used to assign contexts to this phase are similar to those of later Yavapai or Apache cultural groups, it is vital that archaeologists obtain solid chronometric data for these contexts. Unfortunately, this is often difficult to do, because many possible Archaic period components consist solely of surface lithic scatters.

Formative Period

Squaw Peak Phase (A.D. 1–650/700)

Little is known about the Squaw Peak phase. Originally, it was proposed to fill the gap between the hypothetical end of the Dry Creek phase at A.D. 1 and the first appearance of ceramics in the region by roughly A.D. 700. Breternitz (1960a:21) defined it as the local version of Basketmaker II, and he equated it with a preceramic, agricultural adaptation. The trait list for this phase was based on the findings from two excavated pit structures and included subfloor, bell-shaped storage pits; round to oval manos and hand stones; grinding slabs and stones; flake knives/scrapers; and a lack of ceramics (Breternitz 1960a:21). Domestic architecture is represented by shallow, round surface pit structures or surface structures (Breternitz 1960a:Figure 17; Deats 2011:3.2; see Figure 48, Chapter 6, Volume 1 of this report). No single-component site has been identified that confidently can be assigned to the Squaw Peak phase, although a few radiocarbon-dated components recently have been assigned to it (Edwards et al. 2004; Logan and Horton 1996, 2000). These investigations have added flexed burials and evidence for maize agriculture to the list of traits associated with this time period.

Other than the addition of domestic structures and the incorporation of maize agriculture, this phase is notably similar to the preceding Dry Creek phase. Because of this, several Verde River valley researchers (e.g., Logan and Horton 2000) have questioned the viability of this phase as an analytical unit and have suggested that it may represent the terminal stage of the Late Archaic period.

Hackberry Phase (A.D. 650–700/800)

The Hackberry phase is marked by the first appearance of pottery in the MVRV, particularly the locally produced Verde Brown plain ware. No local painted wares have been assigned to this phase, but several trade wares have been recovered from Hackberry phase contexts, including Snaketown Red-on-gray and Gila Butte Red-on-buff from the Salt-Gila Basin and Lino Gray and Lino Black-on-gray from the Colorado Plateau. The first evidence of contact with Hohokam groups, and possibly even for migration from the south into the Verde River valley, appeared during this time (Breternitz 1960a:26).

Domestic structures are shallow, rectangular pit structures (Breternitz 1960a:Figure 10; Deats 2007:Figure 7, 2011:Figures 3.5, 3.7, and 3.9). As with previous phases, the material-culture attributes of the Hackberry phase are not well defined. The phase originally was based on data from only two sites (Breternitz 1960a:21), and little new evidence has been uncovered to expand this definition.

The Hackberry phase heralds the "appearance" of a distinct cultural group, the Sinagua, who practiced an agricultural subsistence with a sedentary land-use pattern. Although there may have been multiple different groups in the MVRV by this time, at least one was an indigenous population likely descended from local Archaic period populations, who made brown ware pottery, built pit houses in a local styles, and had a preference for inhumation burials—the Southern Sinagua (see Chapter 6, this volume). The change in house style from round to rectangular is typical for groups who change from a mobile to a more sedentary lifestyle. Along the same lines, these indigenous peoples of the MVRV became farmers by acquiring maize through contact with outside maize-growing groups as early as the Squaw Peak phase.

Cloverleaf Phase (A.D. 700/800–900)

A dual settlement pattern has been noted for the Cloverleaf phase, and it most likely reflects the presence of two distinct cultural groups. Large, open villages that displayed Hohokam-like traits, including ball courts, were located in the lowland floodplains. Smaller, more-compact villages were dispersed throughout the upland areas. A variety of agricultural features appeared at this time, including irrigation canals, rock-cleared areas, and rock-outlined waffle gardens. Both pit-walled houses and houses in pits were constructed during the Cloverleaf phase (Fish and Fish 1977:13).

Verde Brown plain ware continued to be produced locally, but other utilitarian types appeared in the region, as well, including Rio de Flag Brown, Rio de Flag Smudged, Deadmans Gray, and Wingfield Plain (Van West et al. 2018). Predominate trade wares included Santa Cruz Red-on-buff from the Salt-Gila Basin and Kana-a Black-on-white from the Colorado Plateau. Rectangular manos and trough metates were common during this time, as were grinding stones and slabs, polishing stones, hammerstones, pestle pounders, choppers, flake knives/scrapers, and basalt hoes/saws/knives. Artifact types typically associated with Hohokam culture and interaction appeared in the Verde River valley during this time, including *Glycymeris* bracelets, abalone pendants, slate palettes, uncarved stone bowls, and basalt cylinders and stone rings. The Hohokam traits likely connote not just Hohokam colonists and descendants but also local emulators (see Chapter 6, this volume).

Camp Verde Phase (A.D. 900–1150)

Important changes in settlement pattern and exchange networks occurred throughout the Verde River valley during the Camp Verde phase. In the MVRV, Hohokam influence peaked during this time, as reflected by the occurrence of Hohokam-style pit houses, ball courts, cremation burials, shell ornaments, red-on-buff pottery, and adobe-capped mounds at sites dating to this time. Toward the end of the phase, however, Hohokam influence declined, and exchange relationships shifted to groups on the Colorado Plateau (Fish and Fish 1977; Pilles 1981a; Tagg 1986). By the late Camp Verde phase, settlement patterns started to shift toward smaller, dispersed villages and isolated homesteads, and many new structures incorporated masonry construction to some extent.

Utilitarian pottery continued to be dominated by Verde Brown, and smaller amounts of Wingfield Plain and Tusayan Corrugated were present. Perforated and unperforated sherd discs, rectangular and round to oval manos, hand stones, grinding slabs and stones, polishing stones, hammerstones, pestle pounders, bone awls, and basalt hoes/saws/knives were all common during this time. Sacaton Red-on-buff from the Salt-Gila Basin dominated the painted collections during the first part of this phase and was varyingly replaced by Black Mesa Black-on-white, Black Mesa–Sosi Black-on-white, Tusayan Black-on-red, and Tusayan Corrugated from the Colorado Plateau. Verde Red-on-buff is the only locally made, painted ceramic type assigned to this phase.

Honanki Phase (A.D. 1150–1300)

The first multiroom masonry pueblos were constructed during this time, including the initial room blocks of large masonry pueblos, such as Tuzigoot and Montezuma Castle (Pilles 1981a). Large and small masonry cliff dwellings were constructed throughout the upland canyons at this time. One-room surface masonry structures and one-room masonry-lined pit structures were constructed, as well (Weaver 2000). Toward the end of this period, fort-like structures were constructed in areas that overlooked the canyon mouths. Despite their defensive appearance, these structures may have been related to increased commercial activity rather than increased hostility (Pilles 1981b:13).

The Hohokam influence had completely disappeared by this time, and instead, a suite of traits attributed to the Southern Sinagua appeared. Utilitarian pottery was dominated by Verde Brown in the first part of the phase and by Tuzigoot Brown in the later part of the phase. T-shaped doorways, full-groove axes, and inhumation burials are all characteristic of this phase. Temporally diagnostic ceramic types included Flagstaff Black-on-white, Walnut Black-on-white, Tusayan Black-on-white, and Tusayan Black-on-red.

Colton (1939a) saw the Honanki and Tuzigoot phases as a time when pueblo peoples moved into the MVRV from homelands above the Mogollon Rim, particularly the Flagstaff area. Colton (1946:304) speculated that during the Honanki phase, the immigrants accepted the Hohokam methods of irrigation, built masonry architecture, and displaced (or assimilated) both the Hohokam and the original inhabitants of the valley—in sum, they absorbed the riverine-oriented population.

Tuzigoot Phase (A.D. 1300–1400)

The Tuzigoot phase marked the end of the Formative period in the Verde River valley and the end of Sinagua occupation in this region. During this time, the various populations from the numerous Honanki phase villages aggregated into roughly 40 large pueblos and associated sites (Pilles 1981b:14). These large, multistoried masonry pueblos are usually located in the lowlands, and they tend to be evenly spaced along each of the major streams in the valley. Although the size of the pueblos increased during this time, room size actually decreased from previous phases (Fish and Fish 1977:18). Small satellite pueblos, extensive agricultural fields, and outlying field houses were typically associated with the large masonry pueblos and probably formed communities.

Tuzigoot Brown and Tuzigoot Red dominated the utilitarian wares from this time, and temporally diagnostic wares included Kayenta Black-on-white, Homolovi Polychrome, Winslow Orange, Jeddito Plain, and Jeddito Black-on-white (Tagg 1986:32). Kivas, community rooms, small granaries, sealed outside doorways, loopholes, and parapet walls were all common during this time (Pilles 1981b:14).

Overview of the LOCAP Site Chronologies

The following section reviews feature information and artifact collections recovered from the 13 sites investigated as part of the LOCAP. Additional information on these sites and specific provenience information for—and illustrations of—recovered artifacts can be found in the respective site descriptions (see Volume 1) and artifact-analysis chapters (see Volume 2). Chronometric data recovered from each site are reviewed, as well, and the particulars of each can be found above and in the respective appendixes.

AZ O:1:50:104/AR-03-04-06-901/902 (ASM/CNF) (Site 104/902)

Several temporal components were identified at Site 104/902, including an Archaic period camp, a Formative period field house, and a short-lived historical-period habitation. The site primarily consisted of an extensive prehistoric ceramic and lithic scatter that could be separated into two loci located on separate sides of a knoll top. Locus A was located to the west of the knoll top and included two rock features (Features 1 and 2). Feature 1 was outside the ROW and therefore was not excavated. It consisted of an alignment of large and deeply embedded sandstone cobbles and was interpreted as the wall of a prehistoric masonry room. A concentration of utilitarian and painted ceramics was located around the inferred structure and included five Jeddito Black-on-yellow sherds, three Deadmans Black-on-gray sherds, a Lino Black-on-gray sherd, and two indeterminate Tusayan White Ware sherds. These ceramic types represent three temporally distinct production ranges; the majority of sherds fall within the A.D. 800–1330 and 1350–1500 time periods. A round, vesicular basalt mano and a vesicular basalt manuport were associated with this feature, as was flaked stone debitage. The artifact collection associated with this feature and its inferred function as a field room suggest that this feature was utilized during the fourteenth and fifteenth centuries A.D. and was affiliated with the Tuzigoot phase of the MVRV sequence. The earlier ceramic types found near the feature could reflect earlier visits to the area, possibly between A.D. 900 and 1100, or curational or recycling behaviors by later groups.

Feature 2 consisted of a cluster of sandstone cobbles; it was excavated, but its function could not be determined. A few pieces of lithic debitage, including two bifacial flakes, were recovered, but no ceramics or other artifacts were found in association with the feature. No temporal association could be discerned for this feature. Three additional manos, numerous bifacial flakes, and a nondiagnostic bifacial knife were recovered from the rest of this locus.

Locus B was located on the lower slopes to the east of the knoll top and consisted of an extensive artifact scatter. A discrete concentration of Alameda Brown Ware sherds was encountered in this area, as well as most of the flaked stone tools and projectile points recovered from the site. Two Archaic period and three Formative period projectile points were collected from this scatter, in addition to four scrapers and a graver. No features were encountered in this area, and no chronometric data was collected. The presence of Archaic period- and Formative period-style projectile points indicate at least two different periods of use; however, the lack of specific diagnostics and chronometric data prevents a more refined temporal assignment for this area.

A third locus, Locus C, contained historical-period materials and a small scatter of prehistoric artifacts. The historical-period component was not explored as part of this project, because it was located outside the ROW and was judged unrelated to the prehistoric component. Two nondiagnostic biface blanks, a few sherds, and a unifacial flaked stone tool were recovered from the prehistoric artifact scatter.

AZ O:1:105/AR-03-04-06-838 (ASM/CNF) (Site 105/838)

Site 105/838 was the most substantial and complex site in the project area and contained at least four different habitation components and three identifiable activity loci. Locus A contained three pit structures (Features 23, 29, and 37) and several thermal features. All of the chronometric data recovered from this site came from the three pit structures. Feature 23 was an east-facing, rectangular pit house that had two central supports, superimposed hearths, a stepped entrance with a stone slab, and a large number of storage pits. A Holbrook Black-on-white, Style B (A.D. 1050–1150), vessel fragment was recovered from near the floor of the structure and probably was on the roof at the time of destruction. Two radiocarbon samples recovered from the structure yielded date ranges of A.D. 1040–1410 and A.D. 970–1260. These radiocarbon dates were statistically similar at the 95 percent confidence level and had a pooled mean of A.D. 1037–1264. Two AM samples from the structure yielded date ranges of A.D. 935–1340 and A.D. 1010–1040/A.D. 1185–1315. The composite AM date for the structure was A.D. 1010–1040/A.D. 1235–1265. Taken together, these data indicate that Feature 23 most likely was destroyed sometime during the eleventh century A.D.

Feature 29 was an oval, east-facing pit structure with sloping walls and a ramped entryway. As did Feature 23, it contained a large number of storage pits. A cluster of Verde Brown sherds was found on the floor and may have originated from a single jar. Other sherds recovered from the floor include Kiel Siel Gray, Rio de Flag, Deadmans Black on Red, and Tusayan White Ware sherds. Together, these sherds have a CD_{95} of A.D. 700–1375 and a CD_{68} of A.D. 775–1300. AM samples were recovered from each of the two hearths in the structure and returned date ranges of A.D. 935–1040/1185–1390 and A.D. 985–1040/1235–1315/1335–1365. The late production date of the Kiel Siel Gray sherds recovered from the floor suggests that the later-dating options may be correct; however, the style of architecture suggests that the earlier-dating options provide the best age estimate for abandonment of this structure. Therefore, I place structure abandonment at between A.D. 985 and 1040.

Feature 37 was a round pit structure with well-defined, inward-sloping walls; two thermal pits; and a small number of postholes. No entrance or formal hearths were found. A large number of ground stone artifacts and several manuports were recovered from the floor. No ceramics were recovered from the floor, and very few were recovered from the upper levels of fill. A San Pedro dart point and several biface flakes were recovered from the fill of Feature 37. An AM date from one of the thermal pits returned date-range options of A.D. 585–690 and A.D. 1760–1815. In addition, several maize cupules recovered from the structure's fill were submitted for AMS dating and returned the 2σ calibrated date range of cal. A.D. 410–600. The AMS results indicate that the structure predates the existing Southwest AM curve and was abandoned prior to A.D. 600, making it one of the few Early Formative period houses to be excavated in the Verde River valley.

The superpositioning of eight thermal features beneath and over the three pit structures indicates that Locus A had a very long use history, although undoubtedly with some hiatuses. Additionally, a large trash midden blanketed this part of the site. The midden contained a large amount of Angell Brown sherds, which have a production range of A.D. 1075–1200. Because the midden covered the three pit structures located in this area and, therefore, could not have been created by these occupants, we believe that another series of pit structures must have been located nearby, possibly outside the ROW. Finally, a Middle Archaic period Gypsum Cave dart point was recovered from a test pit on the south edge of Locus A; however, it was thought that this point had been collected and redeposited by later groups rather than deposited at the site during the Middle Archaic period.

Locus B contained two masonry surface structures (Features 13 and 15), a probable masonry surface structure (Feature 12), and several rock clusters of unknown function. Feature 13 was a rectangular masonry room built within a larger pit that may have been a pit structure at one time. Six obsidian arrow points and a variety of sherds were recovered from the feature. Decorated ceramic types include Black Mesa Black-on-white, Black Mesa or Sosi Black-on-white, Padre Black-on-white, Klageto Black-on-yellow, and Jeddito Black-on-yellow. This collection had a CD_{95} of A.D. 750–1400 and a CD_{68} of A.D. 1050–1350. The recovered artifacts and masonry construction suggest that this structure was contemporary with the late Camp Verde, Honanki, and/or Tuzigoot phase(s). Feature 15, the other masonry structure from this locus, showed evidence of post-reinforced wall construction and was thought to be a pole-and-brush lean-to rather than a true masonry room. No temporally diagnostic artifacts were recovered from this structure, precluding dating of it. Feature 12 was a U-shaped cluster of rocks that was thought to have been a masonry surface structure. It was not excavated, but a few Jeddito Black-on-yellow, Tuzigoot Plain, and Tuzigoot Red sherds were found in the vicinity of the feature, suggesting that it dated to the fourteenth or fifteenth century.

A possible masonry room (Feature 20) was encountered in Locus C but was not excavated. Five Jeddito Black-on-yellow sherds were associated with this feature, suggesting that it was contemporary with the Tuzigoot phase. No other temporally diagnostic artifacts were recovered from this locus.

This site had a complex use history. The first clear evidence for occupation came from Feature 37 in Locus A, suggesting that at least part of the site was occupied by the sixth or seventh century A.D. The AM date for this structure indicates that it was contemporary with the Squaw Peak phase. A second occupation is indicated by the ceramics and the chronometric data recovered from Features 23 and 29, which place this occupation between A.D. 900 and 1100, in line with the Camp Verde phase. The third occupation is indicated by the extensive midden located over the pit structures in Locus A. The ceramics recovered from this midden suggest that it was deposited sometime during the twelfth or thirteenth century A.D., possibly by residents of nearby pit structures. If such pit structures exist, they could be assigned to the late Camp Verde or the Honanki phase. Finally, the presence of masonry rooms in Loci B and C and associated Late Formative period ceramics suggest that a fourth occupation took place during the fourteenth or fifteenth centuries. This occupation would be in line with the Honanki or Tuzigoot phase.

AZ O:1:85/AR-03-04-06-428 (ASM/CNF) (Site 85/428)

Site 85/428 was a multicomponent site that included a Middle Archaic period hunting camp and a Formative period food-processing camp. Four thermal features were excavated, and a number of artifacts were scattered across the site's surface. Feature 1 was a slab-lined hearth; no artifacts were associated with this feature, and it could not be temporally placed. Feature 2 was a multiple-episode roasting area that consisted of an FCR-filled, bell-shaped pit. Two additional pits (Subfeatures 1 and 2) were located at the base of the main roasting pit. Artifacts recovered from this feature included flakes, cores and lithic debris, and five manos. One of the manos was rectangular, suggesting that it had been used with a trough metate. Maize was recovered from the feature's fill and was submitted for AMS dating. This sample returned a 2σ calibrated date range of A.D. 410–600, which indicates that this feature most likely was last used during the early part of the Formative period.

Feature 3 consisted of clean-out debris and most likely was associated with a nearby firepit. No artifacts were recovered, and the feature could not be temporally placed. Feature 4 was a rock-walled roasting pit with an associated clean-out-debris area. The pit walls were highly oxidized, and an AM sample was taken. No artifacts were recovered from this feature. The AM sample returned date-range options of A.D. 585–690, 935–990, and 1760–1890; however, the absence of artifacts precludes the selection of the best dating option for this feature.

Several artifacts were recovered from other areas of the site, including two Tuzigoot Plain body sherds. These ceramics indicate that the site was visited between A.D. 1100 and 1400 or later, but they cannot be associated with any of the excavated features. In addition, three Middle Archaic period Pinto/San Jose-type dart points were recovered from the site's surface. Overall, the diagnostic artifacts in this collection, the AM-date-range options, and the radiocarbon date suggest that this site was utilized at some point during the Middle Archaic period and utilized again during the early part of the Formative period and possibly later in the Formative period, as well.

AZ O:1:77/AR-03-04-06-869 (ASM/CNF) (Site 77/869)

A sparse artifact scatter and two rock alignments were recorded at this site. The rock alignments followed a natural contour in the landscape and were interpreted as either agricultural-field features or as erosion features associated with a nearby historical-period roadbed. Fifty-seven ceramic sherds were recovered from the site, including a Hohokam Buff Ware sherd, 4 Little Colorado White Ware sherds, and a Black Mesa or Sosi Black-on-white sherd. The rest of the sherds included Angell Brown, Winona Brown, and Verde Brown plain wares. Together, the ceramic collection had a CD_{95} of A.D. 725–1350, a CD_{68} of A.D. 875–1225, and an overlap period of A.D. 1075–1180.

Other artifacts recovered from the site include a Middle Archaic period dart-point midsection and a Late Archaic period Elko Corner-notched point fragment. No biface or unifacial flakes were found, and only two cores were encountered. Three sandstone manos were recovered, but none was temporally diagnostic. No chronometric samples were recovered from this site. In all, the recovered artifact collection indicates that the site was used at several different points during prehistory. The dart points suggest that the area was visited briefly during the Middle and Late Archaic periods, and the ceramics point to Formative period use. If the ceramic collection is representative of a single use period, then at least one component can be assigned to the Camp Verde phase of the local sequence. However, it also is possible that the ceramic sherds recovered from the site reflect multiple visits throughout the Formative period.

AZ O:1:131/AR-03-04-06-37 (ASM/CNF) (Site 131/37)

Site 131/37 consisted of two artifact scatters and a basalt quarry and was interpreted as a food-procurement and processing camp. Forty-two ceramic sherds were recovered from the site, including a Hohokam Buff Ware sherd and 2 Kana'a Black-on-white rim sherds. The rest of the ceramics included Wingfield Plain, Verde Brown, Tuzigoot Plain, and Angell Brown plain ware sherds. The ceramic collection for the site had a CD_{95} of A.D. 700–1375 and a CD_{68} of A.D. 875–1300.

Two obsidian projectile-point-preform fragments were recovered that likely date to the Formative period. A third, unifacially flaked point could not be assigned to a type. Six biface blanks were recovered, and all exhibited direct-percussion flaking. Additional flaked stone tools included four scrapers, a spokeshave, and four retouched pieces. Seven pieces of ground stone were recovered, including two halves of a rectangular mano. Rectangular manos are generally used with trough metates and are characteristic of the Formative period.

The artifact collection recovered from this site suggests that it was used sometime during the Formative period. No evidence of an Archaic or a protohistoric period occupation was recovered. The ceramic types recovered from the site have been found together in contexts assigned to the Camp Verde phase, and it is possible that this collection belongs to this phase, as well. However, it is also possible that the collection reflects several different visits that could be assigned to a variety of different phases (e.g., Hackberry, Cloverleaf, and Camp Verde).

AZ O:1:53/AR-03-04-06-745 (ASM/CNF) (Site 53/745)

Site 53/745 was an extensive, multilocus site with occupations spanning the Middle Archaic period through the Late Formative period. A total of 31 features were recorded, including 7 possible wickiup rings, 2 masonry structures, a bedrock metate, a possible retaining wall, and several pits and rock piles. Limited testing was conducted on these features, and virtually all of the artifacts collected from the site came from the dense, mixed surface scatter that blanketed the site.

Two Middle Archaic period points (Gypsum and Pinto/San Jose styles), seven Late Archaic period points (Elko Corner-notched and San Pedro styles), and an indeterminate Archaic period blank point were recovered from across the site. Ninety-eight biface flakes were also recovered; however, no spatial patterning could be discerned, precluding the identification of Archaic period tool-making areas. It is clear that this site was used by Archaic period peoples, but the lack of spatial clustering makes it impossible to identify the nondiagnostic Archaic period material culture that is potentially present at the site.

Seven Formative period arrow points were recovered, as well, including two Hohokam and two Sinagua points. The Hohokam points probably are from the Sacaton phase and can be dated to approximately A.D. 900–1100. Both of these points were found in Locus C; most of the identifiable Hohokam sherds and the only *Glycymeris* bracelet fragment were found nearby. This suggests that Hohokam peoples visited this area at some point after A.D. 900.

A very large ceramic collection was recovered from across the site and included Deadmans Black-on-red, Moenkopi Corrugated, Tusayan White Ware, Little Colorado White Ware, Tsegi Orange Ware, Awatovi Yellow Ware, Tizon Wiped, and Orme Ranch Plain sherds. Taken together, this collection had a CD_{95} of A.D. 700–1350 and a CD_{68}: of A.D. 875–1225. The majority of wares recovered from this site had a production range of between A.D. 900 and 1250.

The presence of possible protohistoric period ceramic types at the site (i.e., Orme Ranch Plain and Tizon Wiped) prompted a TL-dating study. Six sherds from various parts of the site were submitted for TL analysis; three of the sherds were temporally diagnostic painted wares, two were Orme Ranch Plain, and the sixth was Tizon Wiped (see Table 4). The temporally diagnostic sherds were submitted as controls on the technique and provided additional chronometric data for the site. Four of the six sherds had a combined date range of roughly A.D. 960–1250, and the date ranges overlapped between A.D. 1111 and 1120, although they may not reflect the same use event. The remaining two sherds suggested a protohistoric period occupation, with a combined date range of roughly A.D. 1560–1710 and an overlap of A.D. 1646–1659. However, as discussed above, the date ranges from these two sherds are most likely younger than the true production ages for their respective vessels, and they both may date closer to the other sherds than is indicated by these results.

The combined chronometric data indicate that the site was occupied from the Middle Archaic period through the Late Formative period and possibly into the protohistoric period. It is likely that this site was repeatedly visited throughout the Formative period. The Camp Verde and Honanki phases are particularly well represented within the collection.

AZ O:1:28/AR-03-04-06-903 (ASM/CNF) (Site 28/903)

Two activity areas were recorded at this site: Loci A and C. The majority of work was concentrated in Locus A, which was interpreted as a Late Archaic period food-processing camp. A rock-lined hearth was excavated in Locus A, and it was surrounded by flaked stone, ground stone, and faunal bone. The flaked stone collection included 2 San Pedro-type projectile points, a Pinto/San Jose-type point, an Elko-type point, and an untyped Archaic period point. Four Archaic period bifaces were also recovered from this area. Two unifacial sandstone grinding slabs, a sandstone mano fragment, and 15 chert cores, scraping planes, and choppers were associated with the hearth. Six tabular and deep- and shallow-basin metates and 6 additional, unshaped manos were recovered from Locus A. Based on the artifacts from this locus, the collection can be assigned to the Dry Creek phase of the local sequence.

Locus C was interpreted as an agave-procurement locale, based partly on the presence of agave in this area. It consisted of a discrete, high-density flaked stone scatter, and it was located on a small, flat area overlooking the confluence of Dry Creek and a deeply entrenched ephemeral drainage. A Formative period projectile point and a single Verde Brown sherd were recovered from this area, suggesting that the site was revisited at least once after a.d. 800. It is unknown whether this area was also used during the Archaic period, although it seems likely. No chronometric samples were recovered from this site.

AZ O:1:31/AR-03-04-06-244 (ASM/CNF) (Site 31/244)

This was a multicomponent site with occupations thought to date to the Middle and Late Archaic periods and the Formative period. The main occupation was interpreted as a Middle and Late Archaic period hunting and plant-procurement camp. This was based on the recovery of 9 Archaic period projectile points, including 3 Pinto/San Jose types, 1 Mallory type, a possible San Pedro point, a probable Elko point, and 3 unassigned Archaic period points. An additional 27 flaked stone tools were recovered and indicate that plant-processing, butchering, hide-preparation, and woodworking activities took place at the site. A large number of biface flakes were also recovered from the site.

A less-well-defined Formative period component was indicated by the recovery of three Sinagua projectile points. It is unknown how these projectile points relate to the nondiagnostic artifacts recovered from the site, including a metate, four manos, and a hammerstone. No chronometric samples were recovered from this site.

AZ O:1:133/AR-03-04-06-561 (ASM/CNF) (Site 133/561)

An extensive artifact scatter and a roasting pit were spread over three loci at this site. Locus A was interpreted as a Middle and/or Late Archaic period hunting-gathering camp. Eight projectile points were recovered from this locus, including 2 Middle Archaic period Pinto/San Jose points, a Late Archaic period San Pedro point, and an Early Archaic period Lerma-like point that may have actually been an unusual form from the Middle or Late Archaic period. Thirteen retouched tools made from cobbles or cores, including choppers, scrapers, and preforms, were associated with the projectile points. Nine unshaped manos, 2 flat/concave metates, a basin metate, and an untyped metate fragment were recovered from this area, as well. The collection indicates that this area functioned as a hunting-gathering camp where butchering and plant-collecting and preparation activities occurred.

Loci B and C were interpreted as Formative period resource-procurement locales. Locus B consisted of a discrete concentration of ceramic sherds from a wide variety of wares. No features or other artifact types were noted in this area. Diagnostic ceramic types recovered from Locus B include Sosi Black-on-white, Black Mesa Black-on-white, Deadmans Black-on-red, Moenkopi Corrugated, and a variety of Alameda Brown Wares. Together, these sherds have a CD_{95} of A.D. 700–1350 and a CD_{68} of A.D. 850–1175. An examination of the pottery types individually suggested that the more restricted date range is probably a better age estimate for ceramic activity in this area.

Locus C contained an artifact scatter and a partially exposed, ovate roasting pit (Feature 1). The artifact scatter primarily consisted of a cluster of Angell Brown ceramic sherds and a separate cluster of Tizon Wiped sherds that indicate possible protohistoric period use of the area. The cluster of Angell Brown sherds suggests that this area was utilized sometime during or after A.D. 1075–1200. Because Feature 1 was located outside the ROW, it was not excavated; however, the visible portion contained numerous pieces of FCR mixed with several chert flakes. The feature's proximity to modern agave suggests that it may have been used to process this plant resource. Six bifaces were recovered from the artifact scatter in Locus C, and all show varying signs of reduction. A large sandstone grinding slab and an associated mano were noted on the surface of this locus, as well. In all, this locus could be assigned to the Camp Verde or Honanki phase and possibly to the protohistoric period.

The only chronometric data for this site come from Locus C and focus on contexts from the presumed protohistoric period component. First, a Tizon Wiped sherd recovered from the surface scatter was submitted to the University of Washington for TL dating. It returned a date range of A.D. 1762–1820 for the firing of the associated pot. This date range is in agreement with the historical-period age of other sherds of this type (Dobyns and Euler 1958), and it suggests that this area was used to some extent by Yavapai groups during the historical period. This assertion is further supported by the 2σ calibrated date range returned from a pine-charcoal sample from Feature 1 (see Table 3).

AZ O:1:134/AR-03-04-06-187/189 (ASM/CNF) (Site 134/189)

A moderate-density artifact scatter, two possible masonry structures (Features 1 and 2), and two rock features (Features 3 and 4) were recorded at this site. All four features were located outside the ROW and therefore were not excavated. Feature 1 was an ovate, single-coursed basalt and metaquartzite rock ring suggestive of an ephemeral prehistoric structure. Feature 2 was a rectilinear rock alignment that was two courses high in some places and likely represented the collapsed remains of a prehistoric field house. Feature 3 was an ovate concentration of more than 100 well-rounded basalt and quartzite gravels and cobbles; its function was unclear. Feature 4 was a curved rock alignment with an unknown function. There were no artifact concentrations found in direct association with any of these features.

Artifacts recovered from the surface and subsurface concentration located over most of the site included lithic, ceramic, and ground stone types. Three projectile points were identified, including a complete corner-notched dart point that was probably made during the Late Archaic period, the base of a Middle Archaic period Pinto/San Jose point, and the midsection of a Late Archaic period dart point. Five bifaces were recovered from the scatter, as well. The twelve flaked stone tools collected from the site included 7 tools manufactured from cores or cobbles and suggest that some plant-procurement and -preparation activities occurred. This is supported by the recovery of 2 manos from the site, as well. None of these tools were temporally diagnostic. Finally, 4 ceramic sherds were recovered from the site, including 1 Tusayan Black-on-red sherd, 1 Rio de Flag Brown sherd, and 2 Angell Brown sherds. These types represent Northern Sinagua and Kayenta Anasazi production regions. They have a total production date range of A.D. 700–1240 and overlap between A.D. 1075 and 1125.

Together, the features and artifact collection recorded for this site suggest that at least two occupational components were present. The first was interpreted as a Middle or Late Archaic period hunting camp, as indicated by the projectile points and bifaces included in the collection. The second was interpreted as a Formative period field-house locale that was focused on wild-plant-procurement activities. It is thought that the plant-cutting tools may have been associated with the later component, but there is no direct evidence to support this idea. The artifact collection associated with the later component suggests that it should be assigned to the Camp Verde or Honanki phase.

AZ O:1:135/AR-03-04-06-186 (ASM/CNF) (Site 135/186)

This site consisted of a surface and subsurface lithic scatter and was interpreted as a Late Archaic period hunting and plant-procurement and -processing locale. The lithic collection included 2 biface fragments and 17 bifacial flakes. The biface fragments were broken during manufacture and may have been intended to be dart points. Two scrapers, 1 manufactured from a core and the other from a flake, were recovered from the site and probably were used for scraping or cutting. The flakes included in this collection indicated that core reduction and biface manufacturing took place at the site. Finally, 3 oval manos were recovered from the site and represent the only non-flaked stone artifacts encountered. Based on the composition of the recovered collection, this site should be assigned to the Dry Creek phase of the local sequence.

AZ O:1:136/AR-03-04-06-663 (ASM/CNF) (Site 136/663)

This site was defined by a sparse artifact scatter, and it has been interpreted as a possible resource-procurement camp dating to the later part of the Formative period. Two sherds, an Angell Brown jar sherd and an indeterminate Tsegi Orange Ware sherd, were collected from this site. They represent Northern Sinagua and Kayenta Anasazi production areas, respectively, and they have a total production-date range of A.D. 1050–1300.

The rest of the artifacts collected from this site were all flaked stone, including a side-notched obsidian arrow point that is probably associated with Pueblo or Sinagua peoples. A biface and four bifacial flakes were recovered, as was a unifacially retouched flake. A large number of core flakes were included in this collection. The production dates associated with the ceramic wares recovered from this site and the presence of a Tsegi Orange Ware sherd suggest that this occupation was contemporary with the Honanki phase or possibly the late Camp Verde phase.

AZ O:1:137/AR-03-04-06-482 (ASM/CNF) (Site 137/482)

Site 137/482 consisted of a low-density flaked stone scatter that likely represented a Middle Archaic period hunting camp. Only a small part of the site was investigated, because it was primarily located on private land. The collected artifacts included three fragmentary dart points; the pressure flaking present on these points suggests that they may have been from the Middle Archaic period. Three unifacially retouched tools were recovered from the site, as well, and suggest that butchering and hide-preparation activities took place.

Conclusions

The archaeological information gathered during this project indicates that the LOCAP area was occupied repeatedly from the Middle Archaic period through the historical period. There is little evidence for any long hiatuses during this time, although it is difficult to tease out individual occupations and to determine when and for how long those occupations took place, in part because of the fact that many of the investigated sites consisted of mixed surface scatters rather than temporally discrete deposits.

One of the goals for this analysis was to ascertain how the LOCAP data set articulated with the existing phase sequence for the MVRV. This was made difficult by a number of factors, including the paucity of available chronometric data for the project. Furthermore, the discrepancy between the type of site encountered in the project area and the type of site on which the sequence was based made collection comparisons difficult. That is, the phase system and much of our existing knowledge of prehistory in this area has been based on data recovered from habitation sites (Breternitz 1960a; Fish and Fish 1977). This is particularly true for the later periods. Most of the sites investigated in the LOCAP area, however, were resource-procurement and processing sites. They lacked many of the accoutrements of habitation sites, making it difficult to match the data recovered with a predefined collection of distinctive cultural traits. Furthermore, many of these areas clearly were used repeatedly through time and inevitably consisted of temporally mixed collections, making comparisons with established phase definitions meaningless.

Rather than using suites of well-defined attributes to match sites or locales to specific cultural phases, I used temporally diagnostic artifacts and what little chronometric data I could gather to determine the most likely calendrical period(s) of use for each locale. For purposes of comparison, the age estimate(s) allowed us to identify the phases that may have been contemporary with activities in various locales. Overall, I found very few contexts that clearly matched the existing phase definitions, in large part because of the differences between artifact suites and features one would expect to find at procurement sites and those one would expect at habitation sites (e.g., architectural features are much easier to assign to a phase or multiple phases than extramural roasting pits). Without chronometric data and temporally diagnostic artifacts, many locales could only be assigned to general developmental periods (e.g., the Formative period).

As a whole, this project adds to our understanding of prehistory in this area in four ways. First, the recovery of Middle and/or Late Archaic period artifacts from 11 of the 13 investigated sites adds to our understanding of land use and resource-procurement strategies during this time. Some of these areas may reflect hunting losses rather than actual site use, particularly those locales that contained only one or two projectile points. However, others, such as Sites 28/903, 31/244, and 133/561, indicate more-substantial site use. The rock-lined hearth and associated ground stone recovered in Locus A of Site 28/903 suggest that extensive plant-processing activities occurred in this area. They also add to the list of features and artifact types recovered from Archaic period contexts (e.g., grinding slabs, rock-lined hearths, etc.). These more-substantial Archaic period deposits contained large amounts of plant-processing artifacts, seeming to support Weaver's (2000:231) assertion that these groups emphasized wild-plant resources and relied secondarily on hunting activities. Unfortunately, we were unable to add to the scant chronometric data for the Archaic period in this region.

A second important suite of information gained from this project comes from Feature 37 at Site 105/838 and from Feature 2 at Site 85/428. Both of these features have been chronometrically dated to the little-known period between A.D. 1 and 700, which traditionally encompasses the Squaw Peak phase. These are two of just a handful of features in the Verde River valley that have been chronometrically dated to this period (Van West et al. 2018). As one of the few securely dated structures in the region, Feature 37 adds to our understanding of habitation features during this time. The round shape of the structure agrees with Breternitz's (1960a:21) original description for the contemporary Squaw Peak phase; however, this structure contained a number of informal cooking pits rather than the subfloor, bell-shaped storage pits listed in Breternitz's description. It did contain a large number of ground stone artifacts, though, which is in keeping with other similarly aged structures (see Logan and Horton 1996:38–50). Perhaps most importantly, however, is that radiocarbon samples recovered from both Feature 2 (Site 85/428) and Feature 37 (Site 105/838) provide the earliest direct dates on maize from the Verde River valley. The 2σ calibrated date ranges obtained from the maize samples recovered from these two features are in good agreement with radiocarbon dates on structural timbers obtained by Logan and Horton (1996:141–144) for an early structure at the nearby Jack's Canyon site, AR-03-04-6-294 (CNF). These structural timbers returned a cumulative date of A.D. 245–655 (Logan and Horton 1996:49), and this date range has been attached to a burned maize kernel recovered from the fill of the structure's hearth (Hansen 1996:133). However, a better age estimate for the Jack's Canyon structure can be obtained by pooling these radiocarbon ages. None of the ages are significantly different at the 95 percent probability level (T = 5.32; df = 3) (Ward and Wilson 1978:21), and so the ages can be pooled and then calibrated. Using Calib 5.0.1 (Stuiver and Reimer 1993) and the IntCal04 data set (Reimer et al. 2004), the 2σ calibrated, pooled age for this structure is cal. A.D. 390–535. This age is very similar to the 2σ calibrated age of A.D. 410–600 obtained for the maize cupules recovered from both roasting-pit Feature 2 at Site 85/428 and the fill of structure Feature 37 at Site 105/838. Although the Jack's Canyon radiocarbon dates were not obtained directly from maize, they strengthen the argument that maize agriculture was practiced to some extent in the Verde River valley by A.D. 550/600 and probably by A.D. 400.

Accordingly, the third area to which this project adds encompasses our understanding of subsistence and resource-procurement strategies during the Formative period. This includes the collection and processing of wild and cultivated plants and the procurement of raw materials for ground stone manufacturing. Analysis of botanical remains recovered from thermal features and habitation structures (see Chapters 6 and 7, Volume 2) indicate that both wild-plant resources and cultivars were utilized throughout the Formative period. Furthermore, the locations of probable field houses and agricultural fields will help to refine regional land-use studies for the Middle and Late Formative periods. Likewise, the location of probable agave-processing areas adds to our understanding of how this area was utilized through time.

Finally, the variability in the ceramic types recovered from these sites adds to our knowledge of exchange patterns throughout the Formative period. Although it is tempting to think of intrusive ceramic types as diagnostic of a particular phase, it is not the ceramic type but the interaction with a particular production region that is diagnostic. The high percentage of Northern Sinagua ceramics recovered from the project area indicates strong connections with the Flagstaff area, possibly as early as A.D. 700 and definitely by A.D. 1100. Likewise, the common occurrence of Kayenta Anasazi ceramics throughout the project area is strongly suggestive of ties to the Flagstaff area, as well. Unsurprisingly, the two largest sites, Site 53/745 and Site 105/838, showed the greatest variability in their ceramic collections. What is surprising is that the collections from these two sites contained more variety than those from many large sites nearby (see Chapter 2, Table 28, of Volume 2,). In fact, at least 15 types (e.g., Kiel Siel Gray, Lino Black-on-gray, Wepo Black-on-white, Jeddito Corrugated, Deadmans/Floyd Gray, Aquarius Orange, and Orme Ranch Plain) were recovered from LOCAP contexts that hadn't been recovered from other sites in the region. The production regions represented within the collections, however, are very similar, suggesting that the variations in collection composition may be due to excavation or recovery procedures rather than differences in exchange networks. This observation is offered here to highlight the continuing limitations on our understanding of prehistory in this region.

Overall, this project adds to the long litany of calls for more chronometric data and additional excavations of MVRV sites (Fish and Fish 1977; Logan and Horton 2000; Pilles 1996a; Weaver 2000; Whittlesey 1998). Without well-dated contexts, we are hampered in our efforts to address synchronic questions, such as land use and settlement patterns (see Pilles 1996b:71), and diachronic questions, such as population growth and movement and changing interaction patterns. These questions also require a good understanding of the variability present in a region, something that is masked by normative phase systematics. It is hoped that future projects will produce the chronometric data necessary for providing the temporal framework within which these questions can be addressed.

CHAPTER 3

Using Unpainted Ceramics to Identify a Yavapai Presence: A Thorny Problem in Archaeological Inference

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Unpainted ceramics played a key role in defining a possible Yavapai presence at LOCAP archaeological sites. In particular, Tizon Wiped and Orme Ranch Plain were examined, in conjunction with other information, as evidence of possible Yavapai occupation at three LOCAP sites. Although the inference that these pottery types were made by the Yavapai is based on a limited amount of evidence, the assumption has become entrenched in the archaeological literature and among southwestern archaeologists. Accordingly, this chapter seeks to address whether Tizon Wiped and Orme Ranch Plain can be used with any certainty to affiliate a site with the Yavapai.

This unusual approach to cultural affiliation and ethnic identity is dictated by necessity. As Christenson (see Appendix B, Volume 2) observed, identifying the kinds of pottery made by the Yavapai is an archaeological problem, because no vessels known to have been made by the Yavapai have been collected. This chapter seeks to address the issue of the cultural affiliation and ethnic identity of the makers of Tizon Wiped and Orme Ranch Plain ceramics by examining how these archaeological types came to be associated with the Yavapai; how the type descriptions compare to ethnographically described Yavapai ceramics; what the distinguishing attributes of these types are and how they compare to those known to have been made by other, closely related groups, particularly the Western Apache; and the chronometric dates associated with these types. At the end of the chapter, a revised type description for Orme Ranch Plain is presented, based on the ceramics from the LOCAP.

Yavapai and Western Apache Ceramics

There are two reasons both Yavapai and Western Apache pottery are included in the following discussion. The first is that the LOCAP area is in territory that was historically inhabited by both the Yavapai and the Western Apache (Cordell 1984:Figure 1.4; Whittlesey and Benaron 1998:Figure 5.1), and the second is that the Yavapai and the Apache have historically had a close relationship, as well. In particular, they were interned together at the San Carlos Reservation from 1875 to 1900 (Ferg and Tessman 1998:246). The following discussion summarizes what is known about Yavapai and Western Apache pottery from ethnographic information and the history of archaeological classification and description of ceramic types attributed to the Yavapai and the Western Apache.

Ethnographic Information

Yavapai Ceramics

Our knowledge of Yavapai lifeways and material culture indicates that ceramic containers were not an important part of the domestic tool kit. For these highly mobile peoples, basketry and containers of other perishable materials were favored for their lightness and durability. Pottery was used primarily for cooking and food storage (Khera and Mariella 1983:46). This casual approach to ceramic containers was exacerbated in historical-period times. Euroamerican containers rapidly replaced those of Native American manufacture, and pottery was never revived for the tourist and collector trade as it was among the Pueblo and Maricopa peoples (Whittlesey and Benaron 1998:154). Christenson (see Appendix B, Volume 2) noted that an attempt to revive Yavapai pottery making apparently took place in the 1930s, but photographs show that the resulting pottery is similar to Maricopa pottery in shapes, surface treatment, and decoration and thus has little usefulness in understanding early-historical-period Yavapai ceramics.

E. W. Gifford published ethnographies about the Northeastern and Western Yavapai (Gifford 1936) and the Southeastern Yavapai (Gifford 1932). He interviewed seven individuals (all but one of whom were male—another historical account [Corbusier 1969:39] stated that only women made pottery) for his Northeastern Yavapai discussion, although his principal informant was an elderly man from the Mayer area. All but one of Gifford's informants lived on the San Carlos Reservation with Western Apache people between 1875 and 1900. He admitted, therefore, that "an appraisal of the characteristics they shared before reservation days is very difficult" (Gifford 1936:247). One of Gifford's informants made the observation that her mother did not teach her pottery making because it was a useless art for someone who lived on the reservation and could obtain utensils from non-Indians. This confirms the rapidity with which metal pots and pans, glass containers, and European, American, and Asian ceramics replaced Native American pottery (Whittlesey and Benaron 1998:154). At Yavapai sites occupied in the early twentieth century, archaeologists have found that pottery containers of native manufacture were almost totally absent (see Keller and Stein 1985; Stein 1984).

Northeastern Yavapai pottery was made from clay obtained near Mayer and Jerome. It was fashioned by coiling and smoothed with a paddle and anvil (a pebble). No information concerning temper or clay processing was provided. Gifford's interpreter (a middle-aged man) drew vessel shapes: *imat tisole*, a shouldered vessel with a wide aperture used to boil venison; *kuumat*, a hemispherical bowl used for boiling seeds; and *kuukachakunu'*, small, shallow, hemispherical or subhemispherical bowls used to serve food from larger vessels or carry supplies from the granary to the cooking place (Gifford 1936:Figure 9; illustrated in Whittlesey and Benaron 1998:Figure 5.2). In addition, Gifford (1936:280) described a "bottle-necked pot for carrying water, called *matathiwa*" that was carried inside a burden basket. It was not illustrated.

Corbusier provided a more detailed description of "Apache-Mojave" (by which he apparently meant both the Northeastern and Southeastern Yavapai) (Corbusier 1969:13, Footnote 2) pottery. The following is taken from notes he made in 1886 about his observations during his tenure as the doctor at the Rio Verde Reservation, 1873–1875:

> Basket-ware and vessels of pottery are in common use. Their manufacture is confined to women who own all such property. Unglazed earthen vessels of various sizes for domestic purposes such as pots, *a-mat*, to cook in, with a capacity of from two to three gallons, large shallow bowls to hold food, and water jugs with globular bodies and narrow necks, *a-mat-ha-t-hi-wa*, and *so-wah*, the largest holding as much as 4 gallons, are made out of red clay.
>
> Some of them are decorated with one or two narrow horizontal bands and zigzag lines painted in darker or lighter colored clay. They all have convex bottoms and are thin and very brittle. None of them have feet but those used for cooking purposes are supported over the fire on three stones, *o-huth-ku-nu*.
>
> The moulding is done entirely by hand in the lap or on the ground, yet the vessels are quite symmetrical in shape. The clay of which they are formed is first dried, ground on a metate, and then worked into a dough with saliva and water, which has been rendered mucilaginous by boiling cactus in it. The bottom of the vessel is formed of a lump of dough which is pressed into shape with the hands, and the rest built up of rolls, each of which adds about 1 inch to its height and is allowed to dry a little before another is added. One hand on the inside and the other on the outside press and smooth the clay to produce proper contour and thickness. Saliva is used freely on the hands to facilitate the work.
>
> When completely formed, it is thoroughly dried in the sun or near a fire, and then burnt by itself in an open fire. Strong, light, globular jugs, to carry water in, are made by covering loosely woven baskets with pitch or red clay. These have two small loops or handles on the largest part of the body, for the attachment of a string or band, by which the jug is carried on the back suspended from the head [Corbusier 1969:39].

Gifford (1932:177) interviewed a single elderly, male informant, Michael Burns, for his Southeastern Yavapai ethnography. Basketry or gourd containers were used primarily, both during travel and for carrying water. Ceramic containers were used only for cooking at camp and for storage (Gifford 1932:219). Clay was obtained from a place near the Salt River. It was crushed on a metate and winnowed to remove the large inclusions. Gifford (1932:220) stated, "No temper was added." Ground red mineral pigment, or face paint, was added to the clay if a red color was desired. The vessel was built up by coiling (including the base) without use of the paddle and anvil. Coils were pinched together, and the surface was scraped and polished with a sherd. The finished containers were not decorated. After drying, they were fired in the open. Gifford's informant described three shapes: a pot for boiling, a bottle-necked olla for water, and a bowl for drinking. There were no plates or parching dishes (Gifford 1932:220).

Gifford described Western Yavapai pottery in slightly more detail. The red clay was obtained in many places and was ground on a metate to smooth out the lumps. Temper was "fine gravel or sherds ground on metate. Also a small cactus (6 inches high), called *tapā*, with the thorns burned off, was mashed and mixed with clay, and chopped roots of grass were added. These 2 sticky vegetable ingredients made clay hold together" (Gifford 1936). These organic materials also would create a dark-gray or black core under the typical low-temperature, open firing conditions that apparently were used. Pots were started with a flat disk to which coils were added; the completed pot was finished by paddle and anvil. Gifford (1936:281) observed, "[i]n shaping surface, pot was rubbed many times with wet hands. After pot was shaped a slip of red paint . . . was put over outside with bare hands." The "red paint" was likely hematite obtained from a cliff face near modern Williams, Arizona (Gifford 1936:277). The pots were fired on their sides in the open, on the same day they were made. Gifford (1936:280) described only three vessel shapes: "(1) shallow dish for food; (2) deep bowl with incurved rim for cooking; (3) globular bowl with outcurved rim for water carrying." Omitted from the descriptions of Yavapai pottery is any discussion of scraping, wiping, or otherwise texturing the surfaces of the vessels. In fact, the discussion of Western Yavapai pottery suggests that pains were taken to smooth the surfaces carefully.

In summary, ethnographic information indicated that historical-period Yavapai pots were made with residual, or primary, clays to which organic materials, primarily cactus and grass, were added. The Western Yavapai also used gravel or sherd temper, which was probably dictated by the character of the local clays. Pots were manufactured by coiling, and the paddle and anvil was used for thinning by the Northeastern and Western Yavapai, although perhaps not by the Southeastern Yavapai. The pottery was fired in the open, was thin, and broke easily. It is clear that a red color was often desired, either by selecting red clay, adding red pigment, or slipping the vessel red. Decoration, if added at all, was accomplished by painting with a lighter or darker red paint or by slip. Importantly, none of the Yavapai groups wiped or striated the surfaces; in fact, polishing or smoothing appears to have been the norm. Vessel shapes crosscut technology and were similar among all Yavapai groups.

Western Apache Ceramics

Whittlesey and Benaron (1998:175) observed that Western Apache pottery never assumed the importance of perishable containers for the same reasons that pottery was unimportant among the Yavapai. Few ethnographies have recorded the manufacture of Western Apache pottery in the late nineteenth century, when reservation life and the availability of nonnative containers caused ceramic manufacture to decline and disappear. As among the Yavapai, ceramic containers were used for cooking and food storage (Whittlesey and Benaron 1998:175).

Grenville Goodwin's unpublished field notes (A-66) housed in the ASM archives indicated that red pottery clay was obtained from several locations, including the eastern slopes of Mount Turnbull. It was ground on a metate, and ground or crushed plant material was added for strength and plasticity. Ground prehistoric potsherds were used as temper. This practice may explain the disparate collection of random prehistoric sherds found at many historical-period Apache sites (for example, see Gerald [1958]). Pots were constructed by coiling and finished by scraping. The pot was begun with a flat disk of clay to which coils were added. Coils were pinched together and scraped into place with a stick. The vessel was then smoothed with a gourd scraper or prehistoric sherd. According to Ferg and Kessel (1987:66–67), stone polishing was not used. Decorations around the neck might have been added; Goodwin's notes mentioned incised, zigzag or parallel, vertical lines.

Western Apache pottery is distinctive for its conical-bottom and wide-mouthed vessel shapes (see Ferg 1987:Figures 5.26 and 5.30), which resemble those of Navajo pottery. Goodwin's informants mentioned large boiling pots, an olla for fermenting beer, a small pot, and a ladle; a cup or bowl also was noted. Archaeologists identify Western Apache pottery by its distinctive striated surface that results from scraping the surface of the container with a brush similar to the type used for brushing hair (Ferg 1992:14). Although this practice is not mentioned in ethnographic discussions, scraping with a stick or a gourd scraper certainly might leave striations. Vessels housed in the ASM show both smoothed and striated surfaces.

In summary, Western Apache pottery as recorded ethnographically was characterized by red clays, thin walls, coil-and-scrape construction, use of residual clays, ground-sherd and organic temper, and conical bottoms. It differs from Yavapai ceramics in that it was not finished with a paddle and anvil, it had a different suite of vessel shapes, and it often had sherd temper. It apparently was not slipped but did have incised decoration on occasion.

Archaeological Classification and Descriptions

Yavapai Ceramics

The first synthesis of Verde River valley prehistory (Breternitz 1960b) made little mention of possible Yavapai pottery and described no possible Yavapai ceramic types. In fact, Breternitz (1960b:25, 27–28) observed a gap in the archaeological record of the region extending from the end of the Tuzigoot phase (ca. A.D. 1425) until the arrival of the Spanish in 1582 and stated his belief that there was little, if any, evidence to correlate the Hakataya (the label given to the indigenous, ancient population of the Verde River valley, see Chapter 3 in Volume 1 of this report) with the Northeastern Yavapai. Subsequent studies took up the issue of Yavapai material culture, particularly ceramics, with more enthusiasm. Gradually, two types have come to be associated with the Yavapai: Tizon Wiped (a Tizon Brown Ware) and Orme Ranch Plain, which originally was not placed into a ware category.

Tizon Brown Ware

Colton (1939b:8–11) originally defined and described Tizon Brown Ware, including the types Cerbat Brown, Aquarius Brown, and Sandy Brown (but not Tizon Wiped). Tizon, or "firebrand," is an early Spanish Colonial name for the Colorado River. Subsequently, Dobyns and Euler (1958) revised the ware description (see also Dobyns 1956). They described the ware as a brown ware, only rarely painted, constructed by coiling and finished by paddle and anvil. Firing in a poorly controlled, oxidizing atmosphere resulted in black, gray, brown, and red surface and core colors; surface finishes were smoothed or wiped with frequent anvil marks. Temper was "sub-angular to rounded opaque quartz, feldspar, and occasional mica flakes" with a coarse to medium-fine texture (Dobyns and Euler 1958). Types assigned to the ware included Cerbat Brown (with rare red- and black-painted variations), Sandy Brown, and Aquarius Brown (with a rare black-painted variation). Tizon Wiped was added as a new type. It was distinguished by its striated interior or exterior surfaces, or both surfaces, but otherwise was similar to Cerbat Brown and Aquarius Brown. Perhaps most importantly, Dobyns and Euler linked the various Tizon Brown Ware types with different cultural groups. The ware as a whole was "made by Upland Arizona Yuman Indians, principally the Walapai, and their direct ancestors of the Cerbat Branch" (Dobyns and Euler 1958). Tizon Wiped was "manufactured by the Havasupai and possibly by the Yavapai" (Dobyns and Euler 1958).

By 1981, when Pilles presented his synthesis of Yavapai archaeology, Tizon Wiped had become entrenched as a Yavapai ceramic type, as well as a Hualapai and Havasupai type (Note: They both were once part of the Pai tribe [Euler and Dobyns 1985:69]; connections discussed by Dobyns and Euler [1958] had been forgotten). Pilles (1981a:165–167) summarized the sites thought to be Yavapai that were known at that time (Turkey Creek Cave, Orme Ranch Cave, Olla Negra Caves, the Stoneman Lake site, the Orme Ranch site, the Wood site, and two sites excavated during the Copper Basin project) (Table 5). Unlike the identifications by Euler and Dobyns (1985), most of these identifications were not made on the basis of historical, ethnographic, or archival data but on the basis of material culture, such as Desert Side-notched points; circular rock outlines for brush structures or wickiups; roasting pits; remains of burned agave or mescal; stone knives for cutting mescal; historical-period items; other late prehistoric and protohistoric ceramics, such as Jeddito Black-on-yellow; and presumed Yavapai-type ceramics. Pilles (1981a:167) stated, "Such features are also typical of the Apache as well as the prehistoric inhabitants of central Arizona, and by themselves are not conclusive evidence of Yavapai occupation." However, he then concluded, "At the present time, ceramics and projectile points appear to be the most reliable artifacts to distinguish Yavapai sites" (Pilles 1981a:167).

Pilles (1981a:169) noted that the characteristics of Tizon Wiped and Cerbat Brown ("which is identical to Tizon Wiped except for a lack of intentional striations" [Pilles 1981a:169]) matched Corbusier's (1969:39) description of Yavapai pottery as thin and brittle and fired in an uncontrolled, oxidizing atmosphere. He also stated that the vessel forms of Tizon Brown Ware "very closely match" (Pilles 1981a:169) the four Yavapai vessel forms reported by Gifford (1936:Figure 9). The similarities in form are not quite as close as Pilles suggested (see Whittlesey and Benaron 1998:Figure 5.2–5.8). For instance, the ethnographically described boiling pot is high shouldered with an outcurved rim and flat base rather than the low-shouldered pots with direct to slightly everted rims and rounded bases that are typical of Tizon Brown Ware. Also, the bowls are subhemispherical to flaring sided and have direct rims and flat bases, as contrasted with the more-globularly shaped bowls with direct to everted rims and rounded bases typical of Tizon Brown Ware. However, the large, globular jars with narrow apertures and lug handles (Dobyns and Euler 1958) could resemble Gifford's (1936:280) "bottle-necked pot for carrying water," but that is uncertain, because the latter was not illustrated.

In 1985, Euler and Dobyns presented ethnoarchaeological evidence supporting their earlier claims. They attempted to use the direct historical approach, looking at sites "known to Walapais to have been occupied by them personally or by their immediate ancestors" (Euler and Dobyns 1985:70). The types Cerbat Brown, Aquarius Brown, and Sandy Brown were found in surface contexts at historical-period sites occupied by the Hualapai, including Mineral Park (AZ F:12:2 [ASM]), the Ghost Dance site (AZ F:12:8 [ASM]/NA3365), Fort Rock (AZ G:15:5 [ASM]), Camp Hualapai (AZ N:1:9 [ASM]), and Ha'Loo Rock Shelter. Excavation at an additional three sites (AZ G:3:3 [ASM]/NA8786C, NA4377, and NA4378) confirmed the association between Tizon Brown Ware and the Hualapai. Euler and Dobyns (1985:79) also suggested that Tizon Wiped was made by the Havasupai.

Euler and Dobyns (1985:84) also indicated that "we are not yet able to define Yavapai ceramics with any surety. A primary reason for this is that, with one exception, no definitely identifiable Yavapai sites have been located." They offered the hypothesis that the Yavapai probably made some variety of Tizon Brown Ware and that different bands of the Yavapai may have produced different variants, although Tizon Wiped was attributed to the Havasupai.

"Yavapai Plain Ware"

Curiously, Wood (1987:115) lumped several different ceramic types and wares into a broad category he called "Yavapai Plain Ware." He described it as "a variable but

Table 5. Verde Valley Sites with Protohistoric Period Ceramics

Site Name/Number	Context	Tizon Brown Ware					Orme Ranch Plain	"Yavapai Plain Ware"	Apache Plain		Prehistoric Ceramics	Other Diagnostic Artifacts and Features	Chronometric Dates	References	Comments
		Tizon Brown Ware	Tizon Wiped	Cerbat Brown	Aquarius Brown	Sandy Brown			Apache Plain	Rimrock Variety					
AR-03-04-01-270 (CNF)			X				X							Pilles 1981a:169–170	
AR-03-04-06-306 (CNF)				X										Logan and Horton 1996	
AZ N:7:231 (ASM)							X							Leonard et al. 1999	
AZ N:7:255 (ASM)	surface		X		X					X				Leonard et al. 1999	Multicomponent.
AZ O:1:53/AR-03-04-06-745 (ASM/CNF)	surface		4				121				X	wickiup foundations	1 Orme TL date, A.D. 1608; 1 Orme TL date, A.D. 1155; Tizon TL date, A.D. 1128	Feathers 2018; Lengyel 2018; Vanderpot 2018a	
AZ O:1:105/AR-03-04-06-838 (ASM/CNF)	Feature 27 midden		2								Angell Brown, Verde Brown			Vanderpot 2018b	
	Feature 30 roasting pit		1								13 indeterminate brown ware				
AZ O:1:133/AR-03-04-06-561 (ASM/CNF)	Feature 1 roasting pit		8								X		1 Tizon TL date, A.D. 1791	Feathers 2018; Lengyel 2018; Wegener and Vanderpot 2018	
AZ O:15:67 (ASM)							X			X		indeterminate protohistoric points		Huckell 1978	
Brown's Ranch Rockshelter/AZ U:1:25 (ASM)			X	X			X					punctated, decorated sherds		Ferg 2002	
Copper Basin (two sites)	surface						12							Pilles 1981a; Westfall and Jeter 1977	
Cross Creek Ranch Pueblo/AR-03-04-06-703 (CNF)	roasting pit	1						2			Alameda Brown Ware		A.D. 1290–1440, from C-14	Horton and Hattendorf 2000; Logan and Horton 2000	Multicomponent; mean C-14 date from an associated pueblo is A.D. 1215, or Southern Sinagua Honanki phase.
	roasting pit		1 or 2?	1 or 2?				1?			Alameda Brown Ware			Horton and Hattendorf 2000; Logan and Horton 2000	Multicomponent.
Hualapai sites—historical period (n = 3)	excavation	X												Euler and Dobyns 1985	
Hualapai sites—historical period (n = 5)	surface			X	X	X								Euler and Dobyns 1985	
Jack's Canyon/AR-03-04-06-304 (CNF)	surface?							44						Hattendorf 1996; Logan and Horton 1996	
	roasting pit												A.D. 1690–1730 or A.D. 1820–1920; A.D. 1485–1950, from C-14		No associated ceramics.
Lower Verde Archaeological Project Site 66/1157	surface		86 from 1 vessel								Gila Plain	Late Archaic period point		Whittlesey et al. 1998:186–189	Surface scatter site.
Middle Verde River prehistoric cliff dwelling (Honanki?)							1 reconstructible vessel		1 reconstructible vessel					Ferg 1992; Pilles 1981a; Whittlesey and Benaron 1998	
NA1502			X				X							Pilles 1981a:170	
NA18188												9 Lower Colorado Buff Ware sherds		Keller and Stein 1985	
NA18190		2									X	wickiup foundations		Keller and Stein 1985	Historical-period Yavapai site; sherds "resemble" Tizon.

continued on next page

Site Name/Number	Context	Tizon Brown Ware					Orme Ranch Plain	"Yavapai Plain Ware"	Apache Plain		Prehistoric Ceramics	Other Diagnostic Artifacts and Features	Chronometric Dates	References	Comments
		Tizon Brown Ware	Tizon Wiped	Cerbat Brown	Aquarius Brown	Sandy Brown			Apache Plain	Rimrock Variety					
Olla Negra Caves	excavation		42								X	Desert Side-notched points, mescal cut with a metal knife, mescal knives, metal, glass, metal knife blade, infantry-uniform button		Pilles 1981a; Pilles and Katich 1967	A.D. 1865–1875.
Orme Ranch Cave/NA6656	all nine levels						X				Wingfield Plain	Desert Side-notched points, Yavapai-style bow, bark- and grass-lined storage bin		Breternitz 1960b; Pilles 1981a	151 total Orme Ranch Plain sherds.
	lower five levels		X	X	X		X								
Orme Ranch											X	wickiup foundations, roasting pit, Levi rivet		James 1972; Pilles 1981a	Occupied by Yavapai 1900–1920.
Skeleton Cave/AZ U:7:3 (ASM)		1												Ferg and Tessman 1998	Cave near the Yavapai massacre cave.
Stoneman Lake	excavation										Jeddito Black-on-yellow	possible Desert Side-notched point, wickiup foundations, possible roasting pits		Metcalf n.d.; Pilles 1981a	
Sycamore Cave/AR-03-04-06-45 (CNF)							1 reconstructible jar							Clauss 2004b	
Turkey Creek Cave	excavation		X	X	X						Wingfield Plain	Desert Side-notched point, cane arrow shaft, peach pits, a nail, a shoe fragment, newspaper		Euler 1958; Euler and Dobyns 1985; Pilles 1981a	Ethnohistoric Northeastern Yavapai (Gifford 1936:269–271); Wingfield Plain thought to be from a nearby pueblo.
Willow Beach		X									Lino Black-on-gray (A.D. 700)			Schroeder 1952	
Wood	excavation											Desert Side-notched points, wickiup foundations, roasting pits, charred agave		Pilles 1981a	"Several late sherds from the surface . . . tenuously suggest a post-1300 Yavapai occupation" (Pilles 1981a:166).
Yavapai Ethnoarchaeological Project (YEAP) 23		2												Christenson 2018; Telles and McConnell 2000	Multicomponent.
YEAP 32		1					X				Jeddito Yellow Ware	Desert Side-notched points		Christenson 2018; Telles and McConnell 2000	
YEAP 33		1					2				Jeddito Yellow Ware	Desert Side-notched points		Christenson 2018; Telles and McConnell 2000	

Key: TL = thermoluminescence.

generally thin and hard or brittle paddle-and-anvil pottery (sometimes coil-and-scrape?) also known in several variations such as Tizon Wiped and Orme Ranch Plain." Wood indicated that "Yavapai Plain Ware," like Apache pottery, was characterized as having rough, striated, or scored surfaces produced by wiping the wet vessel surface with a corn husk. It contained sand or crushed-sherd temper and was dark gray to black, sometimes reddish brown. Wood assigned these ceramics a post–A.D. 1500 date. He concluded that "[t]he actual relationship between these potteries and ethnographic Yavapai populations is more suggestive than conclusive" (Wood 1987:116). Not a formal, vetted ware, Wood's "Yavapai Plain Ware" should not be confused with Kirkland Gray, a San Francisco Mountain Gray Ware (Colton 1958), also known as Yavapai Plain.

Dating Tizon Brown Ware and "Yavapai Plain Ware" Ceramics

Overall, there are very few chronometric dates associated with presumed Yavapai ceramics. These ceramics have been dated primarily by stratigraphic and ceramic associations. Tizon Brown Ware is thought to be an extremely long-lived ceramic type, extending from A.D. 700 to the early historical period. Schroeder (1952) assigned the early date on the basis of its association with Lino Black-on-gray pottery at Willow Beach on the Colorado River. No chronometric dates for Tizon Brown Ware were reported from the contexts discussed by Euler and Dobyns (1985). Several sites were surface contexts with only general evidence for historical-period occupation, such as cans, glass, and nails (Euler and Dobyns 1985:73).

A large, cobble- and slab-lined roasting pit at Cross Creek Ranch Pueblo (AR-03-04-06-703 [CNF]) yielded a calibrated 2σ radiocarbon date of A.D. 1290–1440 on charcoal collected from the feature (Logan and Horton 2000). One Tizon Wiped sherd and two "Yavapai Plain Ware" sherds were found in the roasting pit. A second roasting pit yielded Cerbat Brown, Tizon Wiped, and "Yavapai Plain Ware" sherds but produced no chronometric dates. Prehistoric Alameda Brown Ware sherds also were found in the fill of both features. Charcoal samples from pueblo rooms yielded a mean radiocarbon date of A.D. 1215, placing this component in the Southern Sinagua Honanki phase. Because ceramic types thought to represent protohistoric Yavapai manufacture were found in the roasting pit, Logan and Horton (2000:111) concluded that the site may have seen limited use that probably postdated the pueblo occupation "by protohistoric (Yavapai) groups." However, another possibility is that the radiocarbon date confirmed that Cerbat Brown, Tizon Wiped, and "Yavapai Plain Ware" were made as early as the thirteenth century.

One of the Jack's Canyon sites, AR-03-04-06-304 (CNF), produced two roasting pits, neither of which was lined with slabs or cobbles. One feature was disturbed and provided no suitable materials for radiocarbon dating. The second yielded two radiocarbon samples with calibrated 2σ date ranges of A.D. 1690–1730/1820–1920 and A.D. 1485–1950 (Logan and Horton 1996:68). Although these dates indicated use in the protohistoric or historical period, none of the "Yavapai Plain Ware" ceramics were associated with the roasting pits.

The LOCAP project ran a TL date on a Tizon Wiped sherd from the surface of AZ O:1:53/AR-03-04-06-745 (ASM/CNF) (Site 53/745) that gave a date range of A.D. 1128 ± 66 (see Table C.6 in Appendix C, Volume 2) (see further discussion below). This site is a multicomponent site that has probable wickiup rings with associated Orme Ranch Plain sherds (Cerbat Brown had also been identified as associated with them by a previous project and may have been identified as "indeterminate sand-tempered brown ware" by the LOCAP project [Stone and Hathaway 1997:39]); so, the early date of the Tizon Wiped sherd was somewhat surprising, although it falls within the accepted range for the type (see Appendix D, Volume 2). Lengyel pointed out that the only source of identifiable error (anomalous fading) would cause an underestimation rather than an overestimation of age; however, this particular sample was not thought to have anomalous fading (see Appendix D, Volume 2). The date range for the site as a whole is Middle Archaic period to Late Formative period, with a strong Southern Sinagua component dating to the Camp Verde phase (A.D. 900–1150) (see Chapter 10 in Volume 1).

Another TL date was run on a Tizon Wiped sherd from a roasting pit (Feature 1) at AZ O:1:133/AR-03-04-06-561 (ASM/CNF) (Site 133/561) that produced a date range of A.D. 1791 ± 29 (see Table C.6 in Appendix C, Volume 2) (see further discussion below). The pit was described as a well-preserved roasting pit (see Chapter 13 in Volume 1), and wood charcoal was collected but not radiocarbon dated. Also, the pit was outside the ROW and was not excavated. Although two other loci at the site were placed in the Middle to Late Archaic and Formative periods, the authors felt that the locus with the roasting pit was likely protohistoric (see Chapter 13 in Volume 1).

Orme Ranch Plain

Orme Ranch Plain—clearly a misnomer, in that this pottery is an obliterated, pinched-corrugated ware—was first described by Breternitz (1960b) on the basis of excavations at Orme Ranch Cave (NA6656), located in a basalt flow in the upper Agua Fria drainage in PNF. The four-chambered cave contained an ash pit, a firepit, a slab-lined storage cist, and a bark- and grass-lined storage bin. Numerous prehistoric pottery types and other material culture were found, as well as 151 sherds of Orme Ranch Plain. Breternitz (1960b:28) described the pottery as fashioned by coiling and pinching and containing angular calcite crystals and pyroclastic material. It was black, sometimes brown, and had a wall thickness of 4–7 mm. Illustrations indicated a pinched-corrugated surface with rows of corrugation separated by scraping and scoring. The interiors were scraped.

The lack of reconstructible vessels precluded discussion of vessel shape, although sherds indicated jars with slightly recurved necks.

Concerning its cultural affiliation, Breternitz (1960b:28) observed that none of his professional colleagues would identify Orme Ranch Plain as an Apache type, and it was "[t]hought to be Northeastern Yavapai." The associated material culture strengthened the possible cultural affiliation. This included Tizon Brown, Aquarius Brown, and Tizon Wiped pottery; Pai-style serrated arrow points; a Yavapai-type unnotched self bow that was cut with a steel knife; basketry "typical of the Apache-Yavapai-Havasupai twining found on burden baskets" (Breternitz 1960b); the bark bin; three kaolin cobbles that might have been used as paint to prevent sunburn, as recorded by Gifford (1936:277); and the presence of plant foods that were recorded by Gifford (1936:256–258) as eaten by the Yavapai (Breternitz 1960b:31–37). Breternitz (1960b) provided additional reasoning for the inference that Orme Ranch Plain was made by the Yavapai: the pottery was most abundant in the upper four levels of Orme Ranch Cave, it did not resemble Apache ceramics and also did not belong to any defined prehistoric pottery types or wares of the area, and the site was within the ethnographically described territory of the Northeastern Yavapai.

Pilles (1981a:169–170) also discussed Orme Ranch Plain in his synthesis of Yavapai archaeology. He observed that Orme Ranch Plain was reminiscent of the obliterated, vertically corrugated pottery found in central Arizona after A.D. 1200 and noted that it "has no counterpart in the ceramic tradition of other Yuman groups" (Pilles 1981a:169). He stated that the pottery was made by vertically pinching coils of clay together and then partially obliterating them, "perhaps by the use of a paddle-and-anvil." He observed that the type primarily represented globular jars, although the only complete vessel known at that time was a small bowl in the Sharlot Hall Museum collections. Because the type was found with Tizon Wiped at four sites, including Turkey Creek Cave, Pilles (1981a:170) concluded that although it is unusual, Orme Ranch Plain "does appear to be a Yavapai ceramic type."

In a discussion of Upland Yuman ceramics, Euler and Dobyns (1985:88) reiterated Breternitz's (1960b) association of Orme Ranch Plain with the Northeastern Yavapai. They also stated that "[a]t Turkey Creek cave we recovered several blackish-brownish sherds which may have been Yavapai; however, we were unable to make positive identifications" (Euler and Dobyns 1985:88). They provided no further information about or description of this pottery.

As discussed above, Wood (1987:115) placed Orme Ranch Plain in "Yavapai Plain Ware." He described it as an obliterated-corrugated type that was distinct from other so-called Yavapai types. However, the online Ceramic Manual 2001 of Northern Arizona University's Anthropology Department (Clauss 2004a) placed Orme Ranch Plain in Tizon Brown Ware.

Dating Orme Ranch Plain

No dates were obtained from Orme Ranch Cave, the type site for Orme Ranch Plain. There was little stratigraphic evidence in the published report to support the type's chronological placement. Prehistoric pottery and Orme Ranch Plain pottery were mixed in all levels. Breternitz (1960b:36) noted that this mixture reflected disturbance by human and animal occupants. Breternitz (1960b) believed that the Yavapai occupation was represented by the upper four levels in the cave deposits, because "Orme Ranch Plain is very scarce in the bottom five levels of the cave." All pottery was less abundant in these deposits than in the uppermost four levels, however (for example, 80 percent of the local plain ware, Ash Creek Brown, was found in Levels 1–4). Tizon Brown and Tizon Wiped sherds were found only in the lower five levels. The presence of intact features suggested little disturbance from natural or cultural processes. In short, evidence for the chronological placement of Orme Ranch Plain is entirely ambiguous from this context.

The LOCAP project ran TL dates on two Orme Ranch Plain sherds from the surface of Site 53/745 (see further discussion below). They were both in the vicinity of the wickiups on the site (see Chapter 10 in Volume 1). One sample yielded a 1σ date range of A.D. 1155 ± 99, and the second sample had a 1σ range of A.D. 1608 ± 51 (see Table C.6 in Appendix C, Volume 2). Although the second sample is closer to the expected date in the protohistoric period, it is thought to have anomalous fading, which would mean that it is possibly older, though likely still to fall within the historical or protohistoric period (see Appendix D in Volume 2). The early date for the first sample is unexpected for Orme Ranch Plain, because the younger end of the range is still at least 250 years earlier than the hypothesized early dates for Orme Ranch Plain (ca. A.D. 1500). Finally, an additional problem is the possibility that both sherds came from the same vessel (see Appendix C in Volume 2). It should be noted that the Tizon Wiped sherd from the same wickiup-associated surface context had a date range of A.D. 1128 ± 66. This closely matches the date range for the first Orme Ranch sample as well as the range of the other associated prehistoric ceramics (A.D. 775–1200) (see Chapter 10 in Volume 1).

Western Apache Ceramics

Archaeologists have identified several varieties of Western Apache pottery. James Gifford (1980:163–164) first described Apache Plain based on his work in rockshelters near Point of Pines on the San Carlos Reservation. Its attributes included thin vessel walls; infrequent neck fillets; rough, irregular surfaces with prominent striations; and occasional coils at the rim and rim notching or pinching. Its characteristic dark core may be the result of the organic materials added to the paste. Only jars were recorded. Ferg

(1992:27) indicated that Apache Plain, Apache variety, was synonymous with Apache Plain as described by Gifford.

Wood (1987:115) provided the following description of Apache Plain: "A relatively thin rough-surfaced paddle-and-anvil-made pottery," although ethnographic discussions indicated that the pottery was made by coiling and pinching. "It is red-brown to ashy grey to black in color, fine sand tempered, and characterized by rough surface finishes produced by scoring or wiping" (Wood 1987:115). As noted by Gifford (1980), sometimes a coil was added to the rim. Wood (1987:115) also noted that at least one potential variety, sometimes called Rimrock Plain (first identified by Schroeder [1960:141–142]), has been recognized within Apache Plain. He described it as characterized by patterned fingernail indentations, usually arranged in rows. The variety was most common in and around the Verde River valley, Payson Highlands, and Sierra Ancha. Wood noted that this kind of decoration also has been found on prehistoric brown ware of central Arizona. According to Ferg (1992:27), Apache Plain, Rimrock variety, is Apache Plain with one or more rows of decorative fingernail indentations around the neck or shoulder.

A third variety of Apache Plain is the Strawberry variety (Pilles 1981a:Figure 2), which represents Apache Plain vessels with allover fingernail indentations (Ferg 1992). The vessel found with an Orme Ranch Plain container in a rockshelter would be classified as Apache Plain, Strawberry variety. Photographs of the vessel shown on the Northern Arizona University Ceramic Manual 2001 Web site (Clauss 2004b) showed clearly that the fingernail indentations were placed across the individual vessel coils and were not used to bond adjacent coils together.

Dating Apache Ceramics

It is thought that Southern Athapaskan groups learned pottery making from their sedentary Plains-village and Pueblo farming neighbors no earlier than the seventeenth century (A.D. 1625–1725) (Baugh and Eddy 1987:794). In turn, the Western Apache made pottery that was closely related to Navajo ware, and it is thought that "Navajo utility ceramic[s] may not necessarily be of indigenous manufacture until the Gobernador phase" (A.D. 1700–1750 or 1775) (Baugh and Eddy 1987:797). Therefore, although sometimes dated to as early as A.D. 1300 (Clauss 2004b), generally, Apache Ware is dated to A.D. 1700–1850 (Clauss 2004b; Wood 1987).

LOCAP Ceramics

Probable protohistoric ceramics, possibly associated with the Yavapai, were identified from three sites during the LOCAP ceramic analysis (see Chapter 2 in Volume 2). All three sites had been recognized as possible protohistoric Yavapai sites by previous investigators. A brief summary of the ceramics, features, and other diagnostic artifacts is presented below and in Tables 6–8. For a full description of the sites see Chapters 6 and 10 in Volume 1 and Chapter 13 in Volume 1, and for the full description of all ceramics from the sites, see Chapter 2 in Volume 2.

Table 6. Protohistoric Period Ceramics at Site 105/838

Ceramic Form, by Type	Count	Provenience
Tizon Wiped		
Indeterminate jar	2	Feature 27
Indeterminate jar	1	Feature 30
Sandy Brown		
Indeterminate form	1	Feature 29

Table 7. Protohistoric Period Ceramics at Site 53/745

Ceramic Form, by Type	Count	Provenience
Tizon Wiped		
Indeterminate jar	4	site surface
Orme Ranch Plain		
Indeterminate jar	10	site surface
Indeterminate form	11	site surface

Table 8. Protohistoric Period Ceramics at Site 133/561

Ceramic Form, by Type	Count	Provenience
Tizon Wiped		
Indeterminate jar	8	surface

AZ O:1:105/AR-03-04-06-838 (ASM/CNF) (Site 105/838)

ARS thought that Site 105/838 might be affiliated with the protohistoric Yavapai, based on ceramic types and expedient sandstone grinding implements (Stone and Hathaway 1997:24). SRI's investigation of Locus A also indicated a protohistoric occupation, possibly Yavapai.

Locus A is on the western slope of the hill that comprises most of the site and is immediately adjacent to the SR 89A roadbed. It has been disturbed by erosion, road construction, and the historical-period Cottonwood–Sedona road that crosses through it (see Chapter 6 in Volume 1). The locus was completely excavated and contained three pit structures and several thermal features dating to the Squaw Peak (A.D. 1–600) and Camp Verde (A.D. 900–1150) phases of the

Southern Sinagua (see Chapter 6 in Volume 1). Feature 27 is the general midden overlying Locus A. Two Tizon Wiped sherds from an indeterminate jar form were found in it (see Table 6) (see Table 11 in Chapter 2, Volume 2; see Chapter 6 in Volume 1). Also found in the midden was an ash-filled pit (Feature 30), possibly a cleaned-out roasting pit (a loose concentration of fire-cracked cobbles was found nearby) that was intrusive to a pit structure (Feature 29). The ash-filled pit contained 1 Tizon Wiped sherd from an indeterminate jar form and 13 indeterminate, sand-tempered brown ware sherds (see Table 15 in Chapter 2, Volume 2; Chapter 6 in Volume 1). The fill of Feature 29 also contained a Sandy Brown sherd of indeterminate form (see Table 14 in Chapter 2, Volume 2). Just east of Features 29 and 30, also within the midden, is Feature 31, a rock-lined roasting pit. It contained 1 Deadmans Black-on-red sherd (A.D. 900–1100) (see Table 10 in Chapter 2, Volume 2) and 1 indeterminate sand-tempered brown ware sherd (see Table 15 in Chapter 2, Volume 2; Chapter 6 in Volume 1). Although no possible Yavapai sherds were found associated with it, rock-lined roasting pits such as this have been reported from Yavapai contexts (Peter Pilles, personal communication 1998; see Chapter 6 in Volume 1).

AZ O:1:53/AR-03-04-06-745 (ASM/CNF) (Site 53/745)

ARS thought that Site 53/745 was Yavapai, based on the presence of six probable *u-wa'*, or wickiup, circles; ceramics (including Cerbat Brown and Orme Ranch Plain); and expedient ground stone implements (Stone and Hathaway 1997:36–39). SRI's investigation of Site 53/745 also indicated a protohistoric occupation, possibly Yavapai.

SRI identified seven possible protohistoric wickiup circles in Loci C and E (Features 8–10, 12–14, and 17), and four more were later documented by CNF-sponsored investigations (Features 22, 24, 26, and 31) (see Chapter 10 in Volume 1). The latter four are not discussed further here. SRI surface collected three possible wickiup circles (Features 8–10). None had directly associated possible protohistoric ceramics. Feature 8 was associated with sherds dating to A.D. 775–1200 (Deadmans Gray, Verde Brown, and indeterminate sand-tempered brown ware); however, several Orme Ranch Plain sherds were found in the vicinity (see Chapter 10 in Volume 1). Only flakes were associated with the other two features.

All sherds were from surface contexts and were point located on the site map. The sherds included 4 Tizon Wiped sherds from an indeterminate jar form (see Table 7). One of these had a 1σ TL date range of A.D. 1128 ± 66 (see Table C.6 in Appendix C, Volume 2; Table D.1 in Appendix D, Volume 2). There were also 10 Orme Ranch Plain sherds from indeterminate jar forms and 111 from indeterminate forms (see Table 7). Two Orme Ranch Plain sherds were dated using TL. One sample yielded a 1σ date range of A.D. 1155 ± 99, and the second sample had a 1σ range of A.D. 1608 ± 51, but fading may mean that it is older (see Appendix C in Volume 2; see Table D.1 in Appendix D, Volume 2). The ceramic collection is comparable to that of Site 105/838, except for a greater presence of indeterminate Tsegi Orange Ware (A.D. 1050–1300), Awatovi Yellow Ware (A.D. 1300–1625), Orme Ranch Plain, and other Hopi Mesas/Hopi Buttes and Northern Sinagua types (see Chapter 10 in Volume 1).

Other possible evidence of protohistoric occupation, besides the wickiups and ceramics, are the presence of 10 possibly recycled Archaic period projectile points and the presence of a large amount of sandstone grinding implements and sandstone manuports, particularly downslope from Feature 8 (see Chapter 10 in Volume 1). However, excavation by CNF personnel and volunteers of four wickiup circles produced no further evidence of the dates or functions of the features, and no other protohistoric artifacts, such as Desert Side-notched or Cottonwood-style projectile points, were found (see Chapter 10 in Volume 1).

AZ O:1:133/AR-03-04-06-561 (ASM/CNF) (Site 133/561)

Although they observed no diagnostic artifacts, CNF thought that Site 133/561 might be protohistoric Yavapai because of the presence of expedient sandstone manos (Khera and Mariella 1983:39; Schroeder 1974:254). ARS later recorded the site as a low- to moderate-density flaked stone scatter (Stone and Hathaway 1997:49). During initial reconnaissance of the site, SRI found it to be five times larger than previously recorded and divided it into three loci (Loci A–C) (see Chapter 13 in Volume 1). Locus C was surface collected and had evidence of possible protohistoric occupation. It contained a well-preserved roasting pit (Feature 1), possibly for agave; a sandstone grinding slab and mano; and six bifaces of local chert (see Chapter 13 in Volume 1). The ceramics included eight Tizon Wiped sherds from an indeterminate jar form (see Table 8). One of the Tizon Wiped sherds was TL dated and had a 1σ range of A.D. 1791 ± 29 (see Table C.6 in Appendix C, Volume 2; see Table D.1 in Appendix D, Volume 2); however, the rest of the ceramics in Locus C dated to A.D. 900–1250 (Alameda Brown Ware, Deadmans Black-on-red, Tusayan Gray Ware, and Tusayan White Ware) (see Chapter 13 in Volume 1).

Discussion

By examining sites that are thought or known to be protohistoric Yavapai (see Table 5), some tentative correlations can be made among site locations, features, and artifacts (cf. Whittlesey and Benaron 1998:Tables 5.3. and 5.4). These sites are often in caves or rockshelters or are open-air artifact scatters. A number of the open-air sites have circular, cleared areas that are likely foundations for *u-wa* or wickiups. Roasting pits are also fairly common features. These appear to have been for roasting mescal or agave, as evidenced in some cases by plant remains. Some cave sites have preserved agave remains, and mescal knives are occasionally found. Nearly all of these sites have prehistoric components, as well, and many have evidence of prehistoric artifact reuse. In particular, ground stone tools were reused, and flakes and projectile points (particularly Archaic period dart points, perhaps because they are large and are often made of high-quality, imported material) were often retouched into new tools. Expedient, unshaped ground stone, often of sandstone, is also fairly common, as are protohistoric or late prehistoric Apache and Hopi ceramics. Possible diagnostic artifacts include Tizon Brown Ware ceramics, particularly Tizon Wiped; Orme Ranch Plain pottery; and Desert Side-notched (Baumhoff and Byrne 1959; Holmer and Weder 1980) or similar arrow points that are serrated with deeply notched bases. Historical-period artifacts are also fairly common. These associations have been made before by other researchers, all of whom also noted that none of these traits, in part or as a whole, can be definitively tied solely to the Yavapai (e.g., Ferg and Tessman 1998; Pilles 1981a; Whittlesey and Benaron 1998; Wood 1987). Many of these traits can also be associated with prehistoric cultures, other Pai groups, or the Apache. Other issues that complicate a definitive association with the Yavapai include formation processes at protohistoric sites, particularly those used by mobile hunter/gatherers; the nature of the pottery; problems with ethnohistoric data; the lack of collected pots known to have been made by the Yavapai; the rapid assimilation of Western material culture; and the relationship of the Yavapai with other groups, particularly the Western Apache.

Protohistoric sites can be difficult to identify for a number of reasons (Donaldson and Welch 1991; Gregory 1981). In particular, the short time frame they represent means that less material is left behind in the archaeological record. Also, there has been less time for natural or cultural processes to lead to burial and preservation, which means that they are still exposed at the surface and are easily eroded and visible to those who might remove items. These late sites can also be problematic for using some kinds of chronometric-dating techniques, particularly radiocarbon dating (Whittlesey et al. 1998). When these sites are used by mobile hunter/gatherers, like the Yavapai and Apache, even more issues arise. The mobility of these groups means that they did not stay in one place very long and so left less of an archaeological signature. They tended not to build permanent structures or features, and they tended to use lightweight items that were perishable, such as basketry, rather than pottery. They may also have preferred to use local resources, including scavenged items, rather than to carry raw materials or finished products from far away. They were then likely to leave these items behind, and because of the use of local and reused materials, the items may have blended in with the local archaeological signature.

These issues hold true for Yavapai and Western Apache protohistoric sites. Both were mobile groups who entered central Arizona relatively late in prehistory or protohistory. The Yavapai are documented in central Arizona by the 1600s, and the Apache likely entered the area around A.D. 1750 (Whittlesey and Benaron 1998:144–146). Both groups were highly mobile hunter/gatherers who relied more on wild foods and raiding than on farming (Cordell 1984:9–10; Whittlesey and Benaron 1998:143, 182), and both groups relied on basketry more than pottery (Whittlesey and Benaron 1998:154, 175). Neither group built permanent structures but, rather, used brush huts or wickiups or even caves and rockshelters (Whittlesey and Benaron 1998:150–153, 172–174). Both groups also tended to scavenge materials from prehistoric sites for reuse (Ferg and Tessman 1998:236; Goodwin 1942; Whittlesey and Benaron 1998:183). Finally, both groups also destroyed individuals' personal property at death (Whittlesey et al. 1998:211).

Pottery was not commonly used by most hunter/gatherers, because it is too heavy and too fragile to move easily. The durability and lightness of basketry and skins made their use more practical. Technological issues, such as knowledge of local clay and temper locations and qualities as well as the time needed to make, dry, and fire ceramics, may also have hampered their use by mobile groups. The two types thought to have been made by the Yavapai—Tizon Wiped and Orme Ranch Plain—are typical of the types of pottery used by mobile hunter/gatherers, because they are relatively thin and light and require relatively little in terms of time, skill, or technology to produce. They are both built through coiling and thinned by paddle and anvil or scraping, and they are both low fired in a poorly oxidizing environment. These types are fairly fragile both because of their thinness and because of the low temperatures at which they are fired. Both types appear to have been highly utilitarian, used mostly for carrying and storing liquids and dry stuffs and for cooking, because jars are, by far, the most common form and many have evidence of use over a fire, such as burned and spalled exterior surfaces. The wiped surface of Tizon Wiped and the corrugations of Orme Ranch Plain were likely more for practical purposes, such as preventing slippage and increasing surface area for heating and cooling, than for decoration. Unfortunately, these same technological characteristics and uses, coupled with a mobile lifestyle and formation processes, have consequences for the archaeological record and may partly explain why the sherds of these two types tend to be both rare and quite small. Because of the preference for basketry and skin containers, not many of these types of pots were likely produced. Those that were made were likely used for activities that could easily cause them to break, such as cooking and transportation. In addition, because they were used so late in history, they tend to remain on the site surface, where they become eroded and get trampled into small pieces and are probably picked up for reuse or by modern collectors.

Another issue is the paucity of Yavapai ethnographies (Gifford 1932, 1936) or historical accounts (Bourke 1971; Corbusier 1969). The ones that exist only occasionally address pottery, and those that do go into relatively little detail. There are also several issues with the accounts that discuss ceramics. First, none of them are Native accounts; all are written by Westerners. Second, many accounts confuse the different Yavapai tribes, lump them together (for example, Khera and Mariella [1983:38] commented that Gifford lumped two Northeastern Yavapai subtribes together), or confuse the Yavapai with other groups, particularly the Apache and Mojave—a problem exacerbated by the names given to Yavapai groups historically, such as "Apache-Mojave" (Corbusier 1969). For example, it is noted that "some of Gifford's Northeastern informants said that a few of Dr. Corbusier's statements applied to the Tonto Apache and not to the Yavapai at all" (Corbusier 1969:13, Footnote 2). Third, nearly all of the informants were males, although Corbusier (1969:39) noted that pottery "manufacture is confined to women who own all such property." Fourth, some of the interviews and notes were made many years after most, if not all, pottery making had ceased.

Interestingly, Corbusier's (1969) discussion of Northeastern and Southeastern Yavapai pottery making closely matched Gifford's (1936) discussion of Western Yavapai pottery making. However, Gifford's (1932) discussion of Southeastern Yavapai pottery, which would seemingly match Corbusier's discussion, varied somewhat from both descriptions, likely because Gifford's Southeastern Yavapai informant was Michael Burns, who was male. It is likely that, although he probably saw and used pottery, he did not make pottery or even see pottery made very often. Also, Michael Burns was just a child—approximately 6 or 7 years old—when the Skeleton Cave Massacre happened in December of 1872 (Bourke 1971), which means that he was about 9 or 10 when removed to the San Carlos Reservation. Once on the San Carlos Reservation, native pottery was rapidly replaced by Western wares (Gifford 1936). Tellingly, the details that Burns gave that did match the other accounts were attributes that would be fairly obvious to the casual user and observer, such as the color (red), coiling, scraping and polishing, and the vessel forms. Burns claimed that neither temper nor the paddle and anvil were used, contradicting the other accounts; however, these are things that would be less noticeable to the user or casual observer, particularly a young child.

The time lag between observation and recording may also be a problem. Corbusier's account (1969) was written about 11 years after his tenure as a doctor with the Yavapai. He also dealt with many other Native American groups after working with the Yavapai (Corbusier 1969), and it is possible that he forgot or confused some details. As noted earlier, Corbusier, like many others, called the Yavapai "Apache-Yumas" or "Apache Mojaves" and apparently sometimes confused the various groups (Corbusier 1969:13, Footnote 1). For instance, he stated that Yavapai pottery was decorated with painted zigzags and horizontal lines, something no other ethnographer or historical-period account has mentioned. (However, it should be noted that the Sitgreaves [1962 (1853):Plate 17] expedition report included a lithograph that showed a "Yampai" Indian with a pot or basket that had a zigzag or lightning-bolt design. Also, the rare painted varieties of Cerbat and Aquarius Brown have basically linear designs [Dobyns and Euler 1958]). It is possible that he confused it with the pottery of other groups, perhaps the Apache who did incise their pottery. Similarly, Gifford's interviews took place in the 1920s–1930s, about 50 years after the Yavapai had been settled at San Carlos and had adapted to Western culture. It also appears that Gifford himself did not see any Yavapai vessels and relied solely on informant's memories.

There are also no extant vessels in collections that are securely known to have been made by the Yavapai. In addition, there are also no historical-period photographs that clearly show pottery vessels at Yavapai encampments (Whittlesey and Benaron 1998:160). Instead, historical-period photographs primarily show baskets and metal vessels. Therefore, the attribution of Tizon Wiped and Orme Ranch Plain to the Yavapai has been made by archaeologists. Tizon Brown Ware has been attributed to the Hualapai by Euler and Dobyns (1985) through the direct historical approach. They excavated sites that were said by living Hualapai to have been occupied by them in the past, and they recovered enough Tizon Brown Ware to convince them it was made by the Hualapai (Euler and Dobyns 1985). Unfortunately, the only known whole vessels are from unprovenienced sites (Whittlesey and Benaron 1998:155–156). The attribution of the types Tizon Wiped and Orme Ranch Plain to the Yavapai has largely been based on their occurrence at sites that were either said to have been occupied by the Yavapai or located in Yavapai territory (Whittlesey and Benaron 1998:158). Orme Ranch Plain was also attributed to the Yavapai by Breternitz (1960b) because it did not resemble known Apache types and was also different from any known prehistoric types. However, the only known whole vessel of Orme Ranch Plain was found in a cliff dwelling along with an Apache Plain, Strawberry variety, vessel (Whittlesey and Benaron 1998:156–157). In addition, enough sherds of an Orme Ranch Plain jar were recovered from NA18192 (AR-03-04-06-458 [CNF]) to make a reasonable reconstruction of it (Dosh 1985). The only vessel that has come from a living Yavapai person is a Verde Brown jar that has a typical Yavapai water-basket form and is unlike any of the pottery forms described by Gifford (1936). It was said to have been made by the owner's grandmother while at Camp Verde (Pilles 1981a). There is also plenty of ethnographic and archaeological evidence to suggest that, rather than making pottery, the historical-period Yavapai often obtained it through trade with the Pima (Whittlesey and Benaron 1998:159–160).

Perhaps the strongest association between the Yavapai and Tizon Wiped is from Skeleton Cave, where about 76 Yavapai were killed by the U.S. Cavalry in 1872 (Ferg and Tessman 1998). At least 7 of 11 "presumed . . . Yavapai-made Tizon Wiped" sherds were found in a small rockshelter just east of Skeleton Cave (Ferg and Tessman 1998:257–258). It is unclear from which cave the other 4 sherds came. At least two vessels were represented, and rim sherds indicated that one was a jar with a short neck that was either slightly outflared or vertical (Ferg and Tessman 1998:258). However, Ferg and Tessman also admitted that "[b]ased on the wiped sherds alone, it would be difficult to argue whether the . . . occupation was by Yavapai or Western Apache because Tizon Wiped and Apache Plain can be difficult or impossible to distinguish in sherd form" (1998:258).

One reason there is a lack of pottery known to have been made by the Yavapai is because they rapidly adopted non-Native containers. For instance, Keller and Stein (1985) reported investigations at three Yavapai wickiup (*u-wa'*) sites near modern Prescott, Arizona. The sites were occupied between about 1900 and 1934, following the period of confinement on the San Carlos Reservation. The recovered collections were remarkable for the almost-complete replacement of domestic containers of Native American manufacture with those of European or American manufacture—commercial ceramic cups, bowls, plates, platters, and a teapot; metal cans, buckets, and a teakettle; enamel ware; and glass bottles. Two of the three sites yielded 16 sherds. NA18188 produced 9 sherds of Lower Colorado Buff Ware. This ware was popular among the Hualapai in the historical period (Dobyns 1956) and may also have been obtained by the Yavapai after 1900 (Keller and Stein 1985:47). NA18190 yielded 7 sherds, 2 of which resembled Tizon Brown Ware. The remainder were typed as Verde Gray, Sandy variety; Wingfield Plain; and Prescott Gray. Keller and Stein (1985:47) suggested that although "[a]ny or all of these types could be of Yavapai manufacture," the sherds might represent "long-curated pieces or recovered cache vessels" left prior to the San Carlos confinement. A similar lack of Native ceramics and their replacement by Western wares by the 1930s have been reported at such historical-period sites as the Bartlett Dam construction camp (Douglas et al. 1994) and Yavapai sites at Fort McDowell (Stein 1984).

Perhaps the most difficult issue in determining which ceramics can be associated with the Yavapai is the Yavapai's relationship with the Western Apache. The Yavapai and the Western Apache appear to have had an initially contentious relationship when they were interned together at the Rio Verde Reservation, because they lived on opposite sides of the river (Corbusier 1969). They also fought on the march from the Rio Verde Reservation to the San Carlos Reservation. However, Corbusier (1969:16) also noted that many of the Indians at the Rio Verde Reservation "are Yavapais who have taken Apache women for wives—probably stolen them—from among the Pinal and other Apaches south of the Salt River." Even the most famous Yavapai leader, Delshay, was apparently part Yavapai and part Apache (Ferg and Tessman 1998:276). Not only did the Yavapai and the Apache intermarry (Ferg and Tessman 1998; Goodwin 1942), but many had both a Yavapai and an Apache name and spoke both languages (Ferg and Tessman 1998:276). They also shared part of their territory, including the LOCAP area covered in this study (Whittlesey and Benaron 1998:145, Figure 5.1). They also often allied with each other against other Pai groups (Gifford 1932; Goodwin 1942:51, 88; Whittlesey and Benaron 1998:182), and the Hualapai and Havasupai often allied against the Yavapai (Reid and Whittlesey 1997:115). The fact that the Yavapai and the Apache had similar hunter/gatherer lifestyles also means that they shared similar technologies, land-use patterns, food-acquisition techniques, and general lifeways (Whittlesey and Benaron 1998:179–183). As a consequence, their material culture would have been similar, and many sites, particularly desirable landscape features, such as caves or rockshelters, would have been used by both groups. Indeed, the ethnohistorical and archaeological evidence indicates that the Western Apache and the Yavapai did have a very similar suite of material culture (for a full discussion of Western Apache and Yavapai shared material culture see Ferg and Tessman [1998] and Whittlesey and Benaron [1998]) and did occupy many of the same sites (Ferg and Tessman 1998:236).

It is perhaps not surprising, then, that Yavapai and Western Apache ceramics would be similar and difficult to distinguish from one another (see Clauss 2004b; Wood 1987:116). Wood (1987) suggested that Yavapai pottery may have been derived from Apache ceramics as the consequence of frequent contact between and the coresidence of the two peoples in the Verde River valley: "Yavapai pottery has no apparent precedent in Arizona other than Apache Plainware, and Apachean ceramic development can be traced back to prehistoric sources in the northeastern Southwest and the Great Plains" (Wood 1987:116). An instance that demonstrated the similarity between types thought to be associated with the Apache and the Yavapai involved two complete or reconstructible vessels found in a prehistoric cliff dwelling in the middle Verde River region. According to Ferg (1992:26), Pilles suspected that the site was Honanki. One vessel was Orme Ranch Plain, and the other was an Apache Plain, Strawberry variety, vessel (Pilles 1981a:Figures 1 and 2). Both were bowls with wide apertures and outflaring rims, and both had horizontal bands of pinch marks or fingernail marks around the exterior. The main differences were the shapes; the Apache vessel was less globular and had a more-steeply rounded base (illustrated in Pilles [1981a:Figure 2] and Whittlesey and Benaron [1998:Figure 5.6]).

Another reason Yavapai and Apache ceramic types may be similar and are often associated with one another is intermarriage. Paste recipes are often dependant on the local availability of resources and the characteristics of local clays, but surface treatment and forms are the results of motor skills and habits that, once learned, can be difficult to change. Surface treatments may be somewhat easier to learn than construction techniques, and surface appearance may be under greater cultural pressure to conform to a group's aesthetic values. Form is usually determined by function, and as long as the function can be fulfilled, then changes in form may not be as readily adopted. Therefore, any intermarriage between Yavapai and Apache might have led to the production of pottery that had paste indicative of local manufacture and surface treatment that may also have reflected the local group's aesthetic values but that may have had construction techniques or forms that were nonlocal. A possible example of this kind of amalgamation of attributes is a partial vessel "found near Superior" that Ferg and Tessman (1998:258–259) thought might be the same one depicted in a historical-period photograph of Skeleton Cave. As they noted, the jar was wiped on the interior and exterior and had a wide mouth, relatively short vessel height, a short neck with a slightly outflared rim, and a somewhat pointed base. They stated that this mix of ceramic attributes "may be characteristic of pottery made by groups of mixed Southeastern Yavapai and Southern Tonto or San Carlos Apache" (Ferg and Tessman 1998:259).

The ethnohistoric and archaeological evidence indicated that distinguishing between Yavapai and Western Apache sites, particularly in areas of geographic overlap, is extremely difficult, if not futile. In fact, it is becoming increasingly clear that the Western Apache, particularly the Northern Tonto, and the Yavapai, particularly the Eastern groups, had very similar material cultures and intermarried to such a degree that they are archaeologically indistinguishable (Ferg and Tessman 1998; Whittlesey et al. 1998). The cultural traits that distinguished the two groups (e.g., language, social organization, and beliefs) are not recoverable archaeologically (Whittlesey et al. 1998:214).

Conclusions

Can Tizon Brown Ware, particularly Tizon Wiped, be used to associate a site with the Yavapai? Tizon Brown Ware is found across southern California and western Arizona as well as in the territory occupied historically by the Yavapai (Christenson 2018). It clearly was not made solely by the Yavapai but also by the Hualapai and Havasupai, as suggested by Euler and Dobyns (1985:79). The distribution also suggests that it may have been made by non-Pai peoples, as well. Tizon Brown Ware also is a very-long-lived type that was made long before any definitive evidence of Yavapai occupation of the Verde River valley. The ware is also similar to several prehistoric wares and can be difficult to separate from those wares in sherd form. The type Tizon Wiped is mostly strongly associated with the Havasupai, although it was perhaps made by the Yavapai, as well (Euler and Dobyns 1985). It is also very similar to Apache Plain, which is also striated, and the two are difficult to separate in sherd form (but see Ferg 1992). All of these factors mean that it is impossible to affiliate a site with the Yavapai based on Tizon Wiped alone. Because of its long period of use and widespread distribution, other evidence must be provided—first, to indicate that it is from the protohistoric period and, second, that it might be associated with a Yavapai occupation. Even then, a Western Apache or other Pai affiliation cannot be ruled out.

Can Orme Ranch Plain be associated with the Yavapai? Unlike Tizon Wiped, it is a younger type that first appeared during the protohistoric period. Although it is similar to some prehistoric types, the combination of paste, form, and surface treatment is relatively unique to the type. The type is also somewhat more localized to the Yavapai territory than is Tizon Wiped. Like Tizon Wiped, it alone is not strong evidence for a Yavapai occupation; other evidence must be brought to bear in order for a site with Orme Ranch Plain sherds to be affiliated with the Yavapai.

Until more research is done on Tizon Wiped and Orme Ranch Plain, they can only very tentatively be used, along with other supporting evidence, to affiliate a site with the Yavapai. Ethnographic information about Yavapai pottery indicated that it was red (from either the paste or the slip), thin, fragile, formed with coils, shaped with a paddle and anvil, and organically tempered; that it sometimes had gravel or sherd temper; and that it was probably only smoothed or lightly striated or scraped. The shapes were those described by Gifford (1932, 1936) and Corbusier (1969). Except for the forms, the use of paddle and anvil, and the relative rarity of sherd temper, this is basically the description of Apache Plain. The best and virtually only way to distinguish between types attributed to the Yavapai and those attributed to the Apache is by form, which is mostly easily done with partially reconstructible or whole vessels, as seems to have been confirmed by Goodwin's (A-66, A-71) Apache informants, who indicated that although they frequently used Yuman pottery, it could be readily distinguished from Apache pottery by its shape. Therefore, if there are no partial or whole vessels at a site, it is prudent to consider other evidence, such as the contexts and associations of these types, before assigning any cultural affiliation(s). The types themselves are not sufficient to affiliate a site solely with the Yavapai, and until more is learned, a Western Apache or other Pai-group affiliation with these sites cannot be ruled out.

Additional research is needed on both Tizon Wiped and Orme Ranch Plain. In particular, research toward more-precise dating of these types needs to be done. More petrography and instrumental neutron activation analysis should also be done, in order to determine where these types were produced and whether they were moved very far from their production areas. Finally, more archival research on the Yavapai and the Apache could clarify what kinds of pottery each group made and used.

Revised Type Descriptions for Orme Ranch Plain

Orme Ranch Plain is a late prehistoric to protohistoric (A.D. 1500–1850) obliterated-corrugated plain ware that is similar to Apache Plain ware as well as to some prehistoric wares. By the time it began to be made in central Arizona, Tizon Brown Ware was centuries old. However, the similarity of the paste recipes of Tizon Brown Ware and Orme Ranch Plain suggests that the latter should be placed in Tizon Brown Ware. The possibility that Orme Ranch Plain and Tizon Wiped belong to the same ware is strengthened by the petrographic analysis that Christenson (2018) conducted during the LOCAP. He analyzed 17 sherds (Tizon Wiped, Orme Ranch Plain, and a fingernail-indented sherd not assigned a type label but possibly an Apache Plain type) collected from LOCAP sites and other sites in historically documented Yavapai territory (Christenson 2018). Most Tizon Wiped and Orme Ranch Plain sherds contained arkosic inclusions derived from a granitic source, either crushed or disintegrated granite or granodiorite. Four sherds, including the fingernail-indented sherd, 1 Orme Ranch Plain sherd, and 2 Tizon Wiped sherds, had a composition corresponding to the mineral tonalite. This uncommon granitic rock has been found in prehistoric sherds from the Verde River valley (Christenson 1999; Heidke et al. 1996). Because the mineral inclusions in these sherds differed from the local bedrock geology in the region, Christenson (1999) suggested that the makers of the pottery preferred to use granitic material rather than locally available streambed sand, which may suggest the use of residual clays containing granitic-rock particles or the addition of crushed granitic rock as temper. It also may indicate that the analyzed ceramics were not made in the LOCAP area.

Ware: Tizon Brown Ware

Revised type name: Orme Ranch Obliterated-corrugated

Date range: A.D. 1500–1800/1850

Construction: coiling; thinned by paddle and anvil or scraping

Firing: in a poorly controlled, oxidizing atmosphere, sometimes a reducing atmosphere

Surface treatment: Exteriors are unpolished with vertically pinched corrugations that are obliterated, sometimes to the point of appearing only as lumps. Narrow wipe marks or striations are sometimes present between the corrugations. Interiors usually have narrow wipe marks or striations, or they may be left unfinished or lightly smoothed. Wipe marks or striations can give a slightly scummy appearance. Anvil marks may also be present.

Surface color: usually black to dark gray but may also be light brown, brown, or reddish brown; the range of colors is due to uneven oxidation during firing but may also result from sooting, fire clouds, or smudging

Paste: contains coarse to medium-fine arkosic (quartz and feldspar) inclusions derived from a granitic source, either crushed or disintegrated granite or granodiorite (Christenson 2018; Gilpin and Phillips 1998); mica is occasionally present; sherd or volcanic-ash inclusions are rare; black, unoxidized cores are common

Paste color: black to dark gray, sometimes brown to reddish brown

Wall thickness: range of 0.3–2 cm; average of 0.7 cm

Vessel forms: Vessel forms are almost exclusively jars. The only complete vessel, however, is a deep, flared-rimmed bowl in the Sharlot Hall Museum (Pilles 1981a:Figure 1). Jars have slightly recurved to outcurved necks and slightly everted to direct rims with round lips. Bodies are globular, and bases appear to be flat to slightly rounded.

References: defined by Breternitz (1960b), Clauss (2004a), Pilles (1981a), Whittlesey and Benaron (1998), and Wood (1987)

Cultural affiliation: possibly Yavapai; may also be associated with other Pai groups or the Western Apache

CHAPTER 4

Dendroclimate Reconstruction for the Middle Verde River Valley

Carla R. Van West

The goal of this chapter is to identify climate episodes that influenced water availability and plant growth, which in turn influenced agricultural potential, range conditions, and sustainable settlement in the LOCAP locality. To meet this goal, this chapter presents a 1,418-year tree-ring-based climate reconstruction applicable to the MVRV.

The climate reconstruction is based on two chronologies from north-central Arizona. The first tree-ring chronology is the 1,418-year (A.D. 571–1988) Don-Verde chronology (VERDE) created by Donald A. Graybill. VERDE is a revised and updated version of an earlier prehistoric chronology known as AZNOF and living-tree chronologies from Slate Mountain, Dry Creek, and Hackberry Canyon (Graybill 1989:27–28). The prehistoric component of VERDE was developed from prehistoric and living-tree conifer specimens retrieved from north-central Arizona, from Arizona 1 -by-1 geographic-map Quadrangles N, O, and the Flagstaff area. It is a mixed-species chronology composed of Douglas fir *(Pseudotsuga menziesii* [Mirbel] Franco), ponderosa pine (*Pinus ponderosa* Douglas ex. P. & C. Lawson), and piñon pine (*Pinus edulis* Engelm.). The living-tree component of VERDE was developed from ponderosa pine and Douglas fir trees in Walnut Canyon, near Flagstaff, and from piñon pine in the Dry Creek area, near Sedona. In this chapter, I use VERDE to model variation in annual total precipitation. The second tree-ring chronology is the 2,660-year (663 B.C.–A.D. 1997) San Francisco Peaks Bristlecone Pine (*Pinus aristata* Engelm.) chronology (SFPB) updated and reported by Matthew W. Salzer (2000). SFPB was created from living trees and remnant wood on the high peaks (ca. 3,536 m, or 11,600 feet) of the San Francisco Mountains near Flagstaff, Arizona. In this chapter, I use SFPB to model variation in annual mean maximum temperature.

As with a recent dendroclimate reconstruction prepared for the Fence Lake project (Van West and Grissino-Mayer 2005), I have paired the annual trends displayed in these two chronologies to infer when local climate was similar to or different from the long-term trend in annual moisture and temperature patterns documented for north-central Arizona. The VERDE chronology was selected to represent local precipitation trends in the MVRV, and the SFPB chronology was selected to represent regional temperature trends. Using them together permits me to monitor variation in local precipitation independent from variation in temperature.[1] This method also permits me to identify time intervals that were not only "dry" or "wet" but also "dry and warm," "dry and cool," "wet and cool," and "wet and warm." Insofar as each of these persistent states has a different effect on plant growth, farming success, and sustainable human settlement, it is useful to reconstruct both of these potentially limiting or permitting climatic conditions.

Methods

For each tree-ring chronology, Graybill (1989) and Salzer (2000) used standard methods to create or update their chronologies (Fritts 1976; Holmes 1983; Stokes and Smiley 1996). This involved sample collection and preparation, cross-dating, measurement, statistical verification for accuracy of measurement and cross-dating procedures, standardization of each ring-width series through a curve-fitting process that removed age- and size-related variabilities and retained climate-related variability in

[1] The correlation between these two time-series is –0.05, indicating that there is virtually no linear correlation between these two chronologies. They are, then, independent measures of climate, insofar as each can be considered a proxy for precipitation or temperature.

the resulting tree-ring indices, and, finally, combining all tree-ring series, using a mean value function, to create an overall mean site chronology. Thereafter, a battery of statistical studies relating modern climate (i.e., historical records of instrumented data) to recorded stream flow and tree growth were conducted, with the goal of producing mathematical equations (transfer functions) that would allow these two researchers to estimate the climate variable (annual stream-flow discharge or annual mean maximum temperature) they wanted to reconstruct. The interested reader is urged to consult Graybill (1989) and Salzer (2000) for a complete description of the methods used to build each chronology and to develop the respective dendrohydrological and dendroclimate reconstructions. Underlying both of these dendrochronological reconstructions is the assumption that tree growth is strongly associated with climate (Fritts 1976; Fritts et al. 1965). It is this basic principle that allows dendrochronologists to transform the trends in tree-ring chronologies into reconstructions of given climatic variables.

To conduct this study, I undertook the following steps. First, I acquired digital files containing the VERDE chronology and the SFPB temperature reconstruction. The VERDE standard chronology was acquired from the University of Arizona's Laboratory of Tree-Ring Research. These data were provided as electronic files by dendrochronologist Gary Funkhouser, who carried on many of the paleoenvironmental-reconstruction tasks undertaken by Don Graybill after Graybill's death. I acquired the SFPB temperature chronology on disk from Dr. Mark Elson, Desert Archaeology, Inc. (DAI), Tucson, with the permission of Dr. Salzer, because this chronology had not yet been published in the International Tree-Ring Database when I conducted this study. These SFPB data are now published (Salzer and Dean 2007).

Second, in order to jointly use these two different data sets, I converted each series into a time series composed of standard-deviation units (z-scores) that had a long-term mean of 0 and a standard deviation of 1. This was done simply by deriving a series mean and standard deviation for each original series, subtracting the series mean from each annual value, and then dividing the difference by the series standard deviation (see Appendix A, Column 3).

Third, I annotated Appendix A with frost-ring data provided by Salzer (2000:91–98) and noted the number of "extreme" values contained in the VERDE and SFPB chronologies. Frost rings are annual growth rings damaged by exposure to prolonged subfreezing temperatures during the growing season of the tree. Documentation of when these damaging frosts occurred may be used to suggest when crops growing at lower elevations might have been adversely impacted by detrimental frost during their own growing seasons (see Appendix A, Column 8). I defined extremes as annual-precipitation and annual-temperature values less than or equal to –1.28 standard deviations below the long-term normal and values greater than or equal to +2 standard deviations above the long-term normal[2] (see Appendix A, Column 11). The reason for this asymmetry is simple. Trees cannot register negative growth. Given certain inimical environmental conditions, ring production stops or is so severely curtailed that a "missing ring" is registered in the series of rings produced by that tree. This is not true, however, for moisture and temperature conditions *above* long-term normal. Additional moisture and heightened or prolonged warmth without an accompanying drought generally results in wider rings and more-robust tree growth. Thus, a typical plot of tree-ring indices or reconstructed precipitation values expressed as z-scores always has negative values that are truncated at about 2 standard-deviation units below the mean, whereas positive values frequently exceed 2, 3, 4, and even 5 standard-deviation units above the mean. For this reason, values between –1.28 (approximately 40 percent of the variability to the left of the mean under a normal curve) and +2 (approximately 48 percent of the variability to the right of the mean under a normal curve) includes 88 percent of all variability. Beyond these limits, I believe, climatic conditions would have been so unusual that the normal range of agricultural strategies would have been inadequate to cope with the excessive drought, moisture, cold, or heat.

Fourth, I needed to see how these two unsmoothed, annual data sets (Figure 4) covaried through time. I plotted the resulting z-scores from VERDE and SFPB on a single graph (Figure 5) in which the long-term mean value for each data set was 0 and a standard-deviation unit was 1. I present these data graphically for A.D. 571–1988. In Figure 5, the VERDE data (blue)—the proxy of precipitation trends through time—are plotted on top of the SFPB data (red)—the proxy of temperature trends through time. To facilitate perceiving trends, I have smoothed these data by presenting them as a 5-year moving average weighted by standard methods.

When the spikes displayed in Figures 4 and 5 are upward and positive, they indicate wetter-than-normal or warmer-than-normal conditions relative to their respective long-term trends. Conversely, when the spikes are downward and negative, they indicate drier-than-normal or cooler-than-normal conditions relative to the long-term trends

[2] Dean (1988a:138) observed that using a reference of 2 standard-deviation units to indicate extreme climate episodes (i.e., extreme climate episodes that occur only 5 percent of the time) was unrealistic for archaeological applications, because local populations likely were affected by climatic variation long before climatic conditions had reached such unusual levels. Dean therefore proposed using ±1.1 standard-deviation units as a more suitable reference for examining smoothed series (Grissino-Mayer 1995:72). Smoothed series have fewer extreme values, lower amplitudes, and smaller ranges than unsmoothed series. Thus, our choice of thresholds for "extreme" values in an unsmoothed data set differs from that suggested by Dean, who used the ±1.1-standard-deviation limit to define "normal."

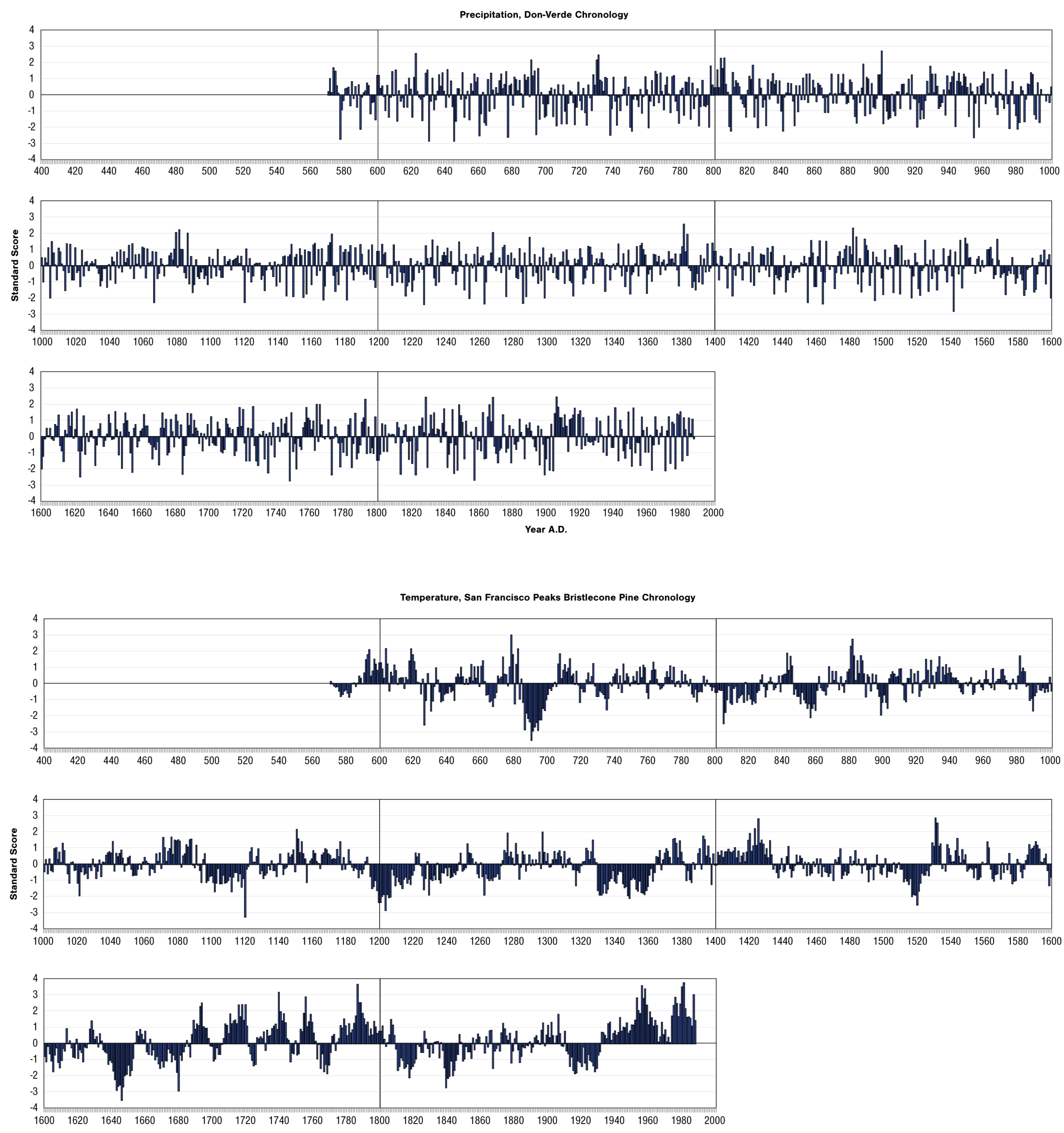

Figure 4. Top graph: Reconstructed annual total-precipitation values (Don-Verde tree-ring chronology) for the A.D. 571–1988 period. Values are unsmoothed annual values expressed as z-scores. Upward spikes represent wetter-than-normal and warmer-than-normal years and intervals; downward spikes represent drier-than-normal and cooler-than-normal years and intervals. Bottom Graph: Reconstructed annual mean maximum-temperature values (San Francisco Peaks Bristlecone Pine tree-ring chronology) for the A.D. 571–1988 period. Upward spikes represent wetter-than-normal and warmer-than-normal years and intervals; downward spikes represent drier-than-normal and cooler-than-normal years and intervals.

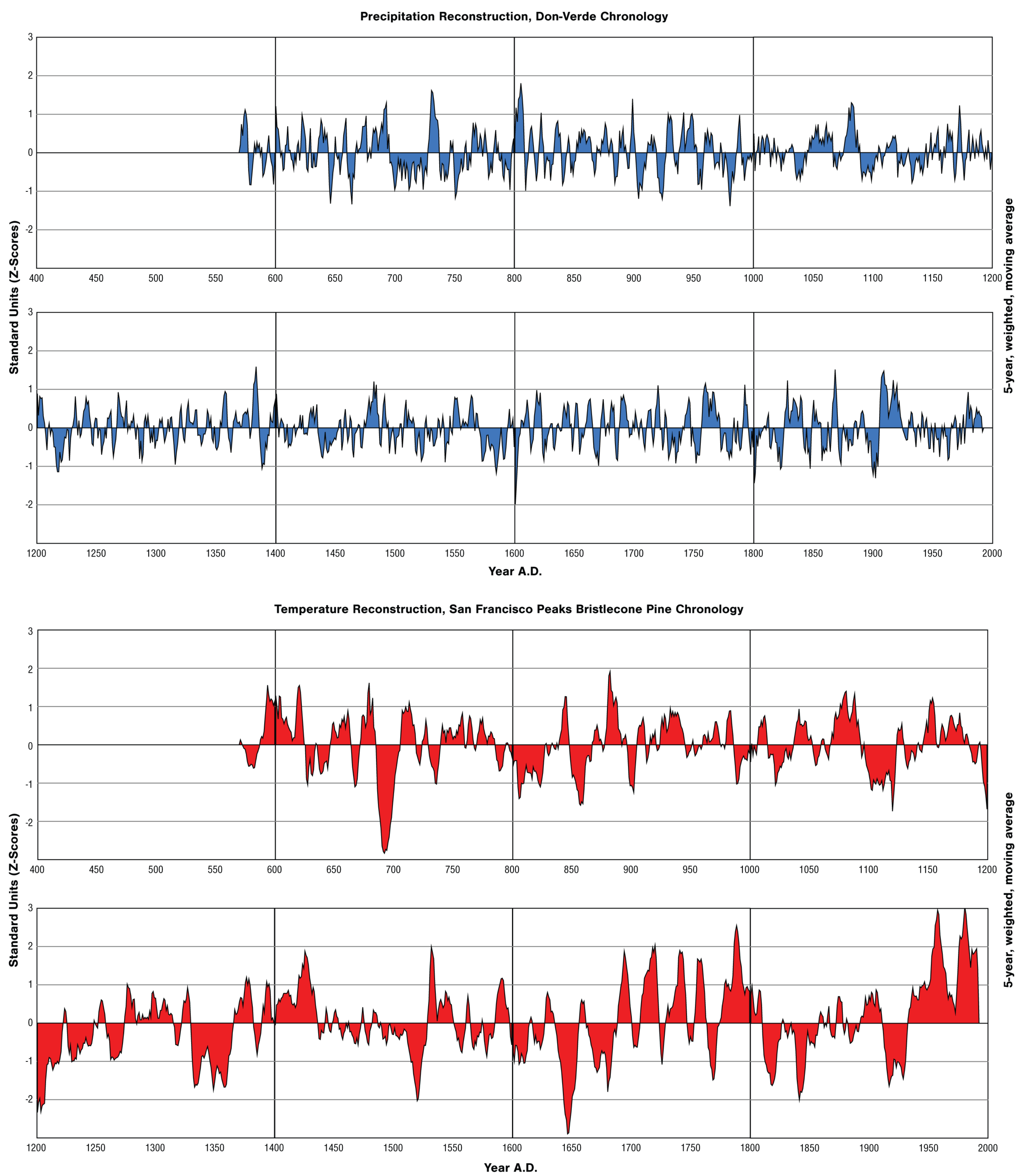

Figure 5. Smoothed annual total-precipitation values (Don-Verde tree-ring chronology) overlain on reconstructed annual mean maximum-temperature values (San Francisco Peaks Bristlecone Pine tree-ring chronology) for the A.D. 571–1988 period. Both time series have been smoothed with a weighted 5-year, running mean to highlight short-term trends. Upward spikes represent wetter-than-normal and warmer-than-normal years and intervals; downward spikes represent drier-than-normal and cooler-than-normal years and intervals.

expressed in each series. These graphs show that over the course of these 14 centuries, wetter-than-normal intervals were accompanied by cooler-than-normal intervals (i.e., "wet and cool") and drier-than-normal intervals were accompanied by warmer-than-normal intervals (i.e., "dry and warm") over 51 percent of the time. Importantly, however, I found many intervals when wetter-than-normal conditions were accompanied by warmer-than-normal temperatures (i.e., "wet and warm") (23 percent) and intervals when drier-than-normal conditions were accompanied by cooler-than-normal temperatures (i.e., "dry and cool") (26 percent). The data displayed in Figures 4 and 5 also show marked variation in the *duration* (the number of years the condition persisted), *magnitude* (the z-score value and its extreme beyond normal variation), and *internal variability* (fluctuating values and persistence of a given trend) within a given interval.

Fifth, to evaluate the meaning of this variation, I subdivided the 1,418-year joint record (A.D. 571–1988) into a consecutive series of contrasting intervals defined by their differing durations, magnitudes, and internal variabilities. I did this by first plotting the VERDE and SFPB data on separate graphs, both as annual values (see Figure 4) and together as smoothed values, using a standardized, weighted, 5-year moving average to reveal local trends (see Figure 5). I then used a combination of visual inspection of the graphs and scrutiny of the z-scores to determine when one interval ended and the next one began. The persistence of a joint condition (e.g., dry and cool vs. dry and warm), the magnitude of a very extreme z-score, and the sign change (positive to negative or vice versa) were used to terminate a period. After some experimentation with the length of a meaningful interval, I established that the minimum duration of an interval was 3 years. For the purposes of this analysis, I determined that single or double years of some extreme magnitude (less than or equal to –1.28 and greater than or equal to +2) were unanticipated perturbations or "climatic episodes" (rather than "climate intervals") that humans could survive by using stored foods, local redistribution or exchange of essential food items, and temporary moves. By these methods, I was able to partition the 1,418-year record into 173 intervals (1,394 years) ranging in duration from 3 to 26 years, and 14 climatic episodes (24 years), each representing 1- or 2-year, extreme conditions (see Appendix A, Column 15).

Sixth, I classified the intervals so that each represented one of four possible climatic conditions. To do this, I calculated a mean and standard deviation for the VERDE and SFPB z-score series within each of the 173 intervals and 14 climatic events (see Appendix A, Columns 4 and 7). Again, I used a combination of visual inspection of annual and smoothed graphs and visual inspection of the sign and value of the mean to assign the 189 intervals and climate episodes to one of eight climatic descriptors (see Appendix A, Columns 9 and 10). Intervals were characterized as wet or warm when their mean values were positive numbers. Conversely, intervals were characterized as dry or cool when their mean values were negative numbers. Thus, four possible climate classes emerged from this classification: dry and warm, wet and cool, dry and cool, and wet and warm.

Seventh, in order to evaluate which climatic intervals might force a human response, I needed a replicable method to determine their potential severity. My goal was to rank the 173 intervals and 14 climatic events by a derived climatic-intensity value (CIV) that took into consideration the magnitude of the moisture *and* temperature conditions, how long the conditions lasted, and how much variability occurred within a given time interval. This was a three-step process.

- For each of the 173 intervals, I calculated a precipitation index using the VERDE data and a temperature index using the SFPB data. Both indices considered the magnitude, duration, and internal variability; the interval (z-score) mean represented magnitude, the interval length represented duration, and the interval (z-score) standard deviation represented internal variability. I calculated the precipitation index as: (mean * number of years) ÷ standard deviation. For example, using numbers rounded to two decimals (see Appendix A), the Interval 4 precipitation index was calculated as follows: –1.91 = (–0.23 * 8)0 ÷ .94 (or more accurately expressed as –1.9106 = [–0.2256 * 8] ÷ 0.9448). I calculated the temperature index in the same way: (mean * number of years) ÷ standard deviation. For example, the Interval 4 temperature index is 5.03 = (0.17 * 8)0 ÷ .28 (or more accurately expressed as 5.0322 = [0.175 * 8]0 ÷ .2781).

- Then, I sorted all intervals and events by their precipitation-index values and then their temperature-index values and associated each with ranks (Tables 9 and 10; see Appendix A). First, the climate intervals were ordered by precipitation-index values. Rank 1 was assigned to the intervals with the highest-negative and highest-positive precipitation-index values (–29.89 and 26.52) (see Table 9), and Ranks 97 and 90, respectively, were assigned to the intervals with the lowest-negative and lowest-positive precipitation-index values (–0.49 and 0.73) (see Table 9). Similarly, the climate intervals were ordered by temperature-index values. Rank 1 was assigned to the intervals with the highest-negative and highest-positive temperature values (–59.99 and 64.07) (see Table 10), and Ranks 97 and 90, respectively, were assigned to the intervals with the lowest-negative and lowest-positive index values (–0.36 and 0.2) (see Table 10).

Table 9. All Dendroclimate Intervals, Sorted by Precipitation Rank

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank
17	663	664	2	dry	cool	2	–29.89	1
155	1707	1709	3	dry	warm	—	–24.42	2
34	808	809	2	dry	cool	2	–18.54	3
121	1435	1450	16	dry	cool	2	–14.10	4
87	1192	1194	3	dry	warm	—	–14.01	5
135	1569	1583	15	dry	cool	1	–13.56	6
74	1088	1108	21	dry	cool	2	–12.48	7
28	737	762	26	dry	warm	5	–11.22	8
90	1205	1220	16	dry	cool	6	–10.42	9
51	918	925	8	dry	warm	3	–10.16	10
181	1892	1904	13	dry	warm	5	–9.03	11
67	1033	1039	7	dry	warm	—	–8.46	12
165	1772	1790	19	dry	warm	7	–8.14	13
136	1584	1592	9	dry	warm	4	–7.80	14
159	1727	1739	13	dry	warm	4	–7.66	15
49	903	910	8	dry	warm	2	–7.65	16
24	706	717	12	dry	warm	4	–7.52	17
149	1664	1671	8	dry	cool	4	–7.30	18
32	786	797	12	dry	cool	3	–7.28	19
114	1385	1389	5	dry	cool	2	–6.84	20
186	1943	1964	22	dry	warm	11	–6.82	21
78	1129	1145	17	dry	cool	1	–6.75	22
6	596	599	4	dry	warm	1	–6.45	23
84	1174	1177	4	dry	warm	1	–6.42	24
168	1809	1823	15	dry	cool	11	–6.19	25
36	815	818	4	dry	cool	1	–6.09	26
175	1869	1871	3	dry	cool	1	–6.06	27
23	694	705	12	dry	cool	10	–5.47	28
128	1492	1506	15	dry	cool	3	–5.29	29
53	933	937	5	dry	warm	—	–5.12	30
167	1794	1808	15	dry	warm	1	–5.00	31
72	1085	1086	2	dry	warm	—	–4.91	32
170	1841	1847	7	dry	cool	6	–4.72	33
38	823	830	8	dry	cool	3	–4.68	34
30	777	779	3	dry	warm	1	–4.45	35
172	1856	1864	9	dry	warm	3	–4.38	36
10	613	615	3	dry	warm	—	–4.32	37
130	1517	1528	12	dry	cool	9	–4.31	38
46	882	884	3	dry	warm	2	–4.30	39
14	645	654	10	dry	warm	4	–4.27	40
62	990	998	9	dry	cool	2	–4.16	41
107	1335	1341	7	dry	cool	3	–4.08	42
56	951	957	7	dry	cool	3	–3.89	43
60	980	984	5	dry	warm	3	–3.84	44
162	1753	1755	3	dry	warm	—	–3.77	45
117	1406	1416	11	dry	warm	2	–3.72	46
147	1653	1654	2	dry	cool	1	–3.62	47
26	723	727	5	dry	warm	1	–3.60	48

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank
131	1529	1548	20	dry	warm	5	–3.43	49
100	1282	1288	7	dry	warm	2	–3.36	50
59	974	979	6	dry	cool	1	–3.18	51
2	578	580	3	dry	cool	1	–3.16	52
40	839	841	3	dry	warm	1	–3.13	53
143	1626	1634	9	dry	warm	1	–3.09	54
111	1360	1364	5	dry	cool	2	–2.97	55
126	1485	1488	4	dry	cool	1	–2.92	56
102	1292	1314	23	dry	warm	1	–2.86	57
161	1747	1752	6	dry	cool	2	–2.84	58
70	1067	1073	7	dry	warm	1	–2.72	59
123	1463	1474	12	dry	cool	2	–2.63	60
16	660	662	3	dry	warm	1	–2.62	61
20	677	677	1	dry	warm	1	–2.56	62
109	1346	1352	7	dry	cool	6	–2.53	63
8	603	607	5	dry	warm	2	–2.49	64
92	1224	1227	4	dry	cool	2	–2.45	65
145	1646	1648	3	dry	cool	4	–2.43	66
44	864	866	3	dry	warm	—	–2.42	67
177	1878	1883	6	dry	cool	1	–2.42	68
104	1321	1324	4	dry	warm	—	–2.34	69
77	1123	1128	6	dry	warm	—	–2.32	70
153	1694	1698	5	dry	warm	1	–2.29	71
94	1244	1251	8	dry	cool	1	–2.16	72
157	1722	1724	3	dry	cool	2	–2.11	73
42	846	847	2	dry	cool	1	–2.09	74
138	1598	1602	5	dry	cool	2	–2.01	75
64	1005	1005	1	dry	cool	1	–1.97	76
4	584	591	8	dry	warm	1	–1.91	77
176	1872	1877	6	dry	warm	—	–1.86	78
142	1622	1625	4	dry	cool	1	–1.85	79
97	1262	1264	3	dry	cool	2	–1.84	80
82	1164	1169	6	dry	warm	1	–1.72	81
179	1886	1887	2	dry	cool	1	–1.66	82
80	1156	1158	3	dry	cool	2	–1.66	83
151	1684	1687	4	dry	cool	1	–1.62	84
12	624	631	8	dry	cool	4	–1.61	85
119	1421	1426	6	dry	warm	2	–1.54	86
140	1613	1613	1	dry	warm	1	–1.53	87
58	967	973	7	dry	warm	—	–1.31	88
25	718	722	5	dry	cool	—	–1.07	89
115	1390	1398	9	dry	warm	—	–1.07	90
184	1921	1931	11	dry	cool	4	–0.98	91
76	1120	1122	3	dry	cool	2	–0.89	92
66	1013	1032	20	dry	cool	2	–0.88	93
91	1221	1223	3	dry	warm	—	–0.85	94
103	1315	1320	6	dry	cool	2	–0.84	95
88	1195	1199	5	dry	cool	4	–0.59	96

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Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank
95	1252	1257	6	dry	warm	1	–0.49	97
18	665	669	5	wet	cool	1	0.73	90
47	885	895	11	wet	warm	1	0.87	89
185	1932	1942	11	wet	warm	—	0.87	88
96	1258	1261	4	wet	cool	—	0.93	87
122	1451	1462	12	wet	cool	2	0.94	86
108	1342	1345	4	wet	cool	—	0.99	85
137	1593	1597	5	wet	warm	—	1.08	84
63	999	1004	6	wet	mild	—	1.13	83
85	1178	1183	6	wet	warm	1	1.21	82
9	608	612	5	wet	warm	1	1.28	81
48	896	902	7	wet	cool	3	1.30	80
79	1146	1155	10	wet	warm	3	1.54	79
134	1564	1568	5	wet	cool	—	1.83	78
99	1273	1281	9	wet	warm	1	1.86	77
101	1289	1291	3	wet	warm	—	1.93	76
73	1087	1087	1	wet	warm	1	2.02	75
154	1699	1706	8	wet	cool	—	2.06	74
105	1325	1329	5	wet	warm	—	2.25	73
178	1884	1885	2	wet	cool	—	2.30	72
158	1725	1726	2	wet	cool	1	2.41	71
31	780	785	6	wet	warm	—	2.60	70
125	1482	1484	3	wet	warm	1	2.62	69
68	1040	1051	12	wet	warm	—	2.71	68
86	1184	1191	8	wet	cool	—	3.14	67
174	1867	1868	2	wet	cool	2	3.14	66
81	1159	1163	5	wet	warm	—	3.17	65
11	616	623	8	wet	warm	3	3.22	64
54	938	944	7	wet	warm	1	3.26	63
139	1603	1612	10	wet	cool	2	3.34	62
116	1399	1405	7	wet	warm	—	3.74	61
129	1507	1516	10	wet	cool	1	3.91	60
50	911	917	7	wet	cool	—	3.93	59
171	1848	1855	8	wet	cool	1	4.12	58
133	1559	1563	5	wet	warm	—	4.37	57
65	1006	1012	7	wet	warm	—	4.49	56
187	1965	1988	24	wet	warm	12	4.51	55
41	842	845	4	wet	warm	—	4.53	54
164	1763	1771	9	wet	cool	4	4.57	53
45	867	881	15	wet	warm	2	4.77	52
118	1417	1420	4	wet	warm	—	4.84	51
124	1475	1481	7	wet	cool	—	4.94	50
7	600	602	3	wet	warm	—	5.05	49
98	1265	1272	8	wet	cool	1	5.16	48
13	632	644	13	wet	cool	—	5.25	47
150	1672	1683	12	wet	cool	2	5.39	46
61	985	989	5	wet	cool	1	5.72	45
166	1791	1793	3	wet	warm	1	5.76	44
173	1865	1866	2	wet	warm	—	5.95	43

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank
144	1635	1645	11	wet	cool	5	5.95	42
156	1710	1721	12	wet	warm	3	5.97	41
113	1382	1384	3	wet	cool	1	6.22	40
5	592	595	4	wet	warm	1	6.31	39
132	1549	1558	10	wet	cool	—	6.32	38
160	1740	1746	7	wet	warm	1	6.47	37
37	819	822	4	wet	cool	—	6.58	36
120	1427	1434	8	wet	warm	—	6.59	35
83	1170	1173	4	wet	warm	—	6.66	34
148	1655	1663	9	wet	warm	—	6.85	33
110	1353	1359	7	wet	cool	6	6.88	32
57	958	966	9	wet	warm	—	6.88	31
29	763	776	14	wet	warm	—	6.99	30
21	678	685	8	wet	warm	2	7.01	29
146	1649	1652	4	wet	cool	4	7.19	28
112	1365	1381	17	wet	warm	—	7.48	27
39	831	838	8	wet	cool	—	7.53	26
1	571	577	7	wet	cool	—	7.93	25
43	848	863	16	wet	cool	4	7.97	24
22	686	693	8	wet	cool	9	8.00	23
89	1200	1204	5	wet	cool	5	8.12	22
93	1228	1243	16	wet	cool	1	8.18	21
106	1330	1334	5	wet	cool	4	8.89	20
152	1688	1693	6	wet	warm	1	9.07	19
141	1614	1621	8	wet	cool	—	9.11	18
52	926	932	7	wet	warm	—	9.24	17
183	1911	1920	10	wet	cool	5	9.76	16
69	1052	1066	15	wet	cool	—	9.77	15
15	655	659	5	wet	warm	—	10.00	14
180	1888	1891	4	wet	cool	—	10.32	13
35	810	814	5	wet	cool	—	10.48	12
19	670	676	7	wet	warm	—	10.53	11
169	1824	1840	17	wet	cool	5	10.74	10
127	1489	1491	3	wet	cool	—	10.85	9
71	1074	1084	11	wet	warm	2	11.78	8
182	1905	1910	6	wet	warm	1	13.10	7
75	1109	1119	11	wet	cool	2	13.54	6
55	945	950	6	wet	cool	—	14.43	5
33	798	807	10	wet	cool	4	14.68	4
27	728	736	9	wet	cool	3	14.72	3
163	1756	1762	7	wet	warm	1	15.16	2
3	581	583	3	wet	cool	—	26.52	1

Table 10. All Dendroclimate Intervals, Sorted by Temperature Rank

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Temperature Index	Temperature Rank
34	808	809	2	dry	cool	2	–59.99	1
17	663	664	2	dry	cool	2	–54.72	2
110	1353	1359	7	wet	cool	6	–42.86	3
158	1725	1726	2	wet	cool	1	–40.14	4
22	686	693	8	wet	cool	9	–39.49	5
90	1205	1220	16	dry	cool	6	–33.06	6
168	1809	1823	15	dry	cool	11	–28.95	7
106	1330	1334	5	wet	cool	4	–27.81	8
75	1109	1119	11	wet	cool	2	–26.76	9
89	1200	1204	5	wet	cool	5	–25.48	10
183	1911	1920	10	wet	cool	5	–24.45	11
184	1921	1931	11	dry	cool	4	–23.38	12
146	1649	1652	4	wet	cool	4	–22.90	13
93	1228	1243	16	wet	cool	1	–21.61	14
149	1664	1671	8	dry	cool	4	–20.91	15
98	1265	1272	8	wet	cool	1	–19.51	16
109	1346	1352	7	dry	cool	6	–18.81	17
144	1635	1645	11	wet	cool	5	–18.44	18
150	1672	1683	12	wet	cool	2	–18.32	19
130	1517	1528	12	dry	cool	9	–18.02	20
66	1013	1032	20	dry	cool	2	–17.94	21
139	1603	1612	10	wet	cool	2	–17.62	22
88	1195	1199	5	dry	cool	4	–17.33	23
62	990	998	9	dry	cool	2	–17.23	24
107	1335	1341	7	dry	cool	3	–17.22	25
27	728	736	9	wet	cool	3	–16.16	26
37	819	822	4	wet	cool	—	–16.15	27
164	1763	1771	9	wet	cool	4	–16.00	28
18	665	669	5	wet	cool	1	–14.88	29
129	1507	1516	10	wet	cool	1	–14.36	30
48	896	902	7	wet	cool	3	–14.10	31
86	1184	1191	8	wet	cool	—	–14.04	32
23	694	705	12	dry	cool	10	–13.41	33
78	1129	1145	17	dry	cool	1	–13.39	34
3	581	583	3	wet	cool	—	–12.56	35
74	1088	1108	21	dry	cool	2	–11.94	36
134	1564	1568	5	wet	cool	—	–11.31	37
69	1052	1066	15	wet	cool	—	–10.88	38
145	1646	1648	3	dry	cool	4	–10.67	39
135	1569	1583	15	dry	cool	1	–10.22	40
169	1824	1840	17	wet	cool	5	–10.17	41
33	798	807	10	wet	cool	4	–9.93	42
13	632	644	13	wet	cool	—	–9.92	43
128	1492	1506	15	dry	cool	3	–9.66	44

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Temperature Index	Temperature Rank
154	1699	1706	8	wet	cool	—	–9.56	45
132	1549	1558	10	wet	cool	—	–9.15	46
32	786	797	12	dry	cool	3	–9.10	47
2	578	580	3	dry	cool	1	–9.00	48
170	1841	1847	7	dry	cool	6	–8.72	49
161	1747	1752	6	dry	cool	2	–8.45	50
111	1360	1364	5	dry	cool	2	–8.39	51
138	1598	1602	5	dry	cool	2	–7.63	52
108	1342	1345	4	wet	cool	—	–7.59	53
35	810	814	5	wet	cool	—	–7.57	54
171	1848	1855	8	wet	cool	1	–7.17	55
103	1315	1320	6	dry	cool	2	–6.73	56
25	718	722	5	dry	cool	—	–6.28	57
141	1614	1621	8	wet	cool	—	–5.89	58
124	1475	1481	7	wet	cool	—	–5.86	59
12	624	631	8	dry	cool	4	–5.79	60
61	985	989	5	wet	cool	1	–5.78	61
43	848	863	16	wet	cool	4	–5.42	62
44	864	866	3	dry	cool	—	–5.42	63
55	945	950	6	wet	cool	—	–5.35	64
92	1224	1227	4	dry	cool	2	–5.25	65
36	815	818	4	dry	cool	1	–5.17	66
96	1258	1261	4	wet	cool	—	–5.05	67
38	823	830	8	dry	cool	3	–5.02	68
1	571	577	7	wet	cool	—	–5.01	69
142	1622	1625	4	dry	cool	1	–5.00	70
97	1262	1264	3	dry	cool	2	–4.79	71
42	846	847	2	dry	cool	1	–4.63	72
175	1869	1871	3	dry	cool	1	–4.19	73
157	1722	1724	3	dry	cool	2	–4.12	74
123	1463	1474	12	dry	cool	2	–4.10	75
114	1385	1389	5	dry	cool	2	–4.05	76
94	1244	1251	8	dry	cool	1	–3.88	77
122	1451	1462	12	wet	cool	2	–3.50	78
179	1886	1887	2	dry	cool	1	–3.19	79
180	1888	1891	4	wet	cool	—	–2.93	80
113	1382	1384	3	wet	cool	1	–2.90	81
177	1878	1883	6	dry	cool	1	–2.73	82
174	1867	1868	2	wet	cool	2	–2.54	83
178	1884	1885	2	wet	cool	—	–2.33	84
59	974	979	6	dry	cool	1	–2.25	85
151	1684	1687	4	dry	cool	1	–2.25	86
76	1120	1122	3	dry	cool	2	–2.06	87
50	911	917	7	wet	cool	—	–1.72	88

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Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Temperature Index	Temperature Rank
127	1489	1491	3	wet	cool	—	–1.51	89
121	1435	1450	16	dry	cool	2	–1.48	90
147	1653	1654	2	dry	cool	1	–1.33	91
56	951	957	7	dry	cool	3	–1.28	92
80	1156	1158	3	dry	cool	2	–1.06	93
63	999	1004	6	wet	cool	—	–1.01	94
126	1485	1488	4	dry	cool	1	–0.86	95
64	1005	1005	1	dry	cool	1	–0.46	96
39	831	838	8	wet	cool	—	–0.36	97
30	777	779	3	dry	warm	1	0.20	90
100	1282	1288	7	dry	warm	2	0.62	89
140	1613	1613	1	dry	warm	1	0.91	88
20	677	677	1	dry	warm	1	1.01	87
10	613	615	3	dry	warm	—	1.14	86
172	1856	1864	9	dry	warm	3	1.18	85
73	1087	1087	1	wet	warm	1	1.51	84
85	1178	1183	6	wet	warm	1	1.78	83
57	958	966	9	wet	warm	—	1.91	82
125	1482	1484	3	wet	warm	1	2.13	81
101	1289	1291	3	wet	warm	—	2.42	80
51	918	925	8	dry	warm	3	2.87	79
87	1192	1194	3	dry	warm	—	2.89	78
21	678	685	8	wet	warm	2	3.14	77
67	1033	1039	7	dry	warm	—	3.44	76
16	660	662	3	dry	warm	1	3.90	75
133	1559	1563	5	wet	warm	—	3.97	74
46	882	884	3	dry	warm	2	4.07	73
8	603	607	5	dry	warm	2	4.25	72
15	655	659	5	wet	warm	—	4.43	71
182	1905	1910	6	wet	warm	1	4.66	70
104	1321	1324	4	dry	warm	—	4.80	69
4	584	591	8	dry	warm	1	5.03	68
148	1655	1663	9	wet	warm	—	5.04	67
31	780	785	6	wet	warm	—	5.17	66
7	600	602	3	wet	warm	—	5.24	65
105	1325	1329	5	wet	warm	—	5.28	64
155	1707	1709	3	dry	warm	—	5.30	63
118	1417	1420	4	wet	warm	—	5.54	62
162	1753	1755	3	dry	warm	—	5.61	61
9	608	612	5	wet	warm	1	5.72	60
26	723	727	5	dry	warm	1	5.87	59
115	1390	1398	9	dry	warm	—	5.88	58
137	1593	1597	5	wet	warm	—	6.04	57
82	1164	1169	6	dry	warm	1	6.06	56
52	926	932	7	wet	warm	—	6.13	55

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Temperature Index	Temperature Rank
84	1174	1177	4	dry	warm	1	6.30	54
70	1067	1073	7	dry	warm	1	6.49	53
95	1252	1257	6	dry	warm	1	6.61	52
19	670	676	7	wet	warm	—	6.98	51
153	1694	1698	5	dry	warm	1	7.03	50
47	885	895	11	wet	warm	1	7.03	49
53	933	937	5	dry	warm	—	7.29	48
81	1159	1163	5	wet	warm	—	7.32	47
5	592	595	4	wet	warm	1	8.19	46
143	1626	1634	9	dry	warm	1	8.57	45
77	1123	1128	6	dry	warm	—	8.69	44
58	967	973	7	dry	warm	—	9.38	43
60	980	984	5	dry	warm	3	9.48	42
11	616	623	8	wet	warm	3	9.58	41
45	867	881	15	wet	warm	2	9.86	40
29	763	776	14	wet	warm	—	9.87	39
68	1040	1051	12	wet	warm	—	9.88	38
160	1740	1746	7	wet	warm	1	9.89	37
163	1756	1762	7	wet	warm	1	10.42	36
120	1427	1434	8	wet	warm	—	10.62	35
99	1273	1281	9	wet	warm	1	10.87	34
41	842	845	4	wet	warm	—	10.91	33
83	1170	1173	4	wet	warm	—	10.98	32
176	1872	1877	6	dry	warm	—	11.15	31
14	645	654	10	dry	warm	4	11.61	30
119	1421	1426	6	dry	warm	2	12.22	29
79	1146	1155	10	wet	warm	3	12.25	28
6	596	599	4	dry	warm	1	12.31	27
65	1006	1012	7	wet	warm	—	12.45	26
54	938	944	7	wet	warm	1	12.47	25
152	1688	1693	6	wet	warm	1	12.61	24
116	1399	1405	7	wet	warm	—	12.80	23
91	1221	1223	3	dry	warm	—	13.00	22
136	1584	1592	9	dry	warm	4	13.26	21
181	1892	1904	13	dry	warm	5	13.94	20
28	737	762	26	dry	warm	5	14.98	19
102	1292	1314	23	dry	warm	1	16.82	18
159	1727	1739	13	dry	warm	4	17.66	17
71	1074	1084	11	wet	warm	2	19.17	16
131	1529	1548	20	dry	warm	5	19.53	15
24	706	717	12	dry	warm	4	19.65	14
49	903	910	8	dry	warm	2	20.09	13
112	1365	1381	17	wet	warm	—	21.12	12
72	1085	1086	2	dry	warm	—	21.31	11

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Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Temperature Index	Temperature Rank
166	1791	1793	3	wet	warm	1	21.47	10
185	1932	1942	11	wet	warm	—	21.81	9
167	1794	1808	15	dry	warm	1	22.19	8
165	1772	1790	19	dry	warm	7	22.92	7
117	1406	1416	11	dry	warm	2	28.52	6
156	1710	1721	12	wet	warm	3	33.32	5
40	839	841	3	dry	warm	1	33.99	4
187	1965	1988	24	wet	warm	12	35.40	3
186	1943	1964	22	dry	warm	11	43.50	2
173	1865	1866	2	wet	warm	—	64.07	1

- Finally, I summed the temperature and precipitation ranks associated with each temporal interval to derive an overall CIV (Table 11). The lower the CIV, the more unusual and severe the climate conditions during that period. The higher the CIV, the more typical and normal the climate conditions. CIVs ranged from 3 to 179. I grouped the 187 intervals and climate episodes by the four climate conditions (i.e., dry and warm, dry and cool, and so on) and ordered them by their overall CIVs, to help us establish where the numerical threshold for likely human responses to extreme climatic variation might be (Tables 12–15).

Results

I delimited 173 intervals (1,394 years) ranging in length from 3 to 26 years, and 14 climatic episodes (24 years), each of either 1 or 2 years' duration, within the 1,418-year joint record for the A.D. 571–1988 time series (Table 16; see Appendix A). Of the total 187 intervals and climate episodes, 50 were dry and cool, 47 were dry and warm, 47 were wet and cool, and 43 were wet and warm. Using a three-step process that took into account the duration of an interval, the magnitude of the interval mean value, and the average variation around the mean condition represented by the interval standard deviation, I derived a single CIV for each interval that allowed me to order climate intervals and episodes by their overall strengths. A preliminary assessment of these rank-order lists (see Tables 12–15) suggested that CIVs of less than about 75 represent the climatic intervals most challenging or permitting to human economic systems.

Temporal Trends

This dendroclimatic record begins in the early portion of the Middle Formative period in the prehistory of the U.S. Southwest (A.D. 500–900) and continues through the historical period (A.D. 1600–present). In terms of cultural-historical sequences, it is applicable to the final years of the Squaw Peak phase (A.D. 1–650) as it has been defined in this report, and it provides an unbroken record through A.D. 1988—the final year of joint data determined by the most recent year in the VERDE tree-ring chronology. In this section, I summarize the dendroclimatic record, by century, and natural breaks in the record, regardless of cultural-historical scheme. Century boundaries are approximate and attempt to capture the century-scale climate as well as conform to the near whole interval. Too few years fell into the sixth century to include them in this discussion. Therefore, this temporal summary begins with those late-500s intervals that appear to signal the beginning of the seventh-century climate regime.

The seventh century, a 122-year span between A.D. 584 and 705, was partitioned into 18 climatic intervals and 2 climatic episodes (Intervals 4–23) (Table 17; see Table 11; Figures 4 and 5). Seven of the 18 intervals were classified as wet and warm, 6 were dry and warm, 3 were wet and cool, and 2 were dry and cool. One of the 2 climatic episodes was dry and cool (Interval 17, A.D. 663–664), and the other was dry and warm (Interval 20, A.D. 677); both represented extreme climate conditions. The intervals ranged in length from 3 to 13 years (mean = 6.6 years; median = 6 years) and included 35 of the 38 years with extreme climate conditions (31.4 percent) reconstructed for this century. More individual years were wetter than normal than were drier than normal

Table 11. All Dendroclimatic Intervals and Associated Indexes, Ranks, and Climatic-Intensity Values

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
1	571	577	7	wet	cool	—	7.93	25	–5.01	69	94
2	578	580	3	dry	cool	1	–3.16	52	–9.00	48	100
3	581	583	3	wet	cool	—	26.52	1	–12.56	35	36
4	584	591	8	dry	warm	1	–1.91	77	5.03	68	145
5	592	595	4	wet	warm	1	6.31	39	8.19	46	85
6	596	599	4	dry	warm	1	–6.45	23	12.31	27	50
7	600	602	3	wet	warm	—	5.05	49	5.24	65	114
8	603	607	5	dry	warm	2	–2.49	64	4.25	72	136
9	608	612	5	wet	warm	1	1.28	81	5.72	60	141
10	613	615	3	dry	warm	—	–4.32	37	1.14	86	123
11	616	623	8	wet	warm	3	3.22	64	9.58	41	105
12	624	631	8	dry	cool	4	–1.61	85	–5.79	60	145
13	632	644	13	wet	cool	—	5.25	47	–9.92	43	90
14	645	654	10	dry	warm	4	–4.27	40	11.61	30	70
15	655	659	5	wet	warm	—	10.00	14	4.43	71	85
16	660	662	3	dry	warm	1	–2.62	61	3.90	75	136
17	663	664	2	dry	cool	2	–29.89	1	–54.72	2	3
18	665	669	5	wet	cool	1	0.73	90	–14.88	29	119
19	670	676	7	wet	warm	—	10.53	11	6.98	51	62
20	677	677	1	dry	warm	1	–2.56	62	1.01	87	149
21	678	685	8	wet	warm	2	7.01	29	3.14	77	106
22	686	693	8	wet	cool	9	8.00	23	–39.49	5	28
23	694	705	12	dry	cool	10	–5.47	28	–13.41	33	61
24	706	717	12	dry	warm	4	–7.52	17	19.65	14	31
25	718	722	5	dry	cool	—	–1.07	89	–6.28	57	146
26	723	727	5	dry	warm	1	–3.60	48	5.87	59	107
27	728	736	9	wet	cool	3	14.72	3	–16.16	26	29
28	737	762	26	dry	warm	5	–11.22	8	14.98	19	27
29	763	776	14	wet	warm	—	6.99	30	9.87	39	69
30	777	779	3	dry	warm	1	–4.45	35	0.20	90	125
31	780	785	6	wet	warm	—	2.60	70	5.17	66	136

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Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
32	786	797	12	dry	cool	3	–7.28	19	–9.10	47	66
33	798	807	10	wet	cool	4	14.68	4	–9.93	42	46
34	808	809	2	dry	cool	2	–18.54	3	–59.99	1	4
35	810	814	5	wet	cool	—	10.48	12	–7.57	54	66
36	815	818	4	dry	cool	1	–6.09	26	–5.17	66	92
37	819	822	4	wet	cool	—	6.58	36	–16.15	27	63
38	823	830	8	dry	cool	3	–4.68	34	–5.02	68	102
39	831	838	8	wet	cool	—	7.53	26	–0.36	97	123
40	839	841	3	dry	warm	1	–3.13	53	33.99	4	57
41	842	845	4	wet	warm	—	4.53	54	10.91	33	87
42	846	847	2	dry	cool	1	–2.09	74	–4.63	72	146
43	848	863	16	wet	cool	4	7.97	24	–5.42	62	86
44	864	866	3	dry	cool	—	–2.42	67	–5.42	63	130
45	867	881	15	wet	warm	2	4.77	52	9.86	40	92
46	882	884	3	dry	warm	2	–4.30	39	4.07	73	112
47	885	895	11	wet	warm	1	0.87	89	7.03	49	138
48	896	902	7	wet	cool	3	1.30	80	–14.10	31	111
49	903	910	8	dry	warm	2	–7.65	16	20.09	13	29
50	911	917	7	wet	cool	—	3.93	59	–1.72	88	147
51	918	925	8	dry	warm	3	–10.16	10	2.87	79	89
52	926	932	7	wet	warm	—	9.24	17	6.13	55	72
53	933	937	5	dry	warm	—	–5.12	30	7.29	48	78
54	938	944	7	wet	warm	1	3.26	63	12.47	25	88
55	945	950	6	wet	cool	—	14.43	5	–5.35	64	69
56	951	957	7	dry	cool	3	–3.89	43	–1.28	92	135
57	958	966	9	wet	warm	—	6.88	31	1.91	82	113
58	967	973	7	dry	warm	—	–1.31	88	9.38	43	131
59	974	979	6	dry	cool	1	–3.18	51	–2.25	85	136
60	980	984	5	dry	warm	3	–3.84	44	9.48	42	86
61	985	989	5	wet	cool	1	5.72	45	–5.78	61	106
62	990	998	9	dry	cool	2	–4.16	41	–17.23	24	65
63	999	1004	6	wet	cool	—	1.13	83	–1.01	94	177
64	1005	1005	1	dry	cool	1	–1.97	76	–0.46	96	172

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
65	1006	1012	7	wet	warm	—	4.49	56	12.45	26	82
66	1013	1032	20	dry	cool	2	–0.88	93	–17.94	21	114
67	1033	1039	7	dry	warm	—	–8.46	12	3.44	76	88
68	1040	1051	12	wet	warm	—	2.71	68	9.88	38	106
69	1052	1066	15	wet	cool	—	9.77	15	–10.88	38	53
70	1067	1073	7	dry	warm	1	–2.72	59	6.49	53	112
71	1074	1084	11	wet	warm	2	11.78	8	19.17	16	24
72	1085	1086	2	dry	warm	—	–4.91	32	21.31	11	43
73	1087	1087	1	wet	warm	1	2.02	75	1.51	84	159
74	1088	1108	21	dry	cool	2	–12.48	7	–11.94	36	43
75	1109	1119	11	wet	cool	2	13.54	6	–26.76	9	15
76	1120	1122	3	dry	cool	2	–0.89	92	–2.06	87	179
77	1123	1128	6	dry	warm	—	–2.32	70	8.69	44	114
78	1129	1145	17	dry	cool	1	–6.75	22	–13.39	34	56
79	1146	1155	10	wet	warm	3	1.54	79	12.25	28	107
80	1156	1158	3	dry	cool	2	–1.66	83	–1.06	93	176
81	1159	1163	5	wet	warm	—	3.17	65	7.32	47	112
82	1164	1169	6	dry	warm	1	–1.72	81	6.06	56	137
83	1170	1173	4	wet	warm	—	6.66	34	10.98	32	66
84	1174	1177	4	dry	warm	1	–6.42	24	6.30	54	78
85	1178	1183	6	wet	warm	1	1.21	82	1.78	83	165
86	1184	1191	8	wet	cool	—	3.14	67	–14.04	32	99
87	1192	1194	3	dry	warm	—	–14.01	5	2.89	78	83
88	1195	1199	5	dry	cool	4	–0.59	96	–17.33	23	119
89	1200	1204	5	wet	cool	5	8.12	22	–25.48	10	32
90	1205	1220	16	dry	cool	6	–10.42	9	–33.06	6	15
91	1221	1223	3	dry	warm	—	–0.85	94	13.00	22	116
92	1224	1227	4	dry	cool	2	–2.45	65	–5.25	65	130
93	1228	1243	16	wet	cool	1	8.18	21	–21.61	14	35
94	1244	1251	8	dry	cool	1	–2.16	72	–3.88	77	149
95	1252	1257	6	dry	warm	1	–0.49	97	6.61	52	149

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Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
96	1258	1261	4	wet	cool	—	0.93	87	–5.05	67	154
97	1262	1264	3	dry	cool	2	–1.84	80	–4.79	71	151
98	1265	1272	8	wet	cool	1	5.16	48	–19.51	16	64
99	1273	1281	9	wet	warm	1	1.86	77	10.87	34	111
100	1282	1288	7	dry	warm	2	–3.36	50	0.62	89	139
101	1289	1291	3	wet	warm	—	1.93	76	2.42	80	156
102	1292	1314	23	dry	warm	1	–2.86	57	16.82	18	75
103	1315	1320	6	dry	cool	2	–0.84	95	–6.73	56	151
104	1321	1324	4	dry	warm	—	–2.34	69	4.80	69	138
105	1325	1329	5	wet	warm	—	2.25	73	5.28	64	137
106	1330	1334	5	wet	cool	4	8.89	20	–27.81	8	28
107	1335	1341	7	dry	cool	3	–4.08	42	–17.22	25	67
108	1342	1345	4	wet	cool	—	0.99	85	–7.59	53	138
109	1346	1352	7	dry	cool	6	–2.53	63	–18.81	17	80
110	1353	1359	7	wet	cool	6	6.88	32	–42.86	3	35
111	1360	1364	5	dry	cool	2	–2.97	55	–8.39	51	106
112	1365	1381	17	wet	warm	—	7.48	27	21.12	12	39
113	1382	1384	3	wet	cool	1	6.22	40	–2.90	81	121
114	1385	1389	5	dry	cool	2	–6.84	20	–4.05	76	96
115	1390	1398	9	dry	warm	—	–1.07	90	5.88	58	148
116	1399	1405	7	wet	warm	—	3.74	61	12.80	23	84
117	1406	1416	11	dry	warm	2	–3.72	46	28.52	6	52
118	1417	1420	4	wet	warm	—	4.84	51	5.54	62	113
119	1421	1426	6	dry	warm	2	–1.54	86	12.22	29	115
120	1427	1434	8	wet	warm	—	6.59	35	10.62	35	70
121	1435	1450	16	dry	cool	2	–14.10	4	–1.48	90	94
122	1451	1462	12	wet	cool	2	0.94	86	–3.50	78	164
123	1463	1474	12	dry	cool	2	–2.63	60	–4.10	75	135
124	1475	1481	7	wet	cool	—	4.94	50	–5.86	59	109
125	1482	1484	3	wet	warm	1	2.62	69	2.13	81	150
126	1485	1488	4	dry	cool	1	–2.92	56	–0.86	95	151
127	1489	1491	3	wet	cool	—	10.85	9	–1.51	89	98
128	1492	1506	15	dry	cool	3	–5.29	29	–9.66	44	73

Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
129	1507	1516	10	wet	cool	1	3.91	60	–14.36	30	90
130	1517	1528	12	dry	cool	9	–4.31	38	–18.02	20	58
131	1529	1548	20	dry	warm	5	–3.43	49	19.53	15	64
132	1549	1558	10	wet	cool	—	6.32	38	–9.15	46	84
133	1559	1563	5	wet	warm	—	4.37	57	3.97	74	131
134	1564	1568	5	wet	cool	—	1.83	78	–11.31	37	115
135	1569	1583	15	dry	cool	1	–13.56	6	–10.22	40	46
136	1584	1592	9	dry	warm	4	–7.80	14	13.26	21	35
137	1593	1597	5	wet	warm	—	1.08	84	6.04	57	141
138	1598	1602	5	dry	cool	2	–2.01	75	–7.63	52	127
139	1603	1612	10	wet	cool	2	3.34	62	–17.62	22	84
140	1613	1613	1	dry	warm	1	–1.53	87	0.91	88	175
141	1614	1621	8	wet	cool	—	9.11	18	–5.89	58	76
142	1622	1625	4	dry	cool	1	–1.85	79	–5.00	70	149
143	1626	1634	9	dry	warm	1	–3.09	54	8.57	45	99
144	1635	1645	11	wet	cool	5	5.95	42	–18.44	18	60
145	1646	1648	3	dry	cool	4	–2.43	66	–10.67	39	105
146	1649	1652	4	wet	cool	4	7.19	28	–22.90	13	41
147	1653	1654	2	dry	cool	1	–3.62	47	–1.33	91	138
148	1655	1663	9	wet	warm	—	6.85	33	5.04	67	100
149	1664	1671	8	dry	cool	4	–7.30	18	–20.91	15	33
150	1672	1683	12	wet	cool	2	5.39	46	–18.32	19	65
151	1684	1687	4	dry	cool	1	–1.62	84	–2.25	86	170
152	1688	1693	6	wet	warm	1	9.07	19	12.61	24	43
153	1694	1698	5	dry	warm	1	–2.29	71	7.03	50	121
154	1699	1706	8	wet	cool	—	2.06	74	–9.56	45	119
155	1707	1709	3	dry	warm	—	–24.42	2	5.30	63	65
156	1710	1721	12	wet	warm	3	5.97	41	33.32	5	46
157	1722	1724	3	dry	cool	2	–2.11	73	–4.12	74	147
158	1725	1726	2	wet	cool	1	2.41	71	–40.14	4	75
159	1727	1739	13	dry	warm	4	–7.66	15	17.66	17	32

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Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
160	1740	1746	7	wet	warm	1	6.47	37	9.89	37	74
161	1747	1752	6	dry	cool	2	–2.84	58	–8.45	50	108
162	1753	1755	3	dry	warm	—	–3.77	45	5.61	61	106
163	1756	1762	7	wet	warm	1	15.16	2	10.42	36	38
164	1763	1771	9	wet	cool	4	4.57	53	–16.00	28	81
165	1772	1790	19	dry	warm	7	–8.14	13	22.92	7	20
166	1791	1793	3	wet	warm	1	5.76	44	21.47	10	54
167	1794	1808	15	dry	warm	1	–5.00	31	22.19	8	39
168	1809	1823	15	dry	cool	11	–6.19	25	–28.95	7	32
169	1824	1840	17	wet	cool	5	10.74	10	–10.17	41	51
170	1841	1847	7	dry	cool	6	–4.72	33	–8.72	49	82
171	1848	1855	8	wet	cool	1	4.12	58	–7.17	55	113
172	1856	1864	9	dry	warm	3	–4.38	36	1.18	85	121
173	1865	1866	2	wet	warm	—	5.95	43	64.07	1	44
174	1867	1868	2	wet	cool	2	3.14	66	–2.54	83	149
175	1869	1871	3	dry	cool	1	–6.06	27	–4.19	73	100
176	1872	1877	6	dry	warm	—	–1.86	78	11.15	31	109
177	1878	1883	6	dry	cool	1	–2.42	68	–2.73	82	150
178	1884	1885	2	wet	cool	—	2.30	72	–2.33	84	156
179	1886	1887	2	dry	cool	1	–1.66	82	–3.19	79	161
180	1888	1891	4	wet	cool	—	10.32	13	–2.93	80	93
181	1892	1904	13	dry	warm	5	–9.03	11	13.94	20	31
182	1905	1910	6	wet	warm	1	13.10	7	4.66	70	77
183	1911	1920	10	wet	cool	5	9.76	16	–24.45	11	27
184	1921	1931	11	dry	cool	4	–0.98	91	–23.38	12	103
185	1932	1942	11	wet	warm	—	0.87	88	21.81	9	97
186	1943	1964	22	dry	warm	11	–6.82	21	43.50	2	23
187	1965	1988	24	wet	warm	12	4.51	55	35.40	3	58

Key: CIV = climatic-intensity value.

Table 12. Dry-Warm Intervals, Sorted by Climatic-Intensity Values

Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
1	165	1772	1790	19	dry	warm	7	–8.14	13	22.92	7	20
2	186	1943	1964	22	dry	warm	11	–6.82	21	43.50	2	23
3	28	737	762	26	dry	warm	5	–11.22	8	14.98	19	27
4	49	903	910	8	dry	warm	2	–7.65	16	20.09	13	29
5	24	706	717	12	dry	warm	4	–7.52	17	19.65	14	31
5	181	1892	1904	13	dry	warm	5	–9.03	11	13.94	20	31
6	159	1727	1739	13	dry	warm	4	–7.66	15	17.66	17	32
7	136	1584	1592	9	dry	warm	4	–7.80	14	13.26	21	35
8	167	1794	1808	15	dry	warm	1	–5.00	31	22.19	8	39
9	72	1085	1086	2	dry	warm	—	–4.91	32	21.31	11	43
10	6	596	599	4	dry	warm	1	–6.45	23	12.31	27	50
11	117	1406	1416	11	dry	warm	2	–3.72	46	28.52	6	52
12	40	839	841	3	dry	warm	1	–3.13	53	33.99	4	57
13	131	1529	1548	20	dry	warm	5	–3.43	49	19.53	15	64
14	155	1707	1709	3	dry	warm	—	–24.42	2	5.30	63	65
15	14	645	654	10	dry	warm	4	–4.27	40	11.61	30	70
16	102	1292	1314	23	dry	warm	1	–2.86	57	16.82	18	75
17	53	933	937	5	dry	warm	—	–5.12	30	7.29	48	78
17	84	1174	1177	4	dry	warm	1	–6.42	24	6.30	54	78
18	87	1192	1194	3	dry	warm	—	–14.01	5	2.89	78	83
19	60	980	984	5	dry	warm	3	–3.84	44	9.48	42	86
20	67	1033	1039	7	dry	warm	—	–8.46	12	3.44	76	88
21	51	918	925	8	dry	warm	3	–10.16	10	2.87	79	89
22	143	1626	1634	9	dry	warm	1	–3.09	54	8.57	45	99
23	162	1753	1755	3	dry	warm	—	–3.77	45	5.61	61	106
24	26	723	727	5	dry	warm	1	–3.60	48	5.87	59	107
25	176	1872	1877	6	dry	warm	—	–1.86	78	11.15	31	109
26	46	882	884	3	dry	warm	2	–4.30	39	4.07	73	112
26	70	1067	1073	7	dry	warm	1	–2.72	59	6.49	53	112
27	77	1123	1128	6	dry	warm	—	–2.32	70	8.69	44	114
28	119	1421	1426	6	dry	warm	2	–1.54	86	12.22	29	115

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Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
29	91	1221	1223	3	dry	warm	—	–0.85	94	13.00	22	116
30	153	1694	1698	5	dry	warm	1	–2.29	71	7.03	50	121
30	172	1856	1864	9	dry	warm	3	–4.38	36	1.18	85	121
31	10	613	615	3	dry	warm	—	–4.32	37	1.14	86	123
32	30	777	779	3	dry	warm	1	–4.45	35	0.20	90	125
33	58	967	973	7	dry	warm	—	–1.31	88	9.38	43	131
34	8	603	607	5	dry	warm	2	–2.49	64	4.25	72	136
34	16	660	662	3	dry	warm	1	–2.62	61	3.90	75	136
35	82	1164	1169	6	dry	warm	1	–1.72	81	6.06	56	137
36	104	1321	1324	4	dry	warm	—	–2.34	69	4.80	69	138
37	100	1282	1288	7	dry	warm	2	–3.36	50	0.62	89	139
38	4	584	591	8	dry	warm	1	–1.91	77	5.03	68	145
39	115	1390	1398	9	dry	warm	—	–1.07	90	5.88	58	148
40	20	677	677	1	dry	warm	1	–2.56	62	1.01	87	149
40	95	1252	1257	6	dry	warm	1	–0.49	97	6.61	52	149
41	140	1613	1613	1	dry	warm	1	–1.53	87	0.91	88	175

Key: CIV = climatic-intensity value.

Table 13. Dry-Cool Intervals, Sorted by Climatic-Intensity Values

Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
1	17	663	664	2	dry	cool	2	–29.89	1	–54.72	2	3
2	34	808	809	2	dry	cool	2	–18.54	3	–59.99	1	4
3	90	1205	1220	16	dry	cool	6	–10.42	9	–33.06	6	15
4	168	1809	1823	15	dry	cool	11	–6.19	25	–28.95	7	32
5	149	1664	1671	8	dry	cool	4	–7.30	18	–20.91	15	33
6	74	1088	1108	21	dry	cool	2	–12.48	7	–11.94	36	43
7	135	1569	1583	15	dry	cool	1	–13.56	6	–10.22	40	46
8	78	1129	1145	17	dry	cool	1	–6.75	22	–13.39	34	56
9	130	1517	1528	12	dry	cool	9	–4.31	38	–18.02	20	58
10	23	694	705	12	dry	cool	10	–5.47	28	–13.41	33	61
11	62	990	998	9	dry	cool	2	–4.16	41	–17.23	24	65
12	32	786	797	12	dry	cool	3	–7.28	19	–9.10	47	66
13	107	1335	1341	7	dry	cool	3	–4.08	42	–17.22	25	67
14	128	1492	1506	15	dry	cool	3	–5.29	29	–9.66	44	73
15	109	1346	1352	7	dry	cool	6	–2.53	63	–18.81	17	80
16	170	1841	1847	7	dry	cool	6	–4.72	33	–8.72	49	82
17	36	815	818	4	dry	cool	1	–6.09	26	–5.17	66	92
18	121	1435	1450	16	dry	cool	2	–14.10	4	–1.48	90	94
19	114	1385	1389	5	dry	cool	2	–6.84	20	–4.05	76	96
20	2	578	580	3	dry	cool	1	–3.16	52	–9.00	48	100
20	175	1869	1871	3	dry	cool	1	–6.06	27	–4.19	73	100
21	38	823	830	8	dry	cool	3	–4.68	34	–5.02	68	102
22	184	1921	1931	11	dry	cool	4	–0.98	91	–23.38	12	103
23	145	1646	1648	3	dry	cool	4	–2.43	66	–10.67	39	105
24	111	1360	1364	5	dry	cool	2	–2.97	55	–8.39	51	106
25	161	1747	1752	6	dry	cool	2	–2.84	58	–8.45	50	108
26	66	1013	1032	20	dry	cool	2	–0.88	93	–17.94	21	114
27	88	1195	1199	5	dry	cool	4	–0.59	96	–17.33	23	119
28	138	1598	1602	5	dry	cool	2	–2.01	75	–7.63	52	127

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Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
29	44	864	866	3	dry	cool	—	–2.42	67	–5.42	63	130
29	92	1224	1227	4	dry	cool	2	–2.45	65	–5.25	65	130
30	56	951	957	7	dry	cool	3	–3.89	43	–1.28	92	135
30	123	1463	1474	12	dry	cool	2	–2.63	60	–4.10	75	135
31	59	974	979	6	dry	cool	1	–3.18	51	–2.25	85	136
32	147	1653	1654	2	dry	cool	1	–3.62	47	–1.33	91	138
33	12	624	631	8	dry	cool	4	–1.61	85	–5.79	60	145
34	25	718	722	5	dry	cool	—	–1.07	89	–6.28	57	146
34	42	846	847	2	dry	cool	1	–2.09	74	–4.63	72	146
35	157	1722	1724	3	dry	cool	2	–2.11	73	–4.12	74	147
36	94	1244	1251	8	dry	cool	1	–2.16	72	–3.88	77	149
36	142	1622	1625	4	dry	cool	1	–1.85	79	–5.00	70	149
37	177	1878	1883	6	dry	cool	1	–2.42	68	–2.73	82	150
38	97	1262	1264	3	dry	cool	2	–1.84	80	–4.79	71	151
38	103	1315	1320	6	dry	cool	2	–0.84	95	–6.73	56	151
38	126	1485	1488	4	dry	cool	1	–2.92	56	–0.86	95	151
39	179	1886	1887	2	dry	cool	1	–1.66	82	–3.19	79	161
40	151	1684	1687	4	dry	cool	1	–1.62	84	–2.25	86	170
41	64	1005	1005	1	dry	cool	1	–1.97	76	–0.46	96	172
42	80	1156	1158	3	dry	cool	2	–1.66	83	–1.06	93	176
43	76	1120	1122	3	dry	cool	2	–0.89	92	–2.06	87	179

Key: CIV = climatic-intensity value.

Table 14. Wet-Cool Intervals, Sorted by Climatic-Intensity Values

Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
1	75	1109	1119	11	wet	cool	2	13.54	6	–26.76	9	15
2	183	1911	1920	10	wet	cool	5	9.76	16	–24.45	11	27
3	22	686	693	8	wet	cool	9	8.00	23	–39.49	5	28
3	106	1330	1334	5	wet	cool	4	8.89	20	–27.81	8	28
4	27	728	736	9	wet	cool	3	14.72	3	–16.16	26	29
5	89	1200	1204	5	wet	cool	5	8.12	22	–25.48	10	32
6	93	1228	1243	16	wet	cool	1	8.18	21	–21.61	14	35
6	110	1353	1359	7	wet	cool	6	6.88	32	–42.86	3	35
7	3	581	583	3	wet	cool	—	26.52	1	–12.56	35	36
8	146	1649	1652	4	wet	cool	4	7.19	28	–22.90	13	41
9	33	798	807	10	wet	cool	4	14.68	4	–9.93	42	46
10	169	1824	1840	17	wet	cool	5	10.74	10	–10.17	41	51
11	69	1052	1066	15	wet	cool	—	9.77	15	–10.88	38	53
12	144	1635	1645	11	wet	cool	5	5.95	42	–18.44	18	60
13	37	819	822	4	wet	cool	—	6.58	36	–16.15	27	63
14	98	1265	1272	8	wet	cool	1	5.16	48	–19.51	16	64
15	150	1672	1683	12	wet	cool	2	5.39	46	–18.32	19	65
16	35	810	814	5	wet	cool	—	10.48	12	–7.57	54	66
17	55	945	950	6	wet	cool	—	14.43	5	–5.35	64	69
18	158	1725	1726	2	wet	cool	1	2.41	71	–40.14	4	75
19	141	1614	1621	8	wet	cool	—	9.11	18	–5.89	58	76
20	164	1763	1771	9	wet	cool	4	4.57	53	–16.00	28	81
21	132	1549	1558	10	wet	cool	—	6.32	38	–9.15	46	84
21	139	1603	1612	10	wet	cool	2	3.34	62	–17.62	22	84
22	43	848	863	16	wet	cool	4	7.97	24	–5.42	62	86
23	13	632	644	13	wet	cool	—	5.25	47	–9.92	43	90
23	129	1507	1516	10	wet	cool	1	3.91	60	–14.36	30	90
24	180	1888	1891	4	wet	cool	—	10.32	13	–2.93	80	93
25	1	571	577	7	wet	cool	—	7.93	25	–5.01	69	94

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Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
26	127	1489	1491	3	wet	cool	—	10.85	9	–1.51	89	98
27	86	1184	1191	8	wet	cool	—	3.14	67	–14.04	32	99
28	61	985	989	5	wet	cool	1	5.72	45	–5.78	61	106
29	124	1475	1481	7	wet	cool	—	4.94	50	–5.86	59	109
30	48	896	902	7	wet	cool	3	1.30	80	–14.10	31	111
31	171	1848	1855	8	wet	cool	1	4.12	58	–7.17	55	113
32	134	1564	1568	5	wet	cool	—	1.83	78	–11.31	37	115
33	18	665	669	5	wet	cool	1	0.73	90	–14.88	29	119
33	154	1699	1706	8	wet	cool	—	2.06	74	–9.56	45	119
34	113	1382	1384	3	wet	cool	1	6.22	40	–2.90	81	121
42	39	831	838	8	wet	cool	—	7.53	26	–0.36	97	123
35	108	1342	1345	4	wet	cool	—	0.99	85	–7.59	53	138
36	50	911	917	7	wet	cool	—	3.93	59	–1.72	88	147
37	174	1867	1868	2	wet	cool	2	3.14	66	–2.54	83	149
38	96	1258	1261	4	wet	cool	—	0.93	87	–5.05	67	154
39	178	1884	1885	2	wet	cool	—	2.30	72	–2.33	84	156
40	122	1451	1462	12	wet	cool	2	0.94	86	–3.50	78	164
41	63	999	1004	6	wet	cool	—	1.13	83	–1.01	94	177

Key: CIV = climatic-intensity value.

Table 15. Wet-Warm Intervals, Sorted by Climatic-Intensity Values

Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
1	71	1074	1084	11	wet	warm	2	11.78	8	19.17	16	24
2	163	1756	1762	7	wet	warm	1	15.16	2	10.42	36	38
3	112	1365	1381	17	wet	warm	—	7.48	27	21.12	12	39
4	152	1688	1693	6	wet	warm	1	9.07	19	12.61	24	43
5	173	1865	1866	2	wet	warm	—	5.95	43	64.07	1	44
6	156	1710	1721	12	wet	warm	3	5.97	41	33.32	5	46
7	166	1791	1793	3	wet	warm	1	5.76	44	21.47	10	54
8	187	1965	1988	24	wet	warm	12	4.51	55	35.40	3	58
9	19	670	676	7	wet	warm	—	10.53	11	6.98	51	62
10	83	1170	1173	4	wet	warm	—	6.66	34	10.98	32	66
11	29	763	776	14	wet	warm	—	6.99	30	9.87	39	69
12	120	1427	1434	8	wet	warm	—	6.59	35	10.62	35	70
13	52	926	932	7	wet	warm	—	9.24	17	6.13	55	72
14	160	1740	1746	7	wet	warm	1	6.47	37	9.89	37	74
15	182	1905	1910	6	wet	warm	1	13.10	7	4.66	70	77
16	65	1006	1012	7	wet	warm	—	4.49	56	12.45	26	82
17	116	1399	1405	7	wet	warm	—	3.74	61	12.80	23	84
18	5	592	595	4	wet	warm	1	6.31	39	8.19	46	85
18	15	655	659	5	wet	warm	—	10.00	14	4.43	71	85
19	41	842	845	4	wet	warm	—	4.53	54	10.91	33	87
20	54	938	944	7	wet	warm	1	3.26	63	12.47	25	88
21	45	867	881	15	wet	warm	2	4.77	52	9.86	40	92
22	185	1932	1942	11	wet	warm	—	0.87	88	21.81	9	97
23	148	1655	1663	9	wet	warm	—	6.85	33	5.04	67	100
24	11	616	623	8	wet	warm	3	3.22	64	9.58	41	105
25	21	678	685	8	wet	warm	2	7.01	29	3.14	77	106
25	68	1040	1051	12	wet	warm	—	2.71	68	9.88	38	106
26	79	1146	1155	10	wet	warm	3	1.54	79	12.25	28	107
27	99	1273	1281	9	wet	warm	1	1.86	77	10.87	34	111
28	81	1159	1163	5	wet	warm	—	3.17	65	7.32	47	112

continued on next page

Severity Rank	Interval No.	Start Year (A.D.)	End Year (A.D.)	No. of Years	Precipitation	Temperature	No. of Extremes	Precipitation Index	Precipitation Rank	Temperature Index	Temperature Rank	CIV
29	57	958	966	9	wet	warm	—	6.88	31	1.91	82	113
29	118	1417	1420	4	wet	warm	—	4.84	51	5.54	62	113
30	7	600	602	3	wet	warm	—	5.05	49	5.24	65	114
31	133	1559	1563	5	wet	warm	—	4.37	57	3.97	74	131
32	31	780	785	6	wet	warm	—	2.60	70	5.17	66	136
33	105	1325	1329	5	wet	warm	—	2.25	73	5.28	64	137
34	47	885	895	11	wet	warm	1	0.87	89	7.03	49	138
35	9	608	612	5	wet	warm	1	1.28	81	5.72	60	141
35	137	1593	1597	5	wet	warm	—	1.08	84	6.04	57	141
36	125	1482	1484	3	wet	warm	1	2.62	69	2.13	81	150
37	101	1289	1291	3	wet	warm	—	1.93	76	2.42	80	156
38	73	1087	1087	1	wet	warm	1	2.02	75	1.51	84	159
39	85	1178	1183	6	wet	warm	1	1.21	82	1.78	83	165

Key: CIV = climatic-intensity value.

Table 16. Summary of Climate Classes and Intervals

Precipitation and Temperature Class	Total No. of Intervals and Episodes	No. of Years per Class	Percent of 1,418 Years	No. of Years with Extremes	No. of Climatic Episodes[a]	No. of Climatic Intervals[b]	No. of Years in Class	Range of Interval Length (years)	Median Interval Length (years)	Mean Length of Interval (years)	Standard Deviation of Interval	Coefficient Variation[c] for Class
Dry and warm	47	370	26.1	83 (22.3%)	3	44	366	3–26	6.5	8.32	5.87	0.71
Dry and cool	50	367	25.9	119 (32.7%)	6	44	356	3–21	6.5	8.09	5.03	0.62
Wet and cool	47	359	25.3	77 (21.9%)	3	44	353	3–17	8.0	8.02	3.66	0.46
Wet and warm	43	322	22.7	38 (11.5%)	2	41	319	3–24	7.0	7.78	4.26	0.55
Total	187	1,418	100.0	317 (22.4%)	14	173	1,394	3–26	7.0	8.05	4.71	0.59

Note: Wet periods were more predictable and less variable than dry periods, given coefficients of variation and fewer extremes.

[a] One-year or 2-year "episodes"; 24 years total.

[b] Intervals are greater than or equal to 3 years in duration.

[c] Coefficient of variation is the ratio of the standard deviation to the mean; it is used here as a measure of predictability; the lower the value, the more predictable.

Table 17. Dendroclimate Summary, by Century

Climate "Century"	Range of Years (A.D.)	Interval No.	Total Years in "Century"	Number of 1- or 2-Year Episodes	Number of 3+-year Intervals[a]	Interval -Length Range (years)	Mean, Median Interval Length (years)	"Century" Precipitation Mean and Standard Deviation	Precipitation Coefficient of Variation[b]	Precipitation Median Value	Precipitation Minimum Value	Precipitation Maximum Value	"Century" Temperature Mean and Standard Deviation	Temperature Coefficient of Variation[b]	Temperature Median Value	Temperature Minimum Value	Temperature Maximum Value	No. of Wet Years	No. of Dry Years	No. of Warm Years	No. of Cool Years	No. of Extreme Years	Percent of Century Extreme	Character of Century: Precipitation, Wet or Dry		Character of Century: Temperature, Warm or Cool	
																								s/m/e W/D[c]	v/p[d]	s/m/e W/C[c]	v/p[d]
7	584–705	4–23	122	2	18	3–13	6.6, 6.0	0.03 ± 1.09	43.52	0.22	–2.84	2.56	–0.03 ± 1.22	–44.48	0.09	–3.50	3.00	68	54	54	68	38	31.1	s wet	v	s cool	v
8	706–797	24–32	92	—	9	3–26	10.2, 9.0	–0.15 ± 1.06	–7.09	–0.06	–2.45	2.47	0.16 ± 0.66	4.07	0.15	–1.61	1.84	42	50	53	39	17	18.5	e dry	p	m warm	p
9	798–895	33–47	98	2	13	3–16	7.2, 5.0	0.14 ± 1.01	7.07	0.25	–2.23	2.27	–0.16 ± 0.93	–5.69	–0.30	–2.48	2.73	58	40	39	59	20	20.4	e wet	p	m cool	v
10	896–984	48–60	89	—	13	5–9	6.9, 7.0	–0.06 ± 1.08	–19.01	0.08	–2.62	2.70	0.17 ± 0.68	3.89	0.23	–1.94	1.70	49	40	55	34	16	18.0	m dry	p	m warm	p
11	985–1087	61–73	103	3	10	5–20	9.9, 8.0	0.13 ± 0.88	6.81	0.11	–2.25	2.22	0.09 ± 0.74	8.13	0.02	–1.94	1.68	62	41	50	53	10	9.7	e wet	p	s warm	v
12	1088–1194	74–87	107	—	14	3–21	7.6, 6.0	–0.07 ± 0.91	–13.10	0.01	–2.25	1.94	–0.09 ± 0.81	–9.45	–0.11	–3.23	2.14	55	52	48	59	15	14.0	m dry	p	s cool	v
13	1195–1272	88–98	78	—	11	3–16	7.1, 5.0	–0.04 ± 0.94	–25.33	0.12	–2.39	2.05	–0.72 ± 0.76	–1.06	–0.74	–2.84	1.26	43	35	11	67	22	28.2	m dry	v	e cool	p
14	1273–1389	99–114	117	—	16	3–23	7.3, 5.5	0.02 ± 0.91	41.31	0.13	–2.31	2.56	–0.14 ± 0.94	–6.49	–0.03	–2.09	1.99	69	48	56	61	27	23.1	s wet	v	m cool	v
15	1390–1488	115–126	99	—	12	3–16	8.3, 7.5	–0.02 ± 0.91	–40.68	–0.01	–2.31	2.31	0.31 ± 0.74	2.44	0.33	–1.22	2.80	48	51	61	38	12	12.1	s dry	v	m warm	p
16	1489–1597	127–137	109	—	11	3–20	9.9, 10.0	–0.10 ± 0.95	–9.87	–0.04	–2.78	1.70	–0.09 ± 0.89	–9.74	–0.20	–2.51	2.85	54	55	47	62	20	18.3	e dry	p	s cool	v
17	1598–1687	138–151	90	2	12	3–12	7.3, 8.0	0.02 ± 0.97	39.76	0.18	–2.44	1.70	–0.71 ± 0.94	–1.33	–0.69	–3.49	1.40	48	42	20	70	27	30.0	s wet	v	e cool	p
18	1688–1808	152–167	121	1	15	3–19	7.9, 7.0	0.01 ± 1.01	126.17	0.13	–2.70	2.30	0.66 ± 1.06	1.60	0.75	–1.86	3.66	66	55	91	30	28	23.1	s wet	v	e warm	p
19	1809–1891	168–180	83	4	9	3–17	8.3, 7.0	–0.03 ± 1.15	–44.92	0.11	–2.68	2.43	–0.46 ± 0.81	–1.76	–0.37	–2.72	1.25	46	37	25	58	29	34.9	s dry	v	e cool	p
20	1892–1988	181–187	97	—	7	6–22	12.1, 11.0	0.05 ± 1.12	20.60	0.08	–2.33	2.44	0.70 ± 1.30	1.85	0.69	–1.86	3.75	51	46	71	26	35	36.1	m wet	v	e warm	p
Total	584–1988	4–187	1,405	14	170	3–26			–0.14	0.11	–2.84	2.70		–1.20	–0.01	–3.50	3.75	759	646	681	724	316	22.5				

[a] The first three intervals (Intervals 1–3, A.D. 571–583), incorporating 13 years, are not included in this summary.

[b] Coefficient of variation is the ratio of the standard deviation to the mean; it is used here as measure of predictability.

[c] Based on the mean value and its sign; Precipitation: s = slightly (0.00–0.03), m = moderately (0.04–0.10), e = extremely (>0.10); Temperature: s = slightly (0.00–0.09), m= moderately (0.10–0.50), extremely (>0.50).

[d] Based on the standard deviation and coefficient of variation; Precipitation: p = persistent (0–20), v = variable (> 20); Temperature: p = persistent (0–5), v = variable (>5).

(68 vs. 54 years), and more individual years were cooler than normal than were warmer than normal (also 68 vs. 54 years). Although the means and standard deviations for the precipitation and temperature associated with this century suggest that this time period was only slightly wet and slightly cool overall, the graphic representation of this time period suggests considerable variability from interval to interval (see Figures 4 and 5). Four intervals stand out. The first was an 8-year wet and cool interval (Interval 22, A.D. 686–693) that was notable by virtue of its interannual persistence, with many extreme years (see Table 14). The second was a 12-year dry-cool drought (Interval 23, A.D. 694–705), with many extreme years, that followed immediately after the notable wet and cool interval (see Table 13). The third was a short but persistent 4-year dry-warm drought (Interval 6, A.D. 596–599) at the turn of the seventh century (see Table 12). The fourth was a 7-year interval (Interval 19, A.D. 670–676) that was notably wet and warm and contained no extreme values (see Table 15). A total of four frost rings were observed in the SFPB chronology during the 122 years considered here: A.D. 627, 681, 687, and 694 (see Appendix A). The latter two (A.D. 687 and 694) were formed during the era of persistent coolness at the end of the seventh century and the beginning of the eighth century. In sum, the seventh century was a time of moderate values with few and only intermittent extreme yearly values for most of its length. Conditions changed, marked at A.D. 678, when unusually warm or unusually cool conditions occurred and often persisted for years without break.

The eighth century, a 92-year period between A.D. 706 and 797, was partitioned into nine intervals (Intervals 24–32); no distinct climatic episodes were identified (see Tables 11 and 17; Figures 4 and 5). Four of the nine intervals were classified as dry and warm, two were dry and cool, two were wet and warm, and one was wet and cool. The intervals ranged in duration from 3 to 26 years in length (mean = 10.2 years; median = 9 years) and included 17 extreme values (18.5 percent) that predominantly represented drought years. More individual years were dry than were wet (50 dry vs. 42 wet), and more individual years were warm than were cool (53 warm vs. 39 cool). The century-length mean precipitation value for the eighth century was the lowest of all 14 centuries evaluated in this joint chronology. The century-length temperature value, however, was quite moderate in relation to the other centuries. The graphic representations of this time period suggest fairly long and persistent periods of warmth and dryness in the first quarter of the century and again at midcentury, confirming the overall character of the century as generally typically dry and somewhat warmer than the long-term normal condition. Two intervals within this century were high-ranking dry-warm droughts (see Table 12). Interval 28 (A.D. 737–762) was the third-highest-ranking dry-warm drought in the 1,418-year record; it derived this status primarily because of its duration and persistence. Interval 24 (A.D. 706–717) was also high ranking because of its persistence and its far greater number of warmer-than-normal years. Despite this overall trend, two other intervals stand out by way of contrast. Interval 27 (A.D. 728–736) (see Table 14) was a wet and cool interval that persisted for 9 years, and Interval 29 (A.D. 763–776) (see Table 15) was a 14-year wet and warm interval that broke the midcentury drought. Only two frost rings were observed in the SFPB chronology during the eighth century (A.D. 743 and 796) (see Appendix A). The first occurred in notably dry and warm Interval 28, discussed above, and the second occurred in a dry and cool interval (Interval 32, A.D. 786–797) that preceded a long spell of coolness that continued through A.D. 830. In sum, the eighth century was an era of persistent warmth and dryness with a pronounced dry-warm drought in the middle 700s—a climatic feature that was widespread throughout North America (Stahle et al. 2002).

The ninth century, a 98-year span between A.D. 798 and 895, was partitioned into 13 climatic intervals and 2 climatic episodes (Intervals 33–47) (see Tables 11 and 17; Figures 4 and 5). Five intervals were wet and cool, 3 were wet and warm, 3 were dry and cool, and 2 were dry and warm. The intervals ranged in duration from 3 to 16 years in length (mean = 7.2 years; median = 5 years) and included 17 of the 20 years with extreme values (20.4 percent) reconstructed for the century. Both of the climatic episodes were extremely dry and cool (Interval 34, A.D. 808–809, and Interval 42, A.D. 846–847). More individual years were wet than were dry (58 wet vs. 40 dry), and more individual years were cool than were warm (59 cool vs. 39 warm). The mean and standard deviation for the precipitation and temperature values for this century suggest that this period was markedly and persistently wet but moderately and variably cool. However, the graphic representations suggest that there was considerable variability in both precipitation and temperature associated with the ninth century. Two long periods of cooler-than-normal climate alternated with 2 long periods of warmer-than-normal climate, and all were associated with rapidly fluctuating precipitation conditions. The coolness of the late eighth century continued well into the ninth century (the late 700s through the late 840s and again in the late 840s through the early 860s) and is exemplified by notable wet-cool Intervals 33 (A.D. 798–807) and 43 (A.D. 848–863) (see Table 14) and dry-cool episode/Interval 34 (A.D. 808–809) (see Table 13). The persistent warmth of the late ninth century was established by the late 860s and persisted with few interruptions through the first half of the tenth century, and it, too, alternated with intervals of dry and wet conditions. Three frost rings (A.D. 849, 858, and 889) (see Appendix A) were observed in the SFPB chronology during the 98 years considered here. The first two took place in notably cool and wet Interval 43 (A.D. 848–863), with many extremely cool years, and the third took place in warm-wet Interval 47

(A.D. 885–895). In sum, the ninth century witnessed a return to wetter- and cooler-than-normal conditions after a dry and warm seventh century. This condition persisted for much of the century, with 2 notable spans of warmth: at midcentury and near the century's end.

The tenth century, an 89-year span between A.D. 896 and 984, was partitioned into 13 intervals (Intervals 48–60); no distinct climate episodes were identified (see Tables 11 and 17; Figures 4 and 5). Five intervals were dry and warm, 3 were wet and warm, 3 were wet and cool, and 2 were dry and cool. The intervals ranged from 5 to 9 years in length (mean = 6.9; median = 7 years), and 16 years (18 percent of total) were characterized by extreme values. More individual years were wet than were dry (49 wet vs. 40 dry), and more individual years were warm than were cool (55 warm vs. 34 cool). Despite the frequency of a somewhat greater number of wetter-than-normal years, the century-length mean and standard deviation for precipitation indicate that the 89-year span was moderately and rather consistently dry. The century-length mean and standard deviation for temperature indicate that the 900s were moderately and fairly consistently warm, especially in the first half of the century, which correlates well with the greater number of warm years. Only 1 high-ranking dry-warm drought (Interval 49, A.D. 903–910) (see Table 12) stands out among the intervals, although 3 moderately dry-warm droughts, each lasting 5–8 years, happened early and late within this 89-year time period (Interval 51, A.D. 918–925; Interval 53, A.D. 933–937; and Interval 60, A.D. 980–984). The moderately wet and cool Interval 55 (A.D. 945–957) (see Table 14) appears to have broken the fairly long warm period, after which mild temperatures prevailed for much of the midcentury. A total of 10 frost rings were observed in the tenth-century SFPB chronology (A.D. 896, 904, 909, 918, 934, 950, 956, 972, 973, and 982) (see Appendix A). Of these 10 frost rings, only 1 corresponds to and seemingly initiated an extremely cool and somewhat wet interval (Interval 48, A.D. 896–902). The remaining 9 took place within intervals classified as warmer than normal. In general, the tenth century was moderately dry and somewhat warmer than long-term normal, with brief periods of relief from aridity in the 940s and 960s.

The eleventh century, a 103-year span dating from A.D. 985 to 1087, was partitioned into 10 climatic intervals and 3 climatic episodes (Intervals 61–73) (see Tables 11 and 17; Figures 4 and 5). Three intervals were wet and warm, 3 were wet and cool, 2 were dry and warm, and 2 were dry and cool. The intervals ranged from 5 to 20 years in length (mean = 9.9 years; median = 8 years) and included 8 of the 10 years with extreme values (9.7 percent) reconstructed for the century—the lowest percentage for any of the 14 centuries considered in this study. Two of the 3 climatic episodes represented extreme single years; A.D. 1005 was extremely dry, whereas A.D. 1087 was extremely wet. The third episode (A.D. 1085–1086) was a short transition between persistent warm and cool climatic conditions. More individual years within the eleventh century were wet than were dry (62 wet vs. 41 dry), and more individual years were cool than were warm (53 cool vs. 50 warm). The mean and standard deviation for the century-length precipitation value are high, relative to the 1,418-year time series, and they indicate that the century was significantly and predictably wetter than normal. In contrast, the mean and standard deviation for the century-length temperature are low, relative to the time series as a whole, and they indicate that the century was slightly warmer than normal, albeit variably so. The graphic representations of this century correspond well to these statistics and illustrate that there were few extreme years, many fair and mild years, and extended periods of wet and warm years. Several intervals were prominent. Interval 71 (A.D. 1074–1084) represents the single highest-ranking warm-wet interval (see Table 15) in the 1,418-year time series. Interval 66 (A.D. 1013–1032) represents a long span of fair climate during which conditions were neither too dry nor too wet and were cooler than normal (see Table 13). Interval 69 (A.D. 1052–1066) represents a moderately high-ranking wet and cool interval (see Table 14). Four frost rings were recorded in the SFPB chronology for the eleventh century as it is defined here (A.D. 1004, 1041, 1057, and 1076) (see Appendix A). The first two occurred during intervals classified as mild or warm, and the last two occurred in intervals classified as cool. In sum, the eleventh century was climatically 1 of the most moderate of all centuries examined in this study.

The twelfth century, a 107-year period between A.D. 1088 and 1194, was partitioned into 14 intervals (Intervals 74–87); no distinct climatic episodes were identified (see Tables 11 and 17; Figures 4 and 5). Four intervals were dry and cool, 4 were dry and warm, 4 were wet and warm, and 2 were wet and cool. Intervals ranged from 3 to 21 years in length (mean = 7.6 years; median = 6 years) and included 15 years of extreme values (14 percent). More individual years within the twelfth century were wet than were dry (55 wet vs. 52 dry), and more individual years were cool than were warm (59 cool vs. 48 warm). Nevertheless, the mean and standard deviation for the century-length precipitation value indicate that the century, overall, was moderately and fairly predictably dry rather than wet. The mean and standard deviation for the century-length temperature value, however, do suggest that the time period under consideration was slightly cool, although considerable variation in mean maximum annual temperature did exist. The graphic representations of these data illustrate that the early portion of this century, as it is defined here, was markedly cool, whereas the middle and end of the century were warm. These figures also show that precipitation varied considerably throughout the century but that persistently dry conditions prevailed at midcentury. Two notable intervals existed. The first was the highest-ranking wet and cool interval in the 1,418-year record, Interval 75 (A.D. 1109–1119) (see Table 14), which achieved this rank by virtue of its persistently low annual-temperature values, general wetness, and duration of 11 years. Second was a high-ranking dry-cool drought (Interval 78, A.D. 1129–1145) that persisted for 17 years (see Table 13). Four frost rings were recorded within the SFPB chronology (A.D. 1092, 1101, 1109, and 1171) (see Appendix A). The first three occurred in—and seemingly initiated and perpetuated—a long and extremely cool era that began about A.D. 1092 and extended, almost unbroken, until A.D. 1122. The last frost ring occurred within an already-established warmer-than-normal interval. In sum, the twelfth century, as defined here, witnessed four different climate phases that, when combined, may be described as an era of moderate dryness and coolness. The first portion of this 107-year period (A.D. 1088–1119) was dominated by temperatures significantly cooler than normal in conjunction with alternating wet and dry intervals. The dominant condition of this first phase was dry and cool. The second portion of the 107-year period (A.D. 1120–1158) was characterized by mostly dry climate with alternating cool and warm years. The dominant climate condition of this portion was aridity. The third portion of this 107-year period (A.D. 1159–1177) reversed the precipitation-temperature trend. During this phase, the dominant conditions were characterized by elevated warmth with short intervals of alternating dryness and wetness. The final portion of the 107-year period prefigured the cool conditions characteristic of most of the 1200s.

The thirteenth century, which, in terms of climate, spanned a 78-year period between A.D. 1195 and 1272, was partitioned into 11 intervals (Intervals 88–98); no distinct climatic episodes were identified (see Tables 11 and 17; Figures 4 and 5). Five intervals were dry and cool, 4 were wet and cool, and 2 were dry and warm; no interval was wet and warm. The intervals ranged in length from 3 to 16 years (mean = 7.1 years; median = 5 years) and included 22 years with extreme values (28.2 percent). More individual years were wet than were dry (43 wet vs. 35 dry), and more individual years were cool than were warm (67 cool vs. 11 warm). The means and standard deviations for the century-length precipitation and temperature indicate that this 78-year period was somewhat drier than normal and extremely and persistently cooler than normal. The temperature value for the thirteenth century is the lowest of the values for all 14 centuries included in this study. The graphic representations of this century clearly show the persistent cool values for virtually every year in this 78-year sequence and the great interannual variability in annual precipitation. Within this short but dramatic time period, 3 high-ranking intervals are noted. The first is a 16-year period in the early 1200s (Interval 90, A.D. 1205–1220) that represents the third-most-intense dry-cool drought in the 1,418-year record (see Table 13). The second and third intervals are high-ranking wet and cool periods (see Table 14). Although only 5 years in length, Interval 89 (A.D. 1200–1204) was the sixth-most-intense wet-cool period, because each year was reconstructed to have had extremely cool temperature values. Interval 93 (A.D. 1228–1243) was almost as severe, by virtue of its 16-year duration and continuous coolness. Interestingly, only a single frost ring was recorded in the SFPB chronology (A.D. 1200), and this cold-damaged tree ring occurred within an established period of cooler-than-normal climate that appears to have begun in the late 1100s. In sum, the thirteenth century as defined here—truncated immediately prior to the period of time widely known as the era of the "Great Drought" of the U.S. Southwest (Douglass 1929)—was a period of exceptional coolness and overall dryness. The first phase of this 78-year period (A.D. 1195–1227) was overwhelmingly cool and dry, whereas the latter portion of the period witnessed alternating wet and dry conditions associated with the persistent coolness.

The fourteenth century, a climate interval that spanned a 117-year period from A.D. 1273 to 1389, was partitioned into 16 intervals (Intervals 99–114); no distinct climatic episodes were identified (see Tables 11 and 17; Figures 4 and 5). Five intervals were dry and cool, 4 were wet and cool, 4 were wet and warm, and 3 were dry and warm The intervals ranged in length from 3 to 23 years (mean = 7.3 years; median = 5.5 years) and included 27 years with extreme values (23.1 percent). More individual years were wet than were dry (69 wet vs. 48 dry), and more individual years were cool than were warm (61 cool vs. 56 warm). The precipitation mean and standard deviation indicate that this 117-year period was only slightly wetter than normal, but the variability around this mean was quite high. The century-length temperature mean and standard deviation indicate that this period was moderately cool and that annual values varied considerably from interval to interval. The graphic representations of this century, however, indicate that the early portion of the century, as defined here, was generally warmer and drier than normal; the middle portion was significantly cooler than normal, with alternating wet and dry intervals; and the late portion tended toward wet and warm. Five intervals are distinguished by their high-ranking values. The first is a 17-year wet and warm span (Interval 112, A.D. 1365–1381) that is the second-highest-ranking interval of its class (see Table 15). It derives this rank primarily by virtue of its duration and persistent warmth. The second and third are 5-year (Interval 106, A.D. 1330–1334) and 7-year (Interval 110, A.D. 1353–1359) wet and cool intervals that primarily achieved their high rank through their many extremely cool annual values (see Table 14). The fourth and fifth are moderately high-ranking dry and cool 7-year intervals (Interval 107, A.D. 1335–1341, and Interval 109, A.D. 1346–1352) that merit this attention because of their interannual persistence and numbers of extreme temperature values (see Table 13). Importantly, *no* high-ranking, prolonged dry-warm droughts occurred during this 117-year period, despite the fact that the renowned "Great Drought" of 1276–1299 (Douglass 1929) appears in numerous tree-ring chronologies of the northern and eastern U.S. Southwest at approximately this same time. Conditions within this same 24-year interval along the southwestern portion of the Colorado Plateau (including the Flagstaff area and the MVRV) oscillated between wet and dry conditions and mild to moderate warmth (see Appendix A; Table 11; Figures 4 and 5). Individual years within these longer intervals certainly were extremely dry and sometimes warm (i.e., A.D. 1276, 1286, 1288, and 1299), but they were separated by many years of milder conditions. Clearly, geography and geographic location mattered; climatic trends along the southeastern portion of the Colorado Plateau varied in significant ways from the broader regional trends. That the Great Drought was not a climate anomaly in the MVRV is a point I will return to later in this chapter. Three frost rings were observed in the SFPB chronology during the 117 years considered here (A.D. 1329, 1356, and 1358) (see Appendix A). The first, A.D. 1329, appears to have immediately preceded and possibly initiated the long, cool middle portion (A.D. 1330–1364) of this 117-year century. The other two occurred during this extremely cool era. In sum, the fourteenth century, as defined here, was a time of variable precipitation conditions with warmer-than-normal conditions in the earliest phase (A.D. 1273–1329), cooler-than-normal conditions in the middle phase (A.D. 1330–1364), and mixed warm and cool conditions in its final phase (A.D. 1365–1389). When these quite-varied climatic conditions are averaged, the century appears to have been dominated by slightly wet and moderately cool conditions.

The fifteenth century, a climatic period that spanned 99 years between A.D. 1390 and 1488, was partitioned into 12 intervals (Intervals 115–126); no climatic episodes were identified (see Tables 11 and 17; Figures 4 and 5). Four intervals were wet and warm, 3 were dry and warm, 3 were dry and cool, and 2 were wet and cool. Intervals ranged in length from 3 to 16 years (mean = 8.3 years; median = 7.5 years) and included 12 extreme values (12.1 percent). More individual years were dry than were wet (51 dry vs. 48 wet), and more individual years were warm than were cool (61 warm vs. 38 cool). The century-length precipitation and temperature means and standard deviations indicate that the 99-year period was slightly but variably dry and moderately but persistently warm. The graphic representations of the time-series data confirm these patterns, but they clearly show that the first portion of the century was consistently warmer than normal and that the latter portion was mild but tending toward cool. Two intervals are notable. The first is an 11-year dry-warm drought (Interval 117, A.D. 1406–1416) that ranked moderately high for its class (see Table 12). The second was an 8-year wet and warm period that also ranked moderately high for its class (Interval 120, A.D. 1427–1434) (see Table 15). Five frost rings were observed in the SFPB chronology during the 99-year century (A.D. 1408, 1417, 1422, 1453, and 1472) (see Appendix A). The first four frost rings occurred during warm or mild intervals; only the last occurred in a cool interval, during a cooling trend at the end of the century. In sum, the fifteenth century, as defined here, was a time of few extremes and slightly dry to moderately warm conditions, overall. Although the interannual variability in precipitation was high, the temperature trends—warm in the early portion of the century (A.D. 1390–1434) and moderate in the latter portion (A.D. 1435–1488)—remained fairly constant.

The sixteenth century, a climate interval that spanned a 109-year period from A.D. 1489 to 1597, was partitioned into 11 intervals (Intervals 127–137); no climatic episodes were delineated (see Tables 11 and 17; Figures 4 and 5). Four intervals were wet and cool, 3 were dry and cool, 2 were dry and warm, and 2 were wet and warm. Intervals ranged in length from 3 to 20 years (mean = 9.9 years; median = 10 years) and included 20 extreme-value years (18.3 percent). Approximately the same number of years were dry as were wet (55 dry vs. 54 wet), but many more years were cool than were warm (62 cool vs. 47 warm). The precipitation and temperature means and standard deviations for this 109-year period indicate that this century was moderately dry and cool, overall. However, the graphic representations of these data illustrate that this 109-year period was consistently and often significantly cooler than normal at its beginning, persistently dry in its middle, and fairly continuously warm at its end. Five intervals are prominent for their relatively high ranks. Three of these were dry and cool, and 2 were dry and warm; each interval represents a time period in which the climatic condition endured for a considerable number of years. Interval 128 (A.D. 1492–1506), Interval 130 (A.D. 1517–1528), and Interval 135 (A.D. 1569–1583) were high-ranking dry-cool droughts that persisted for 15, 15, and 12 years, respectively (see Table 13). Interval 130 (A.D. 1517–1528) was particularly severe; 9 of its 12 years exhibited extreme climatic conditions (both extreme dryness and extreme cold). Intervals 131 (A.D. 1529–1548) and Interval 136 (A.D. 1584–1592) were notable dry-warm droughts that lasted 20 and 9 years, respectively (see Table 12). The earlier dry-warm drought was high ranking on the basis of its persistent and often excessive warmth, whereas the later dry-warm drought was high ranking primarily because of its continuous and often extreme aridity. A total of four frost rings occurred in this 109-year period (A.D. 1490, 1544, 1569, and 1595) (see Appendix A). Two occurred in already-cool intervals (A.D. 1490 and 1569), and two occurred in warm intervals (A.D. 1544 and 1595). In sum, the sixteenth century, as defined here, was a dry and cool century with a modest number of extremes and variable conditions over time. The earlier portion of the century (A.D. 1489–1528) was persistently and often extremely cooler than normal, with highly variable precipitation conditions. A 20-year dry-warm drought (A.D. 1529–1548) separated the very cool early period from the next period of variable precipitation and persistent coolness

(A.D. 1549–1583). The final years (A.D. 1584–1597) were continuously warmer than normal. Interestingly, evidence of a prolonged and devastating "Sixteenth Century Megadrought," which appears in many tree-ring chronologies in North America (e.g., Acuna-Soto et al. 2002; D'Arrigo and Jacoby 1991; Grissino-Mayer 1995, 1996; Grissino-Mayer et al. 1997; Grissino-Mayer et al. 2002; Hughes and Brown 1992; Rose et al. 1981; Stahle et al. 2000; Van West and Grissino-Mayer 2005; Woodhouse and Overpeck 1998), is not pronounced in the VERDE chronology. It appears to be most pronounced along the southeastern Colorado Plateau from about A.D. 1569 to 1583, as a more or less unrelenting drier-than-normal interval. Elsewhere in the U.S. Southwest, this long and persistent drought began during the second half of the 1500s and continued unabated until the early 1600s.

The seventeenth century, a 90-year climatic period from A.D. 1598 to 1687, was partitioned into 12 intervals and 2 1- or 2-year episodes (Intervals 138–151) (see Tables 11 and 17; Figures 4 and 5). Five intervals were dry and cool, 5 were wet and cool, 1 was wet and warm, and 1 was dry and warm. Both episodes were transitions that included extreme values. One episode (A.D. 1613) represented an extremely dry year between an extremely cool and somewhat wet interval and an extremely wet and somewhat cool interval. The other episode (A.D. 1653–1654) was a 2-year transition from an extremely cool and dry year to a warm and wet interval. The intervals ranged between 3 and 12 years in length (mean = 7.3 years; median = 8 years) and included a total of 27 extreme values (30 percent). Slightly more years were wet than were dry (48 wet vs. 42 dry), but many more years were cool than were warm (70 cool vs. 20 warm). The precipitation mean and standard deviation for this 90-year period suggest that the seventeenth century was slightly wetter than normal, overall, but highly variable from interval to interval. The temperature mean and standard deviation for the 90-year period indicate that the century was extremely and persistently cooler than normal—rivaling the low mean and standard-deviation values for the thirteenth century. The graphic representations of these data support these statistics and enhance the interpretation of the time sequence. These figures clearly show that 3 prolonged periods of persistent cooler-than-normal climate are separated by short warm and wet intervals. Within the 90-year period, 4 intervals are particularly remarkable. All are considerably cooler than normal (see Tables 13 and 14). Interval 146 (A.D. 1649–1652) was an unusual cool and wet 4-year interval in which all 4 years were extremely cool. Interval 144 (A.D. 1635–1645) was an 11-year wet and cool interval in which all years were considerably cooler than normal, and 5 of those years were extremely cool. Interval 150 (A.D. 1672–1683) was a moderately wet and very cool 12-year interval in which all years were considerably cooler than normal, and 2 of those years were extremely cool. Interval 149 (A.D. 1664–1671) was an 8-year dry-cool drought with 4 extreme years (droughts and cold). Five frost rings were recorded in the 90-year period (A.D. 1615, 1625, 1640, 1651, and 1680) (see Appendix A), all solidly within extended cool intervals (A.D. 1640, 1651, and 1680) or immediately before intensely cool intervals (A.D. 1615 and 1625). In sum, the seventeenth century was 1 of the coolest centuries in the 14-century record; it rivals, and in some ways exceeds, the thirteenth century in its overall pattern of coolness. The seventeenth century also contained a high percentage of extreme values—most of them extremely cooler than the long-term average—and tremendous interannual persistence in these temperature conditions. The most-severe periods were dry-cold droughts rather than dry-warm droughts. Few intervals of relatively benign climate occurred. Those who argue for the existence of a "Little Ice Age" in the U.S. Southwest surely can justify the climate during most of the seventeenth century as a contending example.

The eighteenth century, a 121-year period dating from A.D. 1688 to 1808, was partitioned into 15 intervals and 1 climatic episode (Intervals 152–167) (see Tables 11 and 17; Figures 4 and 5). Six intervals were dry and warm, 5 were wet and warm, 2 were dry and cool, and 2 were wet and cool. The single climate episode (A.D. 1725–1726) was extremely cool and was a transition between a short but extremely dry and wet interval and a longer dry and wet interval. The intervals ranged in length from 3 to 19 years (mean = 7.9 years; median = 7 years) and included 27 of the 28 extreme events (23.1 percent) identified in the 121-year period. More individual years were wet than were dry (66 wet vs. 55 dry), and more individual years were warm than were cool (91 warm vs. 30 cool). The century-length means suggest that the period was slightly wetter than long-term normal and very much warmer than the 1,418-year mean. The standard deviations around these means, however, indicate that the variability in annual precipitation was extraordinarily great—in fact, the greatest of all 14 centuries—and that the variability in annual temperature was considerably small, indicating its constancy from year to year. The graphic representations of the eighteenth-century data illustrate these patterns in the time-series data very well. Except for a fairly continuous period of wetter-than-normal conditions at midcentury (A.D. 1856–1763), interannual variation in precipitation was marked with a trend toward increasing numbers of extreme drought years from A.D. 1688 to 1788 as well as a trend toward reduction in the number of extreme drought years from A.D. 1772 to 1808. Five extended, persistent, and often extreme periods of warmth were broken by 4 short, persistent, but mild periods of coolness. Of the 15 intervals, 7 stand out. All 7 are notably warm periods, but 3 were dry intervals, and 4 were wet intervals. Each of the dry-warm droughts was prolonged (see Table 12). Interval 165 (A.D. 1772–1790) was the highest-ranking dry-warm interval within the 1,418-year record; it lasted for 19 years and contained 7 extreme droughts. In contrast, the 4 wet and warm intervals were considerably shorter in length but contained numerous extreme values (see Table 15). Among these were Interval 163 (A.D. 1756–1762), the second- and third-highest-ranking wet and warm intervals in the 1,418-year record; Interval 152 (A.D. 1688–1693); Interval 156 (A.D. 1710–1721); and Interval 166 (A.D. 1791–1793). Five frost rings were recorded in the SFPB chronology during this 121-year period (A.D. 1702, 1712, 1732, 1748, and 1761) (see Appendix A). Only one of these, A.D. 1748, occurred during a short dry and cool interval. In sum, the eighteenth century was a period dominated by a persistent and often extremely warm climate. Precipitation conditions varied greatly from year to year, and modest droughts persisted for fairly long periods of time. These dry-warm droughts were separated by either wet-warm spells or dry-cool droughts. The overall warmth of the eighteenth century stood in stark contrast to the overall coolness of the seventeenth century.

The nineteenth century, an 83-year climatic period dating from A.D. 1809 to 1891, was partitioned into nine intervals and four climatic episodes (Intervals 168–180) (see Tables 11 and 17; Figures 4 and 5). Four intervals were dry and cool, three were wet and cool, and two were dry and warm; no interval was warm and wet. Two of the four climatic episodes were 2-year wet and cool periods (A.D. 1867–1868 and 1884–1885) that were transitions between contrasting conditions. Another was an extreme wet and warm episode (A.D. 1865–1866), and yet another was a dry and cool episode (A.D. 1886–1887); both represented transitional conditions. The intervals ranged in length from 3 to 17 years (mean = 8.3 years; median = 7 years) and included 26 of the 29 extreme values (34.9 percent) identified in this 83-year period. More individual years were wet than were dry (46 wet vs. 37 dry), and more individual years were cool than were warm (58 cool vs. 25 warm). Despite the greater number of wet years, the 83-year-period mean and standard deviation for precipitation indicate that the nineteenth century tended to be slightly dry overall and that considerable variation in precipitation existed from year to year, with many extreme values. In contrast, the 83-year-period mean and standard deviation for temperature correspond well with the high number and persistent pattern of wet years. The graphic representations of these data illustrate the great and often extreme variability in precipitation and the interannual persistence of cool periods, especially in the early half of this 83-year period. Three intervals are notable; two were dry and cool (see Table 13), and one was wet and cool (see Table 14). Interval 168 (A.D. 1809–1823) was ranked as the fourth-most-intense of its class within the 1,418-year record. It was a 15-year interval with 11 extreme values. Its length and magnitude of its persistent coolness and its occasional droughts account for this status. The other dry-cool drought was Interval 170 (A.D. 1841–1847), a 7-year period with persistent and often extreme coolness and frequent droughts. The single wet and cool interval of note was Interval 169 (A.D. 1824–1840), a 17-year period of nearly constant coolness accompanied by generally wetter-than-normal conditions. Four frost rings were recorded in the SFPB chronology during the 83-year period (A.D. 1810, 1828, 1882, and 1884) (see Appendix A). All occurred early within periods that were considerably cooler than normal. In sum, the nineteenth century was a period of overall coolness and frequent droughts. The early portion of the 83-year period (A.D. 1809–1855) was an era of persistent and often extreme coolness, whereas the later portion (A.D. 1856–1891) was mild and showed few extremes in temperature. The frequency of extremes in precipitation (both droughts and wet spells) decreased after A.D. 1868.

The twentieth century, which is represented by the last 97 years in the 1,418-year joint chronology (A.D. 1892–1988), was partitioned into seven climatic intervals (Intervals 181–187); no extreme or transitional 1- or 2-year climate episodes were identified (see Tables 11 and 17; Figures 4 and 5). Three intervals were wet and warm, two were dry and warm, one was wet and cool, and one was dry and cool. The intervals ranged in length from 6 to 22 years (mean = 12.1 years; median = 11 years) and included 35 years with extreme values within the 97-year period (36.1 percent). More individual years were wet than were dry (51 wet vs. 46 dry), and more individual years were warm than were cool (71 warm vs. 26 cool). The means for precipitation and temperature suggest that the century was somewhat wetter and considerably warmer than long-term normal. The standard deviations suggest that there was considerable variability in precipitation but that temperature trends remained fairly consistent from interval to interval. The graphic representations of the twentieth century show a persistent drought just before the turn of the century, a persistent wet period in the early 1900s, a trend toward dryness and increasingly extreme drought years from the 1930s through the 1960s, and a trend toward less-frequent and less-extreme drought years in the 1970s and 1980s. In contrast, the turn of the century showed a persistent warm period of modest proportions, a marked cool period in the early 1900s, and persistent warmth of varying magnitude after 1932. Four intervals stand out. Two were notably dry and warm intervals (see Table 12), one was wet and cool (see Table 14), and the final was wet and warm (see Table 15). The first warm drought (Interval 181, A.D. 1892–1904) straddled the turn of the twentieth century. It was ranked high by virtue of its persistence in both temperature and precipitation and by its high number of extremely dry years. The second warm drought was Interval 186 (A.D. 1943–1964), which incorporated the widely experienced "1950s Drought." As elsewhere in the U.S. Southwest, this drought began in the 1940s, reached a crescendo in the 1950s, and tapered off in the early 1960s. In the combined VERDE-SFPB record, it is the second-highest-ranking dry-warm drought, a status achieved by its duration, magnitude, and interannual persistence. The third notable period was the marked wet and cool spell, Interval 183 (A.D. 1911–1920), which occurred across western North America. It, too, was the second-highest-ranking interval within its class (wet and cool). The final high-ranking interval was Interval 187 (A.D. 1965–1988), one of the warmest and wettest intervals in the joint record. Had the VERDE chronology been longer, the interval duration—and consequently the rank—would have been even greater. Three frost rings were identified in the twentieth-century portion of the SFPB chronology as defined here (A.D. 1923, 1941, and 1965) (see Appendix A). The first took place in an already-cool interval, whereas the latter two took place within warm intervals. In sum, the twentieth century was 1 of the warmest centuries in our 14-century record. The only exception to this characterization was a pronounced cool era between 1909 and 1931. Two significant warm droughts occurred in the 97-year period, one at the start of the period and one at midcentury. The balance of the century was warm and wet.

Summary

In this study, I have drawn from two tree-ring chronologies to model temporal trends in precipitation and temperature for the MVRV. I selected the VERDE tree-ring chronology to model trends in average annual total precipitation and the SFPB tree-ring chronology to model average annual mean maximum temperature. I partitioned the 1,418 years of joint VERDE and SFPB tree-ring chronologies (A.D. 571–1988) into 187 smaller units of time based on their annual values and their patterns of contrast with earlier and later time units. Of these 187 consecutive time units, 173 were considered to be "climatic intervals" ranging in duration from 3 to 26 years (mean = 8 years; median = 7 years). The remaining 14 time units, representing a total of 24 years, were considered to be "climatic episodes" of either 1 or 2 years' duration. These episodes were either short but severe climate events (i.e., years of extreme warmth or coolness, drought or wetness, or some combination thereof) or transitions between contrasting climatic patterns. More individual years were wet than were dry (768 wet vs. 650 dry), and more individual years were cool than were warm (735 cool vs. 683 warm), on the basis of their signs rather than magnitude. However, more intervals were classified as dry and cool, the climate class with more extreme years than any other combination (see Table 16). Conversely, wet and warm intervals were the least numerous and contained the fewest extremes of the four possible climate combinations. Intervals classified as dry and warm tended to be more variable in their duration and magnitude than other combinations.

A total of 337 extremes in climate occurring in 316 separate years were identified in the joint 1418-year record based on their annual magnitude values. Extreme conditions were designated when an annual value was greater than or equal to +2 standard-deviation units (i.e., a z-score) above the long-term mean or when an annual value was less than or equal to –1.28 standard-deviation units below the long-term mean. Thus, years that were classified as extremely warm or cool, dry or wet, or some combination of these occurred 22.5 percent of the time, or nearly once every 4 or 5 years over the 1,418-year time period. Individual centuries, however, exhibited extreme-climate years in either greater or lesser percentages (range: 9.7–36.1 percent). The twentieth century contained the highest percentage of extremes (on average, greater than 1 out of every 3 years), and the eleventh century contained the least number of extremes (on average, less than 1 out of every 10 years).

The overall character of each century was described for the seventh through twentieth centuries. Each "century" was initiated with a climatic interval that marked the beginning of a persistent climate condition, irrespective of calendar year (see Table 17). Similarly, the "century" concluded with the end of a climate interval and its persistent condition, regardless of calendar year. Thus defined, 14 centuries were described by the number and character of climatic intervals and episodes that each contained. Century-length means, standard deviations, and coefficients of variation, as well as minimum, maximum, and median values, were used to describe the overall climate of each century. Centuries were described as wet or dry and as cool or warm, including how extreme and variable these conditions were. Visual inspection of annual and smoothed plots of the precipitation and temperature data were used to confirm or refine these statistical statements. Four centuries—the seventh (A.D. 584–705), ninth (A.D. 798–895), fourteenth (A.D. 1273–1389), and seventeenth (A.D. 1598–1687)—were described as wet and cool. Four centuries—the twelfth (A.D. 1088–1194), thirteenth (A.D. 1195–1272), sixteenth (A.D. 1489–1597), and nineteenth (A.D. 1809–1891)—were described as dry and cool. Three centuries—the eighth (A.D. 706–797), tenth (A.D. 896–984), and fifteenth (A.D. 1390–1488)—were described as dry and warm. Three centuries—the eleventh (A.D. 985–1087), eighteenth (A.D. 1688–1808), and twentieth (A.D. 1892–1988)—were described as wet and warm. Of these, the most-persistent patterns (i.e., year-to-year persistence in both precipitation and temperature conditions, as measured by coefficients of variation) took place in the extremely dry and moderately warm eighth century and the moderately dry and warm tenth century. Such conditions represent century-length eras of greater predictability. In contrast, the most variable patterns (i.e., year-to-year variation in both precipitation and temperature conditions, as measured by coefficients of variation) took place in the slightly wet and cool seventh century and the slightly wet and moderately cool fourteenth century. This kind of variation represents century-length periods of time for which predicting climate conditions on the basis of the previous or current years' conditions would fail much of the time. Thus, these centuries were eras of great uncertainty. All other centuries were mixed in their combinations of persistence or variability. The driest centuries were the eighth and sixteenth centuries, followed by the twelfth and thirteenth centuries, when long or pronounced periods of drought took place throughout much of the U.S. Southwest. The wettest centuries were the ninth, eleventh, and twentieth centuries. The warmest centuries were the twentieth and eighteenth centuries, followed by the fifteenth, tenth, and eighth. The coolest centuries were the thirteenth, seventeenth, and nineteenth. The effects of these separate and combined conditions, along with their persistence or variability, magnitude, and duration, will be explored in the next section, which discusses the relationship between climate and human settlement in the MVRV.

Archaeological Correlates

In this section, I use the dendroclimatic reconstruction based on the joint record of past precipitation and temperature to characterize the climatic condition that prevailed during the cultural-historical sequence documented in the LOCAP investigations. The reconstruction begins in the final years of the Squaw Peak phase and continues through the historical period. The dates used to bracket these developmental sequences are those published by Pilles (1996a:62).

Squaw Peak Phase (A.D. 1–650)

The joint VERDE-SFPB record begins at A.D. 571, in the final 80 years of the long Squaw Peak phase. It is equivalent to the terminal Archaic period of the Northern Sinagua sequence, the Estrella phase of the Gila Basin Hohokam sequence, and part of the late Basketmaker III period of the Pecos classification as it applies to Ancestral Pueblo culture history (Figure 6). In terms of the data presented here, the terminal Squaw Peak phase is represented by a 74-year period contained within Intervals 1–13 (A.D. 571–644) (Table 18; see Table 11; Figures 4 and 5). Although precipitation varied from year to year, temperature patterns appear to have persisted for relatively extended periods of time: a long warm spell (A.D. 584–623) contrasted with a short cool period immediately before it (A.D. 571–583) and after it (A.D. 624–644) (see Figure 4). Because of the length and persistence of this warm era, the terminal Squaw Peak phase can be characterized as somewhat wet and warm. Four intervals were wet and warm, four were dry and warm, three were wet and cool, and two were dry and cool. The intervals ranged in length from 3 to 13 years but averaged just under 6 years in duration, with an equally short median value of 5 years, representing the shortest average interval length within the 1,418-year sequence. Thus, climatic conditions, regardless of precipitation and temperature trends, did not persist for many years at a time. Relatively few years (only 12 out of 74, or 16.2 percent) were reconstructed to have experienced extreme conditions (see Appendix A), suggesting that unusually challenging precipitation or temperature conditions took place about once every 6 years. The dendroclimatic record, however, indicates that the occurrence of extreme years was more frequent at the turn of the century and within the first 3 decades of the A.D. 600s. Two closely spaced years (A.D. 626 and 630) were particularly difficult—they were both extremely dry and cool—and occurred within the cool era at the end of the phase. In addition, a short but serious, 4-year dry-warm drought took place between A.D. 596 and 599. In sum, the terminal Squaw Peak phase was predominantly warm, with rapidly alternating intervals of wetness and dryness, and contained a long warm spell in the late 500s and early 600s. An extended period of coolness after A.D. 623 separates it from the notable warmth at the beginning of the succeeding Hackberry phase.

At least two sites excavated by SRI during the LOCAP had temporal components dating to the Squaw Peak phase. AZ O:1:105/AR-03-04-06-838 (ASM/CNF) (Site 105/838) and AZ O:1:85/AR-03-04-06-428 (ASM/CNF) (Site 85/428) contained features that dated to sometime prior to A.D. 600. Feature 37 from Site 105/838 was a round pit structure with two thermal pits and a small number of postholes. AM dates returned from one of the thermal pits (cal. A.D. 585–690) and radiocarbon dates derived from maize cupules in the pit-structure fill (cal. A.D. 410–600) constitute evidence that this feature was part of a pre–A.D. 600 occupation of this site (see Chapter 2, this volume). If the AM age associated with Feature 37 delimits the possible occupation span, then the Squaw Peak occupation of Site 105/838 took place within the long warm era at the end of the sixth century. Feature 2 from Site 85/428 was a multiple-episode roasting pit that contained maize. An AMS date on a maize kernel returned a 2σ calibrated date of A.D. 410–600. Another roasting feature from Site 85/428, Feature 4, produced three dating options on an AM sample (A.D. 585–690, 935–990, and 1760–1890). Although Lengyel (see Chapter 2, this volume) was unwilling to select the best dating option for this feature without corroborative evidence, the data at hand suggests that Site 85/428 also had a late Squaw Peak phase occupation. Given that these two sites are adjacent, it is reasonable to suggest that they were different loci of a single occupation along Spring Creek in the late Squaw Peak phase.

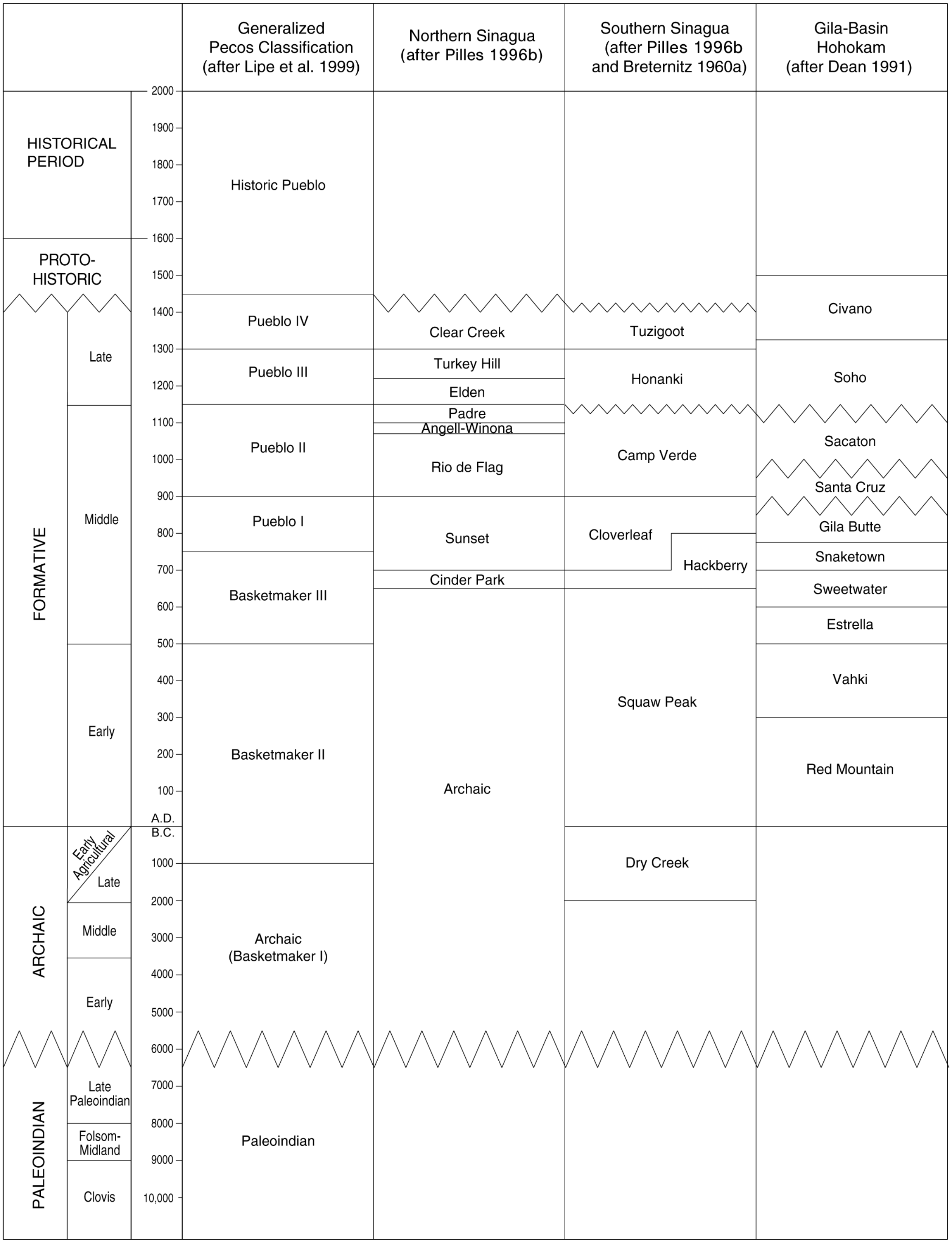

Figure 6. Cultural chronology for the middle Verde River valley.

Table 18. Dendroclimate Summary, by Cultural Phase/Period

Cultural Phase/Period	Range of Years (A.D.)[a]	Interval Nos.[a]	Total Years in Phase	No. of 1- or 2-Year Episodes	No. of 3+-Year Intervals	Interval-Length Range (years)	Mean, Median Interval Length (yrs)	Phase Precipitation Mean and Standard Deviation	Precipitation Coefficient of Variation[b]	Median Value	Minimum Value	Maximum Value	Phase Temperature Mean and Standard Deviation	Temperature Coefficient of Variation[b]	Median Value	Minimum Value	Maximum Value	No. of Wet Years	No. of Dry Years	No. of Warm Years	No. of Cool Years	No. of Extreme Years	Percent of Century Extreme	"Character" of Phase: Precipitation, Wet or Dry: s/m/e W/D[c]	v/p[d]	Temperature, Warm or Cool: s/m/e W/C[c]	v/p[d]
Late Squaw Peak phase	571–644	1–13	74	—	13	3–13	5.7, 5.0	0.07 ± 1.02	13.80	0.18	–2.82	2.56	0.17 ± 0.90	5.44	0.03	–2.55	2.16	40	34	42	32	12	16.2	e wet	p	m warm	p
Hackberry phase	645–705	14–23	61	2	8	1–12	6.1, 6.0	0.00 ± 1.18	508.83	0.26	–2.84	2.15	–0.34 ± 1.38	–4.10	–0.13	–3.50	3.00	38	23	28	33	27	44.3	s wet	v	e cool	p
Cloverleaf phase	706–895	24–47	190	2	22	2–26	7.9, 5.5	0.00 ± 1.04	879.18	0.07	–2.45	2.47	0.01 ± 0.83	147.48	–0.05	–2.48	2.73	100	90	92	98	37	19.5	s wet	v	s warm	v
Camp Verde phase	896–1145	48–78	250	3	28	1–21	8.1, 7.0	–0.01 ± 0.92	–64.90	0.08	–2.62	2.70	0.00 ± 0.77	–351.11	–0.02	–3.23	1.70	139	111	119	131	33	13.2	s dry	v	s cool	v
Honanki phase	1146–1291	79–101	146	—	23	3–16	6.3, 5.0	0.01 ± 1.02	165.88	0.13	–2.39	2.05	–0.22 ± 0.88	–3.98	–0.20	–2.84	2.14	82	64	58	88	33	22.6	s wet	v	e cool	p
Tuzigoot phase	1292–1426	102–119	135	—	18	3–23	7.5, 6.0	0.01 ± 0.84	58.48	0.10	–1.96	2.56	0.04 ± 1.01	23.41	0.16	–2.09	2.80	76	59	77	58	28	20.7	s wet	v	s warm	v
Protohistoric period	1427–1597	120–137	171	—	18	3–20	9.5, 10.0	–0.07 ± 0.96	–14.22	–0.04	–2.78	2.31	–0.06 ± 0.79	–13.52	–0.11	–2.51	2.85	83	88	74	97	28	16.4	m dry	p	m cool	v
Early historical period	1598–1847	138–170	250	3	30	1–19	7.6, 7.0	0.00 ± 1.03	971.92	0.14	–2.70	2.43	–0.07 ± 1.21	–17.63	–0.15	–3.49	3.66	138	112	118	132	75	30.0	s wet	v	m cool	v
Late historical period	1848–1988	171–187	141	4	13	2–24	8.3, 6.0	0.04 ± 1.11	25.83	0.08	–2.68	2.44	0.45 ± 1.19	2.64	0.41	–1.86	3.75	74	67	89	52	44	31.2	m wet	p	e warm	p
All	571–1988	1–187	1,418	14	173	1–26	7.4, 6.4		58.48	–0.10	–2.84	2.70		–3.98	0.05	–3.50	3.75	770	648	697	721	317	22.4				

[a] Nearest whole interval.
[b] Coefficient of variation is the ratio of the standard deviation to the mean; it is used here as measure of predictability.
[c] Based on the mean value and its sign; Precipitation: s = slightly (0.00–0.01), m = moderately (0.02–0.04), e = extremely (>0.04); Temperature: s = slightly (0.00–0.05), m = moderately (0.10–0.20), e = extremely (>0.20).
[d] Based on the standard deviation and coefficients of variation; Precipitation: p = persistent (1–50), v = variable (>50); Temperature: p = persistent (0–10), v = variable (>10).

Hackberry Phase (A.D. 650–700)

As defined by Pilles (1996a:62), the Hackberry phase is an exceedingly short phase that is more or less equivalent to the Cinder Park phase of the Northern Sinagua sequence, the Sweetwater phase of the Gila Basin Hohokam sequence, and the final years of the Ancestral Puebloan Basketmaker III sequence (see Figure 6). The Hackberry phase is represented by a 61-year period equivalent to Intervals 14–23 (A.D. 645–705) (see Tables 11 and 18; Figures 4 and 5) and includes eight intervals and two episodes. Three intervals were identified as wet and warm, two as dry and warm, two as wet and cool, and one as dry and cool. One of the climate episodes was classified as extremely dry and cool (A.D. 663–664), and the other was classified as extremely dry and warm (A.D. 677). The length of an interval in the Hackberry phase was longer than in the late Squaw Peak phase (mean = 6.1 years; median = 6 years), but the persistence of a given climate interval was still shorter than in all later cultural development phases. Although brief, the second half of the seventh century witnessed many extremes in climate and several high-ranking climate intervals. Twenty-seven (44.3 percent) of the 61 years associated with the Hackberry phase were identified as extreme years—the highest percentage of any of the phases delimited within this 1,418-year record. The 15-year period between A.D. 686 and 700 was particularly severe, insofar as every year was reconstructed to be extremely cool and often extremely dry. Three sets of extreme double-year droughts (A.D. 645–646, 663–664, and 699–700) were likely to have been challenging episodes, as well. As defined here, the Hackberry phase was initiated with a relatively high-ranking 10-year dry-warm drought (Interval 14, A.D. 645–654) and ended with a 12-year dry-cool drought (Interval 23, A.D. 694–705). In between, the third-most-intense wet-cool spell (Interval 22, A.D. 686–693) took place within the lengthy period of extreme variation at the end of the seventh century. In sum, the brief Hackberry phase was a time period with many climatic extremes and frequent challenges. Although the statistics for this period suggest that the Hackberry phase was slightly but variably wet and extremely cool throughout, the graphic representations for this time period suggest that alternating intervals of warmth and coolness were present. The duration, magnitude, and interannual persistence of the cold spell at the end of the seventh century constitute the major event of the Hackberry phase.

No sites investigated by SRI contained evidence of occupation dating to the Hackberry phase.

Cloverleaf Phase (A.D. 700–900)

As defined by Pilles (1996a:62), the Cloverleaf phase is coeval with the Sunset phase of the Northern Sinagua cultural sequence, the Snaketown and Gila Butte phases of the Gila Basin Hohokam sequence, and Pueblo I of the Ancestral Pueblo cultural sequence (see Figure 6). The Cloverleaf phase is represented by a 190-year time span equivalent to Intervals 24–47 (A.D. 706–895) with 22 climate intervals and 2 climate episodes (see Tables 11 and 18). Six climate intervals were classified as wet and cool, 6 were dry and warm, 5 were wet and warm, and 5 were dry and cool. Both climate episodes (A.D. 808–809 and 846–847) represent notably dry and cool 2-year events. Intervals ranged from 2 to 26 years in length (mean = 7.9 years; median = 5.5 years). Because several lengthy intervals were included in this phase, the average duration of the climate intervals in the Cloverleaf phase was longer than in the previous Squaw Peak and Hackberry phases. Nevertheless, the median value for interval length was relatively short, indicating that short-term climate trends generally persisted for only 5–6 years. Despite the 190-year mean values for precipitation and temperature, which indicate that the Cloverleaf phase was slightly wet and warm, the standard deviations and coefficients of variation indicate that climate conditions were extremely variable. Whereas the eighth century was an era of persistent warmth and dryness with a pronounced dry-warm drought in the middle 700s, the ninth century was notably wet and often cool. Thus, the mean values associated with the Cloverleaf phase do little to shed light on the overall character of these 2 centuries. Instead, it is necessary to examine the graphic representations of those 190 years (see Figures 4 and 5) and the tables that rank the severity of different climate classes (see Tables 12–15). Two intervals were high-ranking dry-warm droughts: 26-year Interval 28 (A.D. 737–762) and 12-year Interval 24 (A.D. 706–717). The droughts in the early and mid-700s were particularly severe, in terms of their duration, frequency of extreme-value years, and interannual persistence. One climate episode and 1 climate interval were high-ranking dry-cool droughts: Interval 34 (A.D. 808–809) and Interval 32 (A.D. 786–797). Two intervals were high-ranking wet and cool spells: Interval 27 (A.D. 728–736) and Interval 33 (A.D. 798–807). Only a single wet and warm interval, Interval 29 (A.D. 763–776), was sufficiently long and mild to stand out. Of the 190 years spanned by this phase, only 37 (19.5 percent) of those 190 years were classified as extreme examples, and most of those were drought years. Nevertheless, several 2-year sets of climate extremes occurred within longer intervals of variable climate conditions. Sets classified as extremely dry (A.D. 750–751, 808–809, 883–884), extremely wet (A.D. 730–731), extremely cool (A.D. 804–805, 856–857), and extremely warm (A.D. 880–881) were identified. In sum, the Cloverleaf phase was a time of considerable variability in both precipitation and temperature trends. The phase began with a marked dry-warm drought and continued as a predominantly dry era for 6 decades. A lengthy drought in the middle of the eighth century, which persisted in the MVRV area from A.D. 737 to 762, was a widely experienced development in the U.S. Southwest. A long period of cooler-than-normal climate, with alternating intervals of wetter- and drier-than-normal conditions, was established by A.D. 786 and persisted through A.D. 866. The final 3 decades of this 190-year period were almost continuously warm and showed variable moisture patterns.

No sites investigated by SRI contained evidence of occupation dating to the Cloverleaf phase.

Camp Verde Phase (A.D. 900–1150)

The Camp Verde phase is equivalent in time to the Rio de Flag, Angell-Winona, and Padre phases of the Northern Sinagua cultural sequence; the Sacaton phase of the Gila Basin Hohokam sequence; and the Pueblo II period of the Pecos classification for Ancestral Pueblos (see Figure 6). In this study, the Camp Verde phase spans 250 years (Intervals 48–78, A.D. 896–1145) and incorporates 28 climate intervals and 3 climate episodes (see Tables 11 and 18). Eight climate intervals were dry and warm, 7 were dry and cool, 7 were wet and cool, and 6 were wet and warm. One of the 3 climate episodes was a transitional dry and warm event between contrasting environmental conditions (A.D. 1085–1086), 1 was an extremely wet and warm year (A.D. 1087), and 1 was an extremely dry and moderately cool year (A.D. 1005). Although long, the Camp Verde phase included relatively few extreme years; only 33 (13.2 percent) of its 250 years were classified as exhibiting extreme values. In comparison to all other temporal or developmental phases described in this chapter, the Camp Verde phase contained the lowest percentage of extremes, indicating that annual climatic variation typically ranged within normal limits. Also of interest is the fact that the duration of climate intervals was longer than in the three previous phases (mean = 8.1 years; median = 7 years), suggesting that persistence and interannual predictability were fairly high during this phase. Although more years were classified as wet than as dry and more years were classified as cool than as warm, the 250-year means for precipitation and temperature suggest that the Camp Verde phase was, overall, slightly dry and cool. The standard deviations and coefficients of variation, however, indicate that considerable variability in precipitation and especially in temperature characterized this 2½-century-long phase. The graphic representations for this phase also support this interpretation (see Figures 4 and 5). Several intervals are notable, including the highest-ranking wet-cool and wet-warm spells for the 1,418-year record. The phase began with a 7-year wet and cool interval (Interval 48, A.D. 896–902) that contained the single wettest year (A.D. 899) in the 1,418-year record. Immediately thereafter (Interval 49, A.D. 903–910) was a high-ranking, 8-year dry-warm drought. Three extended dry-cool droughts took place in the Camp Verde phase. These included a 9-year drought (Interval 62, A.D. 990–998), a 17-year drought (Interval 78, A.D. 1129–1145), and a 21-year drought (Interval 74, A.D. 1088–1108). Two extended wet-cool spells took place, as well. Interval 75, an 11-year wet and cool spell between A.D. 1109 and 1119, was the single highest-ranking interval in the class. Also high ranking was Interval 69 (A.D. 1052–1066), which represented a 15-year wet and cool spell. Finally, the single highest-ranking warm and wet spell, Interval 71, took place within the 11-year period between A.D. 1074 and 1084. In sum, the Camp Verde phase contained considerable variability in both precipitation and temperature conditions but relatively few extremes. Whereas the majority of the tenth century was moderately dry and somewhat warm, the eleventh century was generally wet and warm, and the first half of the twelfth century was dry and cool. The period between A.D. 1006 and 1084 was probably the most salubrious portion of the Camp Verde phase—the portion with the fewest number of climate extremes and during which overall conditions were mildly warm and wet. In contrast, the 900s were characterized by more-frequent extremes and interannual variability, and the early 1100s were characterized by few extremes and greater persistence from year to year in both temperature and precipitation trends.

At least seven sites investigated by SRI during the LOCAP were inferred to have components dating to the Camp Verde phase (see Chapter 2, this volume). Most of these sites were assigned to the Camp Verde phase on the basis of temporally diagnostic pottery, but one site—Site 105/838—contained features and subfeatures that produced AM and radiocarbon dates that corroborate artifactual evidence. Features 23 and 29 were pit structures with hearths, subfloor pits, and other architectural subfeatures. Feature 29, the earlier of the two structures, is inferred to have been occupied and abandoned sometime between A.D. 985 and 1040. Feature 23 was probably occupied and abandoned sometime between A.D. 1010 and 1040. Together, these dates suggest that Site 105/838 experienced a middle Camp Verde phase occupation in the late tenth or early eleventh century. Despite the relatively high resolution of these absolute date ranges, the resolution of the dendroclimatic record is even greater, and it is not possible to associate the Camp Verde phase occupation of Site 105/838 with a specific climatic interval. Nevertheless, it is possible to describe typical climate conditions within this 55-year period (Intervals 61–67, A.D. 985–1039). More individual years were wet than were dry (29 wet vs. 26 dry), and more individual years were cool than were warm (37 cool vs. 18 warm) during this period, but several extremely dry years (A.D. 991, 993, 1005, 1014) and two long periods of persistent coolness (Intervals 61–64 and Interval 66) influenced the 55-year means and standard deviations for precipitation (–0.05 ± 0.86) and temperature (–0.2 ± 0.64). These statistics suggest that the predominant climate condition was slightly but variably dry and moderately and rather persistently cool during the likely era of occupation.

Honanki Phase (A.D. 1150–1300)

The Honanki phase is coeval with the Elden and Turkey Hill phases of the Northern Sinagua sequence, the Soho phase of the Classic period Hohokam sequence, and Pueblo III of the Pecos classification for the Ancestral Pueblo sequence (see Figure 6). In this study, the Honanki phase includes 146 years and 23 climate intervals (Intervals 79–101, A.D. 1146–1291) (see Tables 11 and 18). Six climate intervals were dry and cool, 6 were dry and warm, 6 were wet and warm, and 5 were wet and cool. More individual years were wet than were dry (82 wet vs. 64 dry), and more individual years were cool than were warm (88 cool vs. 58 warm). The 146-year means for precipitation and temperature suggest that the Honanki phase was slightly wet and extremely cool. The standard deviations indicate that precipitation was quite variable from year to year but that temperature patterns were highly persistent. The graphic representations of these data confirm these overall trends (see Figures 4 and 5) but add detail to the interpretation. Whereas the middle to late twelfth century was generally warmer and often drier than normal, the first quarter of the thirteenth century was cold and dry, and the subsequent two quarters were cool and often wetter than normal. The duration of the average climate interval was significantly shorter than in the previous Camp Verde, Cloverleaf, or Hackberry phases, as expressed by both the mean and median values (mean = 6.3 years; median = 5 years). In addition, the percentage of extreme years (33 years, or 22.6 percent) compared to years within normal variation was also greater than in the previous Camp Verde and Cloverleaf phases. Four intervals stand out during the Honanki phase, and all were periods of extended and extreme coolness. Interval 90 (A.D. 1205–1220) was the third-most-intense dry-cool drought in the 1,418-year record. Interval 89 (A.D. 1200–1204), Interval 93 (A.D. 1228–1243), and Interval 98 (A.D. 1265–1272) were the highest-ranking wet-cool spells of the 146-year period. The sustained coolness of this time period, which began at A.D. 1195 and persisted virtually uninterrupted until A.D. 1272, is the single most-characteristic climate condition of the Honanki phase. In addition, the magnitude of the cooler-than-normal conditions, particularly expressed as extremely cool years, is notable. Within the long, unbroken series of cool years between A.D. 1195 and 1220, 12 of these 26 years were extremely cold (see Appendix A). In sum, the Honanki phase, as defined here, began as a warm period with alternating intervals of wet and dry conditions that lasted from A.D. 1146 to about A.D. 1183. Extremely dry years occurred frequently, but no unusually wet years were identified. At about A.D. 1184, a long era of cool and often cold climate set in and was almost unbroken through A.D. 1272. Precipitation conditions varied considerably during this long period, but wet years predominated after A.D. 1220. The final 19 years of the Honanki phase (A.D. 1272–1291) witnessed a return to generally warmer-than-normal conditions, but no years of extreme warmth were identified. Of great note is the fact that the "Great Drought" of A.D. 1276–1299 (Douglass 1929) was *not* experienced as a long, dry-warm drought in the MVRV. Although individual years within this famous 24-year period were indeed extremely dry (A.D. 1276, 1286, 1288, and 1299), 14 years were classified as wet, and 10 years were classified as dry. Alternating intervals of wet-warm and dry-warm climate (Intervals 99–102) persisted from A.D. 1274 to 1314, and the longest of these signaled the beginning of the Tuzigoot phase, at A.D. 1292 (Interval 102, A.D. 1292–1314). That the final years of the thirteenth century were not extraordinary in terms of climate within the MVRV is important to regional culture history and regional settlement patterns.

At least four sites investigated by SRI during the LOCAP had artifactual evidence of occupation during the Honanki phase (see Chapter 2, this volume). No site component, however, produced AM, radiocarbon, or dendrochronological dates that would provide independent lines of evidence to support or further refine the dates of occupation.

Tuzigoot Phase (A.D. 1300–1425)

The Tuzigoot phase is contemporary with the Clear Creek phase of the Northern Sinagua cultural sequence, the Civano phase of the Classic period Hohokam sequence, and the Pueblo IV period of the Pecos classification for the Ancestral Pueblo sequence (see Figure 6). In this study, the Tuzigoot phase spans a 135-year period contained within 18 climatic intervals (Intervals 102–119, A.D. 1292–1426) (see Tables 11 and 18). Five climate intervals were dry and cool, 5 were dry and warm, 4 were wet and warm, and 4 were wet and cool. Interval lengths ranged from 3 to 23 years. The typical duration of a climate interval was longer than in the previous Honanki phase, as expressed in both the mean and median values (mean = 7.5 years;

median = 6 years) for the 135-year period. Insofar as the persistence of any given climatic pattern was greater in the Tuzigoot phase than in the Honanki phase, the interannual predictability of climatic conditions was also greater. Adding to that state of enhanced predictability is the fact that fewer extremes in climate conditions (28 years, or 20.7 percent) took place in the Tuzigoot phase than in the Honanki phase. More individual years were wet than were dry (76 wet vs. 59 dry), and more individual years were warm than were cool (77 warm vs. 58 cool). Corresponding to these dominant patterns, the means for both precipitation and temperature suggest that the Tuzigoot phase was slightly wet and slightly warm, overall. However, the standard deviations and coefficients of variation indicate that considerable variability in both precipitation and temperature conditions took place. The graphic representations of this 135-year period show a long period of persistent coolness between A.D. 1330 and 1364 and a long period of persistent warmth between A.D. 1401 and 1434, with shorter intervals of warmth and coolness before, after, and between (see Figures 4 and 5). Six intervals are noteworthy. The first is a 23-year dry-warm period that straddled the turn of the fourteenth century (Interval 102, A.D. 1292–1314). This climate interval was only moderately high ranking, but it gains cogency through its persistent warmth rather than the frequency or magnitude of drought conditions. The second is another dry-warm drought (Interval 117, A.D. 1406–1416) that took place close to the end of the Tuzigoot phase as it is defined here. It is ranked high on the basis of its persistent warmth and overall dryness more than its length. The next three intervals represent high-ranking wet-cool (Interval 106, A.D. 1330–1334, and Interval 110, A.D. 1353–1359) or dry-cool (Interval 107, A.D. 1335–1341) periods within the protracted cool era of the middle fourteenth century. The final interval is a 17-year, high-ranking wet and warm interval (Interval 112, A.D. 1365–1381) that appears to correspond to the end of the major Puebloan occupation of large late sites in the valley, such as Tuzigoot Pueblo, which has a final tree-ring date of A.D. 1386 (Robinson and Cameron 1991). In sum, the Tuzigoot phase, as chronologically delimited here, began as a lengthy but only moderately warm and dry period characterized by considerable fluctuation in annual precipitation. This era of moderate warmth persisted more or less continuously from about A.D. 1273 (late in the Honanki phase) to 1329. From A.D. 1330 through 1364, a long cold period (often extremely cold) persisted. The especially cold periods took place in A.D. 1330–1336, 1346–1349, and 1353–1360. As with the earlier and later warm periods, precipitation varied greatly, but extremes were few and widely spaced. With the exception of a short time period of fairly continuous wetness (A.D. 1365–1384) that was accompanied by a few individual years of exceptional moisture (A.D. 1382 and 1384), the remainder of the Tuzigoot phase was warmer than normal, with 2 exceptionally warm years (A.D. 1423 and 1425) at the end of the phase.

At least one site—Site 105/838—experienced short-term occupation during the Tuzigoot phase. Feature 13, a subterranean masonry and cobble-lined room contained pottery types that extended into the post-1300 Tuzigoot period. No tree-ring, AM, or radiocarbon dates were produced to confirm or refine this information, however.

Protohistoric Period (A.D. 1425–1600)

The protohistoric period is the time period after the depopulation of many localities in the U.S. Southwest that were previously inhabited by prehispanic agriculturalists and before most of the written accounts produced by the earliest European and Euroamerican observers. Although traces of permanent occupation in the MVRV by Sinaguans and other puebloans is scant during the protohistoric period, the valley was inhabited by other populations, including one or more bands of ancestral Yavapai. These bands, and perhaps some ancestral Apache groups, are presumed to have been oriented primarily to hunting and gathering economies. In this study, the protohistoric period incorporates 171 years and 18 climate intervals (Intervals 120–137, A.D. 1427–1597) (see Tables 11 and 18). Six climate intervals were dry and cool, 6 were wet and cool, 4 were wet and warm, and 2 were dry and warm. Of note is the fact that the duration of a typical interval was greater in the protohistoric period than in any other developmental period examined in this study. With a mean of 9.5 years and a median of 10 years, the persistence of any given climatic condition was longstanding. Slightly more years were dry than were wet (88 dry vs. 83 wet), but many more years were cool than were warm (97 cool vs. 74 warm). The 171-year means for precipitation and temperature suggest that the protohistoric period was moderately dry and cool. The standard deviation and coefficient of variation for precipitation, however, indicate that several periods of drought persisted and that the frequency of years with extreme drought conditions was high. The standard deviation and coefficient of variation for temperature indicate that temperature patterns were rather variable in much of the period, although a few intervals with persistent warmth or coolness were present. The graphic representations of these data illustrate the variability in both temperature and precipitation (see Figures 4 and 5). The 171-year period examined here began and ended with modest wet and warm intervals but included significant variability between. The protohistoric period included a long era of rather sustained coolness from A.D. 1435 to 1528, a 20-year dry-warm drought between A.D. 1529 and 1548 (Interval 131), a 20-year period from A.D. 1549 to 1568 with wetter-than-normal conditions, and a long drought from A.D. 1569 to 1592 (the local manifestation of the "Sixteenth Century Megadrought") that was initially cool but ended warm. Five high-ranking intervals stand out. Two were dry-warm droughts (Interval 131, A.D. 1529–1548, and Interval 136, A.D. 1584–1592), and three were dry-cool droughts (Interval 128, A.D. 1492–1506; Interval 130, A.D. 1517–1528; and Interval 135, A.D. 1569–1583). As a group, these high-ranking intervals reveal that the periods of A.D. 1517–1548 and A.D. 1569–1592 were particularly challenging times. In sum, the protohistoric period was a time that can be described as having been predominantly dry and cool and experiencing numerous droughts of considerable length.

Occupation of at least one site investigated by SRI during the LOCAP—AZ O:1:53/AR-03-04-06-745 (ASM/CNF)—was posited to have occurred during the protohistoric period. Protohistoric period occupation or use of other sites investigated during the LOCAP was inferred to be likely. Archaeological deposits inferred to be the remains of early Yavapai encampments were investigated outside the ROW by CNF Archaeologist Peter Pilles and volunteers from the VVAS. Unfortunately, no tree-ring, AM, or radiocarbon samples were recovered from these investigations that would shed light on the timing, length, or frequency of occupation at the site (Pilles, personal communication 1999).

Early Historical Period (A.D. 1600–1847)

The early historical period includes the Spanish colonial era (A.D. 1598–1821) and the Mexican period (A.D. 1821–1848). In this study, the early historical period takes in 250 years (A.D. 1598–1847), is equivalent to Intervals 138–170, and includes 30 climate intervals and 3 climate episodes (see Tables 11 and 18). Nine climate intervals were wet and cool, 9 were dry and cool, 7 were dry and warm, and 5 were wet and warm. Of the 3 climate episodes, 1 was extremely cool and wet (A.D. 1725–1726), 1 was extremely dry and cool (A.D. 1653–1654), and 1 was extremely dry and warm (A.D. 1613). The length of a typical period (mean = 7.6 years; median = 7 years) was shorter than in the preceding protohistoric period, but it was essentially the same as the typical period in the equally long Camp Verde phase. Many years (75 years, or 30 percent) of this long period were identified as extreme, and the majority of these were exceptionally cool. More individual years were classified as wet than as dry (138 wet vs. 112 dry), and more individual years were cool than were warm (132 cool vs. 118 warm). The 250-year means for precipitation and temperature support this description, but the standard deviations and coefficients of variation underscore the considerable variation from year to year and interval to interval, particularly in precipitation. Most of the seventeenth century was extremely and persistently cool, with highly variable patterns of precipitation that tended toward wet, overall. Several prolonged wet and cool spells with frequent extremes in cool annual temperature are visible in the graphic representations of this time period (see Figures 4 and 5). In contrast, most of the eighteenth century was exceptionally warm. As with the preceding century, annual precipitation was highly variable, but the averaging effects of wet and dry years suggest that the eighteenth century was only slightly wetter than normal. The first half of the nineteenth century was persistently cool, with numerous extremes in precipitation and temperature values. Fully half of the 30 climate intervals within the early historical period were high-ranking temporal periods. The unusual coolness of the 1600s and early 1800s is exemplified by 4 high-ranking cool-wet spells (Interval 144, A.D. 1635–1645; Interval 146, A.D. 1649–1652; Interval 150, A.D. 1672–1683; and Interval 169, A.D. 1824–1840) and 2 high-ranking dry-cool droughts (Interval 149, A.D. 1664–1671, and Interval 168, A.D. 1809–1823). In contrast, the unusual warmth of the late 1600s and 1700s is exemplified by 4 dry-warm droughts (Interval 155, A.D. 1707–1709; Interval 159, A.D. 1727–1739; Interval 165, A.D. 1772–1790; and Interval 167, A.D. 1794–1808) and 5 warm-wet spells (Interval 152, A.D. 1688–1693; Interval 156, A.D. 1710–1721; Interval 160, A.D. . 1740–1746; Interval 163, A.D. 1756–1762; and Interval 166, A.D. 1791–1793). Among all of these, the extraordinary time periods during which extreme values persisted for many years without break, such as in the 1640s, 1760s, 1810s, and late 1830s and 1840s, surely presented challenging times for native and frontier populations in what is now north-central Arizona. In sum, the early historical period, as it is defined here, was a long period that may be better characterized on the century scale than the historical scale. Considering its 250-year span, nearly 1 out of every 3 years was unusual from the long-term (i.e., 1,418-year) perspective. Prolonged eras of coolness and warmth, as well as frequent droughts—both cool and warm—and infrequent wet years of extreme dimension, were characteristic of the early historical period. Such conditions help set the stage for patterns of economic decisions prior to the period of U.S. possession.

At least one site with chronometric evidence of land use during the early historic period was investigated by SRI during the LOCAP. Feature 1, an isolated roasting feature at AZ O: 1:133/AR-03-04-06-561 (ASM/CNF) (Site 133/561) returned a 2σ calibrated radiocarbon date with three possible use spans (A.D. 1510–1600, 1620–1670, and 1780–1800) on *Pinus* charcoal. A TL assay from a Tizon Wiped pottery sherd recovered from the feature returned a date of A.D. 1791 ± 29. Together, these data suggest that the thermal feature was associated with Yavapai land-use practices in the late eighteenth century, when prevailing climate conditions were warmer than normal and were more often dry than wet.

Late Historical Period (A.D. 1848–1988)

As defined in this study, the late historical period begins with the ceding of most of the U.S. Southwest to the United States by Mexico in the signing of the postwar Treaty of Guadalupe Hidalgo. This cultural-historical period takes in the final 141 years of the joint VERDE-SFPB tree-ring chronology (Intervals 171–187, A.D. 1848–1988) and includes 13 climate intervals and 4 climate episodes (see Tables 11 and 18). Four of the climate intervals were dry and warm, 3 were dry and cool, 3 were wet and cool, and 3 were wet and warm. Two of the climate episodes were wet and cool (A.D. 1867–1868 and A.D. 1884–1885), 1 was dry and cool (A.D. 1886–1887), and 1 was wet and warm (A.D. 1865–1866). More individual years were wet than were dry (74 wet vs. 67 dry), and more individual years were warm than were cool (89 warm vs. 52 cool). Despite the high percentage of years classified as extreme (44 years, or 31.2 percent), the means, standard deviations, and coefficients of variation for this 141-year period indicate that the late historical period was persistently warmer and wetter than long-term normal. In addition, the typical interval of the late historical period endured longer than in the early historical period (mean = 8.3 years; median = 6 years). The graphic representations of these annual data, however, show that these persistent conditions took place at different times (see Figures 4 and 5). The second half of the nineteenth century was almost always drier than normal; a short wet period between A.D. 1865 and 1868 presented the only exception. Concomitant temperatures were generally mild until the last decade of the nineteenth century, when a high-ranking dry-warm drought (Interval 181, A.D. 1892–1904) took place. Thereafter, a 16-year wet spell, initially accompanied by warmer-than-normal temperatures, developed but later was accompanied by extremely cool temperatures, throughout the 1910s. From about A.D. 1920 to 1971, a pattern of increasing frequency and severity in individual drought years was established. When corresponding temperatures were cooler than normal or only mildly warm, climatic conditions were not outstanding in their severity. Such was the case for the dry-cool decade of the 1920s (Interval 184, A.D. 1921–1931) and the somewhat wet and warm era of the 1930s (Interval 185, A.D. 1932–1942) that framed the devastating "Dust Bowl Drought" on the southern plains. However, when the magnitude of individual drought years grew and occurred in the context of persistent and extreme warmth, as happened in the mid-twentieth century (Interval 186, A.D. 1943–1964), climate conditions resulted in a prolonged and severe dry-warm drought ("the 1950s Drought") that had serious consequences for natural ecosystems and their constituents. Between A.D. 1965 and 1973, still-warm but cooler annual temperatures, along with a reduction in the severity of individual drought years, provided a respite from the long midcentury drought. A resumption in persistent and extremely warm temperatures at about A.D. 1973 established a pattern of warmth and wetness that continues through the end of the joint VERDE-SFPB data set. Thus, 4 high-ranking intervals stand out within this 141-year period: 2 dry-warm droughts (Interval 186, A.D. 1943–1964, which represents the second-most-severe such drought in its class, and Interval 181, A.D. 1892–1904), a single wet-cool spell (Interval 183, A.D. 1911–1920, which also was the second-most-extreme example in its class), and a single wet-warm era (Interval 187, A.D. 1965–1988). In sum, the late historical period, as it is defined here, witnessed mostly dry but mild temperature conditions throughout much of the second half of the nineteenth century. A prolonged dry-warm drought took place at the end of the century and persisted through the first few years of the twentieth century. A 15-year wet spell took place immediately following this turn-of-the-century drought, and it reached its peak during 1910–1920. Persistent warmth after A.D. 1932, in combination with fluctuating annual-precipitation patterns, led to a long and severe drought at midcentury that climaxed in the 1950s. The final 2 decades of the joint data set show more-frequent wet years and less-severe drought years than in earlier decades, which, when combined with wetter-than-normal temperatures, resulted in one of the longest and most distinctive warm and wet spells in the 1,418-year record.

Most sites investigated by SRI during the LOCAP had trash deposits or other archaeological evidence of late-historical-period land use in the twentieth century. One site, however, AZ O:1:104/AR-03-04-06-902 (ASM/CNF) (Site 104/902) contained an extensive scatter of historical-period trash dating to the late 1930s (see Chapter 5, Volume 1 of this report). This component was likely used during moderately wet and warm Interval 185 (A.D. 1932–1942).

Summary

The joint VERDE-SFPB chronology was partitioned into nine consecutive cultural-historical periods (see Table 18). The first six (the late Squaw Peak phase through the Tuzigoot phase) represent the prehistoric developmental phases of the Southern Sinagua sequence as it has been delimited by Pilles (1996a). The seventh represents the protohistoric period, and the last two represent the early and later portions of the historical period. Each cultural-historical period was described by its dominant characteristics, and prominent, high-ranking dry-warm, dry-cool, wet-warm, and wet-cool intervals were highlighted. From the perspective of human-environmental interactions, the most-useful characteristics of each phase include the mean and median interval lengths, phase-length means, standard deviations, coefficients of variation, the number and percent of extreme years, the depictions of internal variability, and the identification of intervals with low CIVs in each climate class. Although the duration of any given period influenced its characteristics, the magnitude of specific years and the interannual pattern of positive and negative values were more important in terming climatic character. For example, the brief Hackberry phase (A.D. 650–700) was reconstructed to have been a slightly wet but very cool period with many climate extremes and frequent climatic challenges. In contrast, the long Camp Verde phase (A.D. 900–1150) appears to have been a phase with considerable variability in both precipitation and temperature conditions but with relatively few extremes. The equally long early historical period (A.D. 1600–1848) was slightly wet and moderately cool and experienced a great deal of variability in precipitation, far more interannual consistency in temperature trends, and many years with extreme annual-climate values.

Inspection of the joint VERDE-SFPB tree-ring record revealed the following about each of these nine cultural-historical periods. The following date ranges are those used in *this analysis*, rather than the standard phase or period dates.

- The terminal years of the Squaw Peak phase (A.D. 571–644) were predominantly warm and experienced rapidly alternating intervals of high moisture or aridity. A long warm spell in the late 500s and early 600s and an extended period of coolness between A.D. 623 and 644 were noted.

- The Hackberry phase (A.D. 645–705) was a brief and extremely cool period with many years of extreme climate conditions. Intervals were short and alternated between warmer-than-normal and cooler-than-normal conditions. The length, severity, and persistence of the cold spell at the end of the 600s constitute the major climate event of the Hackberry phase.

- The Cloverleaf phase (A.D. 706–895) was a time of considerable climatic variability. The phase began with a marked warm drought and continued as a predominantly dry era for 6 decades. A long and serious, warm drought took place in the middle 700s. A long period of cooler-than-normal climate, with alternating intervals of wetter-than-normal and drier-than-normal conditions, was established after the mid-eighth-century drought and persisted through the mid-ninth century. The final decades of the 800s were almost continuously warm and were accompanied by variable moisture conditions.

- The Camp Verde phase (A.D. 896–1145) also contained considerable variability in precipitation and temperature but witnessed relatively few years with extreme values. The 900s were moderately dry and somewhat warm, the 1000s were generally wet and warm, and the early 1100s were dry and cool.

- The Honanki phase (A.D. 1146–1291) began as a warm period with alternating intervals of wetness and coolness that persisted until the early 1180s. Thereafter, a long era of cool, and often cold, climate was established and continued virtually unbroken through the early 1270s. Although annual moisture conditions varied considerably during this cool era, wet years were more frequent after A.D. 1220. The final 2 decades of the Honanki phase were warmer than normal, but no extremely warm years were identified, and the local manifestations of the "Great Drought" era were mild.

- The Tuzigoot phase (A.D. 1292–1426) began as a long but moderate, warm drought characterized by considerable fluctuation in annual precipitation. A long cold spell began in about A.D. 1330 and endured through the early 1360s. The final portion of the phase was warmer than normal.

- The protohistoric period (A.D. 1427–1597) was a dry and cool period with numerous droughts of considerable length bracketed by modest wet and warm intervals. Among these long droughts were three especially cool droughts and two warm droughts. In north-central Arizona, the widespread "Sixteenth Century Megadrought" was shorter in duration than in the eastern U.S. Southwest, and it began as a cool-dry interval and ended as a warm-dry interval.

- The early historical period (A.D. 1598–1847) was predominantly dry and cool, with extraordinary variability in precipitation patterns and many extreme years. Most of the 1600s was extremely and persistently cool and experienced highly variable patterns of precipitation that tended toward wet. In contrast, most of the 1700s was exceptionally warm, and the averaging effects of wet and dry years yielded a slightly wetter-than-normal century. The first half of the 1800s was a protracted cool era with many extremes in temperature and precipitation.

- The late historical period (A.D. 1848–1988) witnessed mostly dry conditions and mild temperatures throughout most of the second half of the 1800s. A prolonged, warm drought took place at the end of nineteenth century and persisted through the first few years of the twentieth century. A 15-year wet spell set in and reached its peak in the 1910s. Persistent warmth after A.D. 1932, in combination with fluctuating precipitation, resulted in a long, severe drought at midcentury that climaxed in the 1950s. The final 2 decades of the joint VERDE-SFPB chronology represented one of the longest and highest-ranking warm-wet spells in the 1,418-record.

Concluding Remarks

In this chapter, I have used two long, independent tree-ring chronologies to develop a 1,418-year (A.D. 571–1988) record of climatic variability for north-central Arizona, which includes the MVRV and the LOCAP project area. The joint VERDE and SFPB records were partitioned into 187 time units that represented 173 climate intervals (each 3+ years in duration) and 14 climate episodes (each a 1- or 2-year "event"). Each of the intervals was classified as wet and warm, dry and warm, wet and cool, or dry and cool. I quantified the relative intensity of each climate condition, ranked them from most to least extreme, and assigned each an overall CIV. CIVs were used to identify the most-challenging intervals within each climate class. The resulting data were described as approximately century-length time periods and as a sequence of cultural-historical units. For the few cases in which use dates for specific features and site components investigated during the LOCAP were relatively brief, I was able to suggest what climate conditions were likely in effect. In most cases, however, the inferred occupations or use dates were too broad to correlate with the dendroclimatic record. The mismatch between high-resolution climatic data and relatively low-resolution archaeological data makes this a daunting task.

Sites along the SR 89A ROW investigated during the LOCAP contained temporal components dating to the Archaic (6500 B.C.–A.D. 1), Formative (A.D. 1–1425), protohistoric (A.D. 1425–1600), and early (A.D. 1600–1848) and late (A.D. 1848–present) historical periods. Most of the sites investigated were scatters of surface or near-surface artifacts; few contained buried deposits that were datable via independent chronometric techniques. Three sites—multicomponent habitation site Site 105/838, resource-processing site Site 85/428, and multicomponent resource-procurement and processing site Site 133/561—yielded deposits that could be compared with the dendroclimate record used here. A fourth site (Site 104/902) contained a discrete historical-period component that could be assigned to the late 1930s. A single pit structure from Site 105/838 and a roasting feature from Site 85/428 assigned to the late portion of the Squaw Peak phase were inferred to date to the late 500s—a time period that was rather persistently warmer than normal and experienced alternating intervals of associated wetness and dryness. Two pit structures from Site 105/838 that dated to the middle Camp Verde phase (ca. 985–1040) seem to have been constructed, used, and abandoned during a climate period that experienced more wet years than dry years within a lengthy cooler-than-normal climate. Finally, the extensive scatter of historical-period trash and associated features from Site 104/902 that dated to the late 1930s were apparently deposited during the moderately warm and slightly wetter-than-normal interval in the early twentieth century. This admittedly small sample of sites suggests that occupation in this portion of the MVRV took place under a wide range of climatic conditions. Settlement occurred under either cooler-than-normal or warmer-than-normal conditions, and mild to slightly wetter-than-normal conditions favored prolonged use. A cursory review of the site summary data assembled for the Cornville, Page Springs, and Sedona 7.5-minute maps (see Chapter 3, Table 15, Volume 1 of this report) supported this account, although other issues, including buried features, preservation, and the presence or absence of diagnostic artifacts and features, complicate this interpretation. Numbers of sites, site visibility, and site distribution appear to have been greatest during the warmer- and wetter-than-normal time periods and lowest during time periods that were extremely or persistently dry, cold, or excessively variable.

Given the diversity of landforms, elevations, soils, water sources, and biotic communities contained within the MVRV, it is not surprising that human populations were able to sustain themselves under a wide range of climatic conditions. Depending on the availability of and access to desirable natural resources, the economic emphasis, the available technology, the mobility options, the population size and density, and the duration and intensity of prevailing climate conditions, prehistoric and historical-period inhabitants of the valley could sustain themselves without moving away during pronounced dry and warm intervals or marked wet and cool intervals. That the Great Drought era of the late thirteenth century or the Dust Bowl–era drought did not result in significant population loss in the MVRV is instructive. These renowned droughts were marked in the northern and eastern U.S. Southwest, but they were not particularly severe in central Arizona. In fact, it seems that the Verde River valley received populations from other geographic regions at those times. When, however, severe local droughts did take place, whether warm or cool, and particularly when they endured for many years without significant relief, changes in economic and settlement practices took place, and the era of "the 1950s Drought," which was expressed in north-central Arizona as a 22-year period of excessive warmth accompanied by persistent aridity, is a historical-period example. The drought had negative consequences for topsoil maintenance, cattle ranching, agriculture, and potable water supplies, and it was widely experienced in western North America (Betancourt et al. 1993; Fye et al. 2003; Grissino-Mayer et al. 1997; Grissino-Mayer et al. 2002; Schulman 1956). It is likely that equally intense droughts during the prehistoric period also had serious consequences for occupants of the valley.

In closing, it is fair to say that analysis of a multicentury dendroclimatic reconstruction, such as this one, must include consideration of events and processes at various temporal scales. In some cases (e.g., extraordinary droughts or wet years or the co-occurrence of a high-elevation frost ring that signals the damaging effects of icy weather on growing plants), climatic reconstruction at the resolution of a single year could prove to be essential for interpreting specific human events. In other cases, interval-level reconstructions may prove to be useful for understanding successful farming strategies and techniques or when grasslands might have improved for key prey species. In yet other instances, multidecadal reconstructions may prove useful for contextualizing patterns of aggregation and dispersal and processes of local or regional depopulation. In the next chapter, I integrate the dendroclimatic reconstruction with data and interpretations associated with other sources of paleoenvironmental information (i.e., stream-flow reconstruction, flood history, faunal use, botanical use, and palynological interpretations of the paleoenvironment) to narrate a history of environmental change in the MVRV.

CHAPTER 5

Paleoenvironmental Summary

Carla R. Van West

This chapter summarizes the paleoenvironmental research undertaken for the LOCAP. My goal is to provide a context for addressing subsistence and settlement questions, which are addressed later in this volume. Project specialists studied aspects of five environmental classes—geology, climate, stream flow, plants, and animals. I integrate the essential findings of each of these studies in an environmental history pertaining to the temporal sequence of human occupation in the MVRV. I also augment this narrative with paleoenvironmental and subsistence data from other research projects in and adjacent to the MVRV.

Geological studies undertaken for the LOCAP include the following. Huckleberry and Pearthree (see Chapter 9, Volume 2 of this report) described the geological deposits and geomorphology of selected locales along the LOCAP project area and discussed Verde River dynamics with reference to Southern Sinagua agricultural systems. Ranney (see Appendix A, Volume 1 of this report) described the geological history of a specific landform underlying one of the project's sites, AZ O:1:53/AR-03-04-06-745 (ASM/CNF). Shackley reported on the geological provenance of a large sample of obsidian artifacts (see Appendix E, Volume 2 of this report) and discussed potential source areas for a number of raw materials encountered in the project area (see Appendix F, Volume 2 of this report).

I characterized paleoclimate (see Chapter 4 of this volume) using dendrochronological methods. My dendroclimatic reconstruction is applicable to the A.D. 571–1988 interval, and it integrates extant tree-ring-based reconstructions for precipitation (Graybill and Funkhouser n.d.) and temperature (Salzer 2000). A graphic representation of this paleoclimate reconstruction was presented in Chapter 4, Figure 5. In this chapter, I also use an existing tree-ring-based stream-flow reconstruction for the Verde River prepared by Graybill (1989) and updated by Graybill and Funkhouser (n.d.; Van West and Altschul 1998) for the A.D. 572–1985 interval to describe trends and identify unusually large floods. This stream-discharge reconstruction was examined also by Huckleberry and Pearthree (see Chapter 9, Volume 2 of this report) in their study of extreme floods along the Verde River. A graphic representation of this stream-discharge reconstruction was presented as Figure 47 in Chapter 9, Volume 2 of this report, and is re-expressed in this chapter as Figure 7.

Floral resources and utilized plant species were studied through the archaeological recovery of macrobotanical samples by Adams and Vanderpot (see Chapter 6, Volume 2 of this report) and pollen samples by Fish (see Chapter 7, Volume 2 of this report). Faunal resources and utilized species were studied through the recovery of animal bones (see Chapter 8, Volume 2 of this report) and shell (see Chapter 5, Volume 2 of this report) at project sites by Wegener and Vokes, respectively.

Paleoenvironmental Reconstruction

The term "paleoenvironment" refers to the description of the physical environment prior to the period of instrumental measurements and written observations. The application of the principal of uniformitarianism, the selection and testing of appropriate proxy data, and the careful use of analytic methods are necessary for the reconstruction of past environmental phenomena. Also necessary is the recognition that all environmental phenomena are subject to change through time and across space, although each environmental entity or environmental subsystem changes at a different rate. As a result, different environmental variables and environmental systems can be reconstructed at contrasting levels of temporal and spatial resolution.

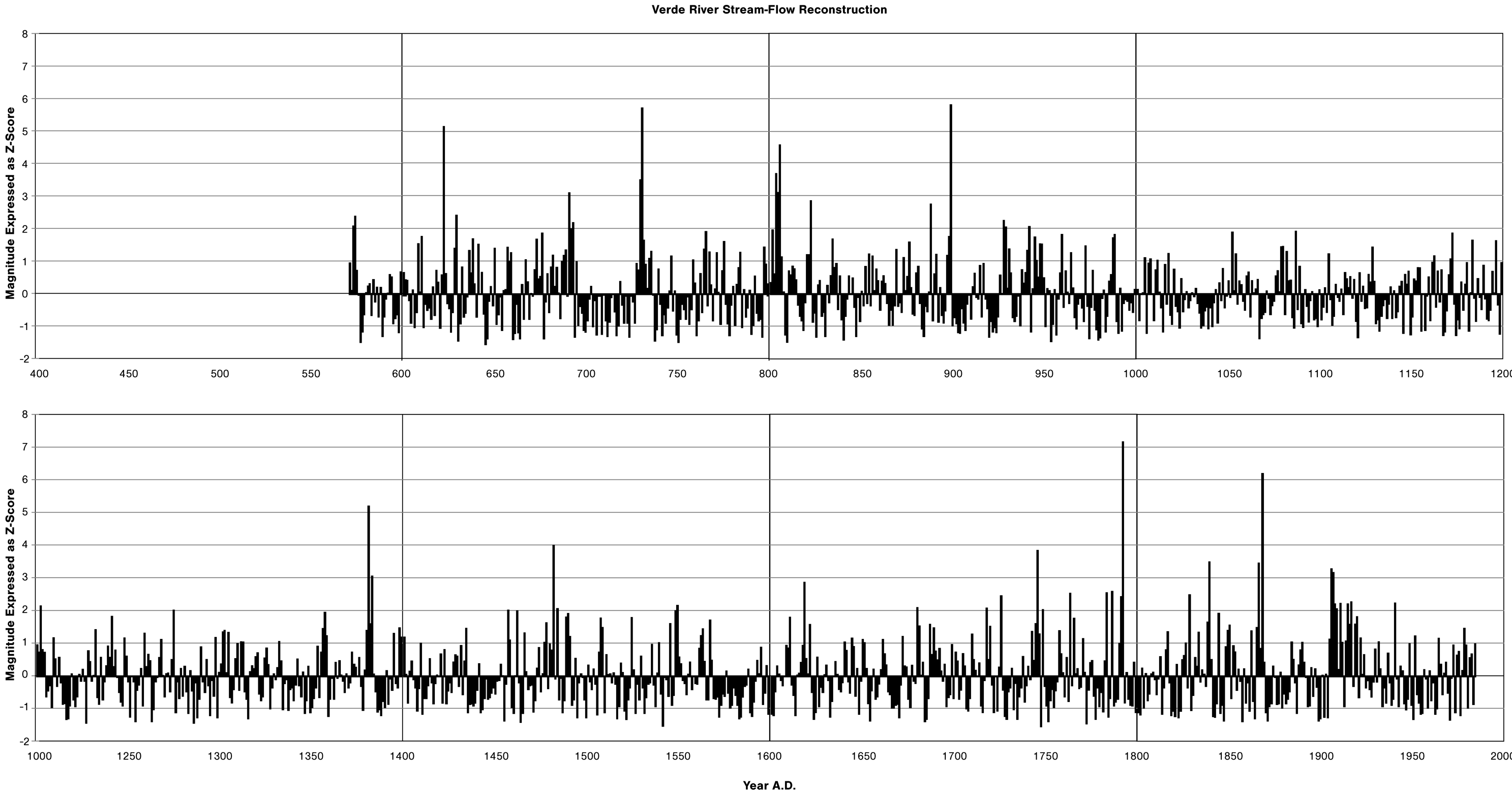

Figure 7. Verde River flow reconstructions for the period A.D. 572–1985 (adapted from Van West and Altschul 1998). Annual discharge values are normalized to z-values.

Some environmental phenomena change so slowly at a given spatial scale that they can be considered "stable" or "nonchanging," given certain research problems. For the purposes of this summary chapter, bedrock geology, gross topography, vegetation zonation, and climate type are considered stable environmental phenomena—environmental entities that have not changed appreciably since the Late Holocene (post–2500 B.C.). Other environmental phenomena change rapidly, and their inherent variability can be observed and measured at the resolution of minutes, hours, days, seasons, and years. Precipitation, temperature, and stream-flow patterns, as well as rapid changes in the size and distribution of given plant and animal species, are examples of environmental variables subject to high-frequency process changes. High-frequency changes occur at temporal scales of less than 25 years and are readily perceived as variable by human observers (Dean 1988a, 1996; Dean et al. 1985). Between the two ends of the variability spectrum are environmental phenomena that change slowly and take place at periodicities of greater than 25 years. Among these low-frequency phenomena are the rise and fall of alluvial groundwater levels, the deposition and erosion of the floodplain, changes in the composition and elevational boundaries of plant communities, and long-term trends in climate (Dean 1988a; Dean et al. 1985; Helvy 1988; Karlstrom 1988).

The environmental narrative developed for this chapter, then, is based on environmental data that can be reconstructed at different temporal (i.e., annual, decadal, centennial, or millennial) and spatial (site-specific, local, or regional) scales and with variable levels of confidence. Some data sets are continuous for discrete intervals (e.g., tree-ring-based reconstructions of climate or stream flow); others are discontinuous (e.g., deposition of floral and faunal remains in archaeological sites and the frequency and detectability of major floods); and yet others are, for all practical purposes, atemporal (e.g., bedrock geology and gross topography). Further, the dearth of higher-resolution environmental data for the Archaic (6500 B.C.–A.D. 1) and Early Formative (A.D. 1–750) periods limits what can be said with confidence about the human-environment interactions in the MVRV during those time periods. After A.D. 750, however, the problem of discriminating human-wrought changes to certain environmental classes (e.g., cultural selection for specific plant and animal species or land modification for irrigation systems or fields) from natural-environmental changes becomes an obvious challenge. Despite these difficulties, the goal of creating an environmental narrative against which the archaeological record can be examined is a worthwhile endeavor. It is worthwhile because such an effort, coupled with the appropriate theoretical framework, allows archaeologists to "differentiate those aspects of [prehistoric] . . . behavior that are sensitive to environmental variability from those that are not" (Dean et al. 1985:538).

Environmental Conditions in the Middle Verde River Valley

The earliest unambiguous evidence of human occupation in the MVRV dates to the middle portion of the Archaic period (ca. 6500 B.C.–A.D. 1.). To date, only three Clovis projectile points associated with the Paleoindian period (ca. 10,000–6500 B.C.) and a few projectile points tentatively associated with the Early Archaic period (ca. 6500–3800) (e.g., Lerma-type points) (see Chapter 3, Volume 2 of this report) have been recovered in the MVRV. Somewhat more frequent and more widely distributed in the MVRV are projectiles, tipped atlatl-thrown darts known as Mallory and Pinto/San Jose points (see Chapter 3, Volume 2 of this report), that date to the Middle Archaic period (ca. 3800–2000 B.C.). More abundant still are dart points known as Gypsum, Elko Corner-notched, and San Pedro points that are assigned to the Late Archaic period (ca. 2000 B.C.–A.D. 1). Thus, the environmental narrative presented in this chapter begins during the Archaic period.

Archaic Period (6500 B.C.–A.D. 1)

When humans first settled the Transition Zone of central Arizona, the MVRV had already taken on its present form. The valley was one of several northwest-southwest-trending, down-faulted, sediment-filled basins surrounded by uplands and drained by a perennial river. To the northeast and southeast was the Coconino Plateau (i.e., one of the many uplands that compose the Colorado Plateau), which was delineated by the irregular escarpment of the Mogollon Rim. To the northwest were the dramatic mesas, buttes, and spires of the Red Rock–Secret Mountain Wilderness area. To the southwest were dark forms of the Black Hills. And throughout the valley were varied land forms, rock and soil types, and plant and animal communities, as well as a number of dependable streams and springs.

Regional paleoenvironmental reconstructions for the southern Colorado Plateau drawn from pollen, macrobotanical, and stratigraphic studies suggest that the Early Archaic period and most of the Middle Archaic period were characterized by an extremely warm and dry climate (e.g., Anderson 1993; Betancourt 1990; Davis and Shafer 1992; Hall 1985; Hasbargen 1993). Often referred to as the "Altithermal" (Antevs 1949, 1955), this postglacial warm and dry period is reconstructed to have had the highest temperatures and lowest effective moisture of the entire Holocene epoch (10,000 B.C.–present). Data suggest that the low effective moisture of this long interval resulted in the upward movement and reorganization of various biotic communities, the expansion of juniper woodlands and desertscrub, significant lowering of regional water tables, erosion of sediments in alluvial corridors, and a reduction in the distribution and dependability of surface water sources. Although various lines of evidence suggest that this era of pronounced warmth began, in some places, as early as 8200 B.C. (approximately 9,000 uncalibrated radiocarbon years B.P.) and ended about 750 B.C. (approximately 2,500 uncalibrated radiocarbon years B.P.), the height of the Altithermal on the Colorado Plateau and adjacent areas was about 5000–3800 B.C. (approximately 7,000–5,000 uncalibrated radiocarbon years B.P.) (Hall 1985:118). After this time, climate ameliorated, and biotic communities readjusted to increased levels of effective moisture and lower temperatures. Stream flow, spring flow, and seasonal runoff increased and became more reliable; water tables rose, floodplains aggraded, and grasslands expanded. In short, the period between 3800 B.C. and 2000 B.C. was essentially a transition from the Altithermal climate regime to the modern climate regime. Ely and her colleagues (Ely 1997; Ely et al. 1993) noted that numerous large floods were common to the 3800–2200/2000 B.C. interval and likely were related to El Niño atmospheric and sea-surface conditions.

With the establishment of modern environmental conditions by about 2000 B.C., a semiarid climate regime characterized by a bimodal precipitation pattern with considerable high-frequency interval variation became the norm. Peak precipitation occurred in the winter (December through March) and summer (June through September), separated by a relatively dry spring (April and May) and autumn (October and November). The southern (and generally lower) portions of the valley likely received less annual precipitation than the northern (and generally higher) portions but probably received a greater percentage of the annual moisture in the summer. Minimum and maximum annual temperatures were undoubtedly controlled by elevation and solar aspect, with low-elevation locales experiencing the highest mean temperatures and high-elevation locales experiencing the lowest mean temperatures.

Plant and animal communities in the vicinity of the MVRV achieved their modern elevation distributions and geographic ranges—with only minor changes prior to historical-period introduction and impacts of domestic animals, fire suppression, logging exotic plant species, and air pollution—sometime in the first millennium B.C. (approximately 2,500–2,000 uncalibrated radiocarbon years B.P.) (Hasbargen 1993:Figure 13). Fire, floods, droughts, insect predation, aggressive hunting of particular animal species, and tree harvesting undoubtedly played a role in shaping and maintaining the structures of biotic communities during the long Archaic period, but the extent and timing of human involvement in the creation and maintenance of this structure are currently unknown.

In short, bedrock geology, gross topography, regional hydrology, climate type, and the existence and locations of biotic communities were stable and dependable environmental factors for human populations in the MVRV after about 2000 B.C. Alluvial groundwater levels, irregular cycles of floodplain deposition and erosion, and high-level soil characteristics were the primary low-frequency environmental factors to which populations responded throughout the Holocene. High-frequency environmental factors always included short-term variations in weather and longer-term trends in climate—factors that had a direct influence on steam discharge and potential flooding. These high-frequency conditions influenced where potable water could be obtained by humans and animals; the productivity of the riparian, grassland, and woodland biotic zones for gathering economic resources; the flow of rivers like the Verde River and its major tributaries; and what soils and land forms were potentially arable when crop cultivation was introduced, in the terminal portion of the Late Archaic period.

The archaeological evidence of plant and animal use during the long Archaic period in the MVRV is surprisingly meager. At the time of my research, I could find no report describing plant remains recovered specifically from Archaic period contexts. Examples of faunal materials recovered from Archaic period contexts are presented by Wegener (see Chapter 8, Table 70, Volume 2 of this report) and were derived from only two sites—the Dry Creek phase type site (NA5005) (Shutler and Adams ca. 1950) and LOCAP site AZ O:1:28/AR-03-04-06-903 (ASM/CNF). Both sites represent short-term encampments along separate reaches of Dry Creek, which is a tributary to the larger stream of Oak Creek. Together, they document that minnow-sized (Cyprinidae-sized) fish, cottontail (*Sylvilagus* sp.), jackrabbit (*Lepus* sp.), pocket gopher (*Thomomys* cf. *bottae*), deer (*Odocoileus* sp.), and pronghorn (*Antilocapra americana*) were among the targeted species by the Late Archaic period.

Formative Period (A.D. 1–1400)

The Formative period in the U.S. Southwest refers to the precolumbian or precontact era, when a major commitment to maize agriculture and a notable investment in a sedentary way of life co-occurred and persisted. For the purposes of this report, we have initiated the Formative period at the beginning of the Christian or Common Era, but in fact, archaeologists do not know with certainty when the Formative period economic adaptation began in the MVRV. Evidence exists elsewhere in the U.S. Southwest for the cultivation of maize and other crops as early as 2000 B.C. (Huber 2005; Huckell et al. 1999, 2001; Lascaux and Hess 2001; Mabry and Doolittle 2004; Smiley and Parry 1990), but to date, the evidence for early crop cultivation in the MVRV dates to the first millennium A.D. The earliest directly dated maize in the Verde River valley was recovered from a Squaw Peak phase (A.D. 1–650) pit-structure floor at LOCAP site AZ O:1:105/AR-03-04-06-838 (ASM/CNF) (Site 105/838) and yielded a 2σ calibrated date range of A.D. 410–600 (see Chapter 2 of this volume). Elsewhere in the MVRV, maize was recovered from a hearth in a pit structure at AR-03-04-06-294 (CNF), which was assigned to the Squaw Peak phase when four pieces of structural wood from that same pit structure derived dates in the 2σ calibrated date range of A.D. 245–655 (Logan and Horton 1996:43). Excavations from these two sites revealed that maize was cultivated in the MVRV prior to A.D. 600 by human groups who continued to use Archaic period–type tools and technology but seemingly did not manufacture or use ceramic containers. Although it could be argued that the Squaw Peak phase is actually the terminal phase of the Archaic period, we currently consider the Squaw Peak phase to be the local manifestation of the Early Formative period.

Squaw Peak Phase (A.D. 1–650)

It is unfortunate that archaeologists know so little about low-frequency and high-frequency environmental conditions that permitted or constrained agricultural endeavors during the Squaw Peak phase. Low-frequency trends influencing regional water tables and floodplain conditions (sediment aggradation vs. erosion) published by Dean (1988b:Figure 5.7) indicated that regional water-table levels were high in the A.D. 100s and again from about 500 through about 750. In contrast, regional water-table levels and floodplains were degrading or low between about A.D. 250 and 375. These data suggest that the maize recovered from Site 105/838 was grown during a period when regional water tables were generally high, floodplains along rivers and their major tributaries were stable or aggrading, and the climate that influenced these hydrological and geological processes was sufficiently and predictably moist, overall.

High-frequency precipitation and temperature data reconstructed from climate-sensitive tree rings (see Chapter 4 of this volume) began at A.D. 571 and represent the final 74 years of the Squaw Peak phase as it has been defined here (see Figure 5). Although precipitation varied considerably from year to year, temperature patterns appear to have persisted for relatively lengthy periods. A long warm spell (A.D. 584–623) contrasted with a short cool period immediately before it (A.D. 571–583) and after it (A.D. 624–644). Within this warm spell, a short, but severe, 4-year-long dry-warm drought occurred between A.D. 596 and 599. Because of the length and persistence of this warm spell, the terminal Squaw Peak phase was characterized as somewhat wet and warm. An extended period of coolness after A.D. 623 separated it from the notable warmth at the beginning of the subsequent Hackberry phase.

High-frequency stream-flow data for the Verde River also exist for the terminal portion of the Squaw Peak phase and are continuous through 1985 (see Figure 7). Graybill (1989) reconstructed stream discharge in the lower reach of the Verde River for the A.D. 572–1985 period using many of the same tree-ring records used in the VERDE data set described in Chapter 4 (see Van West and Altschul [1998:350] for a description of these data, which were augmented with new tree-ring data that filled an earlier gap between A.D. 1370 and 1800). Although Graybill's original reconstruction was prepared to calculate the contribution of the Verde River to the Salt River, this reconstruction can be applied to stream-discharge patterns in the middle Verde River basin, as well.[1]

[1] The Verde River watershed includes more than 17,000 km^2 (6,564 square miles) of central Arizona (Baldys 1990:5, 6, Figure 1; Ely and Baker 1985:104). More than 14,000 km^2 (5,405 square miles) of this runoff is unregulated by dams and reservoirs (House et al. 1995:4). Four gaging stations are located along the unregulated reaches of the Verde River (from northwest to southeast: Paulden, Clarkdale, Camp Verde, and Tangle Creek), and a fifth station exists on the regulated lower reach of the Verde River, below Horseshoe and Bartlett Dams (Bartlett Dam gaging station). The Paulden gage (USGS Gage 09503700) measures discharge from most of the upper Verde River watershed and includes 5,568 km^2 (2,150 square miles), or about 40 percent, of the entire Verde River watershed. Despite its large size, according to House et al. (1995:4), this portion of the Verde River basin contributes little runoff to the peak discharges of large floods recorded at stream-flow gages downstream. The Clarkdale and Camp Verde gages (USGS Gages 09504000 and 09506000) measure discharge in the middle reach of the Verde River (below the Paulden gage to a gage below Camp Verde). Stream flow at the Clarkdale gage station incorporates some 8,148 km^2 (3,146 square miles), or about 60 percent, of the Verde River basin and about 30 percent of the effective-peak-flow-producing area below the gage at Paulden. Stream flow at the Camp Verde gaging station incorporates some 12,028 km^2 (4,644 square miles), representing 85 percent of the Verde River basin and 75 percent of the flood-peak-production area. Although the linear distance between the Clarkdale and Camp Verde stations is not great, the discharge contributions from Oak Creek (920 km^2), Dry Beaver Creek (368 km^2), Wet Beaver Creek (288 km^2), and West Clear Creek (624 km^2) are impressive. Collectively, they account for the about 55 percent of the flow between these two gages (House et al. 1995:4). By the time the Verde River reaches the Tangle Creek gage (USGS Gage 09508500), its flow includes the discharge of East Verde River and Wet Bottom Creek and represents nearly 100 percent of the unregulated watershed (14,227 km^2, or 5,493 square miles), although it adds only 2,200 km^2 (849 square miles) to the total watershed area.

Graybill (1989) used monthly discharge data measured at the gage below Bartlett Dam (USGS Gage 0951000) for the A.D. 1895–1945 interval and monthly discharge data from the

Reconstructed stream flow for the first 73 years of the VERDE-SFPB record indicated that at least one unusually large flood occurred at the end of the Squaw Peak phase (see Figure 7). This flood, which was the sixth-most-extreme flood in the 1,414-year dendrohydrological record, took place in A.D. 622, within an 8-year-long wet and warm interval (A.D. 616–623). Three other large floods of lesser magnitude also occurred in the late Squaw Peak phase. These floods occurred in A.D. 573, 574, and 629. This information supports paleoflood research undertaken at the regional level. Ely and her colleagues (Ely 1997; Ely et al. 1993) noted that the number and frequency of large floods on the perennial rivers in Arizona and Utah increased after 400 B.C., following a 1,600- to 1,800-year period of infrequent, large floods between 2200/2000 and 400 B.C. (approximately 3,600–2,200 uncalibrated radiocarbon years B.P.). The increase in the frequency of severe floods is particularly notable after A.D. 400, with a prominent peak in the frequency of large floods during the A.D. 900–1100/1150 interval and a major decline in the 1200s and 1300s. After A.D. 1400 and continuing to the present, the number of large floods increased once again.

Plants of presumed economic importance for Squaw Peak phase human populations are presented in Table 19. I compiled the tables for this chapter from published and limited-distribution reports on data recovery projects undertaken in the MVRV, and I consulted chapters on the analysis of pollen, flotation, and macrobotanical samples to assemble the diachronic summary. Three sites with temporal components assigned to the Squaw Peak phase provide information on floral resources gathered and used during the Early Formative period. Two of these are LOCAP sites: Site 105/838 and AZ O:1:85/AR-03-04-06-428 (ASM/CNF) (Site 85/428). The third is site AR-03-04-06-722 (CNF), excavated by Logan and Horton (2000). At least one domesticated food taxon was present at this early time: maize (*Zea mays*). Recovery of little barley (*Hordeum pusillum*) also may signal cultivation of an indigenous species (Adams 1987). Numerous taxa representing wild-plant sources of food and medicine also were identified. Among these are milkvetch (*Astragalus* sp.), spiderling (*Boerhavia* sp.), hackberry (*Celtis* sp.), bugseed (*Corispermum* sp.), hedgehog cactus (*Echinocereus* sp.), wild buckwheat (*Eriogonum* sp.), caltrop (*Kallstroemia* sp.), stickleaf (*Mentzelia albicaulis*), pricklypear (*Opuntia* sp.), ricegrass (*Oryzopsis* sp.), plantain (*Plantago* sp.), purslane (*Portulaca* sp.), mesquite (*Prosopis* sp.), bulrush (*Scirpus* sp.), dropseed grass (*Sporobolus* sp.), and globemallow (*Sphaeralcea* sp.). Also present were nondiagnostic plant representatives of the *Chenopodium-Amaranthus* group (cheno-ams), the grass family (Graminacea/Poacea), and the aster/daisy/sunflower family (Compositae/Asteraceae). Fuelwood and construction wood associated with Squaw Peak phase occupations included saltbush (*Atriplex* sp.), crucifixion thorn (*Canotia* sp.), ash (*Fraxinus* sp.), juniper (*Juniperus* sp.), pricklypear or cholla (*Opuntia* sp.), mesquite, oak (*Quercus* sp.), and some form of pine (*Pinus* sp.).

Animal remains recovered in archaeological contexts dated to the Squaw Peak phase were presented by Wegener (see Chapter 8, Table 70, Volume 2 of this report). Two of the three sites used in this table were LOCAP Sites 85/428 and 105/838. Faunal remains inferred to have been subsistence resources included minnow-sized fish, eggs of an unidentified bird (Aves), cottontail, jackrabbit, and deer.

Hackberry Phase (A.D. 650–700)

The exceedingly brief Hackberry phase is a temporal period with few archaeological examples in the MVRV. As described by Van West et al. (see Chapter 3, Volume 1 of this report), this developmental period was distinguished

gage below Tangle Creek (USGS Gage 09508500) for the A.D. 1944–1979 interval to calibrate the relationship among historical-period stream flow, climate, and tree-rings. Although his research application required him to use gages in the lower Verde River basin, hydrologists and geomorphologists have observed that the discharge patterns measured at Camp Verde in the middle reach are, in fact, very similar. House et al. (1995) asserted that the timing of peak discharges at the gages in the Verde River basin are very consistent and are predictable to within an hour. For example, more than 95 percent of the runoff generated by the exceptional February 20, 1993, flood derived from sources upstream of the Camp Verde gage; the flood peak took 5 hours to reach the Tangle Creek gage. In contrast, the majority of runoff generated by the extreme flood of January 8, 1993, derived from tributaries in the lower Verde River basin and reached the Tangle Creek gage 4.5 hours *before* the peak discharge was measured at Camp Verde. Regardless of where heavy rains fell and generated extraordinary runoff, both stations—one in the middle Verde River basin and one in the lower Verde River basin—measured peaks on the same day and reflected patterning across a large region of central Arizona. Recent dendrohydrological research by Hirschboeck and Meko (Salt River Project 2011) bore out these findings and concluded the following: (1) extreme discharge events—both low flows and high flows—tended in the past, as in the present, to occur simultaneously in the upper Colorado and Salt/Verde River basins, (2) synchronous low-flow and high-flow events tended to cluster in time, (3) the continuous period when both basins had extreme low-flow years was 3 years, (4) with any 4-year period, either high-flow or low-flow events that lasted for 2 consecutive years occurred more than 20 percent of the time, (5) the drought of the late 1990s and early 2000s was similar to the widely experienced 1950s Drought, and (6) the tree-ring records indicate that the Salt/Verde River basin had at least eight droughts as severe as the 1950s Drought during the A.D. 1200–1903 interval.

Table 19. Recovered Archaeobotanical Remains Inferred to Have Economic Importance from Squaw Peak Phase Sites in the Middle Verde River Valley

Site No.	Site Type	Uses (Taxon and Part/s)						No. of Samples	Reference
		Foods: Domesticates	Foods and Medicines: Wild Resources	Fuelwood and Building Material	Tools and Other Artifacts	Clothing	Unknown or Other Uses		
AR-03-04-06-722 (CNF)	resource processing			*Juniperus* sp. (charcoal or wood)				1 P, 1 M	Scott Cummings and Puseman 2000
85/428 (ASM/CNF)	resource processing (Feature 2)		*Chenopodium-Amaranthus* group (cheno-am) (pollen), *Eriogonum* sp. (pollen), Gramineae/Poaceae (pollen), cf. Leguminosae/Fabaceae (pollen), *Prosopis* sp. (pollen)	*Atriplex* sp. (charcoal or wood), *Canotia* sp. (charcoal or wood), *Fraxinus* sp. (charcoal or wood), *Juniperus* sp. (charcoal or wood), *Opuntia* sp. (charcoal or wood), *Pinus* type (charcoal), *Prosopis* sp. (charcoal or wood), *Quercus* sp. (charcoal or wood)				1 P, 6 M	Adams and Vanderpot (Chapter 6, Volume 2 of this report); Fish (Chapter 7, Volume 2 of this report)
105/838 (ASM/CNF)	habitation (Feature 37)	cf. *Hordeum pusillum* (spikes and spikelets), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	cf. *Astragalus* sp. (seed), *Boerhavia* sp. pollen), *Celtis* sp. (seed), cheno-am (pollen), Compositae/Asteraceae (seed, achene), *Corispermum* type (seed), cf. *Echinocereus* sp. (seed), *Eriogonum* sp. (pollen), *Euphorbia* sp. (seed), Gramineae/Poaceae sp. (caryopses), Gramineae/Poaceae (pollen), cf. Leguminosae/Fabaceae (pollen), *Kallstroemia* sp. (pollen), cf. *Mentzelia albicaulis* (seed), *Opuntia* sp. (seed), cf. *Oryzopsis* sp. (caryopsis), cf. *Plantago* (seed), *Opuntia* (*Platyopuntia*) sp. (pollen), cf. *Portulaca* sp. (seed), *Prosopis* sp. (pollen), cf. *Scirpus* (seed), Solanaceae (pollen), *Sporobolus* sp. (seed), *Sphaeralcea* sp. (pollen)	*Canotia* sp. (charcoal or wood), *Fraxinus* sp. (charcoal or wood), cf. *Juniperus* (charcoal or wood), *Prosopis* sp. (charcoal or wood)				3 P, 10 M	Adams and Vanderpot (Chapter 6, Volume 2 of this report); Fish (Chapter 7, Volume 2 of this report)

Note: The presence of *Pinus* and *Juniperus* pollen, as well as high-spine and low-spine composite pollen, is not included in this table.
Key: P = pollen; M = macrobotanical.

by the earliest locally made pottery (a plain ware called Verde Brown) in the MVRV and trade wares from both the Salt-Gila River basin (Snaketown Red-on-gray and Gila Butte Red-on-buff) and the Colorado Plateau (Lino Gray and Lino Black-on-gray). The Hackberry phase also is the time period that archaeologists infer was when a small number of Hohokam groups from the Phoenix area first moved into the MVRV, presumably bringing with them their knowledge of irrigation technology to cultivate crops (Breternitz 1960b:26–27). This move into the Verde River valley apparently took place when regional water tables were high and floodplains were stable or aggrading (Dean 1988b:Figure 5.7).

The second half of the seventh century experienced many extremes in climate (see Figure 5). The Hackberry phase was initiated with a relatively high-ranking, dry-warm drought (A.D. 645–654) and ended with a dry-cool drought (A.D. 694–705). In between, a high-ranking wet-cool spell (A.D. 686–693) took place, with abnormally high stream flows for the final 3 years (A.D. 691–693) (see Figure 7).

Because so few sites or site components dating to this short phase have been excavated, little can be said about the inventory of plant and animal taxa used in the late seventh century. The single site in Table 20 that contains a Hackberry phase component is SWCA Environmental Consultants' (SWCA's) Verde Terrace site (AZ N:4:23 [ASM]) (Greenwald 1989), used here to represent a portion of that inventory. The only domesticate identified at the Verde Terrace site was maize. Gathered or encouraged wild plants included sunflower (*Helianthus* sp.), knotweed (*Polygonum* sp.), and cattail (*Typha* cf. *latifolia*) as well as pricklypear/cholla, dropseed grass, and cheno-ams. Fuelwood or construction materials included cottonwood or willow (*Populus* sp.) and common reed (*Phragmites* sp.), as well as mesquite and pricklypear/cholla. Animals of economic importance recovered from the site included mud turtle (*Kinosternon* sp.), pocket gopher, cottontail, and jackrabbit.

Cloverleaf Phase (A.D. 700–900)

The 200-year-long Cloverleaf phase embraced considerable low-frequency and high-frequency environmental variability. Regional water tables had achieved their peak in the early A.D. 700s, but by 750, they had begun to drop dramatically and were accompanied by net erosion to river floodplains. By A.D. 850 or so, regional water tables had fallen to their lowest levels, and floodplains were degraded and incised along many reaches. Not until the mid-900s did regional aquifers rise and floodplains and eroded channels accumulate appreciably more sediment fill (Dean 1988b:Figure 5.7).

The phase began with a marked dry-warm drought (A.D. 706–717) and continued as a predominantly dry era for 6 decades (see Figure 5). The 26-year-long dry-warm drought of A.D. 737–762 is the longest and the third most severe in the 1,418-year tree-ring record. This lengthy drought was widely experienced throughout North America, and some dendrochronologists consider it the "megadrought" of the first millennium A.D. (Stahle et al. 2002). A long period of cooler-than-normal climate with alternating intervals of wetter- and drier-than-normal conditions was established by A.D. 786 and persisted through A.D. 866. The final 3 decades of the phase were almost continuously warm, with variable moisture patterns. Generally speaking, then, the eighth century A.D. can be portrayed as dry and warm, whereas the ninth century was wet and cool.

The stream-flow record indicated that eight major floods and three abnormally high discharge years occurred during the Cloverleaf phase (see Figure 7). Two back-to-back flood years took place in A.D. 730 and 731, just before the long mid-eighth-century drought. Three major floods took place in A.D. 803, 804, and 805. An isolated large flood took place in A.D. 822, and another occurred in A.D. 888. The phase closed with a series of 3 high-discharge years, including the third-most-extreme flood in the 1,414-year paleodischarge record, in A.D. 899. The extraordinary discharge of A.D. 899 may, in fact, be the paleoflood of 1,010 ± 95 uncalibrated radiocarbon years B.P. documented by Ely and her colleagues along various reaches of the Verde River system (Ely 1997; Ely and Baker 1985:124; Ely et al. 1993). All but the A.D. 889 high-discharge event took place in intervals characterized in the dendroclimate reconstruction as wet and cool.

A partial list of plants used in the Cloverleaf phase is provided by two sites listed in Table 20. Although Cloverleaf phase sites are more frequently encountered in archaeological surveys than are Squaw Peak or Hackberry phase sites, few have been excavated. Two sites with clear Cloverleaf phase occupations have been analyzed for their plant remains: the Verde View habitation site (AZ O:5:12 [ASM]) (McGuire 1977) and an unnamed field house near the confluence of the Verde River and West Clear Creek (NA15761) (Stebbins et al. 1981). Maize was the only domesticated crop recovered from these Cloverleaf sites. Wild plants presumed to be of economic importance included beeweed (*Cleome* sp.), Mormon tea (*Ephedra* sp.), juniper, some type of mallow-family (Malvaceae) plant, wild buckwheat, sunflower, pricklypear/cholla, plantain, cheno-am-type plants, and plants in the aster/daisy/sunflower family. Wood and stems used for fuel and construction elements included piñon pine (*Pinus* cf. *edulis*), ash, and reedgrass.

Animal use during the Cloverleaf phase has been recorded, in part, at three sites, all habitation sites. One is the Verde View site cited above, another is Kish (AZ N:4:18 [ASM]) (Munson 1977), and the third is Lazy Bear (NA11076) (James and Black ca. 1974). Among the economic animals in the inventory are some type of bony fish (Osteichthyes), freshwater clam (*Anodonta californiensis*), unidentified bird, cottontail, jackrabbit, woodrat (*Neotoma* sp.), deer, pronghorn, and Merriam's elk (*Cervus merriami*).

Table 20. Recovered Archaeobotanical Remains Inferred to Have Economic Importance from Hackberry-Cloverleaf and Cloverleaf Phase Sites in the Middle Verde River Valley

Site No.	Site Name	Temporal Period	Site Type	Uses (Taxon and Part/s)						No. of Samples	Reference
				Foods: Domesticates	Foods and Medicines: Wild Resources	Fuelwood and Building Material	Tools and Other Artifacts	Clothing	Unknown or Other Uses		
AZ N:4:23 (ASM)	Verde Terrace	Hackberry-Cloverleaf	habitation (Feature 3, Feature 4)	*Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	*Chenopodium-Amaranthus* group (cheno-am) (seed), cheno-am (pollen), *Chenopodium* sp. (seed), *Helianthus* sp. (seed), *Opuntia* sp. (seed), *Polygonum* sp. (seed), *Prosopis* sp. (pollen), Scrophulariaceae (seed), *Sporobolus* sp. (seed), *Typha* cf. *latifolia* (pollen)	Leguminosae/Fabaceae (charcoal or wood), *Opuntia* sp. (charcoal or wood), *Phragmites* (stems, culms; roof-closing material), *Populus* sp. (charcoal or wood), *Prosopis* sp. (charcoal or wood)			Caryophyllaceae (seeds)	1 P, 7 M	Brandt 1989; Scott Cummings 1989
AZ O:5:12 (ASM)	Verde View	Cloverleaf	habitation	*Zea mays* (pollen)	cheno-am (pollen), *Chenopodium* sp. (seed), *Cleome* sp. (pollen), *Ephedra* sp. (pollen), *Eriogonum* sp. (pollen), Gramineae/Poaceae (pollen), *Juniperus* sp. (seed/nut), Malvaceae (pollen), *Opuntia* sp. (pollen), *Plantago* sp. (pollen)	*Fraxinus* sp. (charcoal or wood), *Pinus* cf. *edulis* (charcoal or wood), *Phragmites* (stems, culms; roof-closing material)			*Argythamnia* (formerly *Ditaxis) neomexicana* (seed)	4 P, 12 M	Kelso 1977
NA15761	none	Cloverleaf	field house	*Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	cheno-am (seed)					3 M	Gasser 1981; Gish 1981

Note: The presence of *Pinus* and *Juniperus* pollen, as well as high-spine and low-spine composite pollen, is not included in this table.
Key: P = pollen; M = macrobotanical.

Camp Verde Phase (A.D. 900–1150)

The 250-year-long Camp Verde phase took place when low-frequency hydrological variability was on the upswing for human populations in central Arizona. After nearly a century of low regional water tables and degraded floodplain conditions along major streams, alluvial groundwater levels began to rise, and floodplains again began to accumulate sediments, in the tenth century (Dean 1988b:Figure 5.7).

As with all cultural-historical phases, the Camp Verde phase contained considerable high-frequency variability in both precipitation and temperature conditions but, unlike many phases, contained relatively few extreme years (see Figure 5). In addition, climatic conditions persisted for longer spells than before. These characteristics suggest that climatic persistence and interannual predictability were untypically high during this time period. Whereas the majority of the tenth century was moderately dry and somewhat warm, the eleventh century was generally wet and warm, and the first half of the twelfth century was dry and cool. The period between A.D. 1006 and 1084 was probably the most salubrious portion of the Camp Verde phase, given its overall warmth and wetness and few extreme climate conditions. In contrast, the 900s exhibited more interannual variability in climate conditions and more-frequent extreme years, and the early 1100s had even greater persistence from year to year in both temperature and precipitation trends.

The stream-flow reconstruction for A.D. 900–1150 shows *no* years when mammoth floods of epic proportion occurred (e.g., the floods of A.D. 731 and 899) (see Figure 7). Only 3 years in the early 900s (A.D. 928, 929, and 942) witnessed unusually large discharges, and all three discharge episodes took place in climate intervals that were classified as wet and warm.

Plant exploitation during the Camp Verde phase has been documented at six sites (Table 21). Four were habitations with pit structures and intramural and extramural features, including LOCAP Site 105/838. The other three were Camp Verde phase occupations at the Calkins Ranch site (NA2385) (Stebbins et al. 1981), the Verde Terrace site (AZ O:5:6 [ASM]) (McGuire 1977), and the Alldredge site (NA20981/AR-03-04-06-648 [CNF]) (Logan et al. 1992). A fifth site, the Volunteer site (NA17244) (Halbirt 1984), is considered to have been a Camp Verde phase field house. The sixth site, Jessica (AZ O:1:47/AR-03-04-06-126 [ASM/CNF]) (Weaver 2000), is inferred to have been a resource-procurement locale. Plant remains of domesticated crops recovered from the Camp Verde phase include not only maize and wild barley but also squash (*Cucurbita* sp.), beans (*Phaseolus vulgaris*), and cotton (*Gossypium hirsutum*). By the Camp Verde phase, then, the full complement of southwestern domesticates—corn, beans, squash, little barley, and cotton—were in place.[2] The inventory of wild plants collected for food, medicine, and tools includes Amaranth (*Amaranthus* sp.), manzanita (*Arctostaphylos* sp.), spiderling, *Chenopodium*, beeweed, bugseed, hedgehog cactus, Mormon tea, wild buckwheat, ribseed sandmat (*Euphorbia glyptosperma*), juniper, caltrop, stickleaf, pricklypear, ricegrass, plantain, purslane, globemallow, cattail, wild grape (*Vitis* sp.), yucca (*Yucca* sp.), and buffalo gourd (*Cucurbita foetidissima*). Also present were nondiagnostic representatives of the borage (Boraginaceae), mustard (Cruciferae/Brassicaceae), lily (Liliaceae), and nightshade (Solanaceae) families. Plant choices for fuel and construction elements included juniper, ash, sycamore (*Platanus* sp.), cottonwood or willow (*Populus* sp. or *Salix* sp.), mesquite, reedgrass, saltbush, crucifixion thorn, and Mormon tea.

Faunal use during the Camp Verde phase has been documented, in part, by four habitation sites excavated in the MVRV, including LOCAP Site 105/838. The other three sites are Verde Terrace, Alldredge, and Wood (AZ O:1:29 [ASM]) (Hallock 1984). From these sites, freshwater clam, certain species of bony fish and bird, mud turtle, cottontail, jackrabbit, pocket gopher, woodrat, deer, pronghorn, mountain sheep (*Ovis canadensis*), and mountain lion (*Felis concolor*) were recovered.

Honanki Phase (A.D. 1150–1300)

The 150-year-long Honanki phase began during a time period when regional alluvial water tables were depressed but not at their longtime lows. Concomitant with this drop in groundwater was a widely manifested pattern of floodplain degradation and incision (Dean 1988b:Figure 5.7). This mid-twelfth-century pattern was reversed sometime in the late 1100s, when alluvial groundwater rose and floodplain sediments began accumulating, until the late 1200s.

From the perspective of climate, the Honanki phase began as a warm period with alternating wet and dry conditions between A.D. 1146 and A.D. 1183 (see Figure 5). Within this warm period were a number of extremely dry years (A.D. 1146, 1150, 1156, 1158, 1168, 1175, and 1182), but no extremely wet years were identified. At about A.D. 1184, a long cool, and often cold, period set in and continued almost unbroken through A.D. 1272. The turn of the thirteenth century (A.D. 1196–1206) was particularly severe. Precipitation conditions varied considerably during this long period, but wet years predominated

[2] It is possible, and in fact quite likely, that the renowned "three sisters," plus cotton, were established in the MVRV at a time earlier than the Camp Verde phase. Macrobotanical, flotation, and pollen data supporting an earlier coexistence were not known to me at the time of this writing.

Table 21. Recovered Archaeobotanical Remains Inferred to Have Economic Importance from Early Camp Verde, Camp Verde, and Late Camp Verde Phase Sites in the Middle Verde River Valley

Site No.	Site Name	Temporal Period	Site Type	Uses (Taxon and Part/s): Foods: Domesticates	Foods and Medicines: Wild Resources	Fuelwood and Building Material	Tools and Other Artifacts	Clothing	Unknown or Other Uses	No. of Samples	Reference
47/126 (ASM/CNF)	Jessica	early Camp Verde	resource processing	*Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Chenopodium-Amaranthus* group (cheno-am) (seed), cheno-am (pollen), *Euphorbia* sp. (seed), cf. *Portulaca* sp. (seed), *Portulaca* sp. (seed), *Sporobolus* sp. (seed)				cf. Gramineae/ Poaceae (leaf), *Juniperus* (leaf, branchlet)	1 P, 1 M	Scott Cummings 2000; Kwiatkowski 2000
NA2385	Calkins Ranch	Camp Verde	habitation	*Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Amaranthus* sp. (seed), cheno-am (seed), *Chenopodium* sp. (seed), cf. *Cleome* sp. (seeds), Cruciferae/Brassicaceae (seed), *Juniperus* sp. (seed/nut), *Opuntia* sp. (seed), *Prosopis* sp. (seed/ bean, endocarps), *Sporobolus* sp. (seed), *Yucca* sp. (leaf, seed)	Gramineae/Poaceae (stem fragments), cf. *Juniperus* (charcoal or wood), cf. *Phragmites* (stem fragments)				9 M	Gasser 1981; Gish 1981
AZ O:5:6 (ASM)	Verde Terrace	Camp Verde	habitation	*Phaseolus* sp. (seed/bean), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	*Amaranthus* sp. (seed), Boraginaceae (nutlet), cheno-am (pollen), *Chenopodium* sp. (seed), *Eriogonum* sp. (pollen), Gramineae/Poaceae (pollen), Leguminosae/Fabaceae (unspecified plant part), Malvaceae (pollen), *Plantago* sp. (pollen), *Typha* sp. (pollen)	*Juniperus* sp. (charcoal or wood), *Phragmites* (stems, culms; roof-closing material), *Prosopis* sp. (charcoal or wood)			*Cucurbita foetidissima* (plant part)	6 P, 16 M	Kelso 1977
NA20981, AR-03-04-06-648 (CNF)	Alldredge	Camp Verde	habitation	*Zea mays* (pollen), *Zea mays* (starch)	cheno-am (seed), cheno-am (pollen), *Ephedra* sp. (pollen), Gramineae/Poaceae (pollen), *Portulaca* sp. (seed)	*Acer* sp. (charcoal or wood), *Juniperus* sp. (charcoal or wood), *Platanus* sp. (charcoal or wood)				3 P, 2 M	Scott Cummings and Puseman 1992
NA17244	Volunteer	late Camp Verde	field house	*Cucurbita* sp. (pollen), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	*Arctostaphylos* sp. (seed/nut), cheno-am (seed), cheno-am (pollen), *Cleome* sp. (pollen), *Juniperus* sp. (seed/nut), Liliaceae (pollen), likely *Yucca* sp., *Opuntia* sp. (seed), *Opuntia* sp. (pollen), *Portulaca* sp. (seed), *Typha* sp. (pollen), *Vitis* sp. (pollen), *Yucca* sp. (leaf, seed)		*Lagenaria siceraria* (gourd container, seed)			7 P, 4 M	Gasser 1984; Halbirt 1984
105/838 (ASM/CNF)	none	Camp Verde	habitation (Feature 23, Feature 29)	*Cucurbita* sp. (pollen), *Gossypium hirsutum* var. *punctatum* (seed), cf. *Hordeum pusillum* (spikes and spikelets), *Phaseolus vulgaris* (seed/bean), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	*Boerhavia* sp. (fruit), *Boerhavia* sp. (pollen), cheno-am (seed), cheno-am (pollen), Compositae/ Asteraceae (seed, achene), *Corispermum* type (seed), cf. *Echinocereus* sp. (seed), *Ephedra* sp. (pollen), *Eriogonum* sp. (pollen), *Erodium* (pollen), cf. *Euphorbia glyptosperma* (seed), Gramineae/ Poaceae (caryopses), Gramineae/Poaceae (pollen), *Kallstroemia* sp. (pollen), cf. *Mentzelia albicaulis* (seed), *Opuntia* sp. (seed), cf. *Oryzopsis* sp. (caryopsis), Solanaceae (pollen), *Sphaeralcea* sp. (seed), *Sphaeralcea* sp. (pollen), *Typha* sp. (pollen)	*Atriplex* sp. (charcoal or wood), *Canotia* sp. (charcoal or wood), *Ephedra* sp. (charcoal or wood), *Fraxinus* sp. (charcoal or wood), cf. *Juniperus* (charcoal or wood), *Platanus* sp. (charcoal or wood), *Phragmites* (stems, culms; roof-closing material), *Populus/Salix* type (charcoal or wood), *Prosopis* sp. (charcoal or wood)				13 P, 40 M	Adams and Vanderpot (Chapter 6, Volume 2 of this report); Fish (Chapter 7, Volume 2 of this report)

Note: The presence of *Pinus* and *Juniperus* pollen, as well as high-spine and low-spine composite pollen, is not included in this table.
Key: P = pollen; M = macrobotanical.

after A.D. 1220. The final quarter of the thirteenth century witnessed a return to generally warmer-than-normal conditions, but few years of extreme warmth were identified. Importantly, the "Great Drought" of A.D. 1276–1299 (Douglass 1929), which was experienced in many portions of the U.S. Southwest, was *not* a major drought in the MVRV. Although individual years within the famous 24-year period were indeed extremely dry (A.D. 1276, 1286, 1288, and 1299), 14 years were reconstructed as wet, and only 10 years were classified as dry. Instead of being a long and relentless, warm drought, the final years of the thirteenth century appear to have witnessed alternating intervals of wet-warm and dry-warm climate conditions after A.D. 1274—a pattern that persisted for more than 40 years (through A.D. 1314).

Stream-flow records for the Honanki phase (see Figure 7) indicated that no extraordinarily large floods occurred during the 150-year period. Rather, 2 large-discharge years in A.D. 1202 and A.D. 1275 were reconstructed. The A.D. 1202 flood took place within a cluster of higher-than-normal discharge years during the cold and wet early 1200s. The A.D. 1275 flood was an isolated occurrence within a warm and wet interval near century's end.

A partial inventory of plant use during the Honanki phase is documented in Table 22. Three sites with clear Honanki phase occupations were used to illustrate these uses. Two were habitation sites: Kittredge Ruin (NA4490) (Shutler and Adams ca. 1950) and the Cross Creek Ranch site (AR-03-04-06-703 [CNF]) (Logan and Horton 2000). The third—Hidden House (NA3500/AZ N:4:2 [ASM]) (Dixon 1956)—was the location of a human burial with numerous funerary offerings. Domesticates included maize, two types of bean (*Phaseolus acutifolius* and *P. vulgaris*), two types of squash (*Cucurbita mixta* and *C. moschata*), and cotton. Agave (*Agave* sp.) was also present at one site, and it is likely that this useful plant was being cultivated for food and other purposes by the Honanki phase, if not before. Wild plants collected for food and medicine included Acacia (*Acacia* sp.), hackberry, *Chenopodium*, beeweed, Mormon tea, juniper, pricklypear/cholla, mesquite, oak (*Quercus* sp.), skunkbush sumac (*Rhus trilobata*), globemallow, cattail, and a nondiagnostic member of the sedge family (Cyperaceae). Fuel and construction resources included piñon, juniper, alder (*Alnus* sp.), mountain mahogany (*Cercocarpus* sp.), and saltbush. Other plants gathered for tools and other uses included bottle gourd (*Lagenaria siceraria*), various grasses (Poaceae), and reedgrass.

Faunal use during the Honanki phase has been partially inventoried by four habitation sites. Faunal remains were recovered from Kittredge Ruin, the Cross Creek Ranch site, the Talon site (AZ O:1:141 [ASM]) (Deats et al. 2004), and Panorama Ruin (NA5111) (Shutler and Adams ca.1950). The combined inventory includes freshwater clam, certain species of bony fish, mud turtle, quail (*Callipepla gambelii*), wild turkey (*Meleagris gallopavo*), cottontail, jackrabbit, nondiagnostic members of the squirrel and chipmunk family (Sciuridae), prairie dog (*Cynomys* sp.), pocket gopher, woodrat, muskrat (*Ondatra zibethicus*), canid (*Canis* sp.), bobcat (*Lynx rufus*), deer, pronghorn, and mountain sheep.

Tuzigoot Phase (A.D. 1300–1400/1425)

The final phase in the precontact Formative period sequence is the Tuzigoot phase. The latest Tuzigoot phase tree-ring date from the MVRV is A.D. 1386, and it was recovered from Tuzigoot Pueblo (Robinson and Cameron 1991). This date presumably represents the time of major depopulation in the MVRV, although some archaeologists believe that a small number of Sinagua people continued to live in the valley for several decades (David Wilcox, personal communication 2005). The fourteenth century also is the time that some archaeologists argue was when ancestral Yavapai bands arrived in the MVRV and established what became an enduring presence, after A.D. 1400 (Pilles and McKie 1998).

The events of the fourteenth century took place within a challenging environmental context. As had happened at least twice before during the Formative period (in the A.D. 200s and 800s), regional alluvial water tables were dropping to their long-term low levels (Dean 1988b:Figure 5.7). Likewise, floodplain sediments were actively eroding, and streams were incising into their channels, causing major changes to floodplain morphology.

Although the Tuzigoot phase can be characterized as slightly wet and cool overall, it witnessed, in fact, considerable variability in both precipitation and temperature conditions (see Figure 5). The phase began as a moderately warm and dry period that started late in the Honanki phase and lasted to about A.D. 1329. Thereafter, a long, persistent, and often extremely cold spell set in (A.D. 1330–1364). With the exception of a short span of fairly continuous wetness (A.D. 1365–1384), which included a year of exceptional precipitation (A.D. 1382), the remainder of the Tuzigoot phase was warmer than normal. Two exceedingly warm years (A.D. 1423 and 1425) occurred at the end of the phase.

The paleodischarge record indicated that only two large floods along the Verde River took place during the Tuzigoot phase (see Figure 7). However, significant flooding occurred along various reaches of the Verde River in the A.D. 1381–1384 interval. Particularly dramatic was the flood of A.D. 1382, which has been invoked as a forcing event in the destruction of irrigation systems in the Phoenix Basin and in the decline of Hohokam society (see Abbott 2003:226; Graybill et al. 2006). The A.D. 1382 flood is the fifth-most-extreme paleodischarge event in the 1,414-year stream-flow reconstruction.

The list of plants used in the Tuzigoot phase derived from six sites. Three were habitation sites, and three were

Table 22. Recovered Archaeobotanical Remains Inferred to Have Economic Importance from Early Honanki, Honanki, Honanki–Early Tuzigoot, Late Honanki, Honanki and Tuzigoot, and Tuzigoot Phase Sites in the Middle Verde River Valley

Site No.	Site Name	Temporal Period	Site Type	Uses (Taxon and Part/s)						No. of Samples	Reference
				Foods: Domesticates	Foods and Medicines: Wild Resources	Fuelwood and Building Material	Tools and Other Artifacts	Clothing	Unknown or Other Uses		
5/128 (ASM/CNF)	Centruroides	early Honanki	field house		*Chenopodium-Amaranthus* group (cheno-am) (pollen), *Euphorbia* sp. (seed), Malvaceae (seeds, carpels), *Prosopis* sp. (pollen), *Sphaeralcea* sp. (pollen)				cf. Gramineae/Poaceae (leaf)	2 P, 1 M	Scott Cummings 2000; Kwiatkowski 2000
NA5111	Panorama Ruin	early Honanki	habitation			*Juniperus* (bark—roofing material), *Juniperus* sp. (charcoal or wood)					Shutler and Adams ca. 1950, citing Jones and Fonner ca. 1950
34/535 (ASM/CNF)	Christmas Tree	Honanki	habitation	cf. *Hordeum* sp. (seed), *Zea mays* (pollen)	cf. *Bromus* sp. (seed), cheno-am (seed), cheno-am (pollen), Gramineae/Poaceae (pollen), *Juniperus* sp. (seed/nut), Liguliflorae (pollen), *Polygonum* sp. (seed), *Prosopis* sp. (pollen), *Typha* cf. *latifolia* (pollen)	*Cypressus/Juniperus* type (charcoal), *Pinus* type (charcoal), *Platanus* sp. (charcoal or wood)	*Agave* sp. (cordage, netting, stalk-box, fibers)			3 P, 3 M	Scott Cummings 2000; Kwiatkowski 2000
NA4490	Kittredge Ruin	Honanki	habitation	*Cucurbita mixta* (peduncle), *Phaseolus* sp. (pollen), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Agave* sp. (chewed quids), *Quercus* sp. (acorns)	*Juniperus* sp. (roof beams or roof supports), *Juniperus* sp. (charcoal or wood)	*Agave* sp. (cordage, netting, stalk-box, fibers), *Lagenaria siceraria* (gourd container, seed), Poaceae (seed, cordage, pot-rest, matting), *Phragmites* sp. (arrow shafts)	*Agave* sp. (string apron), *Gossypium* sp. (cloth, blanket, bags, sash, quiver, belt, skein or "turban")	*Agave* sp. (leaves, seeds, quids)		Jones and Fonner ca. 1950
AR-03-04-06-703 (CNF)	Cross Creek Ranch	Honanki	habitation	*Cucurbita* sp. (pollen), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	*Celtis* sp. (seed), *Chenopodium* sp. (seed), *Cleome* sp. (pollen), Cyperaceae (pollen), *Ephedra* sp. (pollen), *Opuntia* sp. (pollen), *Rhus trilobata* (pollen), *Sphaeralcea* sp. (pollen), *Typha* cf. *latifolia* (pollen), *Yucca* sp. (pollen)	*Alnus* sp. (charcoal or wood), *Atriplex* sp. (charcoal or wood), *Cercocarpus* sp. (charcoal or wood), *Juniperus* sp. (charcoal or wood), *Pinus* sp. (charcoal or wood), *Pinus* cf. *edulis* (charcoal or wood)	Poaceae (seed, cordage, pot-rest, matting)		*Agave* sp. (leaves, seeds, quids)	8 P, 6 M	Scott Cummings and Puseman 2000
AZ O:1:141 (ASM)	Talon Site, Areas 23–26 (Feature 1, Feature 2, Feature 8)	Honanki	habitation	cf. *Cucurbita* sp. (squash rind), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	cf. *Boerhavia* sp. (pollen), cheno-am (seed), cheno-am (pollen), *Cleome* sp. (pollen), *Cylindropuntia* (pollen), *Ephedra* sp. (pollen), *Eriogonum* sp. (pollen), Gramineae/Poaceae (pollen), Liguliflorae (pollen), Onagraceae (pollen), *Platyopuntia* sp. (seeds, pads), cf. *Yucca* sp. (plant part)		*Nolina* sp. (matting, fiber)			8 P, 7 M	Deats et al. 2004
AZ O:5:7 (NAU), AR-03-04-06-341 (CNF)	Oak Creek Valley Pueblo	Honanki–early Tuzigoot	habitation	*Cucurbita* sp. (seed), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels), *Zea mays* (pollen)	*Abronia* sp.(pollen), *Acacia* sp. (seed/bean, pod), Amaryllidaceae (pollen), *Boerhavia* sp. (pollen), *Canotia* sp. (pollen), *Celtis reticulata* (seed coat), *Celtis* sp. (pollen), *Cercocarpus* sp. (pollen), cheno-am (pollen), *Cleome* sp. (pollen), Convolvulaceae (pollen), Cruciferae/Brassicaceae (pollen), *Cylindropuntia* (pollen), Cyperaceae (pollen), *Echinocereus* (pollen), *Ephedra* sp. (pollen), *Eriogonum* sp. (pollen), *Euphorbia* (pollen), Gramineae/Poaceae (pollen), *Helianthus* sp. (pollen), *Ipomoea* (pollen), *Juglans major* (nut), Labiatae/Lamiaceae (pollen), Leguminosae/Fabaceae (unspecified plant part), cf. Leguminosae/Fabaceae (pollen), *Liliaceae* (pollen), likely *Yucca* sp., *Mirabilis* sp. (pollen), *Morus* sp. (pollen), *Oenothera* sp. (pollen), *Opuntia* sp. (pollen), Papaveraceae (pollen), Polemoniaceae (pollen), *Platyopuntia* sp. (pollen), Polygonaceae (pollen), Portulacaceae (pollen), Primulaceae (pollen), *Prosopis juliflora* (husk), Rhamnaceae (pollen), *Ranunculus* sp. (pollen), *Rhus* sp. (pollen), Rosaceae (pollen), Rubiaceae (pollen), *Rumex* sp. (pollen), *Sambucus* sp. (pollen), Scrophulariaceae (pollen), Solanaceae (pollen), *Sphaeralcea* sp. (pollen), *Typha* sp. (pollen), *Vitis* sp. (pollen), *Yucca elata* (seed)	*Juniperus* sp. (roof beams or roof supports), *Juniperus* sp. (charcoal or wood)			cf. *Baccharis* sp. (pollen), *Salix* (pollen)	21 M, 35 P	Jeffers 1983

continued on next page

Site No.	Site Name	Temporal Period	Site Type	Uses (Taxon and Part/s)						No. of Samples	Reference
				Foods: Domesticates	Foods and Medicines: Wild Resources	Fuelwood and Building Material	Tools and Other Artifacts	Clothing	Unknown or Other Uses		
NA3500, AZ N:4:2 (ASM)	Hidden House	late Honanki	habitation, burial	*Cucurbita moschata* (seed), *Gossypium hirsutum* var. *punctatum* (seed), *Phaseolus acutifolius* (seed/bean), *Phaseolus vulgaris* (seed/bean), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Acacia* sp. (seed/bean, pod), *Juniperus* sp. (seed/nut), *Prosopis* sp. (seed/bean, endocarps)		*Agave* sp. (cordage, netting, stalk box, fibers), *Forestiera pubescens* var. *pubescens* (*Forestiera neomexicana*) (arrow fore-shaft), *Fraxinus* sp. (arrow foreshaft), *Lagenaria siceraria* (gourd container, seed), *Martynia* sp. (basketry material), Poaceae (seed, cordage, pot rest, matting), *Phragmites* sp. (arrow shafts), *Yucca* sp. (cordage, fiber, basketry)	*Gossypium* sp. (cloth, blanket, bags, sash, quiver, belt, skein or "turban")			Dixon 1956
NA2806, NA10769	Exhausted Cave	Honanki and Tuzigoot	habitation, burial	*Cucurbita moschata* (seed), *Cucurbita* sp. (seed), *Gossypium hopi* (plant part), *Hordeum* sp. (seed), *Phaseolus* sp. (seed/bean), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Acacia* sp. (seed/bean, pod), *Agave parryi* (plant part), *Amaranthus* sp. (seed), *Atriplex elegans* (plant parts), *Celtis* sp. (seed), *Chenopodium* sp. (seed), *Cleome* sp. (seeds), Cyperaceae (plant parts), *Juglans major* (nut), *Juniperus* sp. (seed/nut), Leguminosae/Fabaceae (unspecified plant part), *Opuntia* sp. (seed), *Prosopis* sp. (seed/bean, endocarps), *Quercus* sp. (acorns), *Setaria* sp. (seeds), *Sorghum* sp. (seeds), *Vitis* sp. (seeds), *Yucca* sp. (leaf, seed), cf. *Yucca* sp. (plant part)				*Yucca* sp. (quids)		partial list identified by Hudgens and Hevly 1978, cited in Jeffers 1983
AZ O-5-20 (NAU)	none	Tuzigoot	field house	*Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Argemone* sp. (seed), *Celtis* sp. (seed), *Chenopodium* sp. (seed), Poaceae (seed)					2 M	Van Ness 1990
AZ O-5-21 (NAU)	none	Tuzigoot	field house	*Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Amaranthus* sp. (seed), *Chenopodium* sp. (seed), Compositae/Asteraceae (seed, achene), Poaceae (seed)					2 M	Van Ness 1990
NA15769	none	Tuzigoot	field house	*Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	cheno-am (seed), Cruciferae/Brassicaceae (seed)	cf. *Juniperus* (charcoal or wood)				2 M	Gasser 1981; Gish 1981
AZ N:4:23 (ASM)	none	Tuzigoot	pit structure (Feature 1)	*Cucurbita* sp. (pollen), *Gossypium* sp. (pollen), *Zea mays* (pollen)	cheno-am (seed), *Plantago* sp. (pollen), *Portulaca* sp. (seed)					1 P, 1 M	Brandt 1989; Scott Cummings 1989
NA2733, AZ N:4:1 (ASM)	Tuzigoot Pueblo	Tuzigoot	habitation	*Phaseolus* sp. (seed/bean), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	Poaceae (seed)		Poaceae (seed, cordage, pot rest, matting); *Yucca* sp. (cordage, fiber, basketry)				Hartman 1976, using data from Caywood and Spicer 1935
NA1278, AZ O:5:14 (ASM)	Montezuma Castle	Tuzigoot	habitation, burial	*Cucurbita* sp. (seed), *Gossypium hirsutum* var. *punctatum* (seed); *Hordeum* sp. (seed), *Phaseolus* sp. (seed/bean), *Zea mays* (cobs, stalks, tassles, cupules, and/or kernels)	*Boerhavia* sp. (fruit), Boraginaceae (nutlet), cheno-am (seed), *Cleome* sp. (seeds), Gramineae/Poaceae sp. (caryopses), *Juniperus* sp. (seed/nut), Leguminosae/Fabaceae (unspecified plant part), *Linum* sp. (seeds), Malvaceae (seeds, carpels), *Nicotiana* sp. (seeds), *Platyopuntia* sp. (seeds, pads), cf. *Polygonum* sp. (seed), cf. *Portulaca* sp. (seed), *Prosopis* sp. (seed/bean, endocarps), *Rhus trilobata* (seeds), *Vitis* sp. (seeds), *Yucca*/*Agave* sp. (seeds)	*Phragmites* (stems, culms; roof-closing material), cf. *Stipa* sp. (caryopses), Umbelliferae (mericarp)	*Nolina* sp. (matting, fiber), *Gossypium* sp. (cloth, blanket, bags, sash, quiver, belt, skein or "turban")		*Agave* sp. (leaves, seeds, quids), *Cucurbita foetidissima* (plant part), *Juniperus* (leaf, branchlet), *Yucca* sp. (quids)	3 M	Huckell 1986

Note: The presence of *Pinus* and *Juniperus* pollen, as well as high-spine and low-spine composite pollen, is not included in this table.
Key: P = pollen; M = macrobotanical.

field-house locales. The habitation sites include a portion of Montezuma Castle (NA1278/AZ O:5:14 [ASM]) (Tagg 1986), Tuzigoot Pueblo (NA2733/AZ N:4:1 [ASM]) (Hartman 1976 citing Caywood and Spicer 1935), and a Tuzigoot phase pit structure at SWCA's Verde Terrace site (AZ N:4:23 [ASM]) (Greenwald 1989). The three unnamed field-house sites are AZ O-5-20 (NAU) (Graff 1990), AZ O-5-21 (NAU) (Graff 1990), and NA15769 (Stebbins et al. 1981). The roster of domesticated and cultivated plants was complete: maize, beans, squash, agave, little barley, and cotton. The inventory of wild plants included amaranth, *Chenopodium*, spiderling, hackberry, plantain, purslane, beeweed, juniper, mesquite, skunkbush sumac, wild grape, yucca, pricklypear, and flowering tobacco (*Nicotiana* sp.) as well as nondiagnostic members of the composite, mustard, grass, borage, legume, and mallow families and the cheno-am group. Wood and stems used for fuel and construction included juniper, reedgrass, needlegrass (*Stipa* sp.), and a plant in the parsley/carrot (Umbelliferae/Apiaceae) family. Other plant taxa of economic importance were beargrass (*Nolina* sp.) and buffalo gourd.

The inventory of animals sought out by Tuzigoot phase occupants of the middle Verde River valley (see Chapter 8, Table 70, Volume 2 of this report) derived from faunal recovery at a single site—Tuzigoot Pueblo—long before modern recovery methods and analytic techniques came into being (Caywood and Spicer 1935). Because this was a large, long-lived (and multicomponent) pueblo on the banks of the Verde River, many different animal taxa were recovered from trash deposits in rooms and from extramural middens. Among these taxa were freshwater clam, a great variety of birds, and numerous mammals. No fish were mentioned in the report, but this does not mean fish were ignored by Tuzigoot phase populations (for nearby Perkins Pueblo, see Minckley and Alger 1968). Among the birds, the recovery of duck and goose (mallard duck, *Anas platyrhynchos*, and Canada goose, *Branta canadensis*), various prey species (red-tailed hawk, *Buteo jamaicensis*; Swainson's hawk, *B. swainsoni*; and peregrine falcon, *Falco peregrinus*), and scarlet macaw (*Ara macao*) is notable. Among the mammals, the most commonly encountered remains were cottontail, jackrabbit, deer, and pronghorn. Also present were muskrat, bobcat, beaver (*Castor canadensis*), bear (*Ursus* sp.), badger (*Taxidea taxus*), raccoon (*Procyon lotor*), and unidentified canids (no doubt including domesticated dog).

Protohistoric Period (A.D. 1400/1425–1600)

The protohistoric period is the time period after the depopulation of many localities in the southwestern United States that were previously inhabited by prehispanic agriculturalists and before most of the written accounts prepared by early European and Euroamerican observers. It is also the time when certain ancestral Yavapai bands established their presence in and around the MVRV.

Reconstructions of spatially extensive alluvial groundwater levels and floodplain morphology indicated that the protohistoric period, as defined here, took place under very dynamic conditions. Already degraded alluvial floodplains remained in this condition throughout the 1400s and only slowly began to recover in the 1500s. Regional water tables dropped to their cyclical lows in the mid-1400s and rose throughout the 1500s (Dean 1988a:Figure 5.7).

The climate reconstruction for the MVRV indicated that this 200-year period was predominantly dry and cool, with numerous droughts of considerable length and many extremes in both annual precipitation and temperature values (see Figure 5). The protohistoric period included a long era of rather-sustained coolness between A.D. 1435 and 1528, a 20-year dry-warm period between A.D. 1529 and 1548, a 20-year period during which conditions were wetter than normal, and a long and serious drought from A.D. 1569 to 1592 that was initially cool but ended warm. This last drought was the local manifestation of the renowned "Sixteenth Century Megadrought" (Stahle et al. 2000) that was widely experienced throughout North America.

The Verde River stream-flow reconstruction indicated that the number and frequency of large-discharge years increased over those of the Tuzigoot phase (see Figure 7). Six especially large stream-flow years were reconstructed: A.D. 1457, 1462, 1482, 1484, 1549, and 1550. The A.D. 1482 discharge was the eighth largest in the 1,414-year record. All of these floods took place in wet intervals, but the A.D. 1457 and 1462 floods and the A.D. 1549–1550 floods took place in wet and cool intervals, whereas the A.D. 1482 and 1484 floods took place within a wet and warm interval.

Archaeological sites assigned to the protohistoric period occupation in the MVRV have been poorly dated, as a rule. The best dates derived from thermal features—roasting pits and hearths. Two sites with protohistoric period components are listed in Table 23, but floral remains were not abundant in either context. Together, the Cross Creek Ranch site and the Wood site have provided evidence for the collection and use of agave, *Chenopodium*, purslane, motherwort (*Leonurus* sp.), and various grasses for food and medicine. Wood used for fuel included juniper, sycamore, ash, and saltbush. No sites with protohistoric period components were listed in Wegener's table (see Chapter 8, Table 70, Volume 2 of this report).

Early Historical Period (A.D. 1600–1848)

The early historical period includes the Spanish colonial era (A.D. 1598–1821) and the Mexican period (A.D. 1821–1848)—a period for which only a small number of descriptions of the people, places, and events of central Arizona

Table 23. Recovered Archaeobotanical Remains Inferred to Have Economic Importance from Protohistoric Period Sites in the

Site No.	Site Name	Site Type	Uses (Taxon and Part/s)						No. of Samples	Reference
			Foods: Domesticates	Foods and Medicines: Wild Resources	Fuelwood and Building Material	Tools and Other Artifacts	Clothing	Unknown or Other Uses		
AR-03-04-06-703 (CNF)	Cross Creek Ranch	resource processing (Feature 8, Feature 10)		*Chenopodium* sp. (seed), *Leonurus* sp. (seed), Poaceae (seed), *Portulaca* sp. (seed)	*Atriplex* sp. (charcoal or wood), *Fraxinus* sp. (charcoal or wood), *Juniperus* sp. (charcoal or wood), *Platanus* sp. (charcoal or wood)			*Juniperus* (leaf, branchlet)	2 M	Scott Cummings and Puseman 2000
AZ O:1:29 (ASM)	Wood	campsite, resource processing		*Agave* sp. (heart)						Hallock 1984

Note: The presence of *Pinus* and *Juniperus* pollen, as well as high-spine and low-spine composite pollen, is not included in this table.
Key: M = macrobotanical.

exist. The arrival dates for various Apache bands in the MVRV are unknown, but certainly Apache people traveled through or lived in portions of the valley by the eighteenth century, if not the seventeenth century. During the early historical period, the primary occupants of the valley were Yavapai and Apache peoples, who undoubtedly saw visits to their territories by other indigenous peoples of the larger region.

This 2½-century period took place when regional water tables were generally high and when floodplains were accumulating sediments or were reasonably stable. A secondary depression in alluvial water-table levels occurred in the decades on either side of A.D. 1700 but recovered by the mid-eighteenth century (Dean 1988b:Figure 5.7).

The dendroclimate reconstruction for the middle Verde River region indicated that the early historical period was predominantly dry and cool, with extraordinary variability in precipitation patterns and many extreme years (see Figure 5). Most of the 1600s were extremely and persistently cool, with highly variable patterns of precipitation and tending toward overall wetness. Of all centuries in the tree-ring record, the seventeenth century best exemplifies the local manifestation of the "Little Ice Age" in northwestern Europe (Bradley 2000; Grove 1988; Lamb 1984). In contrast, most of the 1700s were exceptionally warm, with the averaging effects of wet and dry years yielding a slightly wetter-than-normal century. The first half of the 1800s was, again, a protracted cool era with many extremes in temperature and precipitation.

The Verde River stream-flow reconstruction indicated that the number and periodicity of high-discharge events increased dramatically in the early historical period (see Figure 7). Thirteen high-discharge years were reconstructed: A.D. 1618, 1680, 1718, 1726, 1746, 1749, 1764, 1784, 1787, 1792, 1793, 1828, and 1839.

The majority of these high-discharge years took place in the warmer-than-normal eighteenth century rather than the cooler-than-normal seventeenth or early nineteenth centuries. Further, most of these high-flow years took place within temporal intervals that were wet (69 percent) rather than dry (31 percent). The A.D. 1793 event represents the single-most-extreme flood in the 1,414-year dendrohydrologic record. This high-discharge year is a strong candidate for being the extremely large flood dated at 223 ± 70 uncalibrated radiocarbon years B.P. by Ely and Baker (1985:124).

No floral or faunal data clearly associated with the early historical period were available for inclusion in Tables 19–23 or in Wegener's table (see Chapter 8, Table 70, Volume 2 of this report).

Late Historical Period (A.D. 1848–present)

The late historical period is the American period in the U.S. Southwest. After the mid-1860s, Euroamericans established a permanent presence in the MVRV. This occupation corresponds to a regional pattern of diminishing alluvial water tables and concomitant erosion and incision of floodplains in the nineteenth century (Dean 1988b:Figure 5.7).

The paleoclimate reconstruction for the A.D. 1848–1988 period indicates the following (see Figure 5). The second half of the 1800s was mostly dry, with generally mild temperatures. This pattern was broken by a prolonged and warm drought at the turn of the twentieth century (A.D. 1892–1904). A 15-year-long wet spell set in at A.D. 1905 and reached a peak in the 1910s (especially A.D. 1916 and 1917). Persistent warmth after A.D. 1932, in combination with fluctuating annual precipitation, resulted in a long and severe drought (the "1950s Drought") (Schulman 1956; Swetnam and Betancourt 1998) that began in A.D. 1943, climaxed in the 1950s, and ended in A.D. 1964. The final 2 decades of the dendroclimate reconstruction illustrated that this was one of the longest and highest-ranking warm-wet spells in the 1,418-year record. Instrumented values from weather stations in and around the MVRV substantiated this reconstruction (see the discussion on modern climate presented in Chapter 2, Volume 1 of this report).

The Verde River stream-flow reconstruction indicated that the late historical period was a time of many large floods (see Figure 7). Prior to A.D. 1891, the first year for which instrumented values on the Verde River's flow are available from different gaging stations (Ely and Baker 1985; House et al. 1995), the Verde River reconstruction indicated that 2 large-discharge events in A.D. 1866 and 1868 took place during a short but pronounced wet spell. The A.D. 1868 event ranked second in magnitude for the 1,414-year tree-ring record. After A.D. 1890, 19 separate high-discharge events with flows greater than 1,000 m^3 per second have been recorded: A.D. 1891, 1905/1906, 1916, 1920, 1927, 1932, 1937, 1938, 1941, 1951/1952, 1966, 1970, 1972, 1978, 1979, 1980, 1993, 1995, and 2004/2005.

No floral or faunal data clearly associated with the late historical period were included in Tables 19–23 or in Wegener's table (see Chapter 8, Table 70, Volume 2 of this report). Nevertheless, we know from historical records, from analysis of historical-period pollen (Davis et al. 1985), and from modern observations that significant changes in how food and other economic animal species were procured, what plants and animals were desired, and how land was used accompanied the influx of Euroamericans to the MVRV. After the U.S. Civil War (A.D. 1861–1865), military personnel in western garrisons stepped up efforts to halt raiding and attacks by Apaches and other indigenous populations in Arizona. By 1873, most Yavapai and Western Apache living near the MVRV were forced to live on a reservation near Camp Verde. In February of 1875, soldiers under the command of General George Crook escorted the Yavapai and Apache living near Camp Verde on a "trail of tears" march to the San Carlos Reservation, many miles to the east. Almost immediately, immigration of Euroamericans to the MVRV increased markedly. With the threat of Indian raids extinguished, Euroamericans arrived to exploit the valley's mineral wealth and irrigable land and to establish ranches and homesteads. Along with these immigrants came their grazing livestock (especially cattle and sheep), new crops (e.g., wheat, alfalfa, garden crops, and fruit orchards), advanced technology, and wildly different ideas of land ownership and land use. Also accompanying these newcomers were inadvertent introductions of highly competitive exotic weeds and grasses (e.g., cheatgrass [*Bromus tectorum*], Russian thistle or tumbleweed [*Salsola* sp.], and filaree [*Erodium cicutarium*]), proliferation of certain trees and shrubs (e.g., one-seeded juniper, mesquite, and probably pricklypear and cholla) at the expense of other native species once land was cleared or altered by grazing, accelerated erosion, loss or diminishment of riparian vegetation in many settings, and reduction of groundwater supply. In the twentieth century, federal and state laws governing range-carrying capacity, land-use permits, fire-management policy, and natural-resource management minimized certain environmental outcomes and exaggerated others. The cumulative effects of overgrazing, introduced exotics, fire suppression, changing land-use practices, and air and water pollution due to mining and human activities have left a lasting impression on the visual and economic landscape of the MVRV.

Concluding Remarks

The environmental history of the MVRV is a long and interesting tale. When human groups first encountered the valley during the Early Holocene period, they found a broad, well-watered basin bound by the mineral-rich Black Mountains to the south and west and the steep escarpment of the Colorado Plateau to the north and east. Within this valley, they discovered a great and diverse quantity of useful geological, hydrological, botanical, and faunal resources that could support their material and spiritual needs. These environmental riches continue to support and attract human populations today. Although the dynamic elements of the physical environment always have included climate and stream-flow variation, they also have included the many and varied interactions that occur between humans and their physical surroundings. Throughout time, changes in the physical environment of the MVRV have been caused primarily by natural variation in atmospheric conditions as they have been mediated by weather conditions and climate. However, human-induced changes to water sources, soils, mineral deposits, and plant and animal communities have been important factors in the evolution of the contemporary environment. Although we generally recognize the role that historical-period populations played in the alteration of the modern environment, we often do not consider the actions of precolumbian populations.

The role of anthropogenic factors in environmental history probably increased in importance after the introduction of agricultural techniques to the valley in the Late Holocene period. Localized depletion of game resources and fuelwood, land modification (e.g., clearance of vegetation, land leveling, and construction of water-control or water-conveyance features) for crop production and habitation space, water diversion, introduction of nonindigenous crops (e.g., squash, maize, beans, cotton, and certain species of agave) and animals (e.g., dogs and turkeys), proliferation and encouragement of weedy species (e.g., cheno-ams, spiderling, and globemallow) in agricultural settings and in other disturbed places, soil enrichment and loss, and the use of fire to maintain grasslands and attract grazing animals are but a few of the anthropogenic factors that influenced edaphic, hydrological, and biotic resources of the MVRV in the precontact era. The pace of anthropogenic change likely increased after Spanish contact in the late 1500s, but certainly the rapidity and pervasiveness of change were marked during the post–U.S. Civil War American period.

In the next chapter, we use an archaeological database of more than 2,300 prehistoric and historical-period sites to characterize the history of human settlement and land use in the MVRV. We draw on the descriptions of geology, paleoclimate, paleohydrology, Verde River flood dynamics, archaeobotany, and faunal recovery (described in Volume 2 and in this chapter) to establish the environmental opportunities and constraints present for human populations at different points in time. By combining these data, we hope to gain insight into the nature of human-environmental interactions during the Formative period as well as to establish some of the environmental parameters that undoubtedly contributed to the history of human settlement during the Archaic, protohistoric, and early historical periods.

CHAPTER 6

Prehistoric Settlement and Land Use

Carla R. Van West, Michael P. Heilen, Phillip O. Leckman, and Rein Vanderpot

SRI archaeologists conducted data recovery at 13 NRHP-eligible archaeological sites along SR 89A between Cottonwood and Sedona, in the MVRV of central Arizona in 1998. Detailed mapping, excavation, and analyses revealed that most of these sites contained multiple temporal components and provided evidence of occupation and land use from at least the Middle Archaic period through the twentieth century. Based on the recovery and analyses of artifacts, architecture, and environmental remains, we inferred that these sites functioned as resource-procurement and processing locales, short-term encampments, and farmsteads. Cross-dated ceramics, projectile-point chronologies, stratigraphic relationships, and absolute dates derived from radiocarbon assay, AM measurements, and TL analysis provided unambiguous evidence of the presence of human groups in our project area since the Middle Archaic period, about 4,000 years ago. Consequently, we were able to document that Middle and Late Archaic period hunter-gatherers; Early Formative period (Squaw Peak phase) forager-farmers; Middle and Late Formative period agricultural Southern Sinagua groups during the Camp Verde, Honanki, and Tuzigoot phases; and Euroamerican settlers of the twentieth century regularly visited or occupied our project area. We also had evidence, although not as strong, that a small number of Ancestral Yavapai traversed, camped, and acquired resources in the project area. What we did not find, however, was evidence that Paleoindians or Southern Sinagua of the Hackberry or Cloverleaf phase lived in or passed through the project area.

To understand the history of settlement and land use in the linear transect that was our project area, we needed to place our results in a larger geographic context. We framed our project as the LOCAP because our SR 89A project area parallels the route of Oak Creek, and none of our sites is more than 3.7 km north or west of this important perennial stream. Archaeologists have long known that several large Honanki and Tuzigoot phase pueblos were built along lower Oak Creek and the lowest reach of one of its tributaries, Spring Creek (Caywood and Spicer 1935; Mindeleff 1896). Among these late pueblos are the Oak Creek/Atkeson, Sugarloaf/Otten, Big Cornville, Sheepshead, Limestone/Iron Rock/Page Springs, and Spring Creek Ruins. Using the three 7.5-minute quadrangle maps that encompass Oak Creek from Sedona on the north to its confluence with the Verde River on the south (Sedona, Page Springs, and Cornville 7.5-minute quadrangle topographic maps), we conducted a site-file search to gain perspective on the ranges of site types and temporal periods already encountered. These results were presented in Chapter 3, Volume 1 of this report. We quickly learned that sites with components assigned to the Squaw Peak, Hackberry, and Cloverleaf phases are relatively rare in this portion of the MVRV and that sites inferred to have resulted from early Yavapai or Apache land-use practices are often assigned on meager evidence.

We also knew that this portion of the MVRV had long been considered part of the "Verde uplands" (see Colton 1946:304, 1960:74; Pilles 1981b:6, 1996a:59), which presumably was separated from the "Verde lowlands" by an unoccupied and infrequently used environmental zone. Colton (1946:304) was the first to suggest that upland and lowland zones supported two different Formative period populations—the Southern Sinagua in upland locations above 4,500 feet (1,372 m) AMSL and the Hohokam in the lowlands below 3,500 feet (1,067 m) AMSL. Differences in house forms, the presence or absence of public architecture (e.g., ball courts and mounds), mortuary customs, utility and trade pottery, and other material evidence suggested to him that two different pottery-producing groups occupied the MVRV from the time that pottery was first manufactured in the MVRV until the time that masonry pueblos appeared in the lowlands. Colton associated upland sites with plain brown ware pottery with Southern Sinagua populations and lowland sites with plain buff ware with Hohokam populations. Because of significant differences in annual rainfall, temperature, and access to perennial streams across the valley, Colton assumed that upland farmers used dry farming techniques, and lowland farmers used irrigation canals and ditches to raise crops. These environmental differences, then, formed the basis for contrasting subsistence, settlement, and land-use patterns.

To evaluate Colton's informal upland-lowland model of settlement in the MVRV, which has been taken up in modified form by Pilles (1981a, 1996a), we determined to create a GIS-compatible archaeological landscape database that would include the entire MVRV. We worked with Pilles to establish an expanded study area that would encompassed the MVRV. Instead of establishing an elevational or topographic boundary, we simply used the 18 USGS topographic maps that included the MVRV.[1] We developed a series of GIS-compatible archaeological and environmental databases, compiled intermittently over a period of about 10 years, that would allow us to (1) observe the patterns of settlement and land-use through time; (2) characterize what we currently know about settlement; (3) compare temporal patterns of land use to the distributions of important environmental variables, including elevation, site settings, arable land, agave land, streams, and springs; (4) correlate contemporary trends and extremes in reconstructed local climate and Verde River stream flow; and (5) contribute to long-standing discussions about settlement in the MVRV. Among those discussions are questions concerning when agriculture began in the MVRV, whether two or more distinct cultural groups coexisted in the MVRV during the Formative period, whether immigration or aggregation of the existing population in the MVRV contributed to the newly configured settlements of the late Honanki and Tuzigoot phases, and what factors influenced the development of recognizable communities in MVRV.

The ultimate goal of this chapter is to shed light on the history of settlement and land-use patterns in our LOCAP study area[2] (Figure 8). We do this by first examining settlement patterns at the larger scale of the MVRV, characterizing subsistence and settlement per temporal phase with currently available data and examining trends through time. Thereafter, we examine the LOCAP study area and describe its land-use history relative to the evolving narrative for the MVRV as a whole.

The MVRV Archaeological Landscape Database

Data Sources

The creation of the MVRV Archaeological Landscape Database (ALD) was a cooperative effort between SRI and the U.S. Forest Service (USFS). As the lead agency for compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), the USFS played a critical role in selecting the area for study, supplying us with archaeological and environmental data, and directing our research. The MVRV ALD contains numerous data layers, each derived independently for different purposes. We formatted our archaeological site layer (i.e., a database with georeferenced site locations that could be displayed in a GIS) along the lines developed in archaeological site-file books maintained by the CNF for the Sedona and Beaver Creek Ranger Districts. We initially acquired those records in digital form in 2000 and formatted them in a Microsoft Access database. In 2005, we examined maps and paper records stored in Prescott for PNF and added those data to our database. In 2008 and 2009, we added site information gleaned from available site reports, ASM and MNA site records, and AZSITE and CNF spatial-database and attribute files. We also added recent site-location and attribute data assembled by members the VVAS who were conducting survey in the Hackberry Basin under the supervision of Dr. David R. Wilcox, senior research archaeologist at MNA at the time of inquiry.

The MVRV study area, as depicted in Figure 8, encompasses an area of 285,674 hectares, or 2,857 km^2 (705,892 acres, or 1,103 square miles). As of 2007, we estimate that between 8 and 9 percent of that total area had been inventoried for archaeological remains[3] (Figure 9). Archaeological survey-coverage data acquired from the CNF indicated that 10,903 ha (26,942 acres) of land were surveyed as full-coverage blocks, and perhaps as much as

[1] The MVRV is the topographic basin surrounding the middle reach of the Verde River. As defined for this study, the MVRV is separated from the upper Verde River valley at the confluence, above Clarkdale, of Sycamore Creek and the Verde River and is separated from the lower Verde River valley at the confluence of the East Verde and Verde Rivers. The 18 7.5-minute USGS quadrangle maps were presented in Chapter 2, Volume 1 of this report (project setting). From north to south and east to west, they are the Sycamore Basin, Loy Butte, Wilson Mountain, Munds Park, Clarkdale, Page Springs, Sedona, Munds Mountain, Cottonwood, Cornville, Lake Montezuma, Casner Butter, Middle Verde, Camp Verde, Walker Mountain, Horner Mountain, Hackberry Mountain, and Verde Hot Springs quadrangle maps.

[2] The LOCAP study area is a 3-quadrangle-map subset of the 18-quadrangle-map MVRV study area. It comprises the Sedona, Cornville, and Page Springs 7.5-minute USGS quadrangle maps.

[3] The U.S. Department of the Interior National Park Service (NPS) has surveyed Montezuma Castle National Monument (MOCA)—including its outlying unit, Montezuma Well—and Tuzigoot National Monument. Neither of those surveys, however, was indicated in the CNF data layer for survey in the MVRV when we prepared this chapter in 2011.

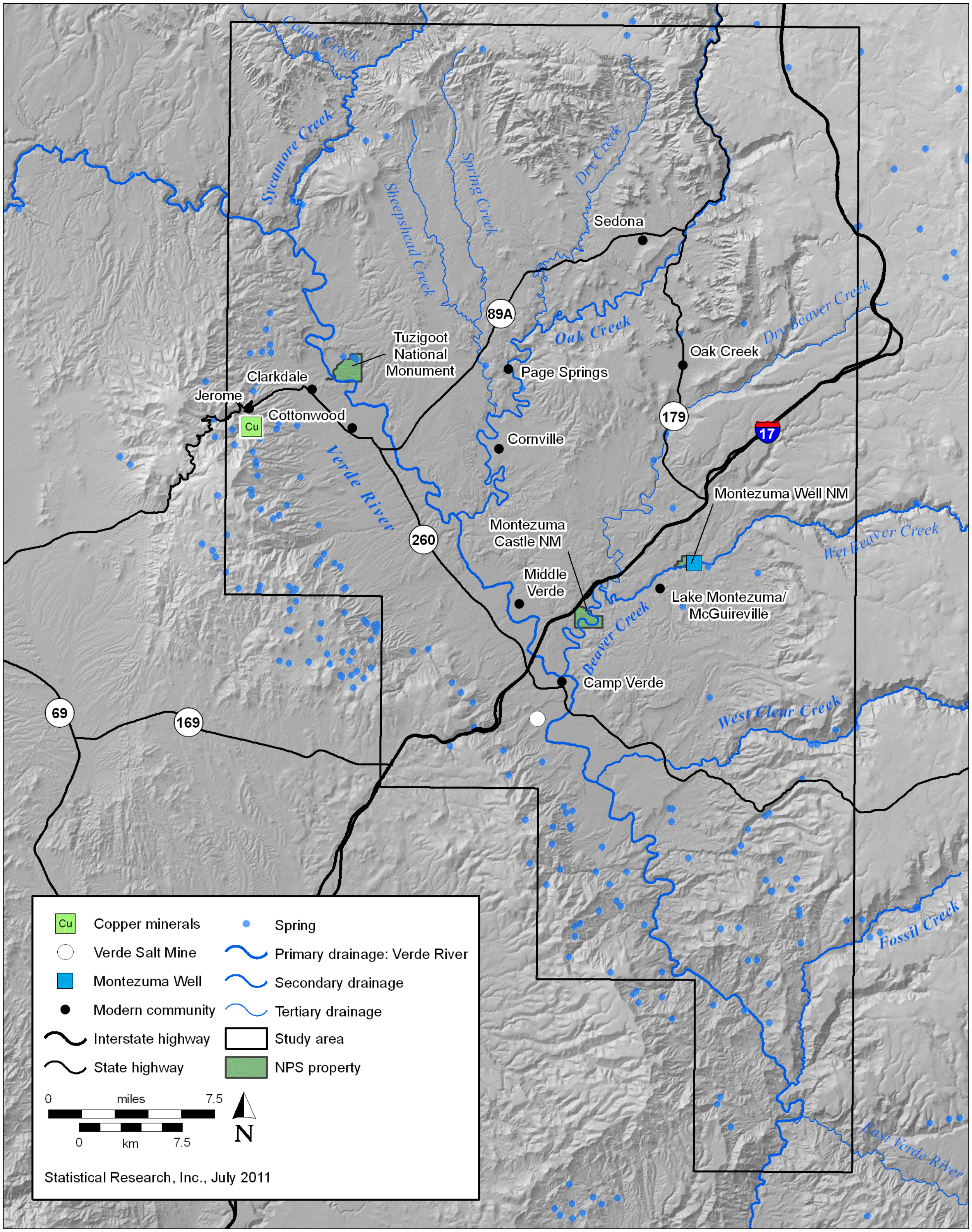

Figure 8. Map of the middle Verde River valley of north-central Arizona, showing the location of the study area.

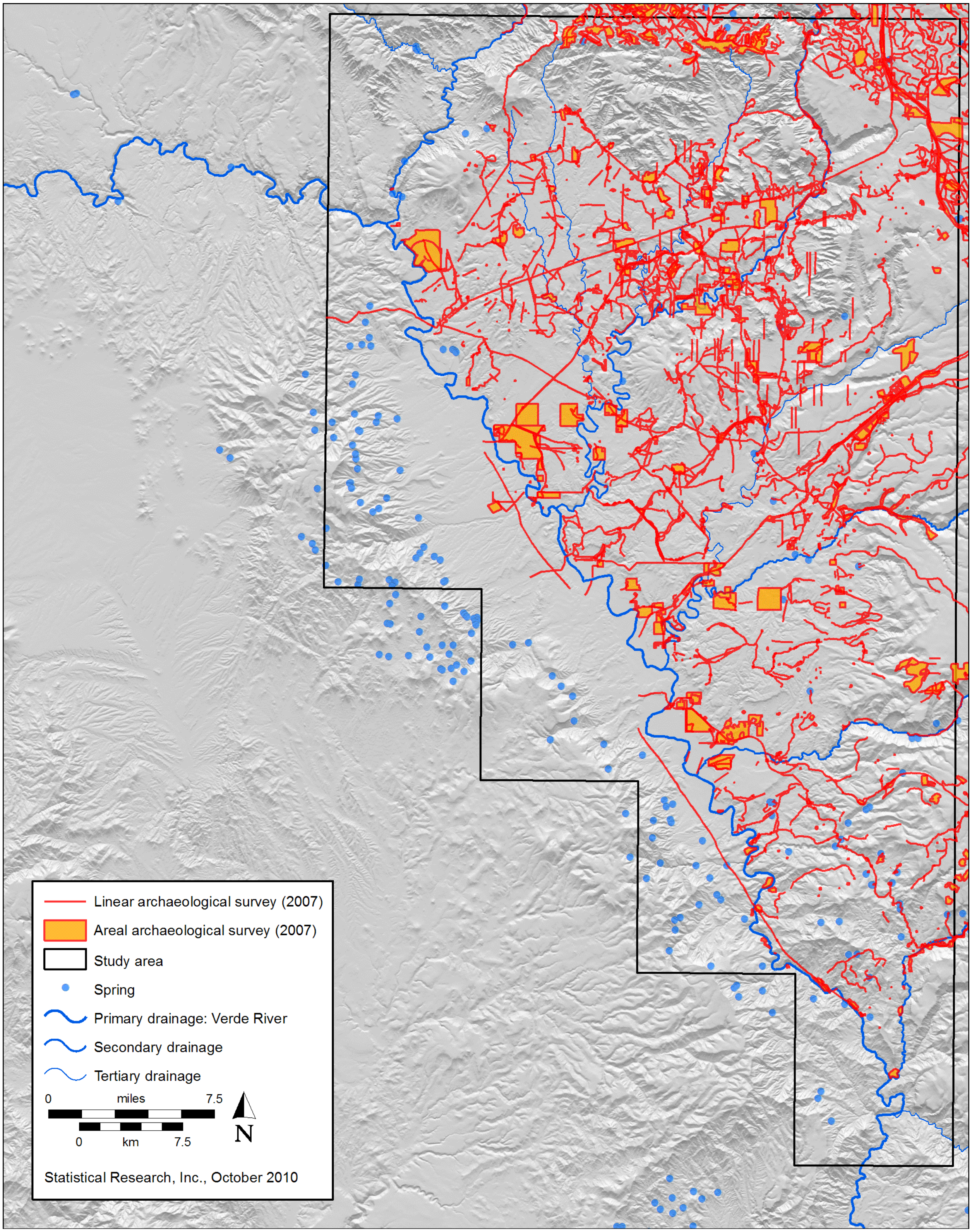

Figure 9. Map of archaeological-survey coverage in the middle Verde River valley.

13,558 ha (33,502 acres) were surveyed in linear transects. Most of those surveys took place on the eastern and northern sides of the Verde River, on state and federal lands. Few archaeological surveys took place on the western and southern sides of the Verde River. As a result, our knowledge of settlement and landscape use is biased in favor of the largest surface sites (sites with 35 or more rooms) throughout the MVRV and locations east and north of the Verde River. Surveys that have taken place since 2007 are not displayed on this map, including the intensive survey in the Hackberry Basin, in the southwestern portion of our study area.

As of the spring of 2008, the archaeological site layer included information on 2,565 individual sites, many of which are multicomponent and characterized in only minimal detail. Of the 2,565 sites, we were unable to acquire or assign Universal Transverse Mercator (UTM) coordinates to 222 sites. In some cases, UTM coordinates were given to us by archaeologists at CNF and PNF. In other cases, we acquired that information from online AZSITE records and from ASM and MNA site cards. In yet other cases, we assigned UTM coordinates with the help on a Web-based program, TopoZone (http://www.TopoZone.com, accessed March 2, 2012).[4] Site locations plotted on 7.5-minute quadrangle maps were used to assign UTM northings and eastings from the site's center ("site centroids"). Eventually, we derived a Microsoft Access database consisting of 2,343 sites that could be used as an archaeological data layer in a GIS-coordinated analysis of site-location and settlement patterning. All UTM information has been projected using the 1927 North American Datum. We used ESRI ArcGIS 9.2 to conduct our analyses.

Other data layers in the MVRV ALD are currently as follows: (1) digital elevational models (DEMs) of the 18 7.5-minute quadrangles, joined as a single topographic base map; (2) rivers, streams, and modern roads, depicted as digital line graphs; (3) all known springs, depicted as points, as recorded by the USGS Geographic Names Information System (http://geonames.usgs.gov, accessed March 2, 2012); (4) TES units of CNF and PNF (Miller et al. 1995; Robertson et al. 2000), depicted as polygons; and (5) soils mapped by the NRCS Soil Survey Office in Flagstaff for select areas in the MVRV, from their soil survey of the Black Hills–Sedona area (Lindsay n.d.), depicted as polygons. The TES data take the form of polygons overlaid on 7.5-minute DEMs that distinguish distinctive ecosystem units. Each unit represents a unique set of landforms, soils, slopes, aspects, climate characteristics, plants, and management challenges. The Flagstaff NRCS Soil Survey allowed us to copy its interim report and soil maps, but it has not yet digitized those soil-map locations. Consequently, we digitized the NRCS data and linked them to tables that the senior author created, to display the information in a GIS environment. Collectively, the five environmental data layers and the single archaeological layer were displayed and analyzed in various combinations with GIS technology, to explore settlement patterns in the MVRV. New layers derived from various GIS queries and data classifications are elements of the overall GIS-project files. The senior author developed Appendix B, which is a series of lookup tables summarizing these data. SRI Soil Scientist Jeffrey Homburg contributed to the study by evaluating each map unit for its potential to successfully produce crops through either irrigation-type or runoff-type agriculture.

[4] The Web-based program TopoZone ceased operation early in 2008. The program was taken over by another Web-based company, Trails.com, but Trails.com no longer uses many of the routines that were part of the TopoZone program. We are aware that the accuracy of the TopoZone UTM coordinates is equivalent to that of the coordinates captured by recreational-grade Global Positioning System (GPS) units rather than professional survey-grade GPS units. We took that lower-spatial-resolution issue into consideration when we designed our GIS-based explorations and analyses.

Archaeological Site Layer

The MVRV ALD contains a wealth of information on the archaeological and historical remains of the MVRV. Although all 2,343 sites can be plotted with UTM coordinates, not every site has been assigned to a cultural tradition, temporal phase, or inferred function; the presence or absence of features or diagnostic artifacts largely determined this outcome. Further, the distribution of archaeological surveys is uneven, with considerably more coverage in CNF than in PNF. Nevertheless, the database is sufficiently large and information-rich to describe chronological trends in settlement, suggest the existence of communities and their territories on the basis of settlement clusters, and, for about half the 2,343 sites, estimate room counts for sites of various types and sizes. We did not modify the field entries contained in the CNF-site-file Microsoft Excel spreadsheets unless we were sure that an entry was incorrect. In a few instances, however, we had access to recent published reports that revised room counts for late sites (e.g., Wilcox and Homlund 2007; Wilcox et al. 2001a), and we updated the database with that information.

Arable-Land Data Layers

To depict the distribution of potentially arable land in the MVRV, we needed to acquire soil maps and associated data. We wanted to know where distinctive soils of variable quality were mapped on the MVRV landscape, in order to classify them according to their potential to successfully raise crops with either irrigation- or runoff-farming techniques. Within the class of irrigation agriculture, we included stream- and spring-fed canal-and-ditch systems, but we also assumed that overbank floodwater and high-water-table farming at the margins of floodplains were possible. Within the class of runoff agriculture, we included farming systems in which surface gradients could have been modified through the construction of terraces, grids, rock piles, brush diversions, and other features to slow rainfall runoff, as well as the flow of seasonal streams, in order to direct and maintain available moisture for crop production.

Fortunately for us, large-scale ecological surveys undertaken for the CNF and PNF and several smaller-scale soil surveys undertaken by soil scientists of the Flagstaff NRCS office were available (Miller et al. 1995; Robertson et al. 2000). The USFS TES surveys were available to us as digitized data sets.[5] The NRCS maps were not digitized when we needed them, but we were able to digitize maps for most of the private land that had not been captured during the USFS TES (Lindsay n.d.). Although we did not use all of the many attributes associated with each TES map unit, we considered many of them in evaluating agricultural potential.

The CNF TES included 136 unique map units; of those, 56 units are located in our 18-quadrangle, expanded study area. The PNF TES inventory included 151 unique map units; 72 of those are located in our 18-quadrangle, expanded study area. All of the 40 NRCS map units described by Lindsay (n.d.) are located in the MVRV. Most portions of the MVRV were inventoried by only one of these survey teams; USFS ecologists classified lands under its management and the NRCS-mapped private lands and other federal lands (e.g., Montezuma Well National Monument, managed by the NPS), as required. In a few locales, however, there was overlap between the NRCS and USFS surveys. Because we were primarily interested in modeling agricultural potential, we gave priority to NRCS soil descriptions when overlap situations were encountered. Few overlaps occurred between the two national forests, but when different agricultural-potential values were assigned to two TES units that obviously represented the same location, we gave priority to the better-documented, and usually the higher-agricultural-potential, location.

With these data and inferences concerning agricultural potential, we were able to create two agricultural-potential data layers—one for irrigation-type agriculture and another for runoff-type agriculture (Figures 10 and 11). Because we know that natural landscapes change over time, and important changes to the Verde River and its tributaries have been documented (e.g., Fish and Fish 1977:10; Whittlesey and Ciolek-Torrello 1998), our estimates of agricultural land available to precontact populations were necessarily approximate. That is particularly true of estimates of irrigable land from perennial streams in the MVRV. The absence of beavers and beaver dams that naturally slowed the flow of streams, the cumulative effects of extreme floods that removed and redeposited alluvial deposits in floodplains, and overall river entrenchment have altered the distributions of sediments and soils along drainages. Examination of the data layers produced here, however, suggested that contemporary soils and landforms provide a reasonable model for the location and relative abundance of arable land during the last two millennia.

Agave-Land Data Layer

Archaeologists have long known that agave was used to manufacture sandals, cordage, textiles, and containers in the MVRV (Dixon 1956; Kent 1954). In the last 20 years or so, charred agave has been recovered from *hornos* (earth ovens) and other contexts at excavated archaeological sites in the MVRV (e.g., Hallock 1984; Logan and Horton 1996), indicating that agave was also used as food. Within the last few years, botanist Wendy Hodgson of the Desert Botanical Garden in Phoenix, Arizona, has identified four cultivated agave species in the MVRV (Hodgson 2007; Hodgson n.d.) that she believes were brought to the valley from elsewhere in precontact times. These four include *Agave delamateri* (the Tonto Basin agave), *Agave phillipsiana* (Phillips agave), and two new species that have not yet received their scientific names—Sacred Mountain agave and Page Springs agave (Table 24). Hodgson (personal communication 2010) (but see Hodgson and Salywon [2013] where officinal genus names are reported: *Agave verdensis* for Sacred Mountain agave and *Agave yavapaiensis* for Page Springs agave) also suspects that two native species of agave growing in the MVRV—*Agave parryi* (Parry's agave) and *Agave chrysantha* (Golden-flowered agave)—were encouraged species. Another cultivated agave, *Agave murpheyi* (Murphey's agave), which has been found elsewhere in central and southern Arizona, may exist in lower-elevational settings of the MVRV.

Two of the most interesting characteristics of these domesticated agave species are that they send up their flowering stalks at different times of the calendar year, and agaves of the same species that mature in a single stand tend to flower at about the same time. In addition, various species thrive at different elevational ranges. Despite that

[5] The USFS conducts TESs on individual forest reserves in the United States. TESs were designed for a variety of uses and resource-management applications. A TES consists "of mapping and interpreting ecosystems through a systematic examination, description, classification, and integration [gradient analysis] of the primary ecosystem components [soil/vegetation/climate]" and "places a major emphasis on recognizing the relationships that exist" among soils, vegetation, and climate, "which, in turn, define terrestrial [ecosystems and] ecological map units" (Robertson et al. 2000:Foreword). That emphasis requires geological, soil, vegetation, erosion, and production data, etc., be collected and recorded simultaneously in the field. Consequently, a TES is distinguishable from traditional soil survey, botanical surveys, or most other integrated inventories.

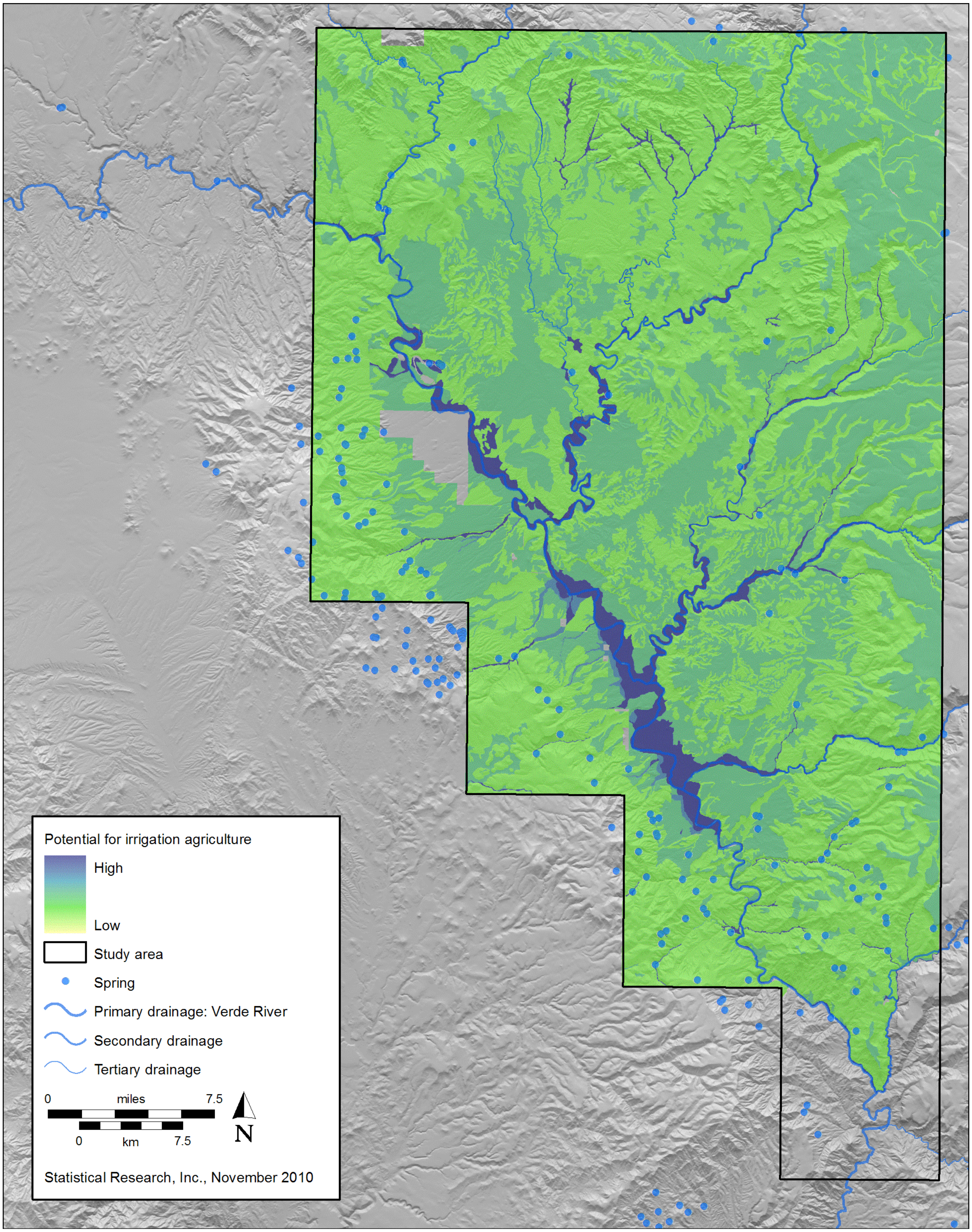

Figure 10. Model of the irrigation-agricultural landscape in the middle Verde River valley.

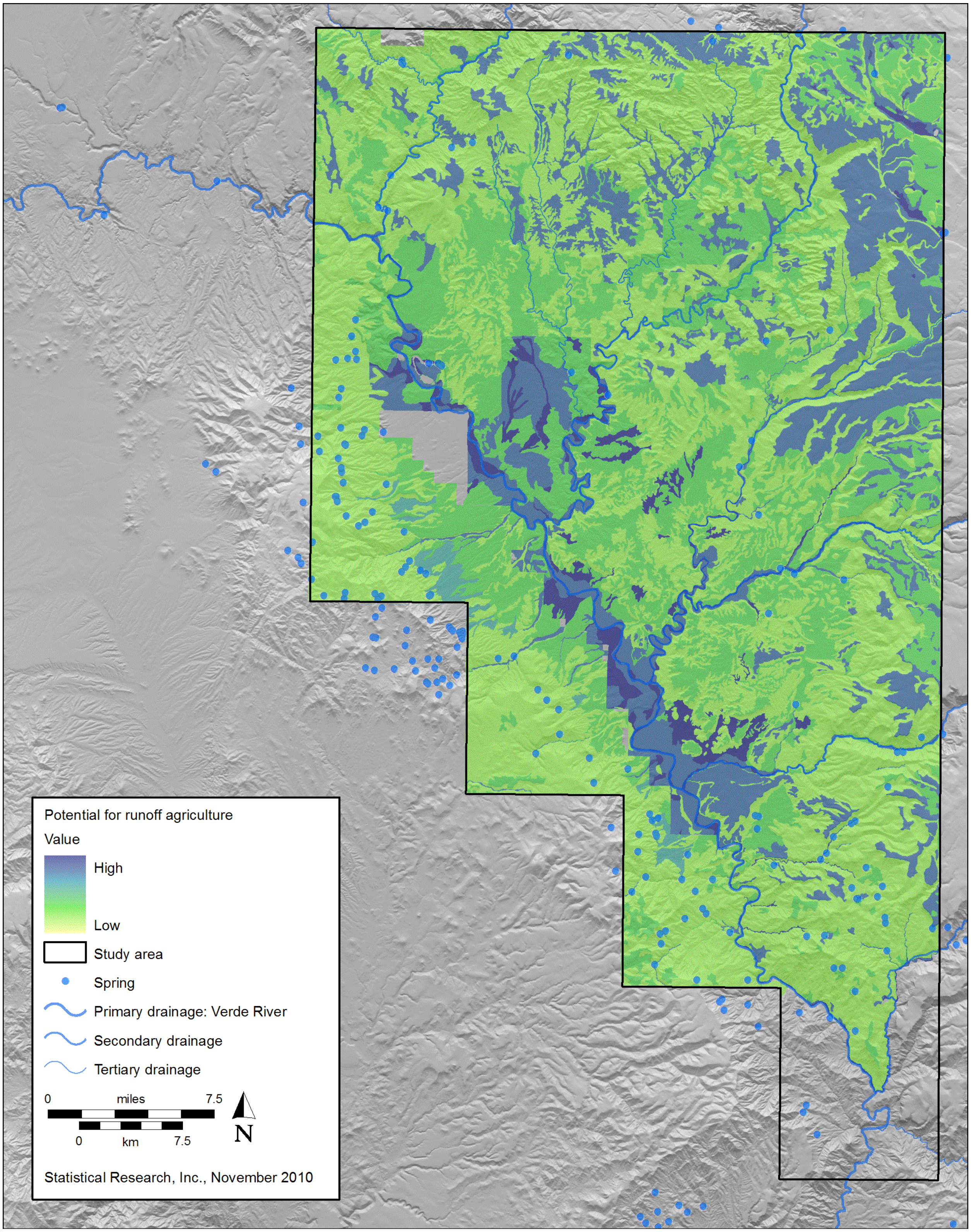

Figure 11. Model of the runoff-agricultural landscape in the middle Verde River valley.

Table 24. Cultivated Agaves in the MVRV

Agave	Status	Location	Elevation Range	When Harvested
Agave murpheyi	introduced to the MVRV from elsewhere; may be a result of crossing *A. angustifolia* and *A. palmeri*	Located in archaeological features, including linear basalt-cobble alignments and rock piles, and on naturally occurring terraces, low ridges, or *bajadas* along Tonto Creek and Salt Verde River in Tonto, Phoenix, Tucson, and Safford basins, among other locations. A Hohokam/Salado association is established.	400–1,000 m in central Arizona	unlike all these other agaves, flowers in late fall
A. delamateri	introduced to the MVRV from elsewhere, including Sierra Anchas, Globe, Coolidge Dam, Tonto Basin, and northern Mexico	Located on basalt slopes or ridgetops or hills, often overlooking water (piñon-juniper woodlands and alluvial terraces). Found at 23 sites in the MVRV located south of Sedona, near Page Springs, in the Tuzigoot area near Pecks Lake, at Camp Verde (Wingfield Mesa and West Clear Creek), and at Sacred Mountain. A very big stand has been recorded that overlooks Oak Creek, northeast of Page Springs, where hundreds of *A. delamateri* grow in association with Sacred Mountain agave and *A. phillipsiana* plants.	700–1,550 m	flowers early July to mid-August
A. phillipsiana	introduced to the MVRV from elsewhere; also found in Tonto Basin, the Hassayampa River area south of Prescott, Sedona, and the Grand Canyon	Some 16–19 sites known at present, including 3 in the Grand Canyon; 10 sites in the MVRV, including stands near Tuzigoot, Page Springs, Sacred Mountain, and the Sedona area (Palatki and Enchanted Resort). *A. phillipsiana* grows with other pre-Columbian agave cultivars, including the Oak Creek/Page Springs plot and near the Sacred Mountain site. Grows near archaeological features.	730–1,430 m	flowers August through mid-September
Page Springs agave (a hybrid of local species and cultivated agave)	endemic to the MVRV (possibly a "signature plant" of the MVRV); may be a cross of *A. chrysantha* with another agave	Located on basaltic soils in dry, exposed ridges overlooking Oak Creek, the Verde River, and West Clear Creek (and Dry Beaver?). Documented at only 10 sites to date, especially near Page Springs, the Sacred Mountain site and the Oak Creek site.	900–1,200 m	flowers in July
Sacred Mountain agave (a hybrid of local species and cultivated agave)	endemic to the MVRV (possibly a "signature plant" of the MVRV); may be a cross of *A. delamateri* and *A. chrysantha*	Located on basaltic soils on ridgetops. Documented at 43 locations to date, including near Montezuma Castle and Well, West Clear Creek, the Sacred Mountain site, the Mindeleff Cavate Lodge site, and the Page Spring and Camp Verde areas. Sacred Mountain agave, along with *A. delamateri, A. phillipsiana,* and perhaps *A. parryi* and *A. chrysantha,* were grown on the more arid slopes and ridgelines near the Sacred Mountain agricultural complex.	1,050–1,350 m	flowers mid-June through July

Key: MVRV = middle Verde River valley.

fact, several species of cultivated and native agaves have been found together at given locales (Hodgson n.d.:19). Hodgson found two domesticated species of agave—Page Springs agave and Tonto Basin agave—growing together near Wet Beaver Creek. Near Sacred Mountain Ruin, on hills surrounding Sacred Mountain, she found Sacred Mountain agave. East of that location, on higher slopes, she identified Tonto Basin agave, Sacred Mountain agave, and Golden-flowered agave growing together. Near Mindeleff's Cavate Lodge Group, Hodgson located Sacred Mountain agave, Tonto Basin agave, and Golden-flowered agave along what appears to be a precontact footpath. Across the valley, she found two species of cultivated agave—Page Springs agave and Phillips agave—near the modern community of Page Springs. Not far away, in a location above Oak Creek, Hodgson found an extremely dense stand of Tonto Basin agave intermingled with Phillips agave and Page Springs agave.

Hodgson's discoveries strongly suggest that precontact populations planted those species. So high were the food and fiber (and beverage?) values of agave that certain species—such as Tonto Basin and Phillips agaves—were carried along by migrants or traders and established in favorable locations, often near human settlements. The newly identified Page Springs and Sacred Mountain agaves may have been developed in the Verde River valley and exported to other locations. Alternatively, the cultivation of small and more easily processed, palatable agaves may have been critical food resources for local groups. Similarly, cultivation of an agave with tender leaves or longer fibers might have been particularly desirable, for a source of textiles and cordage. The facts that agaves of the same species will mature at the same time and that various species mature at different times, suggest that human cultivators deliberately selected plants for maturation times that reduced any potential labor-scheduling conflicts and facilitated the harvesting of multiple plants from the same stand.

Because of the increasing interest in this economically valuable plant, we wanted to depict the locations of the TES units in which agave grows. That information is included in the description of each TES map unit, and it was simply a matter of creating a "look-up" table to display the units in a separate agave data layer (Figure 12). Within the CNF TES, 13 of 136 map units were recorded as containing agave (Miller et al. 1995). Within PNF, 31 of 151 map units contain agave (Robertson et al. 2000). Although specific trees, shrubs, forbs, and grasses were not recorded in the same detail by the NRCS soil survey (Lindsay n.d.), we were able to identify 6 map units that typically contain agave. That information was gleaned from official descriptions of the soil series maintained by the NRCS (see Appendix B). The combined list of map units containing or likely to contain agave was used to create an agave data layer.

Initial Queries of the MVRV ALD

Temporal Components

The MVRV ALD contains records of variable quality for 2,343 sites. Of those, only 1,407 site records (60 percent) contain information that allowed us to assign each site to one or more temporal categories; we lacked temporal information for 936 sites. Table 25 lists the total number of sites by temporal component and indicates which of the sites have been investigated through excavation, testing, or intensive recording and mapping. It is important to note here, however, that not every component in a multicomponent site was equally well represented or investigated. As a result, Table 25 is best viewed as a general summary of those time periods that have received the most attention. Records in the database indicated that 154 (7 percent) of the 2,343 sites have been excavated, in whole or in part, or otherwise investigated in response to NHPA Section 106–compliance projects or academic research. Not surprisingly, more sites dating to the Formative period Southern Sinagua sequence have been investigated than sites from any other time period. Written reports of those investigations are often, but not always, available as limited-distribution publications or unpublished manuscripts on file at the CNF supervisor's office, the MNA, the ASM, and university libraries.

Of the 2,343 georeferenced sites in the MVRV ALD, some 939 include unknown numbers of temporal components. Flaked-stone-artifact scatters without diagnostic artifacts account for most of those. Table 26 lists the numbers of components associated with the 2,343 sites. Although archaeologists occasionally have recorded surface artifact scatters with more than three components, sites with more than three components are recognized primarily after excavation. This component-number pattern suggests that investigation of sites through excavation will result in the identification of many more sites with long histories of occupation or visitation.

Feature Types

The features types recorded in the MVRV ALD are those recorded by CNF in its site-file books for the Sedona and Beaver Creek Ranger Districts. Table 27 lists the feature types associated with our 2,343 sites. Many sites contain more than one feature type. For example, a site might be classified as a pueblo but also have petroglyphs and evidence of a plaza. Similarly, a site may be classified as a rock-art site with either petroglyphs or pictographs, or both. Some

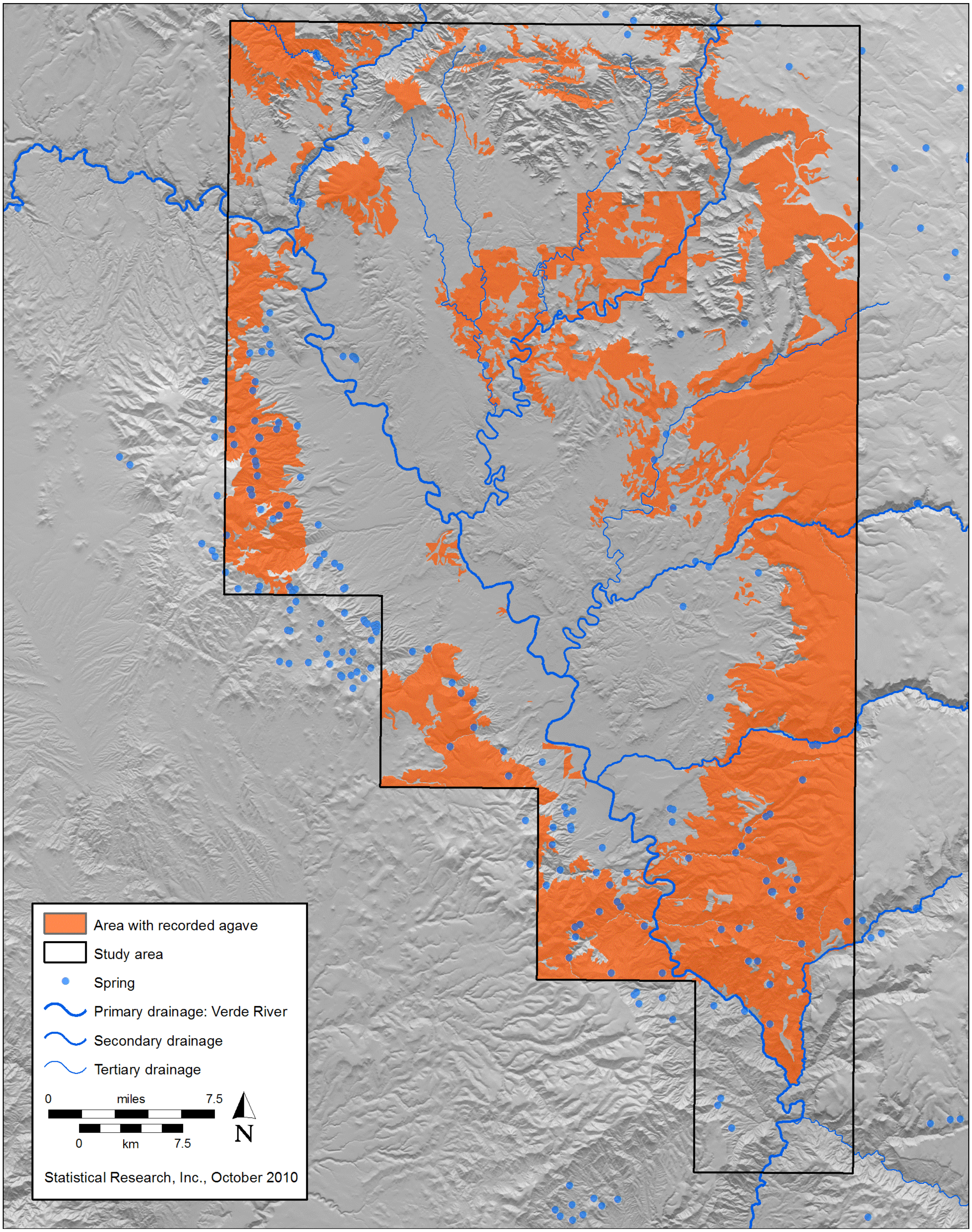

Figure 12. Model of the agave-growing landscape in the middle Verde River valley.

Table 25. Numbers of Excavated and Unexcavated Components in the MVRV ALD Dating to Recorded Temporal Periods

Temporal Phase, by Period	Excavated[a]	Unexcavated	Total[b]
Paleoindian	—	3	3
Archaic (sites containing any Archaic period components, plus sites identified only as Archaic or "Archaic?" period)	38	101	139
Early Archaic	—	1	1
Middle Archaic	—	3	3
Late Archaic/Dry Creek phase	27	60	87
Early Formative (Squaw Peak phase)	8	8	16
Formative (sites containing all Southern Sinagua phases plus sites identified only as Formative period)	103	1,449	1,552
Hackberry phase	6	10	16
Cloverleaf phase	12	97	109
Camp Verde phase	26	218	244
Honanki phase	45	605	650
Tuzigoot phase	39	326	365
Protohistoric (suspected Yavapai or Apache)	18	116	134
Historical	18	255	273
Total number of sites (many with multiple components)	154	2,189	2,343

Key: ALD = Archaeological Landscape Database; MVRV = middle Verde River valley.

[a] The word "excavated," as used here, includes sites that were investigated through detailed recording, surface collection, and test-excavation units, as well as more intense excavation and data recovery.

[b] In a few cases, additional components of the 2,343 sites have been isolated since the MVRV ALD was created.

Table 26. Temporal Components per Site in the MVRV ALD

No. of Temporal Components per Site	No. of Sites
No data, "NA," or unknown	939
1 component	932
2 components	426
3 components	36
4 components	7
≥5 components	3
Total number of sites (many with multiple components)	2,343

Key: ALD = Archaeological Landscape Database; MVRV = middle Verde River valley.

Table 27. T Features Types at Precontact-Period Sites in the MVRV ALD

Feature Type, by Site Type	Excavated[a] Sites	Unexcavated Sites	Total
Rock-art site	10	148	158
Petroglyph	7	116	123
Pictograph	4	38	42
Agricultural site	20	258	278
Rock pile	9	60	69
Terrace	5	61	66
Check dam	5	32	37
Rock alignment	4	67	71
Waffle garden	1	14	15
Irrigation ditch	1	11	12
Reservoir site	—	1	1
Roasting-pit site	20	120	140
Habitation sites	55	776	831
Field house	18	450	468
Cliff dwelling	6	142	148
Pit house	19	88	107
Pueblo	18	155	173
Fortification site	15	100	115
Public- or integrative-architecture site	7	42	49
Plaza	3	26	29
Kiva	1	6	7
Community room	—	13	13
Compound	—	3	3
Ball court	4	5	9
Quarry and mine site	4	28	32
Clay quarry	—	2	2
Lithic quarry	3	26	29
Salt mine	1	—	1
Burial (site with burial[s])	13	10	23
Total number of sites (many with multiple features)	154	2,189	2,343

Key: ALD = Archaeological Landscape Database; MVRV = middle Verde River valley.

[a] The word “excavated,” as used here, includes sites that were investigated through detailed recording, surface collection, and test-excavation units, as well as more intense excavation and data recovery.

of the feature categories include a variety of features or unspecified features. For example, features usually considered indicators of precontact agricultural practices include rock piles, terraces, check dams, rock alignments, waffle gardens, irrigation ditches, and perhaps other physical manifestations that suggest that farming once took place in a given location. Collectively, they are included under the heading “agricultural features.” Although some entries in the database are clearly inferences waiting to be tested (e.g., the number of sites with kivas, community rooms, and compounds), the database allowed us to plot the locations of sites with these suspected features and to make observations and develop research questions concerning their distribution.

Feature types for post-A.D. 1850 historical-period sites are listed in Table 28. Although we used many of the feature types listed in the 2,343-site MVRV ALD, we took the liberty of grouping some of the features under various classes (e.g., military-related, habitation-related, and mining-related features). Also, although this chapter does not consider historical-period settlement and land use, we present that information to assist future researchers who would like to use the database to locate historical-period features.

Site Size Based on Room Count

A useful field in the CNF site-inventory book is “Room Count.” It allowed Pilles (1996a) to depict the locations of

Table 28. Feature Types at Historical-Period Sites in the MVRV ALD

Feature Type	Excavated[a] Sites	Unexcavated Sites	Total
Artifact scatter (trash)	8	64	72
Campsite	—	13	13
Campsite (official)	—	6	6
Campsite (unofficial)	—	7	7
Community structure	—	24	24
Church	—	1	1
Gas station	—	3	3
Hotel	—	1	1
Power plant	—	1	1
School	—	1	1
Structure, other	—	3	3
Structure, unidentified	—	13	13
Townsite	—	1	1
Erosion control	1	6	7
Grave	—	6	6
Habitation related	5	51	56
Dugout	—	1	1
Habitation/homestead	2	34	36
Outhouse	—	2	2
Ranch	2	9	11
Cattle diversion	—	1	1
Corral	—	4	4
Water tank	1	—	1
Irrigation	1	5	6
Lookout	—	1	1
Military related	1	5	6
Battlefield	—	1	1
Fort or fortified	1	4	5
Mining related	1	15	16
Lime kiln	—	1	1
Mine	—	12	12
Salt bin	—	1	1
Sluice box	1	—	1
Tram foundation	—	1	1
Native American (post-1850)	—	9	9
Rock art	—	7	7
Shrine	—	2	2
Transportation related	—	37	37
Bridge	—	6	6
Historic marker	—	1	1
Road	—	22	22
Railroad	—	7	7
Stage stop	—	1	1
U.S. Forest Service ranger station	—	7	7
Information not available	—	4	4
Total	18	255	273

Key: ALD = Archaeological Landscape Database; MVRV = middle Verde River valley.

sites with more than 20 rooms each in his study of Honanki phase settlement and to suggest a hierarchy of residential sites and related facilities that composed settlement systems during the A.D. 1150–1300 time period. We filled in this field in our MVRV ALD whenever it was empty, but the numbers of rooms were reported elsewhere in the site records or in published reports (e.g., Wilcox and Holmlund 2007; Wilcox et al. 2001b). Based on natural clusters of site-size distributions, we established six size classes for habitation sites (Table 29). When we discuss the site maps showing the distribution of sites per temporal period later in this chapter, we use this classification not only to help us identify the hierarchy of contemporary residential site types but also to suggest whether the smaller sites were seasonal residences associated with larger communities.

Table 29. Site-Size Hierarchy Based on Room-Count Estimates in the MVRV ALD

Site-Size Hierarchy	No. of Sites
No rooms or architecture	1,108
Extremely small (1 or 2 rooms)	871
Very small (3–8 rooms)	237
Small (9–19 rooms)	64
Medium (20–34 rooms)	29
Large (35–69 rooms)	19
Very large (70–99 rooms)	9
Extremely large (100 rooms or more)	6
Total	2,343

Key: ALD = Archaeological Landscape Database; MVRV = middle Verde River valley.

An Updated Cultural History of the MVRV

In this section, we summarize what we know about the history of settlement and land use in the MVRV. These summaries supplement the culture-history descriptions provided in Chapter 3, Volume 1 of this report. We draw on data contained in the MVRV ALD and information contained in published and unpublished reports and manuscripts on file at the CNF supervisor's office in Flagstaff. In order to prepare this section, we reviewed many unpublished or limited-distribution reports and prepared summaries of the most informative projects, by temporal period (see Appendix C). We also redrafted selected figures from many of the limited-distribution and unpublished reports, when they provided examples of architectural variability in pit-structure or pueblo design. Because we needed to understand how LOCAP architectural features compared to those investigated by other researchers, we compiled information on feature dimensions. We present that information in this chapter, knowing that other researchers will find them useful.

Paleoindian Period

Sites or site components are assigned to the Paleoindian period (ca. 10,000–6500 B.C.) when diagnostic spear or dart points associated with this temporal period are encountered. In the MVRV, only one Paleoindian period projectile point form[6]—the fluted-base Clovis form—has been reported to date. Clovis points, both as complete specimens or diagnostic basal fragments, have been recovered from at least five locations in the MVRV (Pilles and Geib 2001) and at least one in the upper Verde River valley (Fish and Fish 1977:11). All but one of these points was recovered on the modern ground surface (MGS). The single exception was recovered during excavations at a multicomponent site (AZ O:1:88 [ASM]) on the Crescent Moon Ranch (Shepard et al. 1998:42–47), located along Oak Creek, not far from Red Rock State Park. Because we recognize that whole points were often collected by precontact-period populations, we cannot be sure that these items were originally deposited in situ, or even elsewhere in the MVRV, during the Paleoindian period. The fact that several Clovis points manufactured from locally available stone have been recovered in the Verde River valley, however, suggests that Paleoindian hunter-gatherers once traversed this landscape.

Two sites with Clovis points are listed in the CNF archaeological-inventory files: AR-03-04-06-515 (CNF) and AR-03-04-06-1121 (CNF). CNF Archaeologist Peter Pilles assigned site number AR-03-04-06-515 (CNF) to an isolated Kaibab-chert Clovis point fragment found near Honanki Pueblo on the MGS during a 1986 training exercise for para-archeologists working on CNF lands. Similarly, Pilles assigned site number AR-03-04-06-1121 (CNF) to an isolated Clovis point (a.k.a. the Strauss Clovis site) recovered near Loy Butte.

A third site in the CNF archaeological-inventory files that produced a Clovis point was AZ O:1:88 (ASM), which also was assigned CNF site number AR-03-04-06-412 (CNF). This third point was recovered from subsurface deposits approximately 90–100 cm below the MGS during site excavations and was described as "a heavily patinated basal fragment." Steven Shackley conducted the energy-dispersive X-ray fluorescence (EDXRF) analysis on the item and determined that it was dacite—a fine-grained volcanic stone—probably obtained from Hardscrabble Mesa, about 38 miles from the site (Shepard et al. 1998:42). The

6 As of 2019, seven Clovis points and point fragments (ca. 13,280–12,600 cal B.P.) have been identified within the MVRV (date noted in Vance 2019).

site from which this Clovis point derived also produced four San Pedro points, four Basketmaker corner-notched points, two flexed burials, and a late overlay of ceramics and other ground and flaked stone artifacts.

Two additional Clovis point basal fragments were recovered from the MGS and reported to CNF (Pilles and Geib 2001:9–12). The first surface find was collected near Verde Valley School by a resident teacher. This point is a white petrified-wood basal fragment that analyst Phil Geib suggested had been heat-treated to improve its flakeability. The second surface find was collected near the Village of Oak Creek by a local resident. It is the basal fragment of a Clovis spear or dart point that was determined by EDXRF to have been manufactured from Government Mountain obsidian. Neither of these points was assigned an archaeological site number.

This brief summary highlights an important point concerning Paleoindian period remains in the MVRV. Because Clovis artifacts are rare and are usually found on the MGS, they normally are not recorded as sites. Rather, Clovis points are treated as IOs and known primarily through word-of-mouth, rather than being recorded in official archaeological site databases. Michael Lyndon (2005) made a compelling argument that even IOs of diagnostic projectile points can yield important information on the distribution of technological and cultural traditions during the Paleoindian, Archaic, and Early Formative periods. Consequently, it is clear that efforts should be made to record the locations of all diagnostic projectile points found as IOs. Preferably, these rare IOs should be assigned site numbers, to facilitate their tracking.

The fact that only a handful of Clovis points have come to the attention of the archaeological community is indicative of their relative rarity on the MGS. Surely, many more have been collected by precontact, historical-period, and modern residents of and visitors to the MVRV. Nevertheless, there is a reasonable chance of finding deeply buried, intact Paleoindian period deposits, although many sites of this ancient period surely have been lost to erosion of floodplain deposits and deflation of non-floodplain surface sediments. Future research on this interesting time period[7] should include a reconstruction of past climate and biotic communities dating to the late Pleistocene and early Holocene, in order to identify likely settings of campsites, kill sites, and quarries that might have been places favored by Paleoindian hunters and their hunting-gathering bands.

7 Research on Paleoindian and Archaic period projectile points recovered from CNF by members of the VVAS is underway. See http://www.youtube.com/playlist?list = PL737C90233C0A 8017 for a video taken at the MNA's Avocational Archaeology Contributions Symposium on October 9, 2010. Dr. Ronald S. Krug made a presentation on the same at that symposium and is working with USFS Archaeologist Peter Pilles on that research. For information on the seven Clovis fragments, see Krug and Pilles (2012).

Archaic Period

Recorded Sites

The MVRV ALD contains records for 139 sites variously classified as Archaic, "Archaic?," Early Archaic, Middle Archaic, or Late Archaic period or Dry Creek phase sites. Of those, 38 sites with Archaic period components (ca. 6500 B.C.–A.D. 1) have been subjected to some form of data recovery, including intensive recording and/or in-field artifact analysis, testing, or excavation.[8] The majority of the 38 sites were inferred to be single-component sites; 12 were buried levels or surface loci of multicomponent sites. Nearly all Archaic period sites identified to date have been found in the open, but at least one known Archaic period occupation took place within a rockshelter (Weaver and Lefthand 1996). Figure 13 depicts the locations of the 92 sites assigned to either the Late Archaic period or the Dry Creek phase.

Assigning Sites to the Archaic Period

Most sites assigned an Archaic period occupation date are classified as such because they lack ceramics and contain Archaic period–style projectile points and/or basin-type manos and metates. The so-called "Dry Creek phase" is often assigned to the Late Archaic period, ca. 2000 or 1500 B.C.–A.D. 1, but many contemporary researchers are reluctant to assign collections like those recovered at the Dry Creek type site (Shutler 1950; Shutler and Adams ca. 1949) to any part of the Archaic period. Archaeologists working in the MVRV are aware that aceramic sites also can represent the remains of special-use locales of later Formative period groups or protohistoric- and early-historical-period groups, such as the Yavapai or Apache. Consequently, the temporal assignment of a site to the Archaic period often is tentative, as sometimes indicated by a question mark. Nonetheless, two sites reported by Weaver (2000) produced radiocarbon dates on buried charcoal recovered from inferred Late Archaic period features. These two sites are the Lost Kitchen site (AZ O:1:33 [ASM]) and the Cross Creek Bridge site (AZ O:1:39 [ASM]), which produced 2σ calibrated date ranges[9] of

8 At least two more sites attributed to the Archaic period—the McKie site (AZ O:5:173/AR-03-09-05-378 [ASM/CNF]) and nearby AZ O:5:143/AR-03-09-05-249 (ASM/CNF)—have been investigated through data recovery (Hall and Elson 2002).

9 Van West calibrated the radiocarbon ages reported by Weaver (2000) using Calib 5.0.1. Although Weaver provided the laboratory names and numbers for those samples, the actual radiocarbon-laboratory reports were not included in the

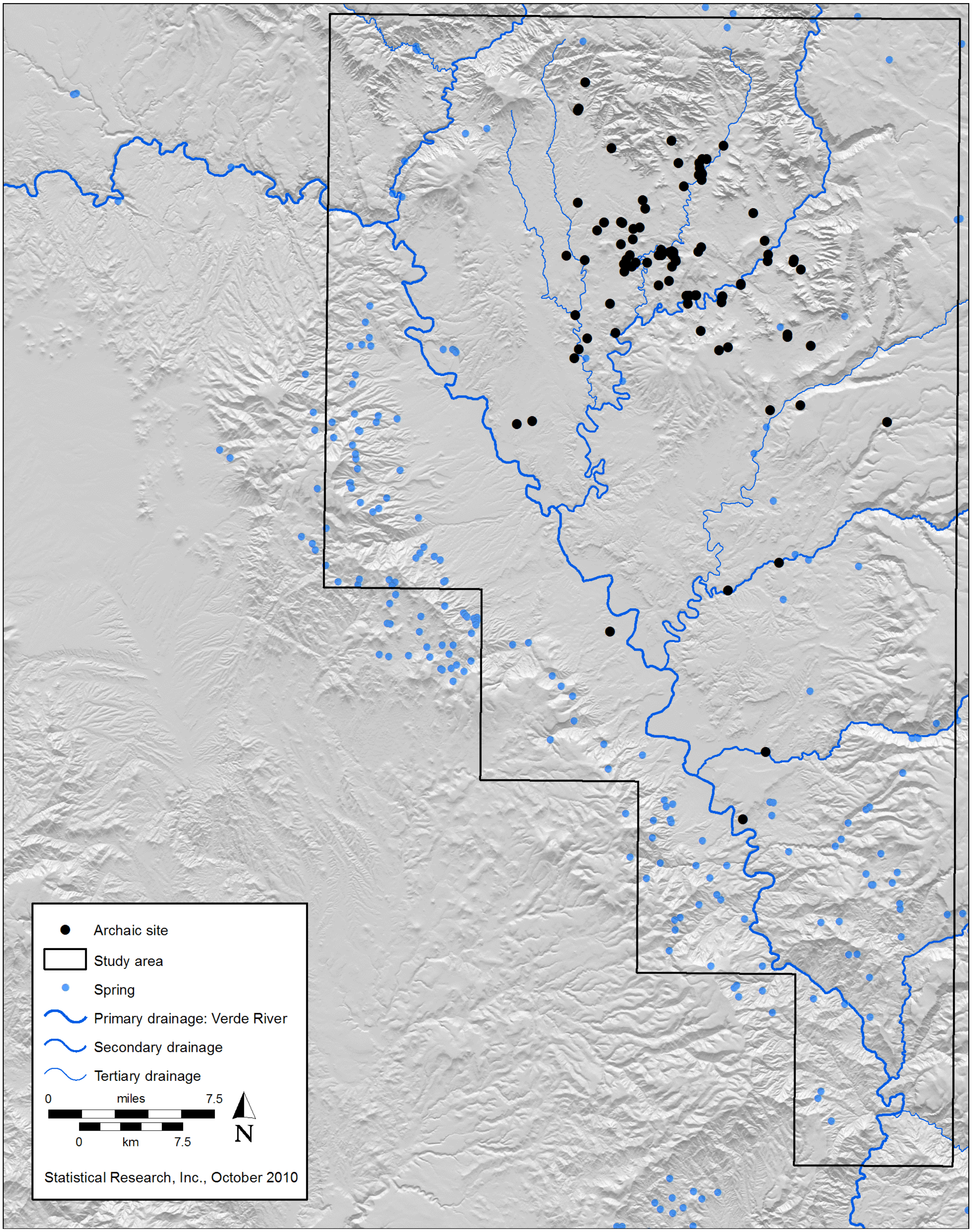

Figure 13. Map showing the locations of Archaic period sites in the middle Verde River valley.

759–400 B.C. and 813–546 B.C., respectively. Undoubtedly, the list of absolutely dated sites of Archaic period age will grow as radiocarbon and other chronometric methods are regularly applied to sites of this time period.

Investigated Sites

SRI's data recovery project along SR 89A between Cottonwood and Sedona was one of at least 12 programs of data recovery that have advanced understanding of the nature of preceramic-period adaptations in the MVRV. Data on features, artifacts, and land-use practices ascribed to the Archaic period are reported for fewer than 20 sites. These include the Dry Creek site (NA5005) (Shutler 1950; Shutler and Adams ca. 1949); the Verde View site (AZ O:5:12 [ASM]) (McGuire 1977); the Smoke Trail site (NA13669) (Etchieson 1977, 1980); the Verde Valley School Road site (NA14450) (Powers 1978); the Marsland site (NA15729) (Dosh and Weaver 1979); Jack's Canyon lithic sites AR-03-04-06-297 (CNF) and AR-03-04-06-306 (CNF) (Bergland 1982); Rancho del Coronado land-exchange sites AZ O:5:19 (NAU) and AZ O:5:22 (NAU) (Graff 1990); Offield land-exchange sites AR-03-04-06-673 (CNF) and AR-03-04-06-674 (CNF) (Horton and Logan 1996); Dusty Cave (AR-03-04-06-481 [CNF]) (Weaver and Lefthand 1996); the Red Rock State Park Full Moon, Lost Kitchen, and Cross Creek Bridge sites (AZ O:1:42 [ASM], AZ O:1:33 [ASM], and AZ O:1:39 [ASM], respectively) (Weaver 2000); and data recovery portions of SR 260 (AR-03-09-05-249 [CNF] and AR-03-09-05-378 [CNF]) (Hall and Elson 2002). Summary descriptions of many of these sites are contained in Appendix C. Pilles and Stein (1981), who prepared an overview of cultural resources in CNF, also cited excavations by Ambler and Sant (1979), Andrews (1981), Powers (1975), and Reid (1975) as examples of data recovery projects that revealed Archaic period remains. More recently, Hall and Elson (2002) discussed the Late Archaic period presence in the MVRV as part of a data recovery project along SR 260.

Features and Artifacts

No habitation structures dating to the long Archaic period have been identified as yet in the MVRV.[10] Archaic period features, however, have been identified. These include hearths and roasting pits and their associated use surfaces, burials—including a flexed human burial without cranial deformation (Deats 2011; Shepard et al. 1998; Weaver 2000:128)—and rock art (Pilles 1994; Zoll 2011).

Outside the MVRV, about 20 miles southwest of Cottonwood and west of the Black Hills, is a large multicomponent site excavated by archaeologists from Soil Systems, Inc. (SSI), during the Stone Ridge Archaeological Project (Leonard and Robinson 2005). SSI archaeologists excavated two Middle to Late Archaic period pit structures (Features 76 and 157) at AZ N:7:286 (ASM), in Prescott Valley (Figure 14; Table 30). Both were squarish in shape and contained informal central hearths, subfloor pits, postholes, and floor artifacts. Radiocarbon assay on charred wood recovered from floor fill (presumably roof or wall materials) yielded two sets of dates for each house. Charred structural wood from Feature 76 yielded two radiocarbon ages, one from the northern half of the feature (Beta-183208) and one from the southern half (Beta-198401). The 2σ calibrated date ranges for Beta-183208 and Beta-198401 were 2140–1770 B.C. and 2470–1970 B.C., respectively. Feature 157 also yielded two radiocarbon ages for charred structural wood on the northern side (Beta-188006) and southern side (Beta-198402) of the house. The 2σ calibrated date ranges for Beta-188006 and Beta-198402 were 2130–1760 B.C. and 2450–1940 B.C., respectively. Given the great similarities in house morphology, content, and radiocarbon ages, we suggest that both of these structures were constructed sometime between 2100 and 1800 B.C. and represent the oldest documented residences in this portion of central Arizona.

Artifacts typically associated with the pre-agricultural Archaic period include basin-type "metates" and one-handed "manos," as well as a variety of unifacially and bifacially flaked "formal" stone tools, including tools used for scraping, graving, planing, cutting, notching, and puncturing tasks. Archaic period metates are nether grinding stones often fashioned from sandstone slabs. The manos are naturally round or oval cobbles used as hand stones with a nether stone to grind seeds, nuts, pigments, and other materials. Manos generally are modified basalt or sandstone cobbles, although a few limestone manos have been reported. Flaked stone tools are made from a variety of locally available raw materials, including Kaibab chert, quartzite, fossilized sponge, fine-grained basalt, and other igneous rock, as well as obsidian believed to be imported from sources outside the MVRV. At least one archaeologist (Bergland 1982) has suggested that Archaic period groups used heat-treating to improve the quality of flaked stone tools, and other archaeologists (Dosh and Weaver 1979) have suggested that some Archaic period hunter groups practiced basal grinding of their projectile points. The diagnostic projectile point types of the long Archaic period in the MVRV are listed in Table 31.

published report. Seemingly, Weaver subtracted the reported radiocarbon ages from A.D. 1950 and retained the standard deviation.

[10] Deats (2011) described three features (Features 22, 28, and 29) at the Gray Fox Ridge Site (AZ N:4:110 [ASM]) that he assigned to the Late Archaic period, which he dated from ca. 2000 B.C. to A.D. 500. We discuss these features in our discussion of the Squaw Peak phase.

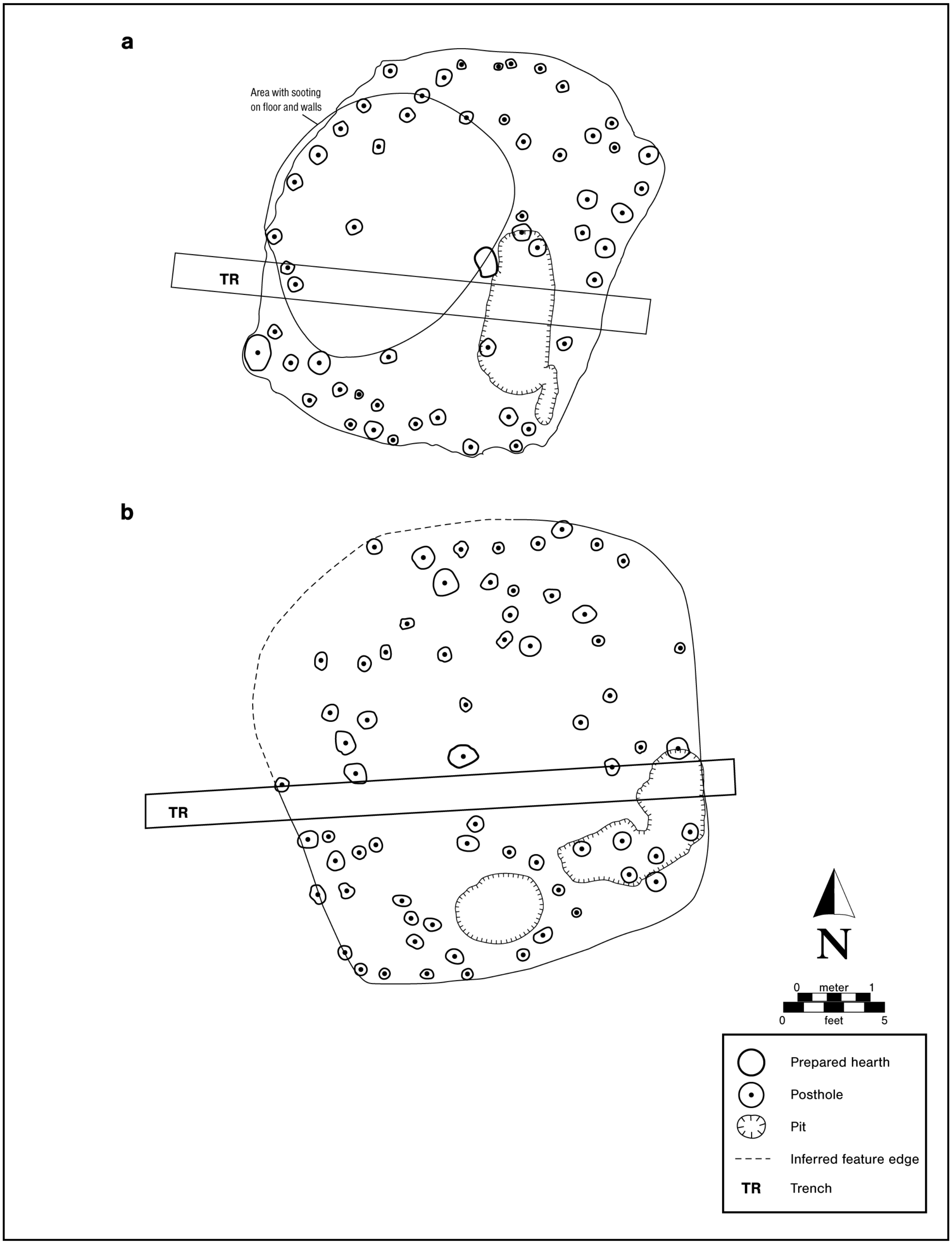

Figure 14. Sketches of two Archaic period pit structures at AZ N:7:286 (ASM) in Prescott, Arizona: (*a*) Feature 76 (Leonard and Robinson 2005:Figure 5.25) and (*b*) Feature 157 (Leonard and Robinson 2005:Figure 5.49).

Table 30. Archaic Period Dwellings in Prescott Valley, ca. 2000 B.C.

Reference	Site No. (ASM)	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m^2)
Leonard and Robinson (2005)	AZ N:7:286	none	76	5.8	4.7	27.3
Leonard and Robinson (2005)	AZ N:7:286	none	157	6.6	6.4	42.2
Mean						34.8
Standard Deviation						10.6

Note: Where used throughout this report, floor area was calculated as **average Length * average Width**, even for round and oval-to-round structures, although it would be more accurate to use the formula **area = $\pi*r^2$** for round structures and **area = π $^1/_2$L* $^1/_2$W** for oval structures. We have rounded the reported or measured dimensions to one decimal place in the chapter tables.
Key: ASM = Arizona State Museum.

Table 31. Diagnostic Projectile Points of the Archaic Period Identified in the Middle Verde River Valley

Temporal Period	Calendar Date Range[a]	Diagnostic Point Types
Early Archaic	ca. 7000/6500– 4200 B.C.	Lerma[b] or Bajada and Northern Side-Notched (Lyndon 2005)
Middle Archaic	ca. 4200– 2600 B.C.	Pinto/San Jose[b] or Pinto/San Jose and Sudden Side-Notched (Lyndon 2005)
Late Archaic (including sites identified as Dry Creek phase)	ca. 2600– 400 B.C.	Elko, San Pedro, and Gypsum[b] or Elko Eared, Chiricahua, San Rafael Side-Notched, Gatecliff Split-stemmed, Armijo, Gypsum Cave (Lyndon 2005), and Cienega (Sliva 1999)

[a] Dates suggested by Lyndon (2005); different dates have been suggested by others.
[b] See Chapter 3, Volume 2 of this report.

Subsistence Remains

Archaeologists have recovered subsistence remains from at least four Archaic period sites in the MVRV (see Appendix C): the Dry Creek site, the Lost Kitchen and Cross Creek Bridge sites in Red Rock State Park, and SRI's site adjacent to Dry Creek Bridge (AR-03-04-06-903 [CNF], also designated AZ O:1:28 [ASM]) (see Chapter 11, Volume 1 of this report). As a group, these faunal collections indicate that deer, pronghorn, jackrabbit, cottontail, Botta's pocket gopher, and fish were hunted or captured species (porcupine and rattlesnake remains also were recovered). The flotation and pollen samples recovered from hearths and roasting pits have indicated that plants gathered by Archaic period foragers included *Chenopodium*, portulaca, hedgehog cactus, and cattail. Charred wood recovered from the thermal features was usually cypress/juniper or pine, indicating that campsites often are found in the piñon-juniper woodlands.

Correlates of Settlement

Figure 15 depicts the locations of all Late Archaic period sites in the 2,343-site MVRV ALD, relative to elevation. Archaic period sites occur on a variety of landforms, ranging from low elevations (below 3,500 feet AMSL) near the Verde River to upland elevations in the Red Rock country and below the Mogollon Rim (between 4,000 and 6,000 feet AMSL). Approximately half the recorded sites assigned to the Archaic period are located within the 4,000–4,500-foot AMSL elevational range, in areas where the piñon-juniper woodlands dominate and where fuelwood and deer are present (the mean elevation is about 4,200 feet AMSL). Concentrations of Archaic period sites are found along Oak Creek, near Sedona, and along the middle and lower reaches of Dry Creek, west of Sedona. A smaller number of Archaic period sites are located in the 3,500–4,000-foot and 4,500–6,000-foot AMSL elevational ranges. Only a few Archaic period sites are in the lowest elevational band (below 3,500 feet AMSL), with most of those near drainages. The Late Archaic period sites in our sample tend to be closer to small drainages than either main streams or springs. Functions inferred for sites include seasonal or temporary campsites (i.e., sites with thermal features and lithic scatters including ground stone) and plant-gathering, hunting, and resource-processing sites (i.e., flaked and ground stone artifact scatters with diagnostic artifacts or "diagnostic" assemblages), stone-tool-manufacturing locales, and places of religious importance (rock-art locales).

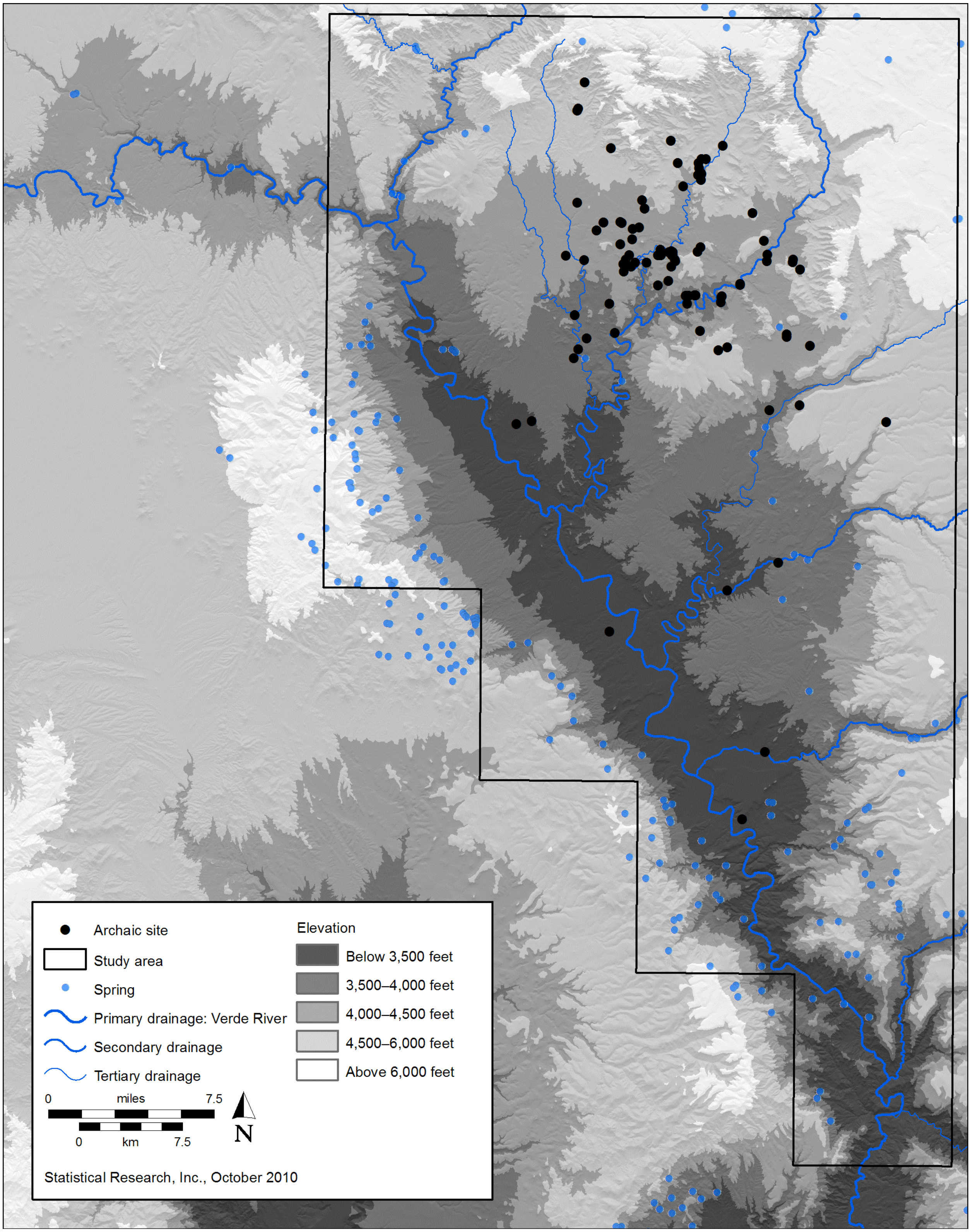

Figure 15. Map showing the elevational ranges of Archaic period sites in the middle Verde River valley.

Hasbargen's (1993) paleoenvironmental reconstruction for Stoneman Lake, immediately east of our study area, indicated that for most of the early and middle Holocene, between about 8500 and 2500 B.P. (ca. 6500–500 B.C.), the Mogollon Rim section of the southern Colorado Plateau was warmer and drier than in the last 2,500 years. Hasbargen (1993:49), like others before him at nearby lakes (e.g., Davis and Shafer [1992] at Montezuma Well and Anderson [1993] at Potato Lake), correlated the changes he observed for this time period in a 2-m-long sediment core from Stoneman Lake to a decrease in winter precipitation and a northward shift in the winter storm track. The preference for campsite locations near perennial streams, reliable springs, and woodland forests may have been a response, in part, to the widespread and persistent aridity of the Early and Middle Archaic periods.

Figure 16 shows the locations of Archaic period sites on the map depicting land units recorded as containing agave. At least half the 139 recorded Archaic period sites in the MVRV are located in or adjacent to biotic communities containing agave. To date, however, no well-dated Archaic period context has yielded evidence of agave procurement.

Inferred Land-Use Patterns

Current understanding of the Archaic period (ca. 6500 B.C.–ca. A.D. 1) in the MVRV is limited. Our knowledge of the "effective environment" exploited by highly mobile Archaic period hunter-gatherers is rudimentary. Likewise, our knowledge of where Archaic period populations hunted and processed game, collected and processed wild plants, procured lithic materials for stone tools, established campsites, buried their dead, gathered together for collective tasks and periodic celebrations, conducted ceremonies, and left enduring evidence of their presence as petroglyphs is poor and unrepresentative. Of the 139 sites inferred to contain Archaic period components, over half were recorded in the Oak Creek and Dry Creek drainages near Sedona, not far from the Dry Creek phase type site, NA5005 (Shutler 1950; Shutler and Adams ca. 1949). Is this site distribution an accurate reflection of Archaic period land use in the MVRV? We think that is unlikely, given the uneven survey coverage in the MVRV (see Figure 9). We suspect that this non-random spatial pattern reflects one or more of the follow biases. First, this portion of the MVRV has been subjected to more survey, testing, and excavation than other portions, given the modern development and land-use practices. Second, we believe that archaeologists working in this portion of the valley typically compare newly identified aceramic artifact scatters to artifacts at the nearby Dry Creek site when the flaked and ground stone artifacts tend to resemble those at the type site. Third, the presence of formal stone tools presumably diagnostic of the Archaic period often leads archaeologists to classify aceramic surface scatters as Archaic period when, in fact, these items could have been collected elsewhere by later Formative period and protohistoric-period groups.

We presume that Archaic period groups traversed both lowlands and uplands in the MVRV in their annual movements, which included localities well outside the MVRV. Because so few Early Archaic period points have been identified, we speculate that the MVRV was used by highly mobile groups with large territories during the Early Archaic period. Beginning slowly during the Middle Archaic period and accelerating in the Late Archaic period, many more formal tools diagnostic of these two subperiods have been recovered. If that pattern is real, it might indicate that more people exploited the resources of the MVRV during that time period. The pattern also suggests that mobility strategies and land-use practices were changing.

Using terminology introduced by Binford (1980), we refer to human groups that live in regions where essential food resources are, more or less, continually available as "foragers" and their organizational strategies as "residential" when they reside in multiple base camps over the course of their settlement cycle and use fewer specialized locations away from their camps. In contrast, we refer to human groups that live in regions where essential food resources are seasonally available as "collectors" and their organizational strategies as "logistic" when they reside in only a few base camps over the course of their settlement cycle and send out task groups to collect and process specific resources at various locations away from the main camp.

High mobility is commonly associated with hunter-gatherers and frequent residential movements. Low mobility is commonly associated with agricultural populations, but low mobility can characterize nonagricultural populations that resided in settings where resources were plentiful and constantly available, such as many hunter-gatherer populations that lived along the Northwest Coast of North America. People in Formative period settlements in the U.S. Southwest tended to practice a sedentary, low-mobility organizational strategy. That strategy seems to have been a response, in part, to a commitment to cultivate crops and the advantage of being physically close to arable land and other critical resources. Although mobility and sedentism are sometimes perceived as opposite ends of the settlement-movement spectrum, they are not mutually exclusive strategies. Varien (1999), following others (Nelson and LeBlanc 1986; Powell 1990), argued that precontact populations could be both mobile and sedentary, and they shifted between the two modes as needed. Barlow (2002) made a similar argument for shifts in resource mix and mobility for Fremont populations in Utah. Regardless of subsistence mode or resource mix, wherever residential moves occur with high frequency, human groups are viewed as highly mobile, and whenever residential moves occur infrequently, human groups are classified as sedentary (Varien 1999). Thus, foragers (e.g., Early and Middle Archaic period groups) with very high residential

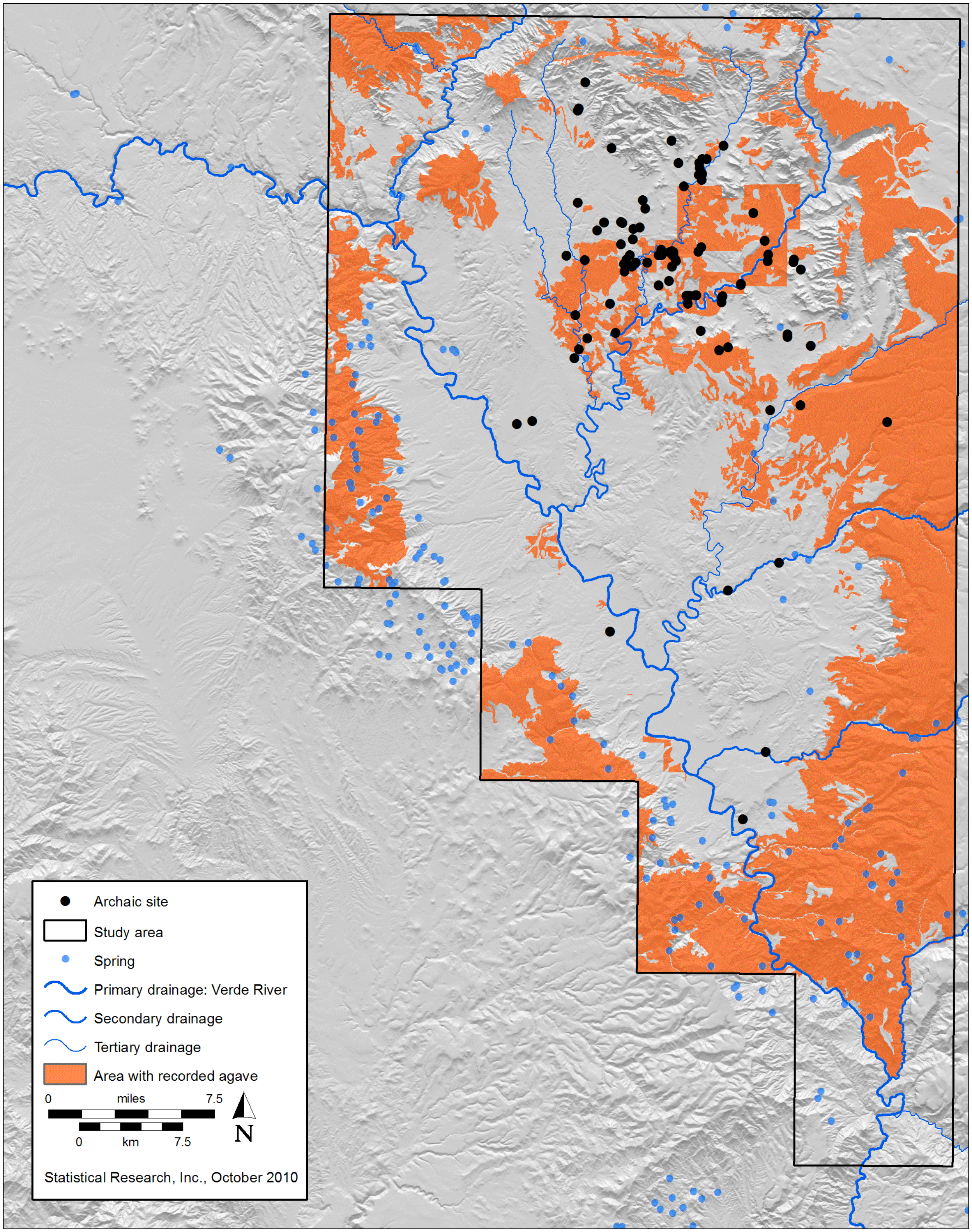

Figure 16. Map showing the locations of Archaic period sites relative to agave-growing land.

mobility are at one end of the settlement-movement spectrum, and farmers (e.g., the Southern Sinagua, Hohokam, and Ancestral Pueblo) who practice intensive agriculture and high residential stability are at the other end. Groups (e.g., Late Archaic/Early Agricultural period populations and some Yavapai and Apache) that cultivate crops but whose economy largely revolves around the availability of wild resources, fall somewhere in between.

From this perspective, it is tempting to suggest that Early and Middle Archaic period groups were residentially mobile foragers who exploited a region considerably larger that the MVRV. With so few sites assigned to these early time periods, and no reliable dates, we can only speculate. We could argue that by the end of the Archaic period and the beginning of the Early Agricultural period (i.e., the Squaw Peak phase), at least some of these small populations were logistically organized "collectors" rather than "foragers." Data marshaled to support such a claim might include the recovery of stone tools manufactured primarily from locally available raw materials, the presence of more permanent dwellings and food-storage pits, and unambiguous evidence of the cultivation of domesticated plants (e.g., maize and little barley).

Significant advances in knowledge about Archaic period lifeways and land-use practices in the MVRV necessarily will entail concerted efforts to identify and precisely date immovable material culture, such as residential dwellings, storage features, hearths, and rock art, as well as movable culture, such as artifacts.

We already know from a handful of excavated sites that Archaic period foragers hunted deer and pronghorn as well as jackrabbit, cottontail, and Botta's pocket gopher and captured fish from local creeks and rivers. We also know that they gathered a wide variety of plants, including *Chenopodium*, portulaca, hedgehog cactus, and cattail, and used cypress or juniper wood and piñon pine wood for fuel. The recovery of these subsistence resources suggests that woodlands, open plains, and riparian settings were exploited by Archaic period groups. The collection and study of additional faunal and floral collections will enable future analysts to suggest what seasons of the year were likely associated with the procurement of specific taxa and when given environmental settings were exploited. Additional unknowns are how widely Archaic period groups of various time spans ranged and whether there were different ethnic groups of Archaic period peoples living in the MVRV at approximately the same time. Progress on these topics will necessarily involve the sourcing of raw materials, study of the technological attributes of stone-tool manufacture (including such attributes as heat-treatment and the use of basal grinding on projectile points), and analysis of assemblage variation among sites. The ability to identify and date plant and animal residues on stone tools would add detail to our understanding of subsistence pursuits. Finally, a comprehensive analysis of Archaic period petroglyphs and burials, along with their physical contexts, could add important detail to our understanding of Archaic period ideology and cultural behavior.

Early Formative Period

Recorded Sites

The MVRV ALD contains records for 16 sites with components assigned to the Early Formative period Squaw Peak phase (ca. A.D. 1–650) (Figure 17). Records for 8 of the 16 sites indicated that they have been investigated beyond initial recording. Currently, we have identified additional sites with Squaw Peak phase components. Among a new total of 20 sites are 11 that have been excavated or tested; the remainder are known or suspected from surface inventory alone. Two of the tested sites are single-component sites; the rest have two to seven temporal components. Four tested or excavated sites with Squaw Peak phase occupations revealed single pit structures, sometimes with extramural features. One site contained two partially superimposed Squaw Peak phase pit structures. Until more information is available, we have assigned the largest Squaw Peak phase occupations to the "extremely small" site-size category (1–2 rooms).

Assigning Sites to the Early Formative Period

In recent years, sites in the MVRV have been assigned to the Early Formative period or the Squaw Peak phase when maize or other organics were recovered from buried features radiocarbon dated to a time of use before A.D. 650 or 700. When the phase was first proposed in 1960 (Breternitz 1960a), however, archaeologists associated excavated pit structures with this phase when aceramic fill and floor-fill levels contained artifact inventories that resembled Late Archaic and Basketmaker II period artifact types (Breternitz 1960a:21). Thus far, only a few sites with Squaw Peak phase components contain features with charred maize parts associated with radiocarbon-dated contexts that date maize, structural wood, or hearth charcoal to sometime between A.D. 400 and 600. Two Squaw Peak phase features at another multicomponent site yielded radiocarbon dates ranging between A.D. 120 and 570, but neither dwelling yielded maize parts. At yet another site, loose human bone from a deeply buried, flexed human burial was radiocarbon dated to A.D. 360–580. In some instances, AM dates have corroborated the radiocarbon assays. Otherwise, Squaw Peak phase sites look very much like Archaic period sites, in regard to artifacts, technology, subsistence practices, and human-burial practices.

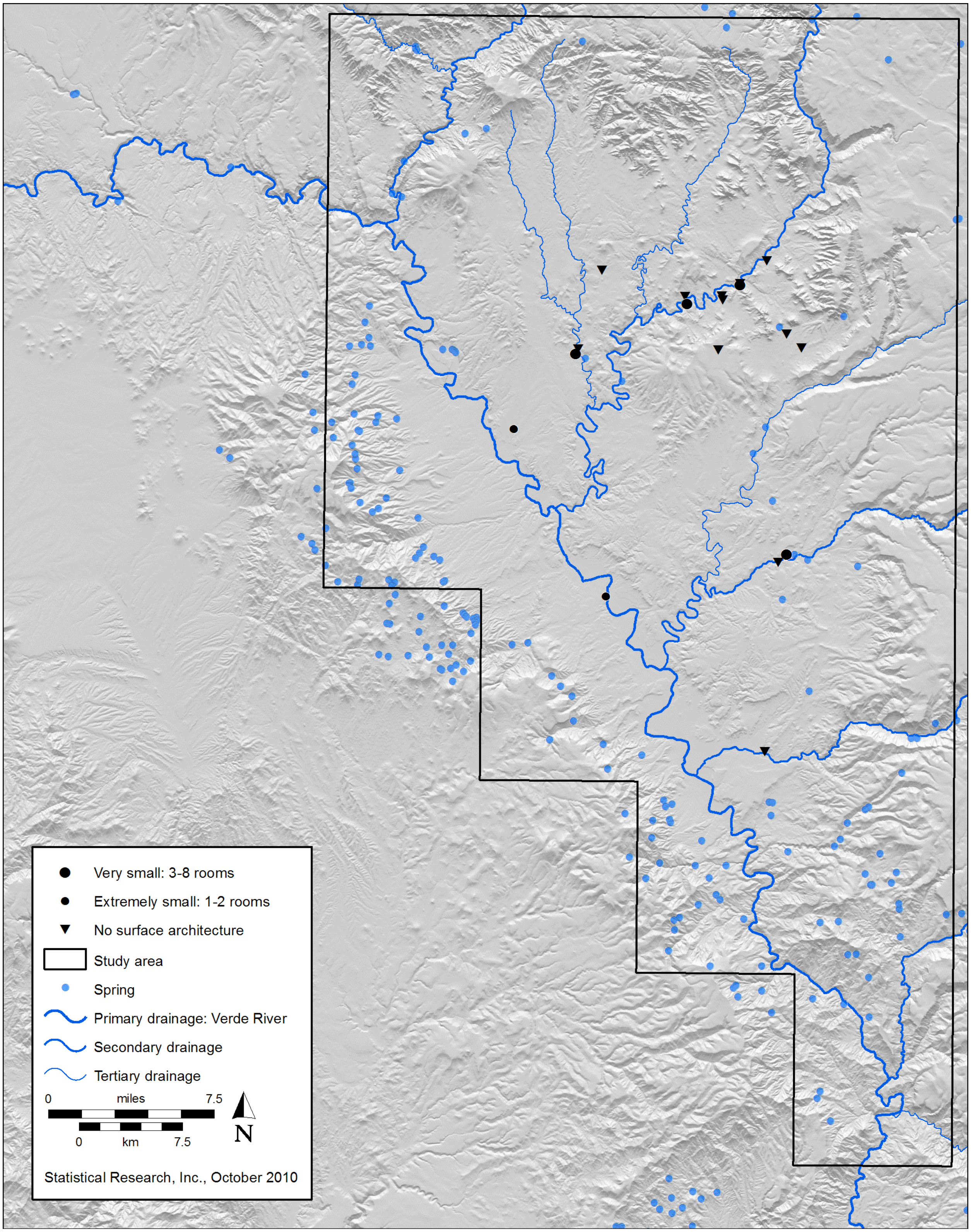

Figure 17. Map showing the locations of Squaw Peak phase sites in the middle Verde River valley.

Investigated Sites

SRI's data recovery project along SR 89A is one of at least nine published projects that describes Early Formative period features in the MVRV. Although some authors (e.g., Logan and Horton 2000:9, 106–108) have explicitly equated the Squaw Peak phase with the terminal portion of the long Archaic period, others have preferred to isolate the Squaw Peak phase as the earliest Formative period phase. We have chosen to retain it as a separate temporal unit, to signify that at least some residents of the MVRV had added cultivated plants to their diet and economic pursuits by the early centuries A.D. Descriptions of features, artifacts, and land-use practices currently ascribed to the Squaw Peak phase are available for a handful of sites (see Appendix C). These include Squaw Peak phase components at the Montezuma Well Unit site (NA4616C) and the Calkins Ranch site (NA2385) (Breternitz 1960a) (but see Stebbins et al. [1981:Table 30] for a reinterpretation of some data reported by Breternitz), Long Bow Ranch sites NA16942 and NA19943 (Weaver et al. 1982), Jack's Canyon site AR-03-04-06-294 (CNF) (Logan and Horton 1996), AR-03-04-06-722 (CNF) (Logan and Horton 2000), Crescent Moon Ranch site AZ O:1:88 (ASM) (Shepard et al. 1998), the Talon site (AZ O:1:141 [ASM]) (Edwards et al. 2004), and SRI sites AZ:O:105/AR-03-04-06-838 (ASM/CNF) and AZ:O:85/AR-03-04-06-428 (ASM/CNF) (Sites 105/838 and 85/428) (see Chapters 5 and 6, Volume 1 of this report). In addition, Deats (2007) reported that a pit structure (Feature 7) excavated at a multicomponent site north of Camp Verde (AZ O:5:155 [ASM]) radiocarbon dated to sometime after A.D. 540 and before A.D. 765 that may date to this Early Formative period. Deats (2011) also reported that two pit structures (Features 22 and 28) and a human inhumation (Feature 29) at the large multicomponent Grey Fox Ridge site (AZ N:4:110 [ASM]) north of Cottonwood dated to the early centuries A.D. AMS radiocarbon ages derived from charred branches from the superstructure of pit-structure Feature 22 yielded a 2σ calibrated range of A.D. 120–330 (Beta-260624). Radiocarbon ages derived from charred reeds (*Phragmites* sp. and *Equisetum* sp.) and wood charcoal from the superstructure of pit-structure Feature 28 produced 2σ calibrated ranges of A.D. 260–290 and 320–570 (Beta-260625).

Data recovery at the large, multicomponent AZ N:7:286 (ASM) in Prescott Valley (Leonard and Robinson 2005) revealed two shallow pit structures (Features 204 and 253) with internal features, artifacts, and subsistence remains (including maize) that were radiocarbon dated to sometime between A.D. 400 and 600 (calibrated)—the same interval as the earliest maize-producing sites in the MVRV. Leonard and Robinson (2005) also reported that three inhumation burials (Features 160, 236, and 280) at that site were coeval with the two pit structures. We have included illustrations of the two pit structures (see Figure 14), to show what we anticipate archaeologists likely will find in the MVRV in the future.

Features

Features associated with Early Formative period occupation of the MVRV consist of pit structures (i.e., pit houses) with interior floor features, including hearths, pits, and postholes; extramural hearths and roasting pits; and flexed burials with and without grave goods (see Appendix C). No artifacts diagnostic of this time period have been identified as yet; seemingly, the roster of artifacts seems identical to Late Archaic period items and technology. Flaked stone tools and technology identical to Archaic period forms and styles are characteristic of the Squaw Peak phase. Ground stone usually takes the form of grinding slabs, shallow basin metates, and one-handed manos, but Martine and Pilles (2005:3) indicated that trough metates (the form typically associated with the processing of maize kernels to produce cornmeal) are also present at Squaw Peak phase sites.

Six, possibly seven, dwellings assigned to the Squaw Peak phase have been excavated in the MVRV (Figure 18; Table 32): House 4 at NA4616C, on the Montezuma Well property (Breternitz 1960a); House 1C at the Calkins Ranch site (NA2385) (Breternitz 1960a) (but see the discussion of the Hackberry phase, below); Feature 2 at AR-03-04-06-294 (CNF), in Jack's Canyon (Logan and Horton 1996); Features 22 and 28 at the Gray Fox Ridge site (AZ N:4:110 [ASM]) (Deats 2011); Feature 37 at Site 105/838, along SR 89A (see Chapter 5, Volume 1 of this report); and possibly Feature 7 at AZ O:5:155 (ASM) (Deats 2007). Although the original shape of the partial structures at Calkins Ranch (House 1C) and the small Jack's Canyon site cannot be easily determined from their plan maps, the site near Montezuma Well, Features 22 and 28 at Gray Fox Ridge (Deats 2011), and the SRI site along SR 89A were all roundish or oval and had floor areas ranging from 17 to 43 m^2. All four had shallow basin-like floor surfaces, informal hearths (firepits), and postholes; the three larger houses had subfloor pits. Deats (2011:3.6) inferred that large pit-structure Feature 22 was a dwelling with four primary support posts and a flat roof and roof entry. Some but not all of these pit structures had floor-contact artifacts. Only one structure, Feature 7 at AZ O:5:155 (ASM), which was assigned a construction date sometime between A.D. 540 and 765, was rectangular and had a short side entry (Deats 2007). Given our current understanding, we consider Feature 7 to be a pit structure postdating the Squaw Peak phase as delimited in this report (see the Hackberry phase discussion, below).

None of these pit structures, including Feature 22 at the Gray Fox Ridge site, was as well-preserved and well-defined as the two Early Formative period structures (Features 204 and 253) excavated in Prescott Valley at AZ N:7:286 (ASM) (Leonard and Robinson 2005) (see Figure 18), a multicomponent site about 20 miles southwest of Cottonwood, on the western side of the Black Hills. Although Leonard et al. (2005:5.285) did not identify the two structures as Early Formative period, they did distinguish them from earlier, Archaic period and later,

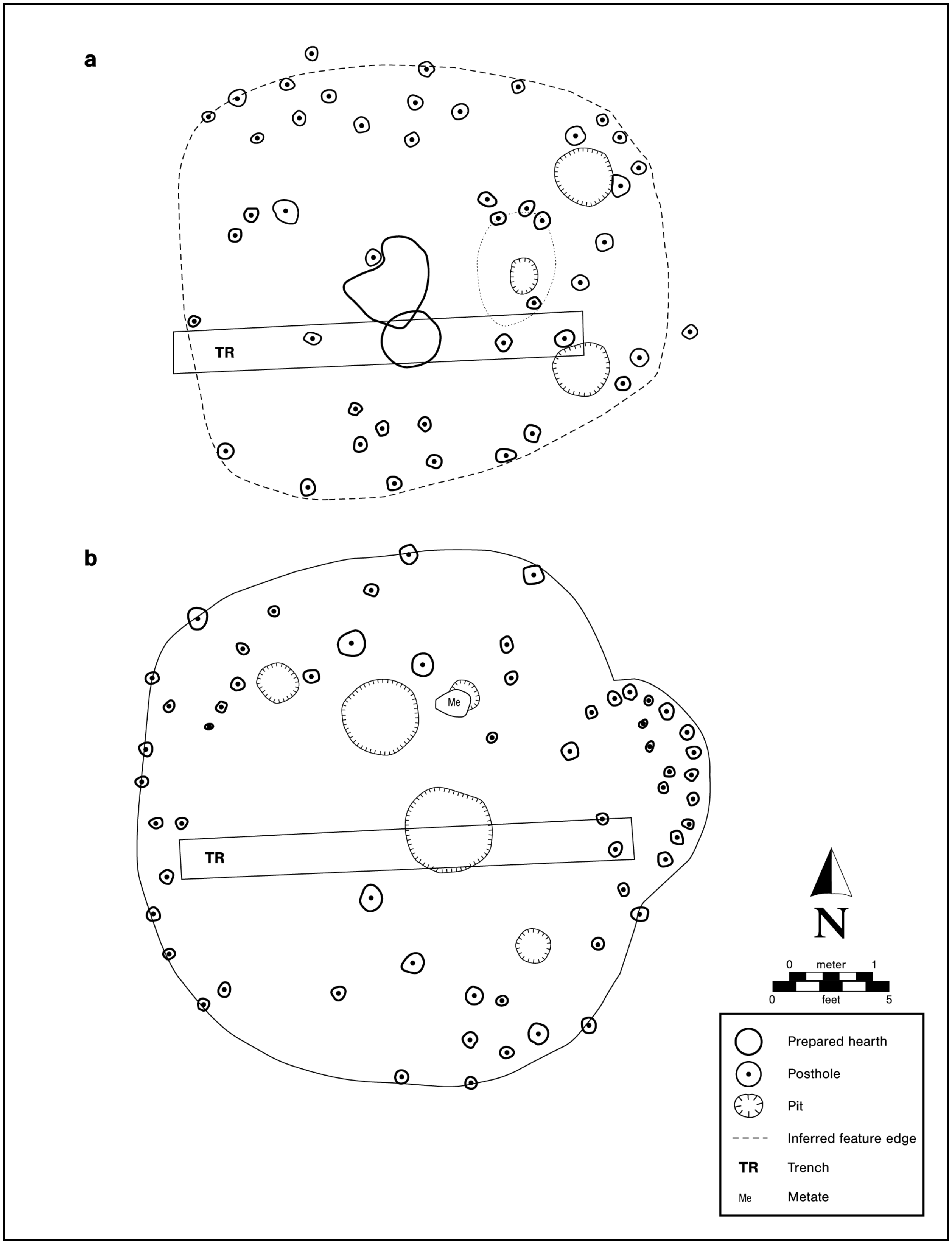

Figure 18. Sketches of Squaw Peak phase (Early Formative period) pit structures at AZ N:7:286 (ASM) in Prescott, Arizona: (*a*) Feature 204 (Leonard and Robinson 2005:Figure 5.52) and (*b*) Feature 253 (Leonard and Robinson 2005:Figure 5.54).

Table 32. Sample of Early Formative Period Dwellings in and near the Middle Verde River Valley

Reference	Site No.	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m²)
Breternitz (1960a)	NA4616C	none	House 4	6.0	5.0	30.0
Deats (2011)	AZ N:4:110 (ASM)	Gray Fox Ridge site	22	6.7	6.4	42.8
Deats (2011)	AZ N:4:110 (ASM)	Gray Fox Ridge site	28	4.7	3.6	16.7
Leonard and Robinson (2005)	AZ N:7:286 (ASM)	none	204	5.8	5.6	32.5
Leonard and Robinson (2005)	AZ N:7:286 (ASM)	none	253	6.4	6.0	38.4
Logan and Horton (1996)	AR-03-04-06-294 (CNF)	none	2	2.8	2.0	5.5
Vanderpot (Chapter 6, Volume 1 of this report)	Site 105/838	Spring Creek Hamlet	37	6.0	6.0	36.0
Mean						28.8
Standard deviation						13.2

Key: ASM = Arizona State Museum; CNF = Coconino National Forest.

ceramic-bearing Formative period sites. Both pit structures were roundish, tending toward squarish, and had central hearths and many peripheral postholes. Pit-structure Feature 253 had a bulging section defined by postholes that was interpreted as a side entry. Importantly, SSI archaeologists recovered a maize cupule in the hearth of Feature 253, although they seemed to dismiss its presence. They submitted samples for radiocarbon assay on charred juniper from the hearth of Feature 204 and two charcoal samples from pit-house Feature 253—one from an unburned pit and another from a charred floor post. The Feature 204 hearth sample (Beta-183227) returned 2σ calibrated date ranges of A.D. 460–480 and 520–770. The charred-wood sample (Beta-183232) from the unburned pit in Feature 253 yielded a 2σ calibrated date range of A.D. 410–580; the charred post (Beta-196198) returned a 2σ calibrated date range of A.D. 260–530. Given the similarities of these structures and their contents, it appears that both houses were constructed after A.D. 400 and prior to A.D. 770. The better-preserved house, from which a maize cupule was recovered, Feature 253, may be the older of the two structures and may have been constructed in the A.D. 400s or 500s.

Subsistence Remains

At least five investigated sites produced subsistence remains: AZ O:1:88 (ASM), on the Crescent Moon Ranch (Shepard et al. 1998); AR-03-04-06-294 (CNF), in Jack's Canyon (Logan and Horton 1996); AR-03-04-06-722 (CNF), south of Sedona (Logan and Horton 2000); and LOCAP Sites 105/838 (see Chapter 5, Volume 1 of this report) and 85/428, (see Chapter 6, Volume 1 of this report). Breternitz (1960a:21) reported the recovery of deer, pronghorn, jackrabbit, and cottontail from Squaw Peak phase contexts, but he did not cite their proveniences.

As a group, these sites have produced evidence from flotation, macrobotanical, and pollen samples that maize and little barley were cultivated and that a wide variety of wild plants were collected for food, fiber, and other household uses. These include cheno-am-type plants, hackberry, yucca, hedgehog cactus, spiderling, purslane, stickleaf, bugseed, mint-family plants, composite-family-type plants, bulrush, common reed, and grasses. Recovered faunal remains include not only the ever-present deer, jackrabbit, and cottontail but also pronghorn, unidentified bird (eggshell), beaver, and turtle (carapaces). Wood types used for fuel range from cypress or juniper to pines, including piñon pine; mesquite; oak; ash; willow or cottonwood; saltbush; crucifixion thorn; and cholla.

The earliest *directly* dated maize in the MVRV was recovered by SRI archaeologists from the floor of a buried pit structure (Feature 37) at Site 105/838 and a roasting pit (Feature 2) at Site 85/428. Both maize samples (Beta-20913 from Feature 2 at Site 105/838 and Beta-208190 from Feature 37 at Site 85/428) yielded the same 2σ calibrated date range: A.D. 410–600. AM dates derived from the same contexts supported those radiocarbon assays with an optional date range of A.D. 585–690 (see Chapter 2 of this volume).

Structural wood associated with maize recovered from a pit-structure hearth (Feature 2.1) at AR-03-04-06-294 (CNF), in Jack's Canyon (Logan and Horton 1996), returned radiocarbon dates that also predated A.D. 600. Four samples of charred wood inferred to be structural posts from Feature 2 were submitted for radiocarbon assay (Beta-45439, Beta-75536, Beta-75537, and Beta-75538). The resulting 2σ calibrated date ranges for the samples were A.D. 425–655, 245–515, 265–540, and 380–590. We pooled the conventional radiocarbon ages reported for these samples (see Appendix C) and obtained a calibrated pooled mean date range of A.D. 391–535. Although dates from this site are earlier than those obtained from the two LOCAP sites, they are dates taken from charred wood that could be older than the date of the pit structure's construction and the deposition of the maize. Nonetheless, absolute dates from these three sites indicated that maize was clearly present and was likely grown in the MVRV as early as the fifth and sixth centuries A.D.

Correlates of Settlement

Most sites inferred to have Squaw Peak phase occupations were components of later-dating sites containing fewer than eight rooms (the "very small" category). Three of the four sites with Squaw Peak phase dwellings contained only a single pit structure each (the "extremely small" category); only the Grey Fox Ridge site contained two non-contemporary Squaw Peak phase pit structures. In every case, however, it is possible that other, undiscovered dwellings were present. Given the small number of sites assigned to this phase, the lack of diagnostic artifacts, and the dearth of well-dated features, we have little confidence in describing the correlates of settlement. Nevertheless, we can make a few preliminary observations on the site-distribution maps presented in this chapter.

The Squaw Peak phase sites identified to date tend to be close to both minor streams and major streams, particularly along the Verde River and on Oak, Wet Beaver, and West Clear Creeks (see Figure 17). We believe the location of the greatest number of sites on and near Oak Creek is not meaningful; instead, it reflects the fact that more survey, testing, and excavation have occurred in that part of the MVRV. Sites thought to date to the Squaw Peak phase are found most frequently between 3,500 and 4,500 feet AMSL (the mean is about 3,900 feet AMSL), but a few are found at lower and higher elevations (Figure 19). Of the sites containing Squaw Peak phase structures, the average elevation is approximately 3,540 feet AMSL. Many of those same sites are on landforms that support agave (Figure 20), but almost all Squaw Peak phase sites are on patches of arable land suitable for runoff-type agriculture or floodwater farming along drainages (Figure 21).

Paleoenvironmental Correlates

Dendrochronological data applicable to the MVRV are available for the late Squaw Peak phase after A.D. 571 (see Chapters 4 and 5 of this volume). Although precipitation patterns varied considerably from year to year during the final seven decades of the phase, temperature trends appear to have persisted for a number of years. A long warm spell (A.D. 584–623) contrasted with a short, cool interval before (A.D. 571–583) and after (A.D. 624–644) it. Within the 40-year-long warm period, were a 4-year-long drought between A.D. 596 and 599 and at least one unusually large flood in A.D. 622. Other notable high-stream-flow years in the dendrochronological record were A.D. 573, 574, and 629. Importantly, independent evidence of an increase in widespread floods on the perennial rivers of Arizona and Utah exists. Using dates derived from slack-water flood deposits, Ely et al. (1993; Ely 1997) suggested that the number and frequency of large floods increased after 400 B.C., following a 1,600±-year interval (2200/2000–400 B.C.) when few large floods occurred.

Paleoenvironmental data for the southern Colorado Plateau relevant to the earlier portion of the Squaw Peak phase (Dean 1988a:Figure 5.7) have indicated that regional water-table levels were high in the A.D. 100s and again from A.D. 500 to about A.D. 750. Starting around A.D. 200, regional water tables began to drop, and river floodplains began to degrade, reaching their regional lows in the fourth century A.D. Most of the fourth century was also characterized by pronounced year-to-year variability in climate conditions. River floodplains began to aggrade by A.D. 375 or 400, when the regional water table rose.

Given the 650+-year duration of the Squaw Peak phase, the small number of absolute dates associated with occupation, and the uncertainty as to when maize was first introduced into the subsistence economies of MVRV populations, our educated guesses concerning climate conditions and land-use practices are few. If, however, maize cultivation did begin sometime after A.D. 400 in the MVRV, as our dates suggest, early farmers exploited the opportunities afforded by the rising water tables, the aggrading floodplains, and the smaller, less-flood-prone drainages with fertile alluvium.

Inferred Land-Use Patterns

In the previous section, we suggested that at least some Late Archaic period populations were logistically organized collectors. If, in fact, the Squaw Peak phase is the terminal portion of the Archaic period in the MVRV, we would propose that by at least the sixth century, if not a century or two before, some Terminal Archaic period populations were logistically organized collectors who began to grow maize along the tributary drainages of the Verde River with runoff- and high-water-table-farming methods. In order to do so, they established residential base camps, which in some cases included pit structures, in settings close to locations where maize could be grown. These campsites were occupied for some unknown lengths of time in the late Spring or early Summer, to prepare fields and sow seeds, and again in the early Fall, to gather the harvest. Whether or not these early farmers remained in the camps for the summer is presently unknown, but analyses of the maturity of faunal and floral remains could shed light on the season(s) of occupation of these camps.

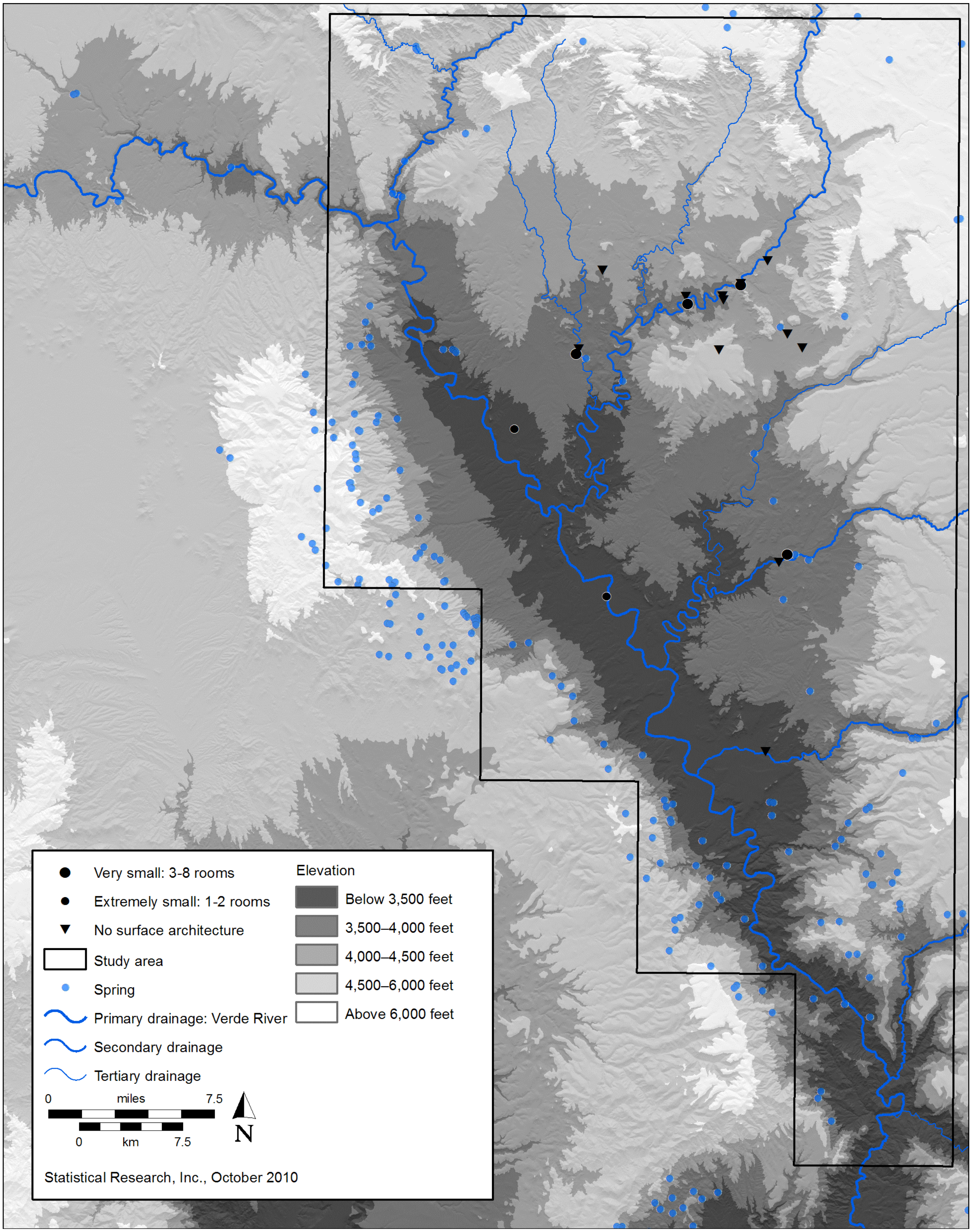

Figure 19. Map showing the elevational ranges of Squaw Peak phase sites in the middle Verde River valley.

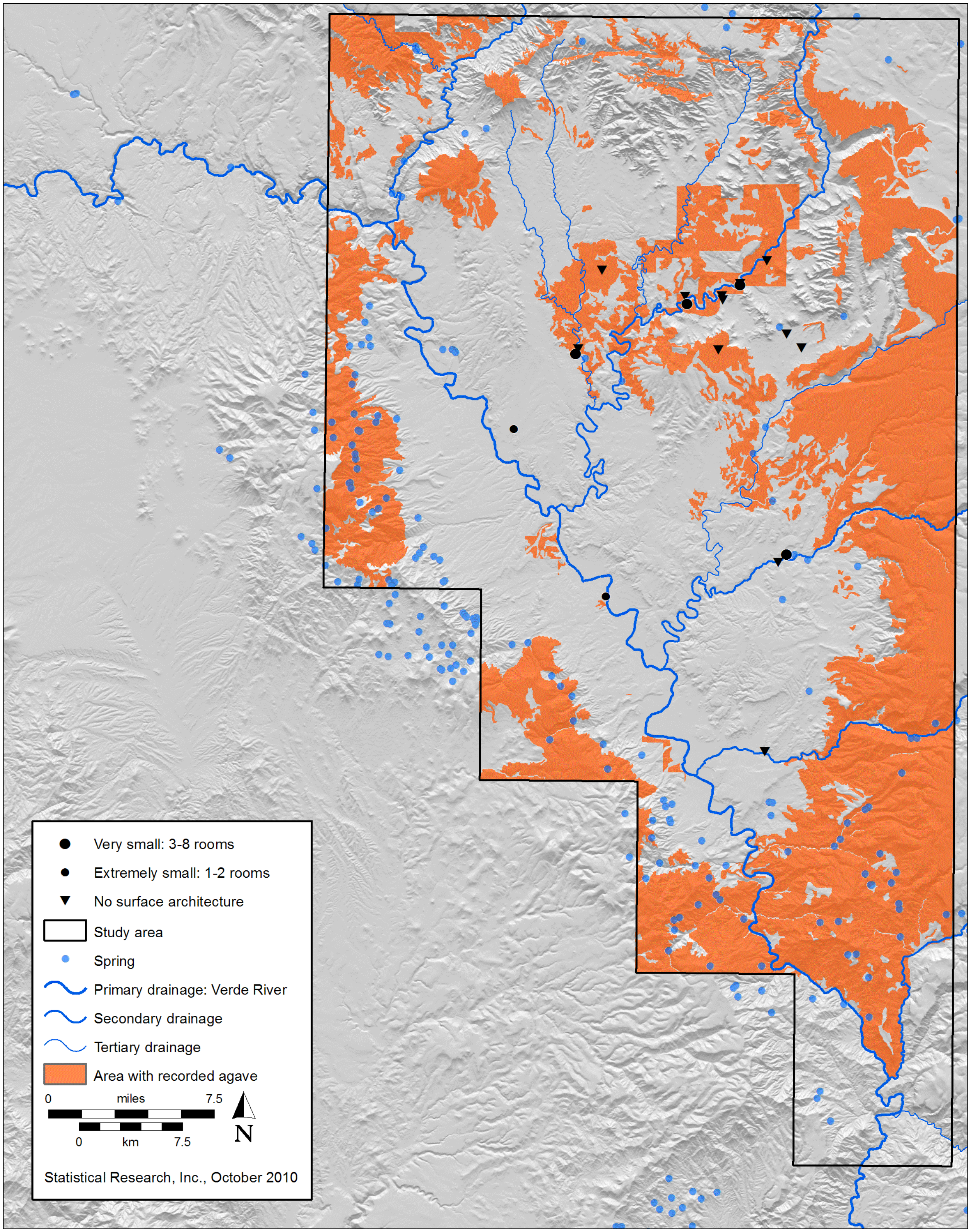

Figure 20. Map showing the locations of Squaw Peak phase sites relative to agave-growing land.

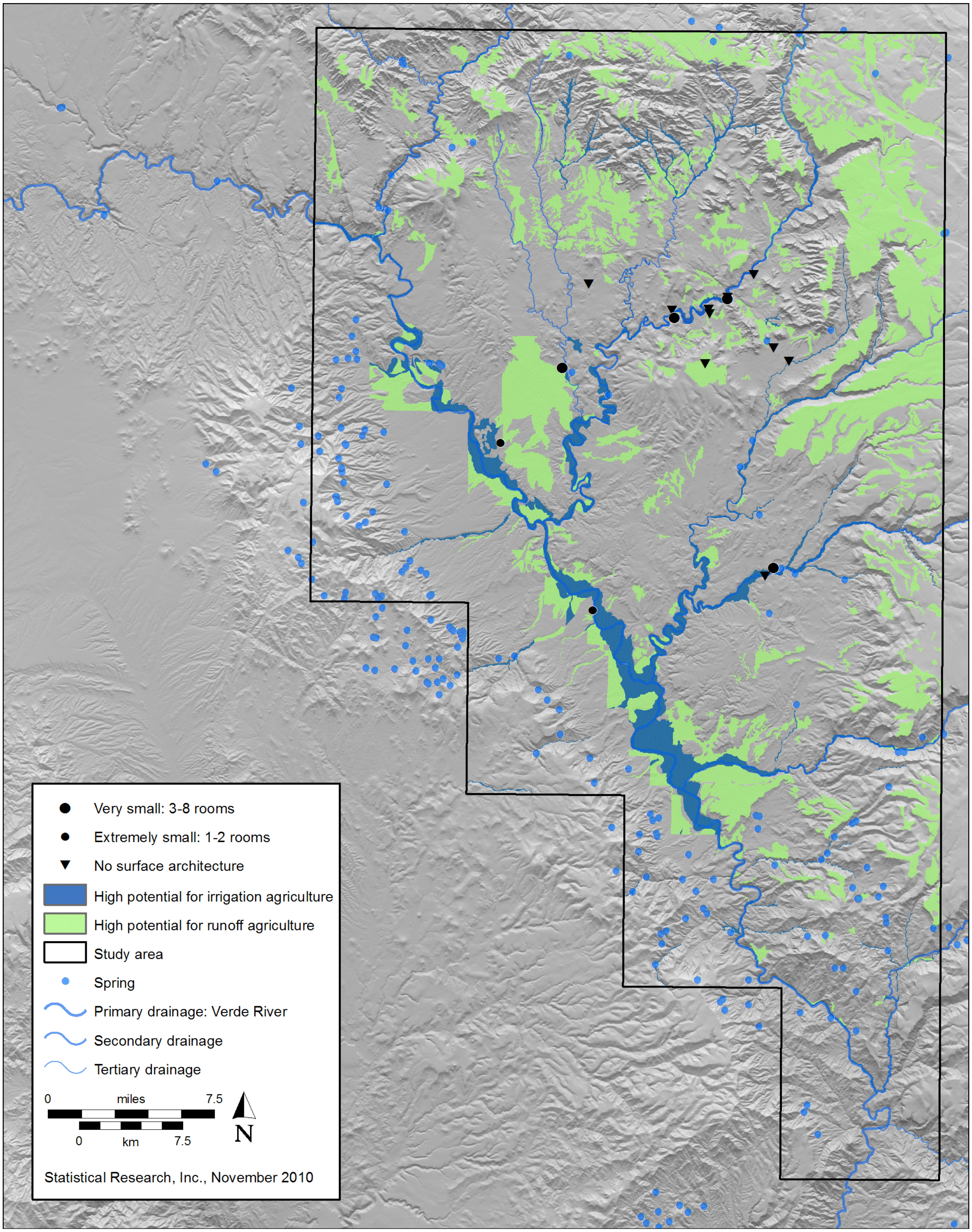

Figure 21. Map showing the locations of Squaw Peak phase sites relative to lands with high potential for irrigation and runoff agriculture.

What is surprising to us is the late date at which maize is first encountered in the archaeological record of the MVRV. Elsewhere in the U.S. Southwest, evidence of the cultivation of early maize begins about 2100–2000 B.C. (Huber 2005:Table 36.3) and is encountered in the southern deserts and the upland mesas of the Colorado Plateau from the same time period. We ask: has this evidence of early agriculture in the MVRV simply not yet been encountered? We think that is likely, but if it is not the case, then we must ask why this was so and who the first farmers were. Were they colonists from elsewhere in the Southwest who brought their seed and maize knowledge with them? Or was the early cultivation of maize fostered by local Archaic period populations who learned about the grain during their extensive travels outside the MVRV? Was the early maize recovered at Site 105/838, for example, grown elsewhere and acquired through trade or theft? Simply because a few kernels of maize are recovered from a handful of sites does not mean that it was grown locally. Still, we think it likely that by the A.D. 500s, at least some groups in the MVRV were growing maize to supplement their largely wild-foods diet. Recovered maize pollen and plant parts other than maize kernels and cobs will be important evidence to support the proposition that maize was grown in the MVRV during the Squaw Peak phase.

Formative Period: Hackberry Phase

Recorded Sites

The MVRV ALD contains records for 16 components or possible components assigned to the Hackberry phase (A.D. 650–700/800) (Figure 22). Of those, 7 sites have been investigated beyond inventory, but only 2 of these 7 were considered single-component Hackberry phase sites. Assigning any component or feature to the Hackberry phase is problematic, however. Features assigned to the Hackberry phase are generally associated with nonarchitectural or extremely small sites (i.e., sites with 1 or 2 rooms); a few are components of multicomponent sites in the "very small" category (3–8 rooms). Recent data recovery of radiocarbon-dated features at 2 sites in the MVRV (1 in the ALD, classified as a Tuzigoot phase artifact scatter, and another not in the ALD) brings the total of known or suspected Hackberry phase components to 18.

Assigning Sites to the Hackberry Phase

Breternitz (1960a:21–22) proposed the Hackberry phase to account for the earliest locally manufactured plain ware pottery in the MVRV. That plain ware, Verde Brown, was accompanied by trade wares from the Salt-Gila Basin (Snaketown Red-on-buff and Gila Butte Red-on-buff) and the Colorado Plateau (Lino Gray and Lino Black-on-gray). The association of these plain wares with cross-dated ceramics permitted him to assign calendrical dates to this phase. At the time of his 1960 publication, he proposed that the Hackberry phase dated between A.D. 700 and 800. In more recent years, the date range associated with this early plain ware phase has been given as A.D. 650–700 (Pilles 1996a) or A.D. 600–700 (Martine and Pilles 2005), although some researchers (Ciolek-Torrello and Whittlesey 1998:Figure 18.1) continue to use A.D. 700–800. More recently, archaeologists working in the MVRV have suggested that the beginning date for the Hackberry phase should be pushed back to A.D. 500 (Deats 2011:1.9, Figure 1.2) or A.D. 550 (Hall and Elson 2002:9, Figure 1.3), given earlier production dates assigned to given ceramic types.

Archaeologists most often assign components or features to the Hackberry phase on the basis of associated ceramics. At the present time, most researchers working with materials from the MVRV accept Wood's (1987) inference that the production period for Verde Brown was A.D. 500–1400. Beck and Christenson (see Chapter 2, Volume 2 of this report) accepted Hays-Gilpin and van Hartesveldt's (1998) conclusion that Lino Gray and other indeterminate plain wares of the Tusayan Gray Ware tradition were produced from A.D. 400 through 1350 and Christenson's (1994) analysis that Lino Black-on-gray vessels were produced from A.D. 640 to 820. The presence of Snaketown Red-on-gray (A.D. 700s) in ceramic collections suggests an occupation no earlier than A.D. 650 and more likely A.D. 700 (Dean 1991:Table 3.3), but the presence of Gila Butte Red-on-buff (A.D. 775–850/900) in ceramic collections, suggests a likely occupation no earlier than A.D. 775 (Dean 1991:Table 3.3). Based on the production dates for these painted ceramics, we suggest that the phase could have begun at least as early as A.D. 650 and ended about A.D. 800. However, if production dates for plain wares are considered, a beginning date of about A.D. 500 for the phase is more likely. Absolute dates from secure contexts attributed to Hackberry phase ceramic collections will help refine these ballpark estimates.

Only in the last few years have archaeologists had the opportunity to date Hackberry phase features with absolute-dating methods. Two multicomponent sites in the MVRV contained radiocarbon-dated features assigned to the Hackberry phase. A radiocarbon assay on charred roof material in pit-structure Feature 7 at AZ O:5:155 (ASM) returned a 2σ calibrated date of A.D. 540–680 (Beta-226415) (Deats 2007).[11] Radiocarbon assay on charred structural wood in three pit structures (Features 6, 19, and 52) at the Grey Fox Ridge site (AZ N:4:110 [ASM]) (Deats 2011) yielded 2σ calibrated date ranges of A.D. 550–770,

[11] Although this site was listed in the MVRV ALD, it was characterized before data recovery as a Tuzigoot phase artifact scatter.

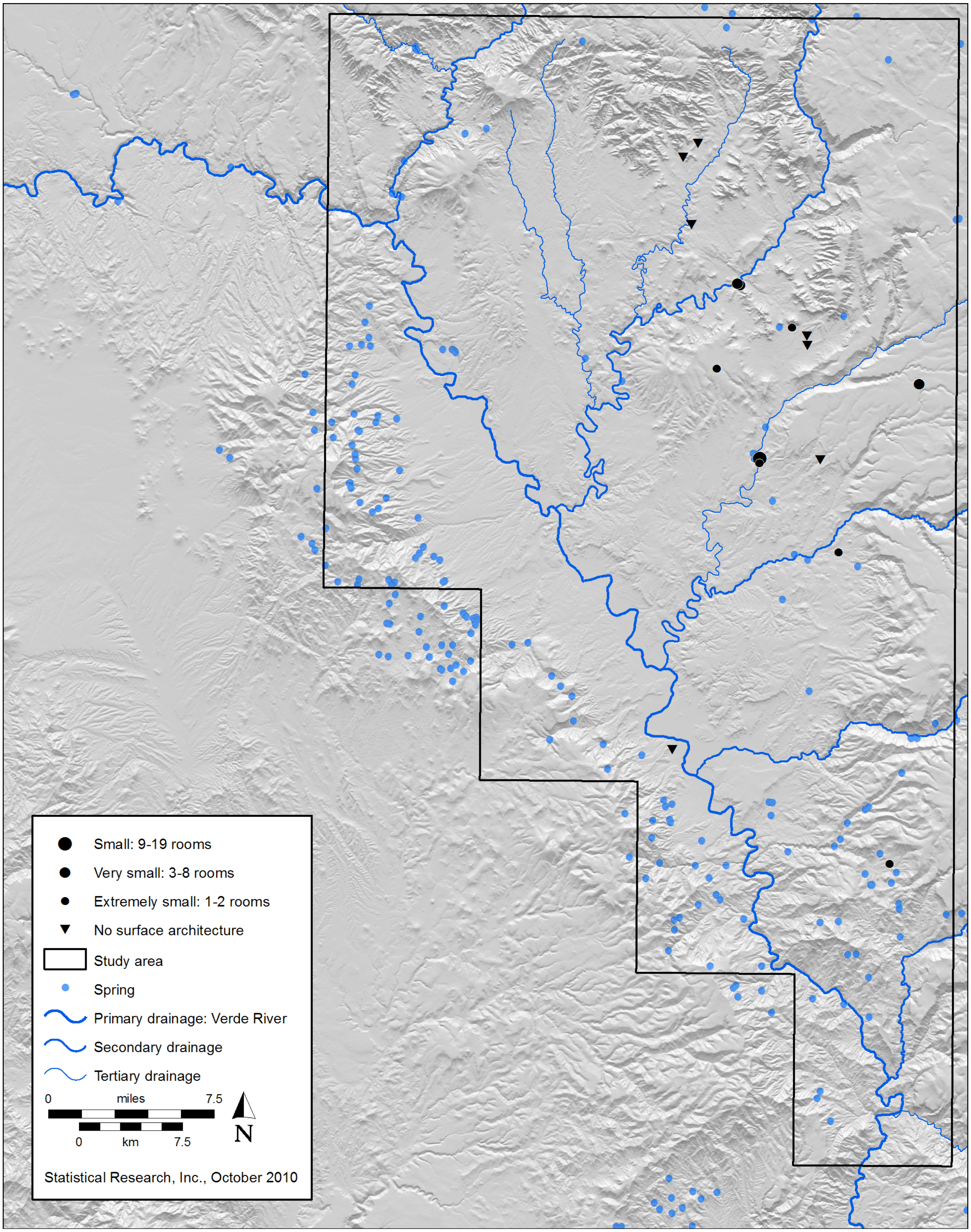

Figure 22. Map showing the locations of Hackberry phase sites in the middle Verde River valley.

A.D. 550–690, and A.D. 660–900, respectively.[12] Given the later date range for Feature 52 at Grey Fox Ridge, as well as its unusual entryway and bench subfeatures, it is possible that this pit structure might more appropriately be considered Cloverleaf phase.

Investigated Sites

We currently are aware of nine sites with Hackberry phase components that have been investigated beyond initial inventory. Among them are the Hackberry Basin site (NA3607) (Breternitz 1960a; Shutler 1951), the Verde Ball Court site (NA3528) (Breternitz 1960a), the Calkins Ranch site (NA2385) (Breternitz 1960a; Stebbins et al. 1981), and AZ O:5:155 (ASM) (Deats 2007) (see Appendix C). Breternitz (1960a:21–22) named the Hackberry phase for Hackberry Basin, on the margins of the MVRV. MNA archaeologists conducted test excavations in a slab-lined pit house at NA3607 that produced Verde Brown and Lino Gray pottery. On the basis of that limited excavation and the recovery of Snaketown Red-on-gray and Gila Butte Red-on-buff sherds at the bottom of the trash mound at the Verde Ball Court site, Breternitz (1960a:21) defined this poorly documented temporal and developmental period.

Investigations undertaken by Stebbins et al. (1981) at the Calkins Ranch site revealed that House 1C, excavated by MNA in 1957 or 1958 (Breternitz 1960a:Figure 10), was not a Squaw Peak phase house as originally inferred but rather a Hackberry phase house with Verde Brown pottery in the floor fill (Stebbins et al. 1981:104, Table 30). House 1C was the partial remains of small, rectangular structure with rounded corners defined by a few perimeter posts. The house was oriented northwest–southeast; the entryway was not preserved. Within it, the walls were three interior postholes, a hearth near the margin of the southwest wall, three bell-shaped storage pits, and seven floor artifacts (6 manos and 1 stone ring). This house was below two upper houses, both of which were inferred to date to the Camp Verde phase.

Two sites, AZ O:1:111 (ASM) (AR-03-04-06-250 [CNF]) and AZ O:1:88 (ASM) (AR-03-04-06-412 [CNF]), were multicomponent sites tested by Shepard et al. (1998) on the Crescent Moon Ranch. Based on a close reading of their report, we infer that AZ O:1:111 (ASM) is more likely a Cloverleaf phase occupation than a Hackberry phase occupation, and AZ O:1:88 (ASM) is more likely the location of two flexed adult burials and a child burial dating to the Squaw Peak phase.

Two other sites (NA17235/AR-03-04-06-42 [CNF] and NA11254/AR-03-04-01-190 [CNF]) were tested, but no reports were published. CNF site files indicated that AR-03-04-06-42 (CNF) was an artifact scatter tested by Robert A. Coody in 1981; it was investigated during a salvage effort after a human burial was encountered. AR-03-04-01-190 (CNF) (also designated AZ O:2:1 [ASM]) was a field house tested by MNA archaeologists. The CNF site database indicated that this structure was located near agricultural terraces and garden plots.

AZ O:5:155 (ASM) was investigated during a data recovery on the private property of the Simonton Ranch, northwest of Camp Verde and west of the Verde River, which was slated for development (Deats 2007). Feature 7 at AZ O:5:155 (ASM) was a large, rectangular pit structure with a short ramp entry, a hearth near the entryway, a four-post main roof-support system with numerous smaller peripheral postholes, and a 2.2-m-long trench that may have been the footing for a screen or deflector. Macrobotanical analysis revealed that *Populus* sp. (likely cottonwood) and *Celtis* sp. (hackberry) were used as fuelwood. The structure had burned, and several 10–15-cm-diameter roof beams (identified as juniper and ponderosa pine) were found in the floor fill, along with charred closing material (cottonwood, bunch grasses, rushes, and daub). A sample of carbonized rush fragments from the burned roof layer was submitted for radiocarbon assay and returned a 2σ calibrated date range of A.D. 540–680 (Beta-226415), which complemented a 2σ calibrated radiocarbon date range of A.D. 540–765 (Beta-132303) derived during earlier site investigations of the same feature (Potter 1999). Floor artifacts included ground stone (including a metate fragment, a hammerstone, and a stone ball), flaked stone debitage, two projectile points, ceramics (including a partially reconstructible vessel, a spindle whorl, and miscellaneous plain ware sherds), and *Glycymeris*-shell-bracelet fragments.

AZ N:4:110 (ASM) was a multicomponent site investigated during a data recovery on private land northwest of Cottonwood in anticipation of the 23-acre Grey Fox Ridge housing development (Deats 2011). The 69 features investigated during data recovery were 18 pit structures, 21 human burials (inhumations and cremations), and 30 nonburial and nonarchitectural features. Four pit structures (Features 6, 19, 52, and 68) were inferred to date to the Hackberry phase as we have defined it. In addition, a human inhumation (Feature 37) seemed to date to the Hackberry phase. Two human cremations (Features 55 and 64) and a bell-shaped pit may also date to the Hackberry phase, but they could also date to the Cloverleaf or Camp Verde phase.

Feature 6 at AZ N:4:110 (ASM) was rectangular in shape and contained two bell-shaped floor storage pits. Deats (2011:3.19) suggested that it had a two-post roof-support system. Because it was partially superimposed by a later, Camp Verde phase pit structure, evidence of a hearth and entryway was absent. Burned reeds and wood charcoal, presumed to have been roof-closing materials, were submitted for radiocarbon analysis (Beta-290622). This sample yielded 2σ calibrated ranges of A.D. 550–720 and A.D. 740–770. Only 1 object was on the floor, a waterworn igneous cobble possibly used as a core. One of the bell-shaped pits contained a few hackberry seeds and 11 sherds, including 6 Prescott Gray sherds from a single jar.

[12] This site was not listed in the MVRV ALD.

Feature 19 at AZ N:4:110 (ASM) was not well preserved, but evidence suggested that it was square to rectangular in shape and contained two collared hearths. Deats (2011:3.13) described it as more of a house-in-pit than a true pit house with earthen walls. Nine artifacts were on the floor, including three cores, faunal remains representing unidentified small mammals and large fish, and Prescott Gray and Verde Brown sherds. Charred wood from the burned superstructure was submitted for radiocarbon analysis (Beta-260623) and produced a 2σ calibrated date range of A.D. 550–690, but ceramics and time-diagnostic artifacts in the floor fill suggested that the structure was constructed and occupied after A.D. 600 (Deats 2011:3.15).

Feature 52 at AZ N:4:110 (ASM) was a subrectangular pit structure with a side alcove-like entryway flanked by two "benches" or a raised sections above the floor. Other than the entry and benches, no floor subfeatures or artifacts were encountered; it is likely that the exploratory backhoe trench removed the central hearth. A charcoal sample composed of charred reed segments and wood charcoal from the floor fill was submitted for radiocarbon analysis and produced a 2σ calibrated date range of A.D. 660–900. This date range plus temporal data associated with floor-fill artifacts suggested that the structure was occupied during the late A.D. 700s to early 800s (Deats 2011:3.28).

Feature 68 at AZ N:4:110 (ASM) was a rectangular pit structure underlying pit-structure Feature 52. It was a rectangular structure without subfeatures, floor artifacts, or evidence of an entryway. Deats (2011:3.23) assigned it a construction date similar to, but slightly earlier than, that of Feature 52 (discussed above) based on its stratigraphic position; he inferred that it, too, likely dated to the later A.D. 700s or early 800s.

Features

Features associated with Hackberry phase occupations include pit houses, field houses, artifact scatters (including ceramics), trash mounds, and human burials. If we are wrong about reassigning the two sites on the Crescent Moon Ranch, then other features associated with this phase would include extramural storage pits and roasting pits. Table 33 provides information on Hackberry phase pit structures in the MVRV.

Subsistence Remains

We have little subsistence information for the Hackberry phase. So few sites have been investigated and reported that we can say little about food and household resources. Faunal bone recovered from the fill of Feature 7 at AZ O:5:155 (ASM) included mule deer, black-tailed jackrabbit, desert cottontail, and turkey, among other unidentified small-, small- to medium-sized-, and large-mammal specimens (Spurr 2007:D.3).

Correlates of Settlement

To date, all sites inferred to have Hackberry phase components have fewer than eight rooms ("very small" category), and the investigated Hackberry phase dwellings have been single pit structures ("extremely small" category). Because so few sites have been assigned to this phase, we have little information to suggest what environmental variables correlate with Hackberry phase settlement. At this time, we make only the following observations. Most Hackberry phase sites are found at elevations in the 4,000–4,500-foot AMSL range (averaging about 4,270 feet AMSL), although a few are lower or higher (Figure 23). The average elevation of the few sites with pit structures assigned to the Hackberry phase is approximately 4,200 feet AMSL, almost 600 feet higher than the average pit structure assigned to the Squaw Peak phase. Hackberry phase sites often are found on landforms with agave or arable land, but not always (Figures 24 and 25). Because the diagnostic artifact

Table 33. Sample of Hackberry Phase Dwellings in the Middle Verde River Valley

Reference	Site No.	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m^2)
Breternitz (1960a); Stebbins et al. 1981	NA3607	Calkins Ranch	House 1C	4.3	3.2	13.9
Deats (2007)	AZ O:5:155 (ASM)		7	8.5	7.8	66.3
Deats (2011)	AZ N:4:110 (ASM)	Grey Fox Ridge	6	3.6	2.4	8.5
Deats (2011)	AZ N:4:110 (ASM)	Grey Fox Ridge	19	4.2	4.0	16.8
Deats (2011)	AZ N:4:110 (ASM)	Grey Fox Ridge	52	4.8	4.1	19.7
Deats (2011)	AZ N:4:110 (ASM)	Grey Fox Ridge	68	3.5	2.5	8.8
Mean						22.3
Standard deviation						22.0

Key: ASM = Arizona State Museum.

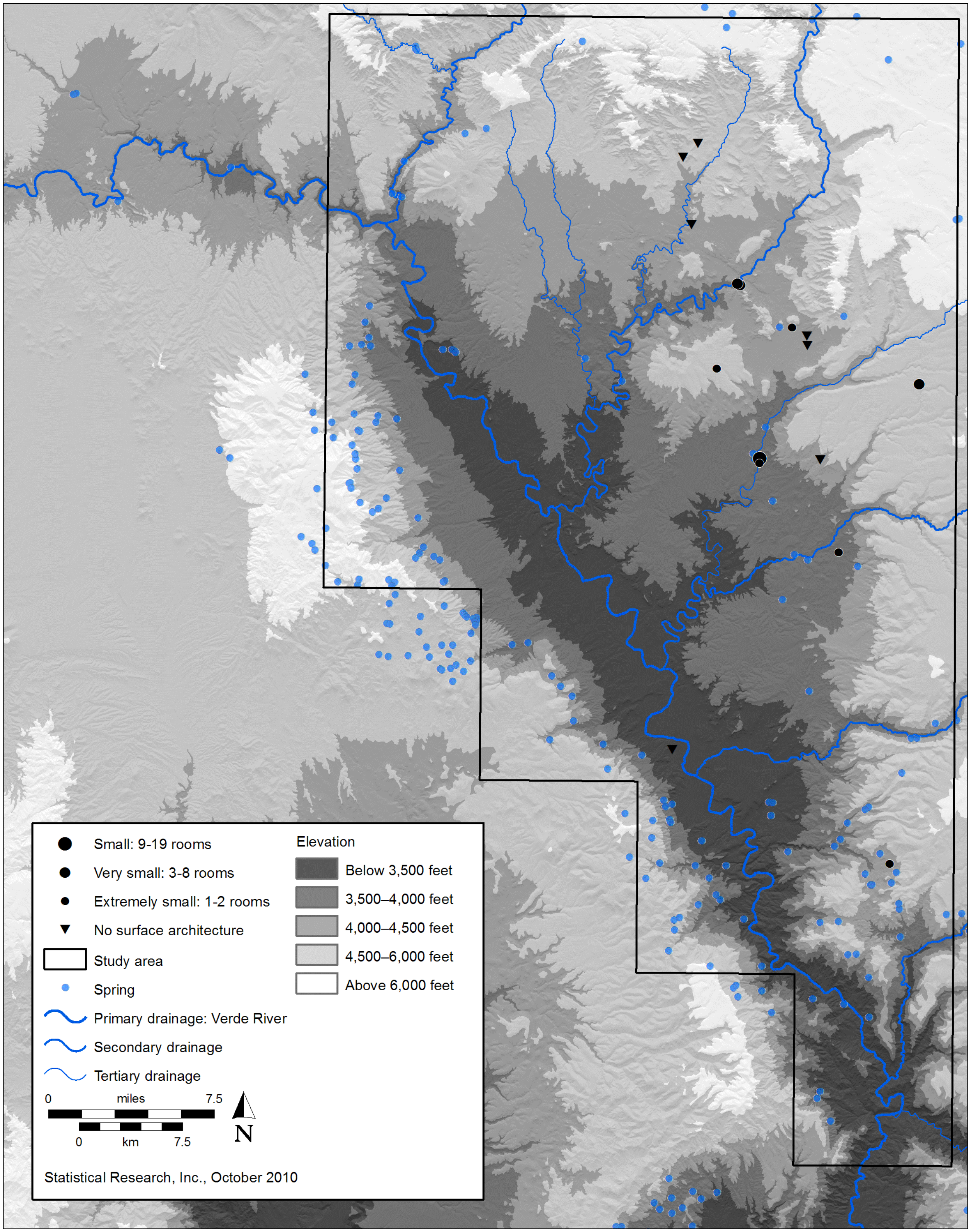

Figure 23. Map showing the elevational ranges of Hackberry phase sites in the middle Verde River valley.

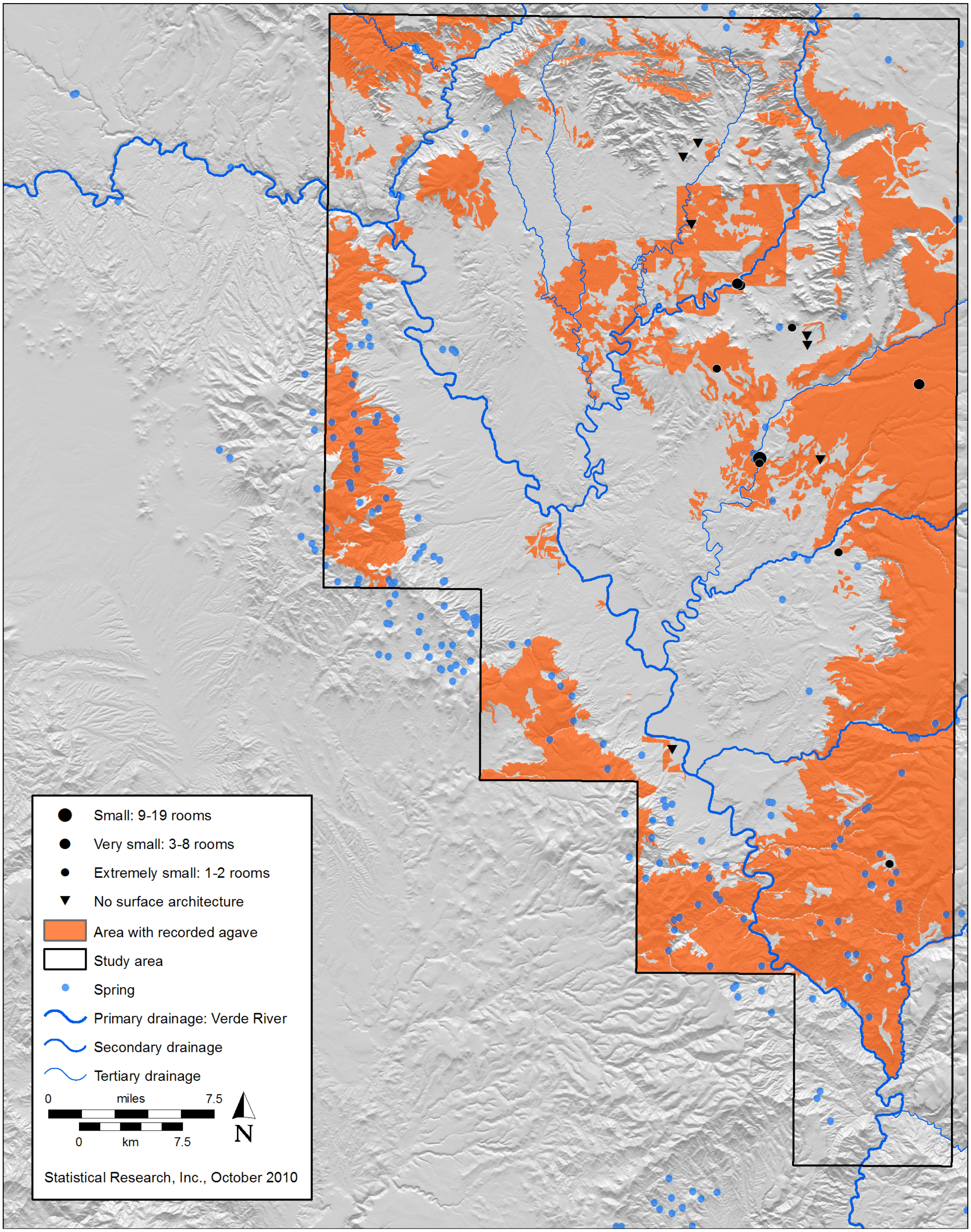

Figure 24. Map showing the locations of Hackberry phase sites relative to agave-growing land.

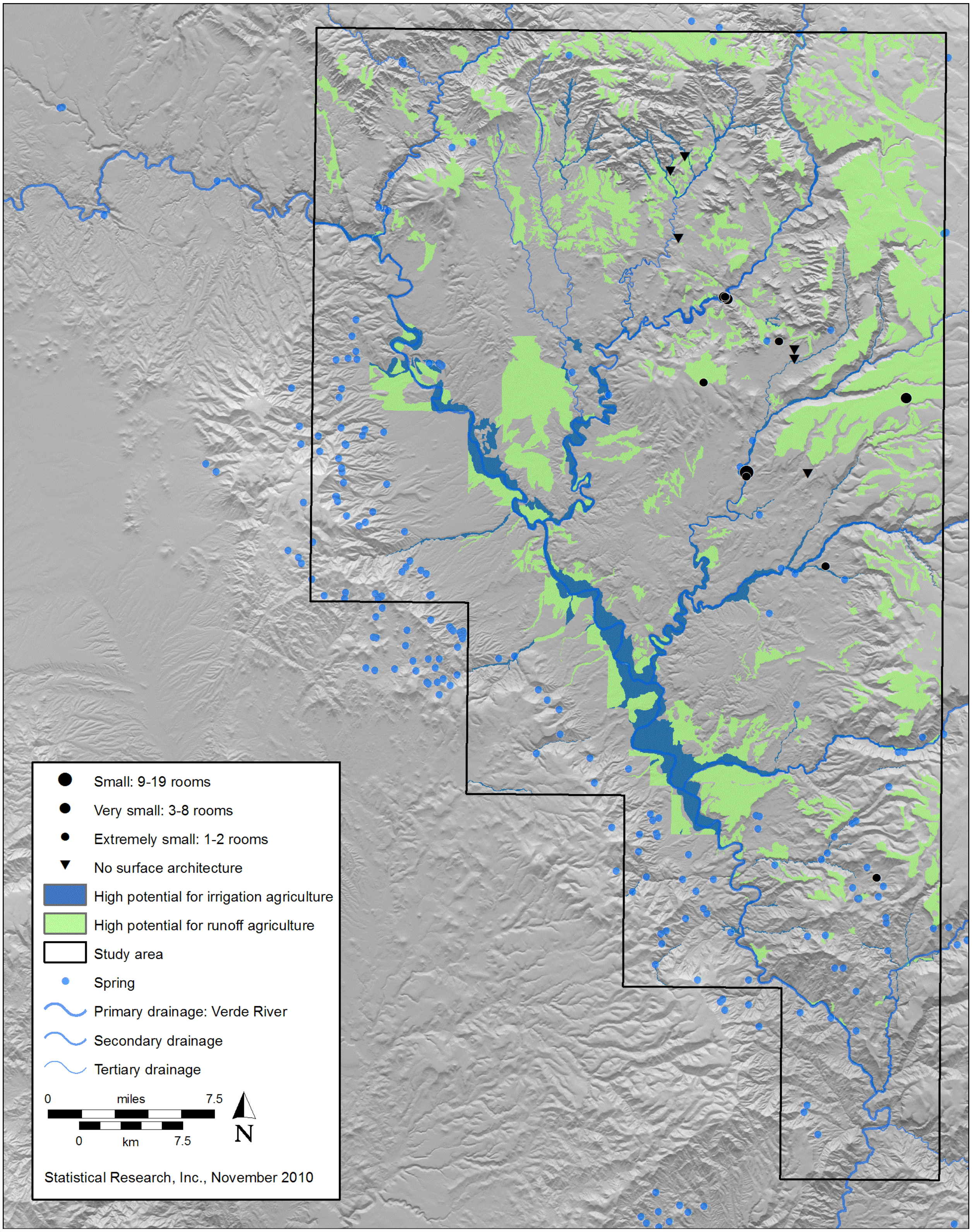

Figure 25. Map showing the locations of Hackberry phase sites relative to lands with high potential for irrigation and runoff agriculture.

for defining the Hackberry phase is a locally manufactured plain ware, Verde Brown, our confidence that these sites have been assigned to the correct and very narrow time period is low.

Our small sample of Hackberry phase sites tend to be on slightly steeper slopes (about 12 percent) than Squaw Peak phase sites (about 9 percent slopes) and somewhat farther away from small and large drainages and known springs. These locations tend to fall close to arable land that is better suited to runoff-type agriculture than irrigation-type agriculture, but choice locations for Hackberry phase sites also include riverine settings (e.g., Oak Creek and Dry Beaver Creek). About half of all Hackberry phase sites are located or near biotic communities that include agave.

Paleoenvironmental Correlates

Because the dating of this phase is so poor, it is difficult to suggest what correlations may have existed between land-use practices and past environmental conditions. What we can say is that the period between A.D. 650 and 700 was a time when regional water tables were high and river floodplains were fairly stable. Dendrochronological reconstructions of precipitation, temperature, and stream flow indicate that variable and often extreme conditions occurred (see Chapters 4 and 5 of this volume). Notable dry-warm droughts, dry-cool droughts, and wet-cool spells were common from the mid–A.D. 600s through the early 700s. Three sets of extremely severe double-year droughts (A.D. 645–646, 663–664, and 699–700) and one 3-year period of unusually high floods (A.D. 691–693) in an already cool and wet period took place within this half century. The duration, magnitude, and interannual persistence of the cool spell at the end of the seventh century undoubtedly had ramifications for successful crop production in the MVRV. The advantageous position of the Calkins Ranch site and the Verde Ball Court site near the confluence of West Clear Creek and the Verde River may have been attractive to Hackberry phase populations, in part because of climate considerations and the abundance of arable land suitable for runoff and irrigation farming.

If the Hackberry phase did continue to A.D. 800, then residents of the MVRV witnessed major environmental changes. The eighth century began with a marked dry-warm drought and continued as a predominantly dry era for six decades. A lengthy drought in the middle of the eighth century, which persisted in the MVRV from A.D. 737 to 762, was widely experienced across the U.S. Southwest. This mid-century drought was accompanied by degrading floodplains and dropping regional water tables—conditions that persisted well into the A.D. 800s. A long period of cooler-than-normal climate with rapidly alternating intervals of wetter- and drier-than-normal conditions was established by A.D. 786 and continued to the end of the century and well beyond. For much of the warm and dry A.D. 700s, then, the most productive agricultural fields would have been along the margins of perennial streams; near dependable springs, where water could have been diverted; or at higher elevations, where rainfall could be retained or harvested. The Hackberry phase type site, NA3607, might be an example of a Hackberry phase settlement in the uplands above 4,500 feet AMSL that was occupied in the eighth century.

Inferred Land-Use Patterns

Too few data are available to suggest anything more than an outline for the Hackberry phase. Occupants of sites assigned to the Hackberry phase appear to have maintained land-use practices similar to those described for the Squaw Peak phase.

Formative Period: Cloverleaf Phase

Recorded Sites

The MVRV ALD indicated that 109 components assigned to the Cloverleaf phase (ca. A.D. 700/800–900) have been recorded (Figure 26). Of those, 12 are components of sites that have been investigated beyond initial inventory. Two of the 12 are represented by single-component sites, and the rest are represented by features at multicomponent sites. Most sites inferred to have Cloverleaf phase components are nonarchitectural artifact scatters and extremely small sites (1–2 rooms); a few sites, however, are larger and fall into the “very small” (3–8 rooms) or “small” category (9–19 rooms). Generally speaking, these larger sites are multicomponent sites with later occupations. Our best guess is that the largest settlements in the Cloverleaf phase were habitations with fewer than 9 noncontemporaneous pit structures.

Assigning Sites to the Cloverleaf Phase

Sites are assigned to the Cloverleaf phase when assemblages from surface artifact scatters or materials recovered from excavations are dominated by local ceramic plain wares in association with cross-dated types assumed to have been acquired through trade and exchange. The local plain ware types are predominantly Verde Brown, but some sites may have Rio de Flag Brown or Wingfield Plain. Extralocal painted ceramic types commonly associated with this time period include Gila Butte Red-on-buff, Santa Cruz Red-on-buff, Kana-a Gray, Kana-a Black-on-white, Wepo Black-on-white, and Deadmans Black-on-red.

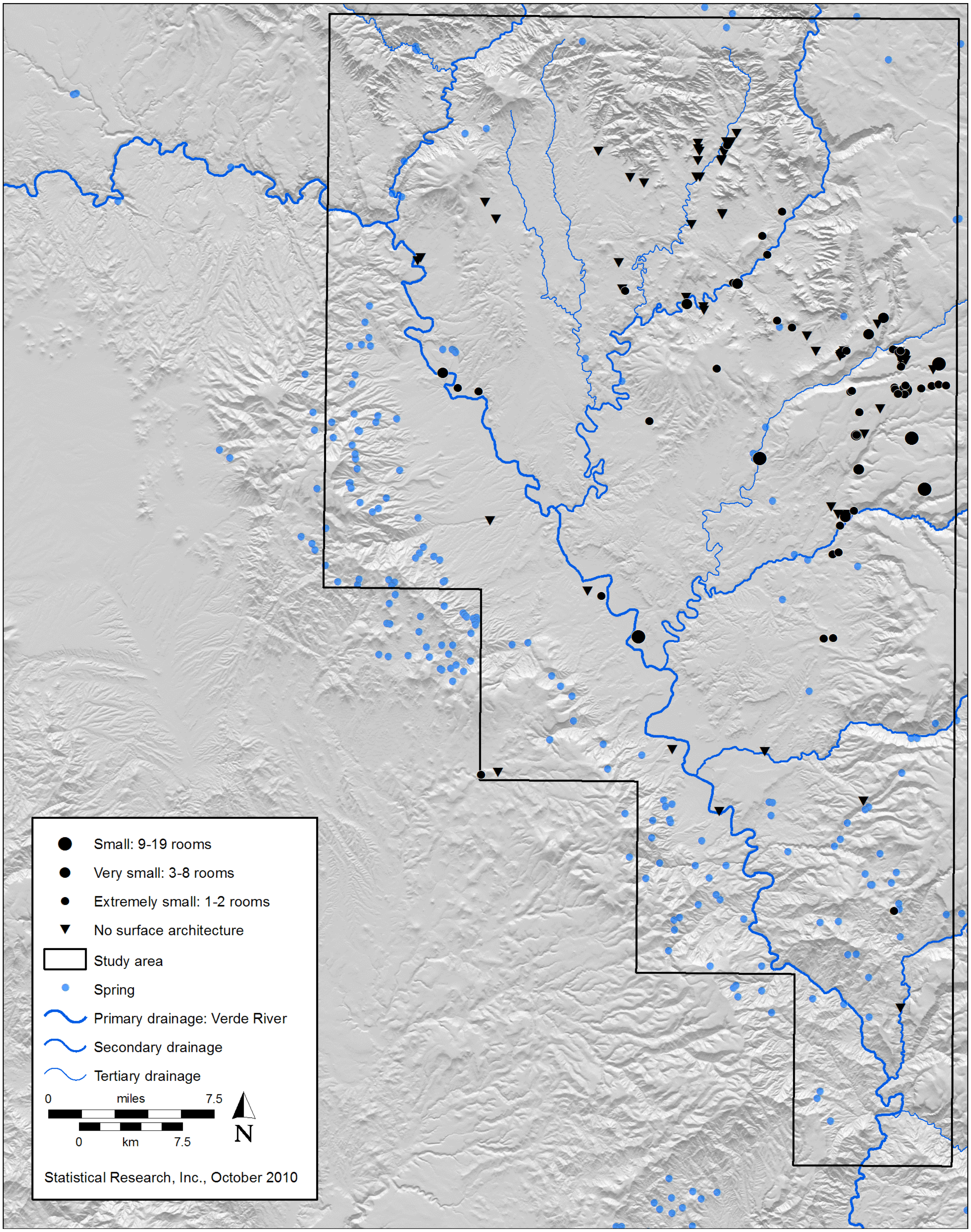

Figure 26. Map showing the locations of Cloverleaf phase sites in the middle Verde River valley.

Investigated Sites

Breternitz (1960a:22) defined the Cloverleaf phase on slightly more evidence than the earlier phases. He used data from four houses at the Calkins Ranch site (NA2385) and ceramics from lower levels of the Verde Ball Court site trash mound (NA3528) to define an MVRV-phase equivalent to the Santa Cruz phase of the Hohokam sequence. The presence of extralocal ceramics from both the south (e.g., Santa Cruz Red-on-buff) and the northeast (e.g., Kana'a Black-on-white and Deadmans Black-on-red) were used to date the features and artifact scatters attributed to this occupational phase. Dean's reconsideration of phases with the Hohokam cultural sequence suggests that the Santa Cruz phase, when Santa Cruz Red-on-buff was the predominant decorated ceramic type, could be as early as A.D. 700 but more likely ranges between A.D. 850 and 950 (Dean 1991:Table 3.3).

In the 50 years since this phase was defined (Breternitz 1960a:22–23), a number of sites with inferred Cloverleaf phase components have been investigated in the MVRV. Among them are the following: Stoneman Lake site (NA11254) (Metcalf 1973), Lazy Bear (NA11076) (James and Black ca. 1974), Verde View (AZ O:5:12 [ASM]) (McGuire 1977; Wasley 1957), Kish (AZ N:4:18 [ASM]) (Dosh 1990; Munson 1977; Zyniecki and Motsinger 1991), SWCA's Verde Terrace site (AZ N:4:23 [ASM]) (Greenwald 1989), the Burgbacher site (AZ O:9:3 [ASM]) (Weaver 1989), Crescent Moon Ranch pit-house-site AZ O:1:111 (ASM) (Pilles 1991; Shepard et al. 1998), AR-03-04-06-516 (CNF) (Weaver and Spaulding (1999), the Jessica site (AZ O:1:47 [ASM]) (Weaver 2000), AR-03-04-06-194 (CNF) (Dosh 2003), the Talon site (AZ O:1:141 [ASM]) (Edwards et al. 2004), and the Grey Fox Ridge site (AZ N:4:110 [ASM]) (Deats 2011). Of these, only eight—Calkins Ranch, Lazy Bear, the ASM's Verde View, Kish, SWCA's Verde Terrace, Jessica, the Crescent Moon Ranch pit-house site, and Grey Fox Ridge—revealed sufficient evidence to tentatively assign them to the Cloverleaf phase as currently dated (see Appendix C). Unfortunately, not all reports and manuscripts have illustrations of Cloverleaf architecture. Figure 27 illustrates the range of architectural forms and intramural features unearthed to date. Table 34 lists pit-structure dimensions for described or illustrated pit structures dating to this time period.

Another structure of comparative interest is a pit structure (Feature 110) excavated at the large, multicomponent AZ N:7:286 (ASM), in Prescott Valley (Leonard and Robinson 2005) (see Figure 27). This house-in-a-pit contained numerous floor features, artifacts, and well-preserved botanical remains. Similar to Calkins Ranch (Houses 4 and 7) and the ASM's Verde View site (Pit Houses 1 and 2), the Prescott Valley pit house had floor grooves around part of the perimeter and upright stone that supported a raised floor or raised platform. A fragment of charred structural wood in contact with the floor (Beta-183211) yielded a 2σ calibrated date range of A.D. 690–990.

Features

Features investigated in Cloverleaf phase contexts include dwellings identified as pit houses and/or habitation structures, seasonally used habitations or field houses, artifact scatters, thermal features (roasting pits or hearths), and human burials (cremations and inhumations). Architectural features may contain one or more subfeatures, including hearths, floor pits/cists, postholes, and notched tabular stones presumably used to support raised floors or platforms. In addition, the first evidence of public or integrative architecture—ball courts and formal trash mounds—occurred in the Cloverleaf phase. Few of these special forms, however, have been professionally investigated and reported.

Based on data provided by Schroeder (1949a, 1949b, 1951), Breternitz (1960a), Fish (1974), and the MNA site files, Fish et al. (1980) identified four ball courts in the MVRV that had their origins in the Cloverleaf phase. These include the two courts at the Verde Ball Court site, one at the Tapco Ball Court site (NA5228), and one at Coons Ranch Ball Court site (NA5275); a fifth early ball court was in the upper Verde River valley, at the Perkins Pueblo (AZ N:4:12 [ASU]). The Verde Ball Court site ball courts and the Coons Ranch Ball Court site ball court continued to be used in the subsequent Camp Verde phase, whereas use of the Tapco Ball Court site and Perkins Pueblo site ball courts was discontinued after A.D. 900. Fish et al. (1980) also identified two sites in the MVRV—the Verde Ball Court site and the Calkins Ranch site—where formal trash mounds were begun during the Cloverleaf phase and persisted until about A.D. 1000, through the early Camp Verde phase.

Pit structures from this time period take four different forms: round, irregular, oval, and rectangular, with and without floor grooves (see Figure 27). The three pit structures at the Stoneman Lake site[13] were round dwellings with ramped entryways. Postholes near the margins of the circular structures and along the elongated entryway were present. A fire-darkened area near the center of the best-preserved structure (Pit House 3) may be representative of this type of seasonal dwelling. Additional postholes within each structure marked the locations of activity areas or features within the main chamber. Each of the three dwellings contained portable ground stone artifacts as well as basalt bedrock exposed on the floor. In at least

13 Metcalf (1973) assigned these pit houses to the Sunset phase (A.D. 700–900) of the Northern Sinagua sequence rather than the Hackberry phase of the Southern Sinagua sequence, based on the predominance of northern-style Alameda Brown Ware.

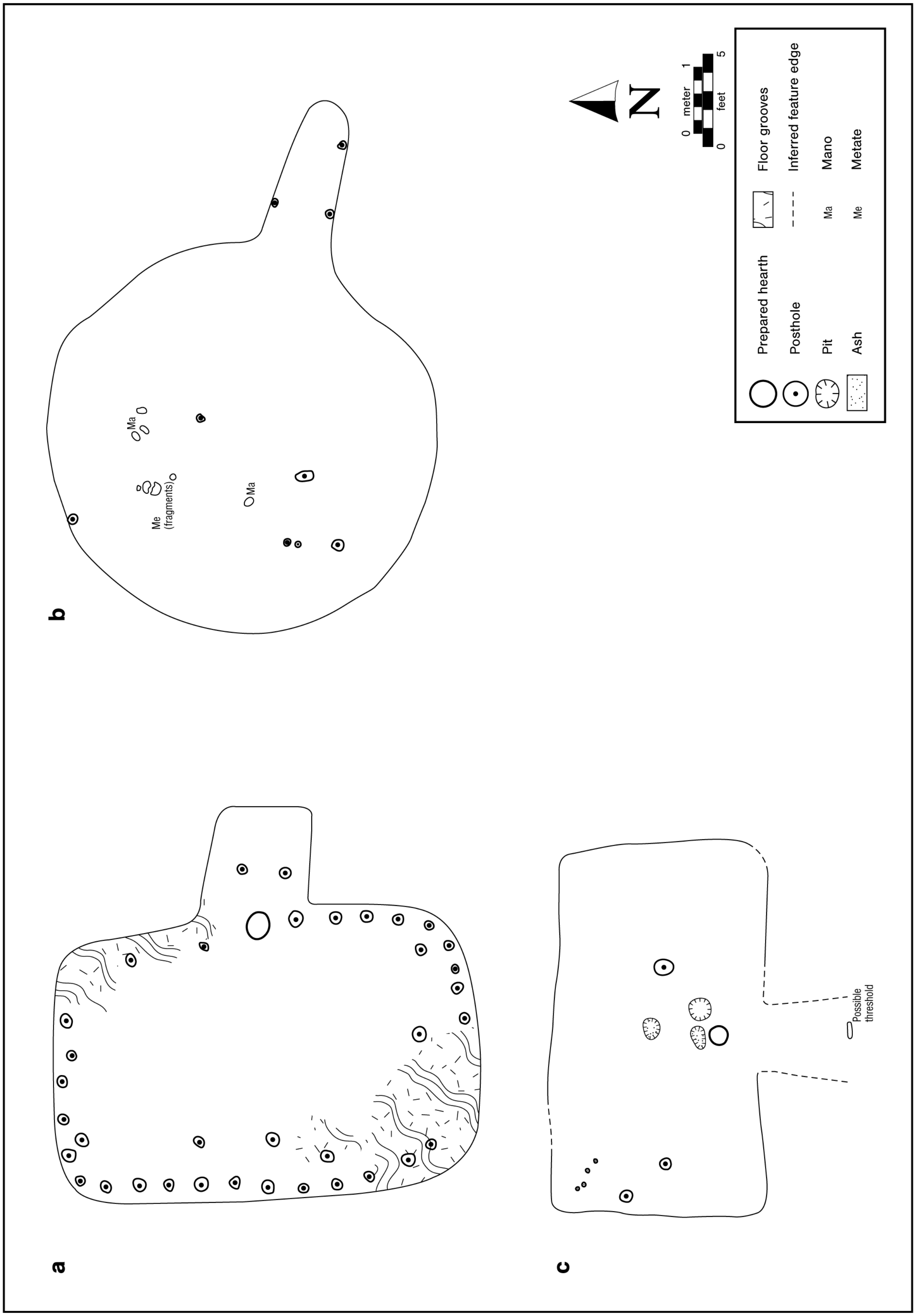

Figure 27. Sketches of Cloverleaf phase architecture in the middle Verde River valley: (*a*) AZ O:5:12 (ASM), the Verde View site, House 1 (McGuire 1977:Figure 6); (*b*) NA11254, Stoneman Lake site, House 3 (Metcalf 1973); and (*c*) AZ N:4:23 (ASM), SWCA Verde Terrace site (Greenwald 1989:Figure 4-4).

Table 34. A Sample of Cloverleaf Phase Dwellings in and near the Middle Verde River Valley

Reference	Site No.	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m^2)
Breternitz (1960a)	NA2385	Calkins Ranch site	4	8.6	5.6	48.0
Breternitz (1960a)	NA2385	Calkins Ranch site	7	6.8	5.6	37.7
Greenwald (1989)	AZ N:4:23 (ASM)	Verde Terrace site	3	5.7	3.2	17.8
Greenwald (1989)	AZ N:4:23 (ASM)	Verde Terrace site	4	5.0	4.0	20.0
James and Black (ca. 1974)	NA11076	Lazy Bear	Pit House 1	3.6	3.0	10.6
Leonard and Robinson (2005)	AZ N:7:286 (ASM)[a]	none	Feature 110	5.5	3.5	19.3
McGuire (1977)	AZ O:15:12 (ASM)	ASM Verde View site	Pit House 1	6.7	4.7	31.4
McGuire (1977)	AZ O:15:12 (ASM)	ASM Verde View site	Pit House 2	6.9	4.0	27.2
Metcalf (1973)	NA11254	Stoneman Lake site	Pit House 1	6.0	6.7	40.4
Metcalf (1973)	NA11254	Stoneman Lake site	Pit House 2	5.8	5.8	33.6
Metcalf (1973)	NA11254	Stoneman Lake site	Pit House 3	5.8	5.9	34.4
Munson (1977)	NA15600	Kish site	Pit House 1	4.0	3.1	12.6
Mean						27.7
Standard deviation						11.7

Key: ASM = Arizona State Museum.

[a] This site is in Prescott Valley, not the middle Verde River valley.

one of these houses (Pit House 2), the exposed bedrock had been used as a grinding surface. Pit House 2 also had an internal storage pit.

Two irregular- to oval-shaped pit structures at the Calkins Ranch site (Houses 2 and 3) (Breternitz 1960a:Figures 13 and 14) had wall-perimeter postholes, a few interior postholes, and floor-contact artifacts. Evidence of a hearth was absent from both structures, but Breternitz (1960a:6) surmised that the ditching machine that trenched through both structures had destroyed their hearths. Neither of these oddly shaped structures had floor grooves.

Another form of pit structure present in the Cloverleaf phase was the Hohokam-like house-in-a-pit. This form is rectangular with rounded corners and an entry along one of the longer walls. Two of the four Cloverleaf phase pit structures at the Calkins Ranch site (Houses 4 and 7) (Breternitz 1960a:Figures 15 and 16) and two Cloverleaf phase pit structures at the Verde View site (Houses 1 and 2) (McGuire 1977:Figures 6, 9, and 12) are houses in shallow pits with perimeter floor grooves and postholes and interior hearths in front of formal entryways with entryway floor grooves and posts. Numerous interior postholes were present in these structures, and at least one of two structures at the Calkins Ranch site (House 7) had tabular notched stones embedded in the basin-shaped floor depression. Because of its large size (48 m^2), Breternitz (1960a:7) inferred that House 4 was a communal structure.

Similarly, the two Verde View site structures were houses-in-pits excavated into caliche. These structures contained wall grooves and entryway grooves, wall-perimeter posts, hearths near entryways, and floor artifacts (McGuire 1977:18). House 2 also had two centerline main posts and preserved roof material identified as charred reed grass. McGuire (1977:18) likened the morphology of these two houses to Haury's (1976:53–56) Sacaton phase House Type S-1.

In Prescott Valley, Feature 110 at AZ N:7:286 (ASM), reported by Leonard et al. (2005), looks very similar to two Verde View pit structures excavated by McGuire (1977), except that it lacked the formal entryway with floor grooves. Feature 110 contained many postholes paralleling a floor groove, as well as four plastered hearths; taken together, this evidence suggests that the house was reused and remodeled several times during its existence. The house also contained one unburned pit and eight upright notched stones that presumably supported one or more platforms or features. Many artifacts were recovered from the floor, including pottery sherds of numerous types assigned a mean ceramic date of ca. A.D. 840 (Christenson and Leonard 2005:Table 8.38), an unidentified brown ware figurine, a Verde Brown spindle whorl, several flaked schist/phyllite tabular tools, a projectile point, cores and core tools, flakes, a lapstone, one- and two-handed manos, a hammerstone, a polishing stone, a shell-bracelet fragment, a stone palette, a manuport, and a number of burned animal bones.

A fourth form—rectangular with rounded corners, an entryway along a long side wall, and no perimeter floor grooves or entryway grooves—was found at SWCA's Verde Terrace site (Feature 3) and the nearby Kish site (Pit House 1). Feature 3 at Verde Terrace had a slightly flared entryway with a possible threshold stone, a hearth near the entryway, two ash pits, several interior postholes, and an interior bell-shaped storage pit. The single pit house from the Kish site contained four subfloor pits, three of which were interconnected. Archaeologists did not find evidence of an interior hearth, however.

Subsistence Remains

Botanical and faunal remains associated with Cloverleaf phase occupations have been recovered from several sites in the MVRV (see Table 70, Chapter 8, Volume 2 of this report). Faunal remains were reported from at least four sites: SWCA's Verde Terrace site, Kish, the Verde View site, and Lazy Bear. Cottontails, black-tailed jackrabbits, and deer were recovered from all four sites. In addition, mud turtle and pocket gopher were recovered from Verde Terrace; minnow-sized fish, unidentified bird, white-foot mouse, and woodrat were recovered from Kish; freshwater clam and Merriam's elk were recovered from Verde View; and pronghorn was recovered from Lazy Bear.

Botanical remains recovered from flotation and pollen samples from Cloverleaf phase contexts were reported from two sites: SWCA's Verde Terrace site and the Verde View site. Both sites yielded evidence of maize and the presence of a variety of useful wild plants (see Table 19, Chapter 5 of this volume). Among these wild plants were members of the goosefoot family, beeweed, Mormon tea, wild buckwheat, juniper, stickleaf, cholla or prickly pear, plantain, and cattail, among others. Wood used for fuel and building materials included ash, cholla, piñon, cottonwood, mesquite, and common reed.

Correlates of Settlement

The data we have compiled to date suggest that it was during the Cloverleaf phase, whatever its beginning and end dates, that "village life" began. At least three excavated sites (Calkins Ranch, the Stoneman Lake site, and Verde View) contained 2–4 Cloverleaf phase pit structures that likely were occupied at the same time. Site-file records also suggested that several unexcavated sites assigned to the Cloverleaf phase likely contain 3–10 pit structures (e.g., AR-03-04-01-734 [CNF], AR-03-04-01-792 [CNF], AR-03-04-06-520 [CNF], and AR-03-04-06-533 [CNF]). Cloverleaf phase occupations, then, may represent the first instance of three or more cooperating households' establishing a residence at a given location. We classify these Cloverleaf phase occupations as examples of very small (3–8 rooms) habitation sites.

Figure 26 depicts the locations of sites assigned to the Cloverleaf phase in the 2,343-site MVRV ALD. The majority of these sites are on the northeastern side of the MVRV, primarily in the uplands, between 4,500 and 6,000 feet (AMSL), along the edge of the Mogollon Rim (Figure 28). The average elevation of our sample of sites with Cloverleaf phase components is 4,530 feet (AMSL). At least one cluster of Cloverleaf phase components is located in the uplands on either side of Rattlesnake Canyon. Although considerably fewer in number, a scatter of sites with Cloverleaf components is below 4,000 feet (AMSL) along the Verde River (e.g., SWCA's Verde Terrace site, Kish, Verde View, the Calkins Ranch site, and Grey Fox Ridge) and the mid- to upper reaches of the three tributaries: Wet Beaver Creek (with a notable cluster near Sacred Mountain), Dry Beaver Creek, and Oak Creek. The upland sites tend to be in areas where agave has been known to grow (Figure 29), but as yet, no agave remains have been recovered from Cloverleaf phase features.[14] Perhaps more importantly, upland sites with Cloverleaf components tend to be located in areas where runoff or floodwater farming would have been possible, whereas lowland sites are associated with arable land that could be farmed with floodwater or irrigation methods in floodplain settings (Figure 30). As a group, sites with Cloverleaf phase components tend to be farther away from minor and major tributaries and springs than sites with Hackberry phase components, but that group tendency does not capture the bimodal pattern of riverine and nonriverine settlement that appears to have been forming during this phase.

Paleoenvironmental Correlates

As with the earlier phases, the beginning and end dates associated with the Cloverleaf phase are debated. As discussed above, the Cloverleaf phase began sometime between about A.D. 700 and 800 (more likely the latter) and ended sometime around A.D. 900. Generally speaking, then, the Cloverleaf phase is ninth-century development. The coolness of the late 700s continued well into the 800s. Overall, it was a century of cooler and wetter conditions that contrasted with the notable warmth and frequent drought of the previous century (see Chapters 4 and 5 of this volume). These climatic conditions partially offset low water tables and entrenched floodplains that characterized much of the U.S. Southwest at that time. Temporal variability in climate, however, was very high throughout the 800s; great adaptability in both subsistence and settlement practices would have been necessary to cope with the lack of interannual predictability and to successfully harvest maize. The ninth century was bracketed by two extreme flood episodes: A.D. 804–805 and 898–899. The flood or floods of A.D. 899 were exceptionally intense and were widely experienced across the U.S. Southwest. Following arguments first presented by Nials and his colleagues for

[14] McGuire (1977:33) recovered three examples of tabular-basalt knives from the Verde View site (AZ O:5:12 [ASM]), and they could be interpreted as indirect evidence of the processing of tough plants such as cactus, yucca, or agave.

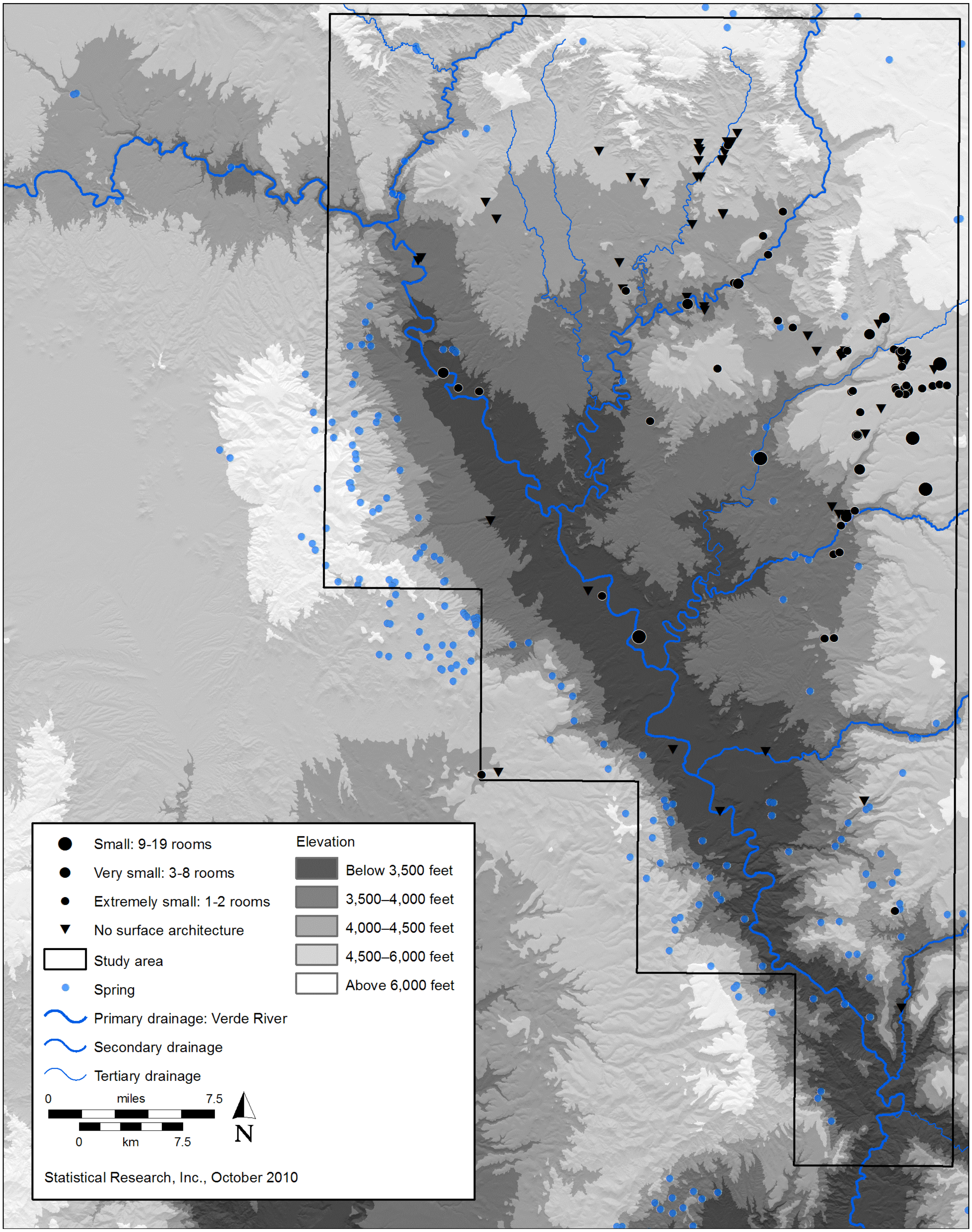

Figure 28. Map showing the elevational ranges of Cloverleaf phase sites in the middle Verde River valley.

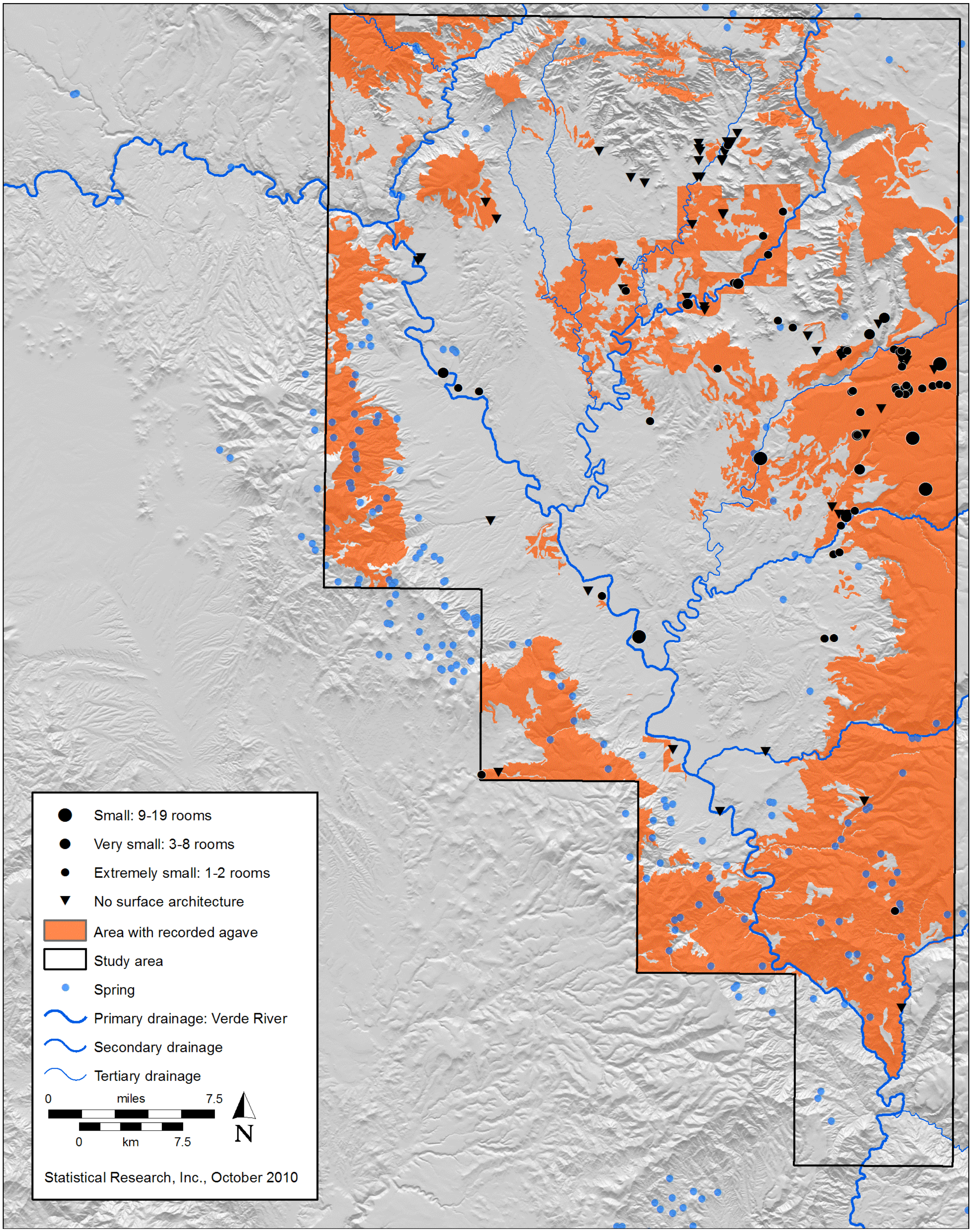

Figure 29. Map showing the locations of Cloverleaf phase sites relative to agave-growing land.

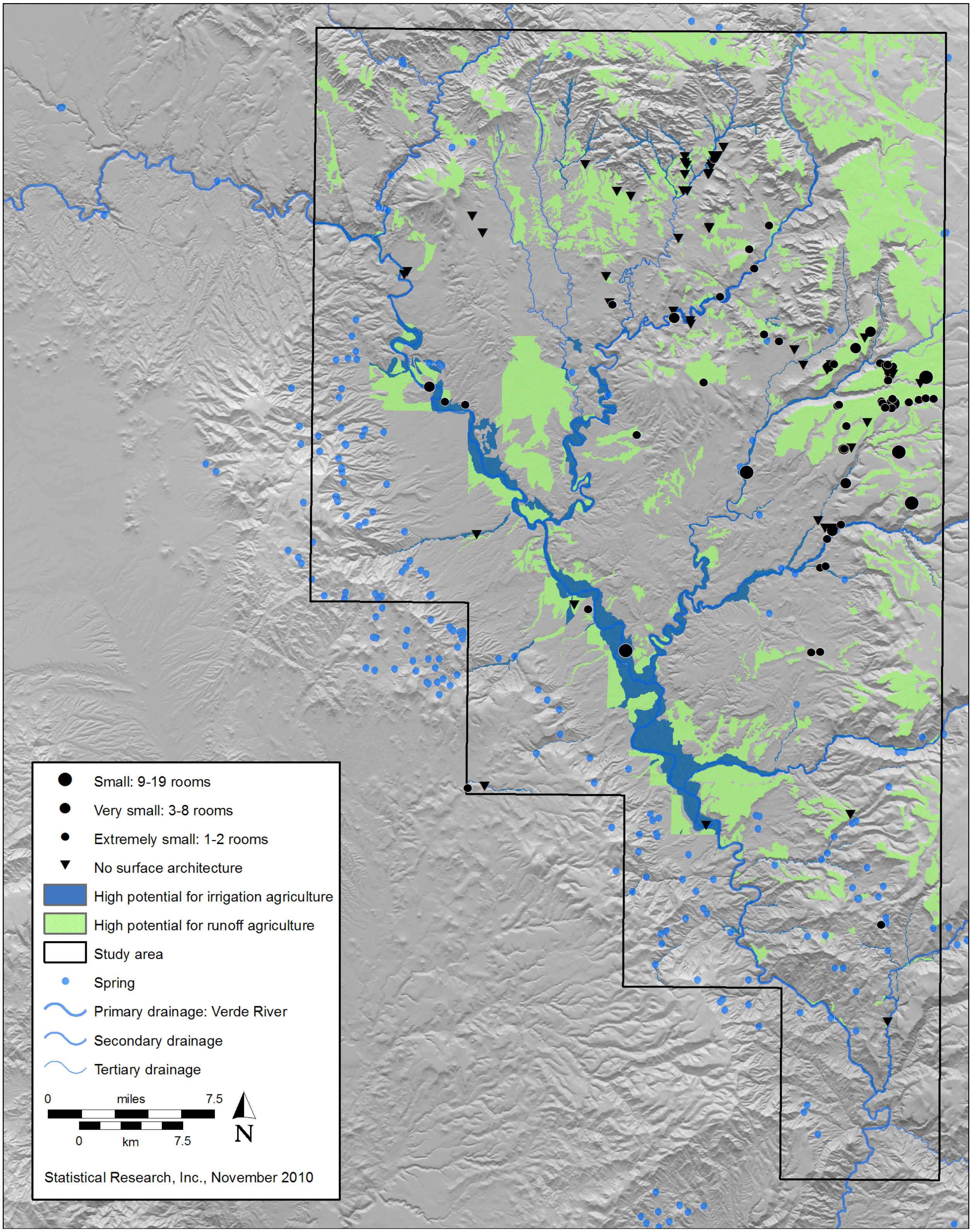

Figure 30. Map showing the locations of Cloverleaf phase sites relative to lands with high potential for irrigation and runoff agriculture.

the Phoenix Basin (Nials et al. 1989), we suggest that this late-ninth-century flood was of sufficient magnitude to have altered floodplain morphology along the middle Verde River and its major tributaries. If at least some Cloverleaf phase residents of the MVRV were irrigation farmers, the late-ninth-century floods could also have done considerable damage to canal systems along the Verde River below Oak Creek, as well as the lower reaches of its major tributaries.

Inferred Land-Use Patterns

Although more sites can be attributed to the Cloverleaf phase than to any of the preceding phases, it is not well understood. What we do know is that at least some Cloverleaf phase populations were committed to an agricultural way of life and that it is likely that two or more different ethnic groups lived in the MVRV for at least part of the year. The variety of dwelling forms present during this 100- to 150-year-long time period suggests that groups representing or emulating building traditions of the plateau/mountains (i.e., Northern Sinagua and Mogollon) and deserts (i.e., Hohokam) were present. That five Hohokam-like ball courts in and adjacent to the MVRV were established during the Cloverleaf phase suggests that leaders wanted to engage local populations in societal activities of mutual interest.

Settlement data indicate that during the Cloverleaf phase, multiple-household groups established small farmsteads near arable land. It is tempting to suggest that the people of the Cloverleaf phase occupations in the lowlands were attracted to given locales to take advantage of running water in the major streams that could be diverted to irrigate crops on adjacent terraces. Multicomponent sites, such as Calkins Ranch and Verde View in the southern portion of the MVRV, contain solid evidence of Cloverleaf phase occupation and house forms similar to those constructed by southern groups (e.g., rectangular houses-in-pits with side entries, floor grooves and perimeter posts, and hearths close to and aligned with formal entryways), which often contained southern-style artifact types other than pottery associated with Hohokam culture (e.g., slate palettes, paint palettes, stone bowls, basalt cylinders, ceramic spindle whorls, and *Glycymeris*-shell bracelets). It is in these same lowland locations that the early Hohokam-like ball courts were established along the Verde River, with a three-court cluster in northwest (the Perkins Pueblo, Coons Ranch, and Tapco Ball Court sites) and another two courts in the southeast (the Verde Ball Court site).

In contrast, Cloverleaf phase settlement in the uplands may have been established as extended-stay base camps to take advantage of summer runoff to cultivate maize and secure wild resources. If the Stoneman Lake site is typical of upland settlement, then a case could be made that the much deeper, circular pit structures with southeast-facing ramped entries were constructed by a social or ethnic group different from the groups who constructed houses at the Calkins Ranch and Verde View sites. Metcalf (1973) assigned the occupation at Stoneman Lake to the Sunset phase (ca. A.D. 700–900) of the Northern Sinagua cultural sequence on the basis of architectural form and recovered artifacts.

Yet another house-form type—the rectangular pit house with rounded corners, a long-side entryway, and no perimeter floor grooves or entryway grooves—found at SWCA's Verde Terrace site and the nearby Kish site as well as the Lazy Bear site may represent the local building traditions of the MVRV.

Until we can date the occupations at each of these sites more accurately, we cannot know whether these dwellings were, in fact, contemporary rather than sequential. Still, the variety of dwelling forms, artifact inventories, and site settings support the idea that different ethnic groups were living in the MVRV at least as early as the Cloverleaf phase.

Formative Period: Camp Verde Phase

Recorded Sites

The MVRV ALD indicated that 244 sites had components dating to the Camp Verde phase (A.D. 900–1150) (Figure 31), and 26 of them have been investigated beyond initial recording. At the present time, we have identified several more sites with Camp Verde phase components, bringing the total to 250 sites. Of those, at least 35 have been investigated. Twelve of the 35 were inferred to be single-component sites, and the other 23 were multicomponent. Of the 35 investigated sites, we are aware of 15 sites with structures and other subsurface features that were excavated, mapped, and described in various degrees of detail. Sites assigned to the Camp Verde phase are either artifact scatters or habitation sites with fewer than 15 rooms. As described for earlier phases, most of the larger sites are multicomponent sites with later occupations.

Assigning Sites to the Camp Verde Phase

Sites assigned to the Camp Verde phase contain artifact collections dominated by local ceramic types from the Alameda Brown Ware series (especially Verde Brown) in association with types assumed to have been acquired through trade and exchange. These commonly include Deadmans Black-on-red, Black Mesa Black-on-white, Sosi Black-on-white, Dogozhi Black-on-white, Tusayan Corrugated, Tusayan Black-on-Red, Holbrook A Black-on-white, Holbrook B Black-on-white, and Sacaton Red-on-buff.

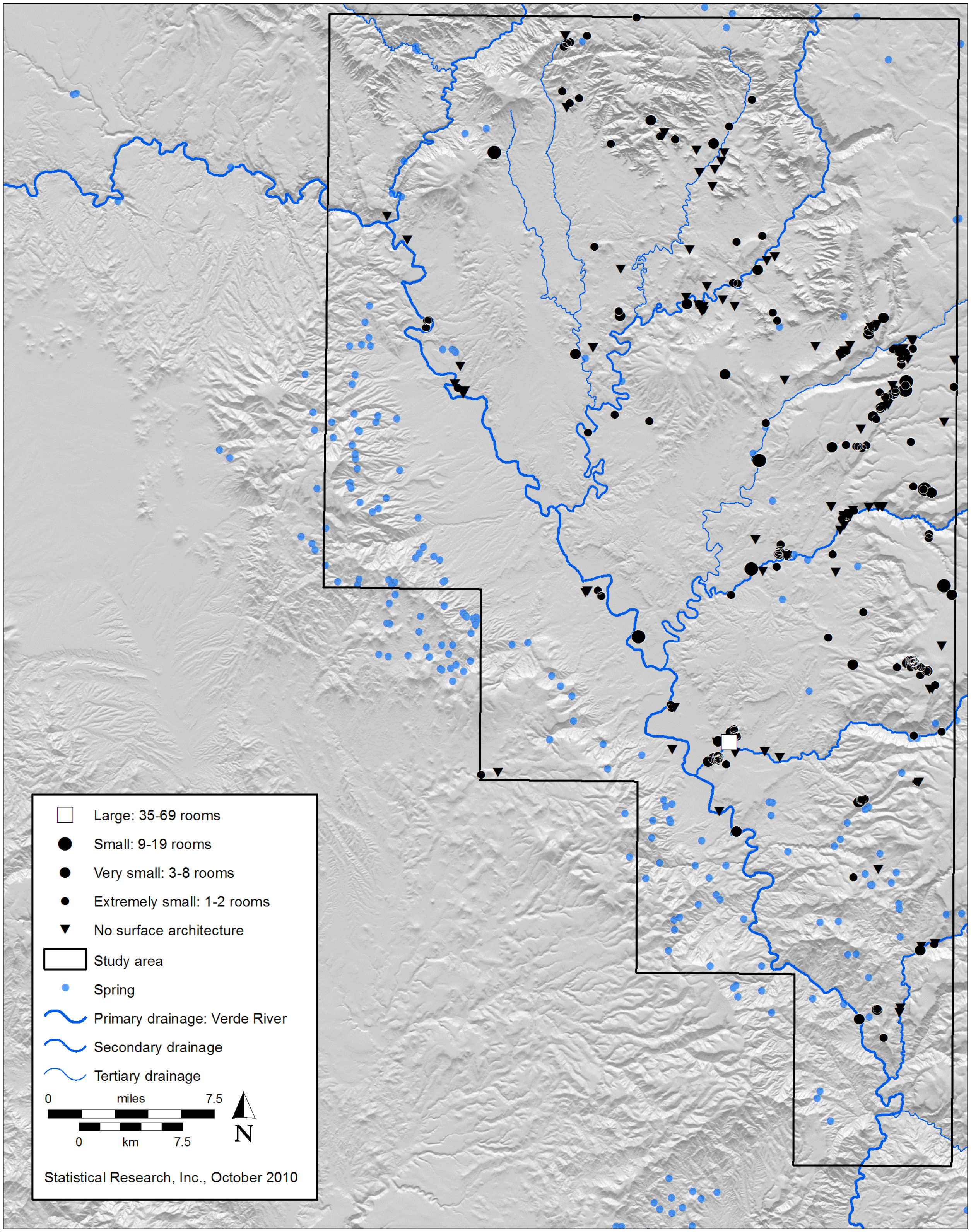

Figure 31. Map showing the locations of Camp Verde phase sites in the middle Verde River valley.

Investigated Sites

Considerably more information is available for the Camp Verde phase than for previous periods and phases. Breternitz (1960a:23) based his description of the Camp Verde phase on his own excavations of houses and trash deposits at the Calkins Ranch site (NA2385), the Verde Ball Court site (NA3528), and the Montezuma Well site complex at NA4616C, as well as data reported for two sites near Tuzigoot Pueblo excavated by Caywood and Spicer (1935); AZ O:5:6 (ASM), excavated by Wasley (1957); and the Winneman Ranch site (NA3945), excavated by Pierson (1959) (see Appendix C for brief descriptions). Since 1960, numerous projects have produced evidence of occupation and land use in the MVRV dating to the period from about A.D. 900 to 1150—the currently acceptable time period for this temporal period (Pilles 1996a), although some investigators have argued for an A.D. 950 start date (Hall and Elson 2002). Breternitz assumed that this period was the MVRV equivalent to the Hohokam Sacaton phase in the Salt-Gila Basin and Pueblo II on the Colorado Plateau, which was then assigned to the A.D. 900–1100 interval. Although the beginning date for this period may be closer to A.D. 950 than 900, we have retained the beginning date of A.D. 900 in this chapter.

Data from excavated features, artifacts, and land-use practices ascribed to the Camp Verde phase since 1960 are available in a number of archaeological reports. Among those are published reports or manuscripts describing the following sites (see Appendix C): the ASM's Verde Terrace (AZ O:5:6 [ASM]) (McGuire (1977); NA15761 (Stebbins et al. 1981); Volunteer (NA17244) (Halbirt 1984); Wood (NA13384) (Hallock 1984); NA17305 (Dosh 1983); Ireye (AZ N:3:31 [ASM]) (Dosh 1990; Zyniecki and Anduze 1996; Zyniecki and Motsinger 1991); Dead Horse Ranch sites AZ N:4:31 (ASM), AZ N:4:33 (ASM), and AZ N:4:34 (ASM) (Zyniecki and Anduze 1996; Zyniecki and Motsinger 1991); Allredge (AR-03-04-06-648 [CNF]) (Logan et al. 1992); SR 179 sites AR-03-04-06-516 (CNF) and AR-03-04-06-611 (CNF) (Weaver and Spaulding 1999); High Lonesome, Waterworks, and Gone Orchard Sites 1–3 (AZ O:1:12 [ASM], AZ O:1:27 [ASM], AZ O:1:15 [ASM], AZ O:1:37 [ASM], and AZ O:1:38 [ASM], respectively) (Weaver 2000); the Verde Ranger Station site (AR-03-04-01-1004 [CNF]) (Martine and Pilles 2005), AZ O:5:155 (ASM) (Deats 2007); the Grey Fox Ridge site (AZ N:4:110 [ASM]) (Deats 2011) and Site 105/838 (see Chapter 5, Volume 1 of this report). An early description of a Camp Verde phase pit structure just north of the MVRV was provided by Caywood and Spicer (1935) in their introduction to the excavation of Tuzigoot Pueblo. Brief descriptions of the Camp Verde occupations investigated by these researchers are found in Appendix C.

Features

The range of feature types recorded for the Camp Verde phase includes pit houses, seasonally used shelters and field houses, cavate rooms, small cliff dwellings, artifact scatters, extramural thermal features (roasting pits and hearths), and public architecture in the form of Hohokam-like ball courts and formal trash mounds. Little work beyond initial recording has been conducted at any of the ball courts. Maps of Camp Verde phase features and site components suggest that intramural and extramural storage may have been more important during this time period. Recovered human remains assigned to this time period take the form of both cremations and inhumations with and without grave goods, suggesting that a variety of burial customs were observed by MVRV populations.

Based on data provided by Schroeder (1949a, 1951, 1974), Breternitz (1960a), Fish (1974), and MNA site files, Fish et al. (1980) identified two ball courts in the MVRV that have their origins in the Camp Verde phase—the Clear Creek Ball Court (NA3527) and the Watters' Ranch Ball Court (NA4643). The identification of these two ball courts brings the total number of ball courts functioning in the MVRV from about A.D. 900 to 1100/1150 to five: at least one at the Verde Ball Court site, one each at Clear Creek and Watters' Ranch, and one at the Coons Ranch site. Late in the Camp Verde phase (ca. A.D. 1125), as presently dated, the Sacred Mountain Ball Court was constructed.

Fish et al. (1980) also identified three sites in the MVRV that seem to have established their formal trash mounds during the Camp Verde phase—one found at Montezuma Well Unit (NA4616A), another at the Clear Creek Ruin, and a third mound at Watters' Ranch. Deposition on the mounds at the Calkins Ranch site and the Verde Ball Court site continued from the Cloverleaf phase into the early portion of the Camp Verde phase (ca. A.D. 1000) but not much later.

As with Cloverleaf phase structures, Camp Verde phase pit structures representing dwellings, field houses, communal structures, and other functions take several forms: rectangular, round, and irregular (Figure 32). They also vary considerably in size, suggesting different functions and residential arrangements (Table 35). Pilles (1996a:64) said, "large, circular, and sub-square pit houses with ramp entries, identical to those found in the Flagstaff area, occur in the Verde Uplands, while shallower pit houses in a variety of shapes are more common in the Verde Lowlands."

The most common form is a rectangular dwelling with rounded corners and an entry on one of the longer sides. All have internal hearths and postholes (often indicating a gabled-roof system of centerline posts), and some have one or more interior storage pits. Some of these rectangular structures are Hohokam-like houses in pits with floor grooves and perimeter posts in both the main chamber and the entryway (e.g., the Winneman Ranch site, House A;

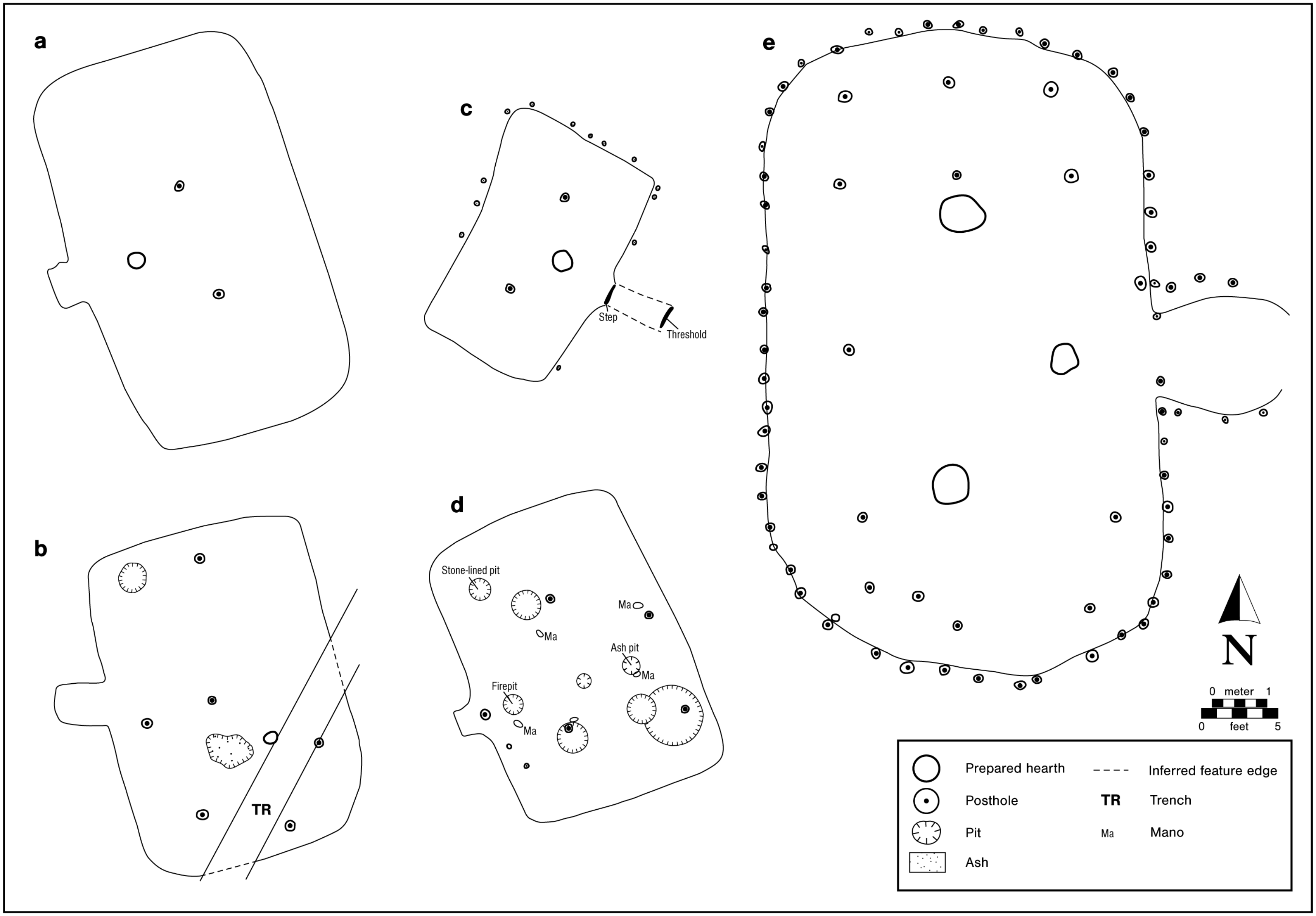

Figure 32. Sketches of Camp Verde phase architecture in the middle Verde River valley: (*a*) NA3528, Verde Ball Court site, House 2 (Breternitz 1960a:Figure 11); (*b*) AZ O:5:6 (ASM), Verde Terrace site, Pit House A (McGuire 1977:Figure 31); (*c*) NA20981, Allredge site, Feature 1 (Logan et al. 1992:Figure 3); (*d*) NA13384, Wood site, Pit House 1 (Hallock 1984:Figure 4); and (*e*) NA4616C, Montezuma Well Unit, House 3 (Breternitz 1960a:Figure 6).

Table 35. A Sample of Camp Verde Phase Dwellings and Structures in the Middle Verde River Valley

Reference	Site No.	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m²)
	Early Camp Verde Phase (ca. A.D. 900–1050)					
Wasley (1957)	AZ O:5:6 (ASM)	Wasley's Pit House	House 1	2.6	2.0	5.3
Pierson (1959)	NA3945	Winneman Ranch	House A	7.6	4.3	32.7
Breternitz (1960a)	NA3528	Verde Ball Court	House 2	6.7	4.0	26.8
Breternitz (1960a)	NA2385	Calkins Ranch	House 1A	5.0	4.5	22.5
Breternitz (1960a)	NA2385	Calkins Ranch	House 1B	4.8	4.5	21.4
Breternitz (1960a)	NA4616C	Montezuma Well Unit	House 1	5.2	4.2	21.8
Deats (2011)	AZ N:4:110 (ASM)	Grey Fox Ridge	59	3.6	3.0	10.5
Vanderpot (Chapter 6, Volume 1 of this report)	AZ O:5:105/AR-03-04-06-838 (ASM/CNF)	Spring Creek Farmstead	23	5.5	4.5	24.8
Vanderpot (Chapter 6, Volume 1 of this report)	AZ O:5:105/AR-03-04-06-838 (ASM/CNF)	Spring Creek Farmstead	29	6.0	3.4	20.4
Mean						20.7
Standard deviation						8.3
	Late Camp Verde Phase (ca. A.D. 1050–1150)					
Breternitz (1960a)	NA4616C	Montezuma Well Unit	House 2	4.6	2.2	10.1
Breternitz (1960a)	NA4616C	Montezuma Well Unit	House 3	7.6	4.7	35.7
Hallock (1984)	NA13384	Wood	Pit House 1	5.6	4.2	23.2
Hallock (1984)	NA13384	Wood	Pit House 2	5.0	4.5	22.5
Hallock (1984)	NA13384	Wood	Pit House 3	6.0	5.5	33.0
Hallock (1984)	NA13384	Wood	Pit House 4	5.0	5.0	25.0
Hallock (1984)	NA13384	Wood	Pit House 5	5.5	5.0	27.5
Hallock (1984)	NA13384	Wood	Pit House 6	5.5	4.5	24.8
Hallock (1984)	NA13384	Wood	Pit House 7	4.5	4.0	18.0
Halbirt (1984)	NA17244	Volunteer	1	5.6	4.5	25.2
Logan et al. (1992)	NA20981	Alldredge	1	4.8	3.0	14.4
Deats (2007)	AZ O:5:155 (ASM)		17	4.8	4.4	20.7
Mean						23.3
Standard deviation						7.2
	Unspecified Camp Verde Phase (ca. A.D. 900–1150)					
Caywood and Spicer (1935)	NA3544	none	Figure 1 House	5.2	3.0	15.5
Breternitz (1960a)	NA2385	Calkins Ranch	House A	8.8	6.4	56.2
Breternitz (1960a)	NA2385	Calkins Ranch	House B1	3.2	2.2	6.8
Breternitz (1960a)	NA2385	Calkins Ranch	House B2	4.2	3.7	15.5
Breternitz (1960a)	NA2385	Calkins Ranch	House C	4.0	2.6	10.4
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 1	6.0	4.8	28.9
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 2	4.8	4.4	21.5
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 3	4.0	3.4	13.7
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 4	6.2	4.4	28.1
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 5	6.8	4.8	32.8
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 6	6.2	5.0	32.3
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 7	6.0	4.6	27.7
McGuire (1977)	AZ O:5:6 (ASM)	ASM's Verde Terrace	House 8	6.6	4.7	31.1
Stebbins et al. (1981)	NA17761	none	Structure 1	5.5	3.4	18.7
Deats (2011)	AZ N:4:110 (ASM)	Grey Fox Ridge	58	4.5	2.8	12.6
Mean						23.5
Standard deviation						12.5

Key: ASM = Arizona State Museum; CNF = Coconino National Forest.

the Verde Ball Court site, House 2; Montezuma Well site NA34616C, House 3; and the Calkins Ranch site, Pit House A). The similarity of these Hohokam-like houses and the Hohokam-like MVRV houses attributed to the Cloverleaf phase is striking (see Figure 27 for the Verde View site and Calkins Ranch House 4). Others are rectangular pit structures without floor grooves in the main chamber or entryway (e.g., Site 105/838, Feature 29; the Verde Terrace site, Pit House 4; the Volunteer site, Feature 1; AZ O:5:155 [ASM], Feature 17; and the Grey Fox Ridge site, Features 58 and 59) or rectangular pit structures with stone-slab thresholds at the entryway (e.g., Site 105/838, Feature 23; the Allredge site, Feature 1; and the Wood site, Pit House 1; also compare with the late Cloverleaf phase house from SWCA's Verde Terrace site, AZ N:4:23 [ASM]).

At least two Camp Verde phase structures are rectangular features constructed partially with stone cobbles, and they contain storage pits or shallow depressions but no hearths (e.g., Calkins Ranch, Pit House C, and NA15761, Structure 1). These may have functioned as seasonal field houses or storage facilities rather than dwellings.

Less common are the round and irregularly shaped structures. Forms vary from round and squarish dwellings with ramp-type entryways, interior firepits, storage pits, and postholes (e.g., the Calkins Ranch site, Houses 1A and 1B, and the Wood site, Pit House 5) to round, hut-like dwellings (e.g., the Wood site, Pit Houses 2, 4, 6, and 7), to irregular features with hearths (e.g., the Wood site, Pit House 3, and ASM's Verde Terrace, Pit House 8).

The sizes of these dwellings vary considerably (see Table 35); authors often infer that the largest structures were community houses and that the smallest were field houses used by individuals or small groups for a short period of time. Because of greater numbers of cross-dated decorated pottery, archaeologists have been able to suggest that some structures date to the early (ca. A.D. 900–1050) or late (ca. A.D. 1050–1150) portion of the Camp Verde phase.

Subsistence Remains

Botanical and faunal remains retrieved from Camp Verde phase components of sites in the MVRV continue to show that a wide array of plants and animals were grown, gathered, hunted, and caught to satisfy subsistence needs. We draw on well-reported faunal collections from three sites in the MVRV to illustrate this range: the ASM's Verde Terrace site, the Wood site, and Site 105/838 (see Table 70, Chapter 8, Volume 2 of this report). Cottontails, jackrabbits, deer, pocket gophers, Botta's pocket mouse, woodrats, and freshwater clams were recovered from all three sites. In addition, unidentified fish, bird, and mouse remains; ground squirrel; bighorn sheep; mountain lion; and rattlesnake were recovered from Camp Verde phase contexts.

Plant remains recovered as macrobotanical samples or from flotation and pollen samples are well represented in Camp Verde phase contexts. We use data reported from six sites in the MVRV to illustrate the variety of plants used during this time period: Jessica, the Calkins Ranch site, the ASM's Verde Terrace site, the Allredge site, the Volunteer site, and Site 105/838 (see Table 19, Chapter 5 of this volume). Archaeologists recovered maize from all six sites, but other domesticates were present at some sites. Squash was recovered from the Volunteer site field house and Site 105/838. In addition to maize and squash, dry beans, little barley, and cotton were recovered from Camp Verde phase contexts at Site 105/838. The Camp Verde phase, then, is the earliest time period for which the full complement of domesticated species—other than domesticated agave—is present in the archaeological collections of the MVRV.

Variations in wild-plant assemblages seem to reflect, in part, access to local resources. Using the same sites included above, it is possible to list a few of the better-preserved wild plants used during the Camp Verde phase. Economically important wild plants recovered from these six sites as a group include cheno-am-type plants (e.g., goosefoot), cholla or prickly pear, purslane, cattail, beeweed, wild buckwheat, rice grass, dropseed grass, caltrop, stickleaf, plantain, juniper, yucca, and sedge, among others. Wood used for fuel and building materials at the sites collectively includes juniper, ash, sycamore, box elder or maple, cottonwood or willow, crucifixion thorn, mesquite, reed grass, saltbush, and Mormon tea. Interestingly, we did not find any reports that listed agave as one of the plants recovered from Camp Verde phase contexts.

Correlates of Settlement

As is evident from an inspection of Figure 31, the distribution of site components assigned to the Camp Verde phase is similar to that described for the Cloverleaf phase, but denser. In addition, several new areas, particularly in the Red Rock canyons north and west of Sedona and the southern portion of the MVRV, host Camp Verde–age habitation sites. At least six site clusters in the eastern portion of the MVRV are evident, two persisting from the earlier, Cloverleaf phase period, but four newly present. The most notable of these are in the middle reach of Wet Beaver Creek (the Montezuma Well and Watters Ranch vicinity) and the lower reach of West Clear Creek (the Clear Creek Ruins vicinity), each with community or integrative architecture. The Watters Ranch–Montezuma Well cluster contains the Watters Ranch ball court and mound and another site with a mound, AR-03-04-01-49 (CNF). The Clear Creek Ruins cluster contains two ball courts: AR-03-04-01-273 (CNF) and AR-03-04-01-616 (CNF) (the Clear Creek Ball Court). A mound at the Calkins Ranch site is located near the courts at the Verde Ball Court site, on the opposite, western side of the Verde River. An additional cluster of mostly field houses in the uplands near Bald Hill is evident but is likely the result of greater survey in that area.

As with the Cloverleaf phase, sites tend to be distributed below 3,500 feet or above 4,500 feet AMSL (Figure 33), but more sites are located in the intervening elevations (3,500–4,000 and 4,000–4,500 feet AMSL). The average elevation for all sites with Camp Verde phase components is about 4,440 feet AMSL, some 90 feet lower than the aggregate value for sites with Cloverleaf phase components. Proximity to major streams and irrigable agricultural land correspond to settlement and land use along the Verde River and its major tributaries, whereas upland sites in the eastern portion of the MVRV correspond to land with high potential for runoff agriculture and land units containing agave (Figures 34 and 35).

Habitation sites assigned to the Camp Verde phase appear to have slightly more intense Camp Verde–age occupation, as evidenced by more dwellings and features assigned to this time period. However, we are reluctant to suggest that Camp Verde phase occupation represents more-permanent settlement or coresidence of larger household groups, given that this phase is longer than the Cloverleaf phase, and the majority of sites with Camp Verde phase components continued to be occupied into the subsequent Honanki phase. Based on the data contained in the MVRV ALD, we guess that the largest Camp Verde phase habitation sites (e.g., the Calkins Ranch site, the ASM's Verde Terrace site, the Wood site, AR-03-04-01-787 [CNF], AR-03-04-01-79 [CNF], AR-03-04-01-904 [CNF], and AR-03-04-06-23 [CNF]) were no larger than our "small" category (9–19 rooms). With notable exceptions, most of these farmsteads or small hamlets were along the Verde River and its major tributaries.

Paleoenvironmental Correlates

The 250-year-long Camp Verde phase took place when streamflow variability was low, floodplains generally were stable or aggrading, and extreme floods did not occur. Unlike most phases, the Camp Verde phase contained few extreme years and greater persistence in climate conditions than did the preceding few centuries. These conditions suggest that interannual predictability in climate conditions was unusually high during this phase, especially after A.D. 1000 (see Chapters 4 and 5 of this volume). Whereas the majority of the tenth century was moderately dry and somewhat warm, the eleventh century was generally wet and warm, and the first half of the twelfth century was dry and cooler. The period between A.D. 1006 and 1084[15] likely was the most salubrious portion of the Camp Verde phase, given its mild climate and few extremes. In contrast, the 900s had more variability from year to year and more-frequent years characterized by conditions higher and lower than the long-term normal. The early 1100s had greater temporal persistence in year-to-year precipitation and temperature than the 1000s, but the early and mid-1100s also experienced changes to the floodplain and regional water-table levels that were likely interpreted as negative by farmers.

Inferred Land-Use Patterns

Given the considerable variability in architectural styles and the tendency to have contrasting site distributions in riparian and upland settings, it is tempting to support Colton's assertion that different cultural groups exploited these contrasting environmental locations. Although there may indeed have been more than two different groups in the MVRV, at least one of them was an indigenous population likely descended from local Archaic period populations (Central Arizona Tradition) who made brown ware pottery using Mogollon Tradition techniques, built locally adapted styles of pit houses, had a preference for northern pottery trade wares, and generally gave their deceased inhumation burials. These are the cultural groups commonly referred to as the Southern Sinagua. Another group was composed of Hohokam colonists and descendants as well as local followers who either maintained or emulated the customs common in the Hohokam heartland. Among those customs were traditions associated with house form and construction details, acquisition of pottery trade ware that included Hohokam types, specific artifacts associated with ceremonies, human cremation, and an emphasis on irrigation technology in riparian settings. Although the name *Hohokam* is often used to refer to this group, it is very possible that most members were indigenous people.

Multiple-structure habitation sites, 1–2-room field houses, artifact scatters, roasting pits, and storage features are located in both riparian and nonriparian settings. Sites inferred to have been agricultural fields associated with Camp Verde phase land use (e.g., AR-03-04-01-1191 [CNF], a sparse artifact scatter associated with basalt-cobble borders) are more often encountered in nonriparian and upland settings. How much of that pattern is attributed to better site preservation and more-intensive inventory in the uplands is presently unknown. Sites with inferred communal facilities and public architecture (mounds and ball courts), however, are exclusively in lowland settings, near perennial streams.

Successful harvests using a variety of farming techniques would have been possible in a wide variety of settings, in both the uplands and the lowlands, during this long phase. We suspect that scattered MVRV upland settlements that depended on dryland, runoff, and spring-fed systems would have been sustainable during the slightly drier years of the

[15] Recent research by Elson et al. (2009) has strongly suggested that Sunset Crater erupted in the A.D. 1080s, most likely in the A.D. 1085–1090 interval. Whether that eruption correlated to weather and climate changes remains unknown. Regardless, the post-1085 period is more or less equivalent to the late Camp Verde phase—a time when changes in subsistence and settlement practices in the MVRV are likely to have occurred.

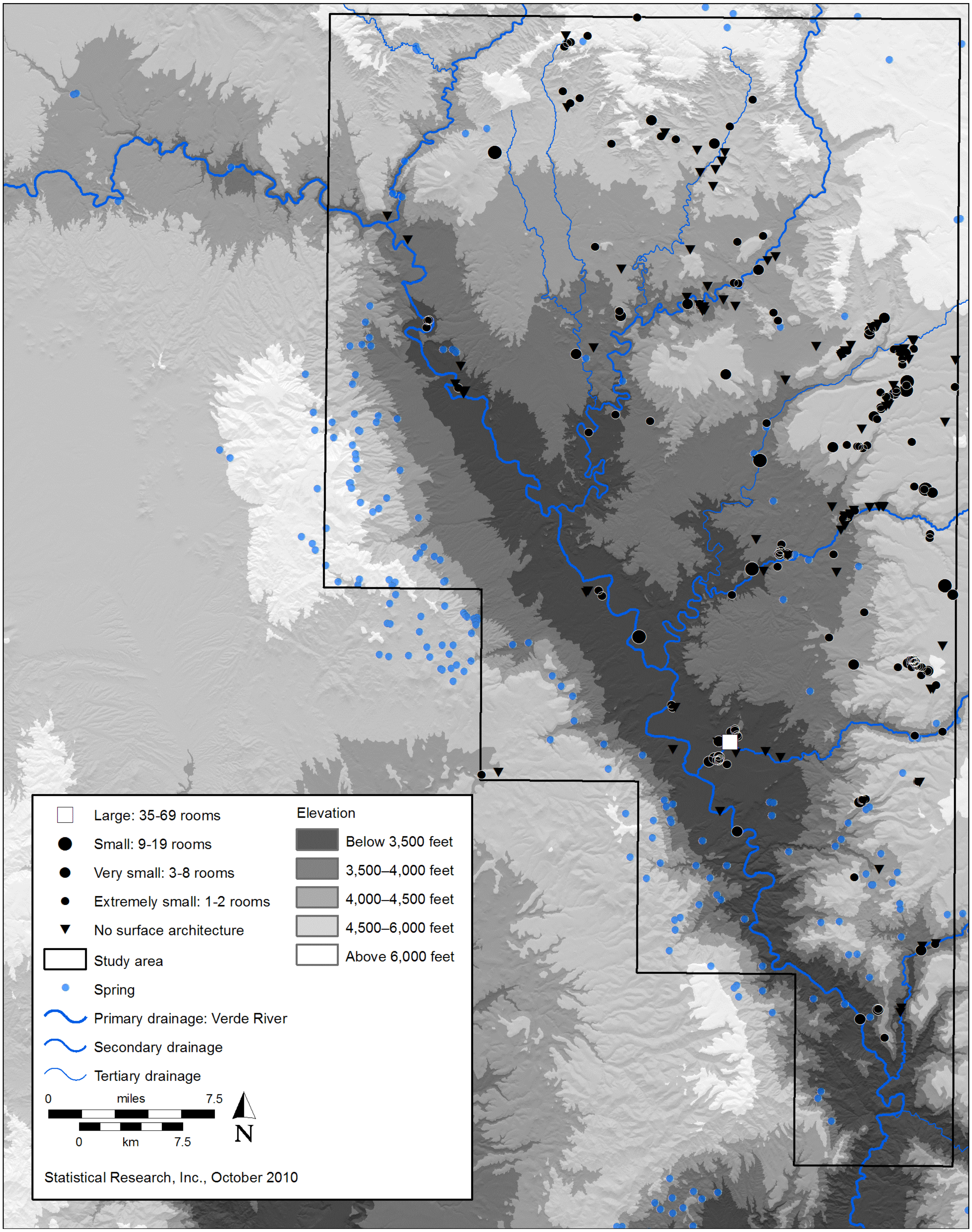

Figure 33. Map showing the elevational ranges of Camp Verde phase sites in the middle Verde River valley.

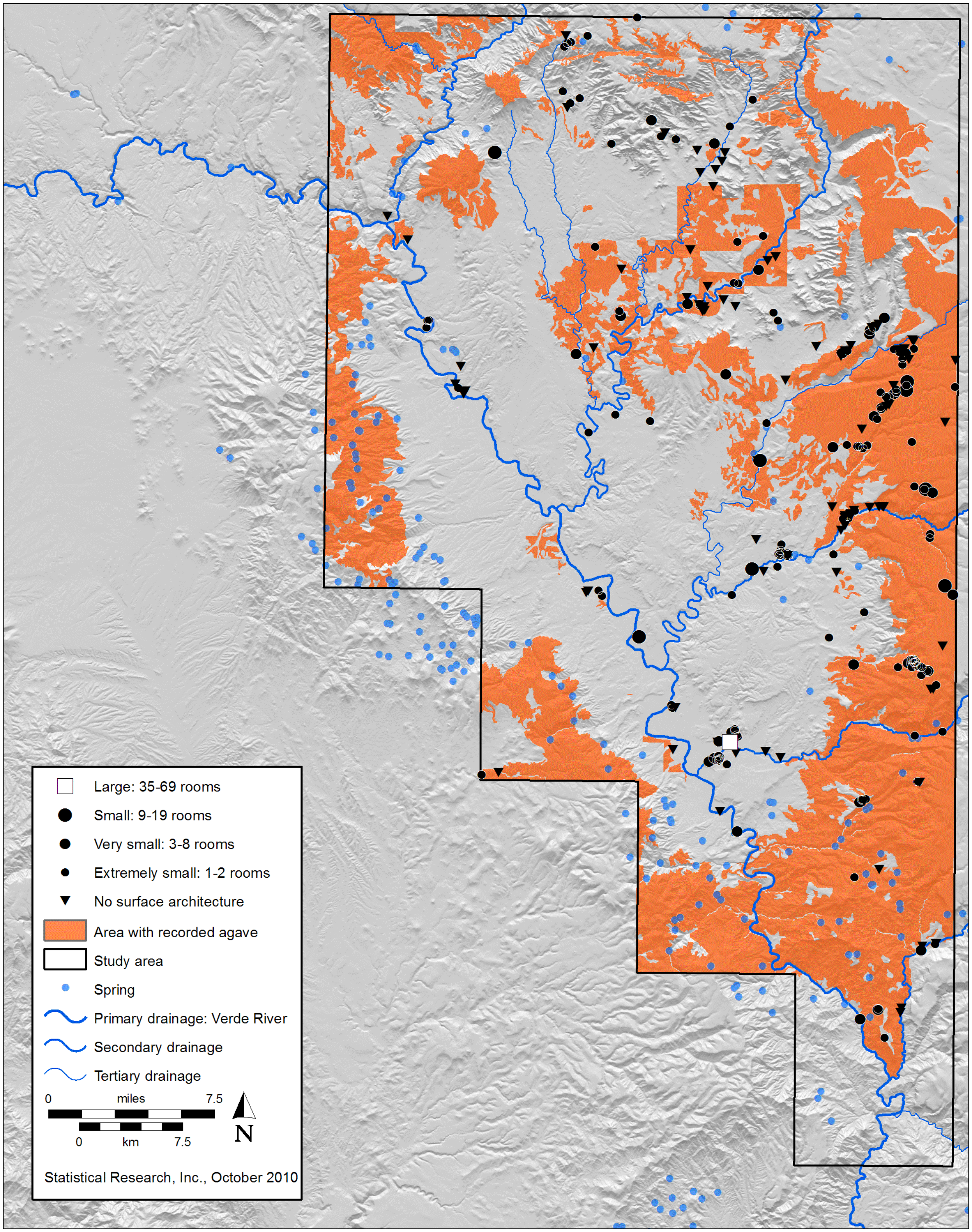

Figure 34. Map showing the locations of Camp Verde phase sites relative to agave-growing land.

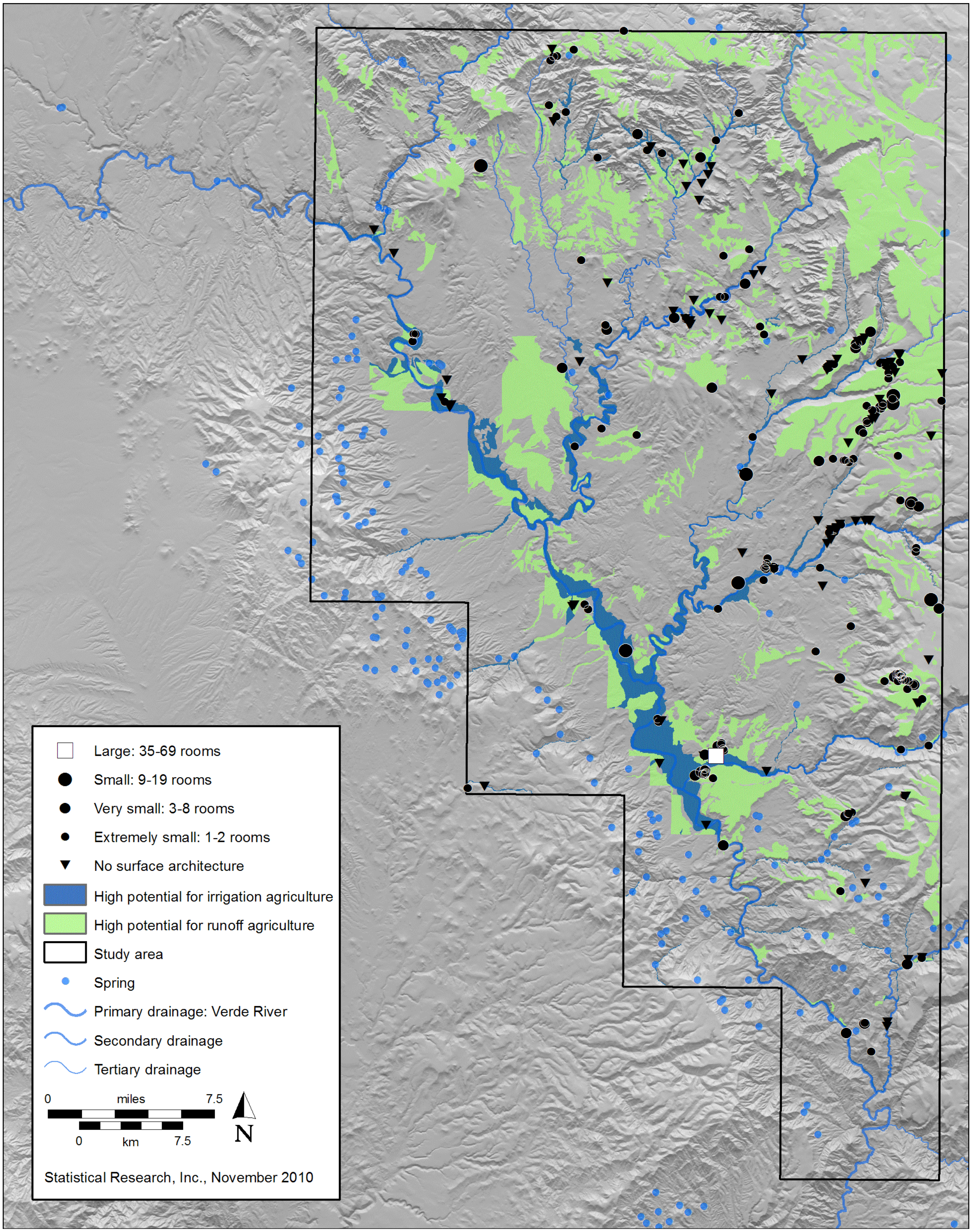

Figure 35. Map showing the locations of Camp Verde phase sites relative to lands with high potential for irrigation and runoff agriculture.

early Camp Verde phase, before A.D. 1000, but potentially larger settlements using irrigation agriculture in the lowlands were sustainable throughout the period, especially during the late Camp Verde phase, after the A.D. 1080s. Still, the attraction of upland settings for hunting and gathering above 4,000 feet AMSL would have been a constant for all populations in the MVRV, and it is unlikely that those settings were the exclusive domain of any human group.

Formative Period: Honanki Phase

Recorded Sites

There are more site components attributed to the Honanki phase (A.D. 1150–1300) than to any other time period in the MVRV. In part, these high numbers reflect the fact that many Honanki phase structures were constructed as aboveground masonry features that leave a more permanent and visible surface signature and contain more time-diagnostic decorated ceramics. The MVRV ALD contains records for 650 sites containing Honanki phase components (Figure 36), and we subsequently identified 5 more sites with Honanki phase components. Of the total 655, at least 45 sites have been subjected to some form of data recovery beyond initial recording, including intensive mapping and/or in-field artifact analysis, testing, or excavation. Twelve of the 45 investigated sites were inferred to be single-component sites, and 33 are multicomponent sites with two or more components each. Most of these multicomponent sites continued to be used well into the Tuzigoot phase (ca. A.D. 1300–1425), but a number of sites were also occupied in earlier phases. Sites inferred to date to the Honanki phase occur as featureless surface artifact scatters and as architectural sites ranging in size class from extremely small (1 or 2 rooms) through large (35–69 rooms).

Colton (1939a) defined the Honanki and Tuzigoot phases to account for what he believed was a movement of pueblo peoples into the MVRV from homelands above the Mogollon Rim. Colton (1946:304) speculated that during the Honanki phase, "invaders" (i.e., the Northern Sinagua) from the northeast entered the MVRV, accepted the Hohokam methods of irrigation, and displaced (or assimilated) both the Hohokam and the original inhabitants of the valley. Based on archaeological investigations at Tuzigoot Pueblo (Caywood and Spicer 1935), Colton (1946:304) also recognized that early components of some of the large, late pueblos in the MVRV dated to the Honanki phase.

Table 36 lists the largest Honanki and/or Tuzigoot phase sites as presented by Pilles (1996a) and with additions and revisions suggested by Wilcox et al. (2001a:176–180), Wilcox and Holmlund (2007), and information contained in the MVRV ALD. Following Pilles (1996a), this table only lists sites with 20 or more rooms. Most of those have not been professionally investigated or reported beyond initial recording. Even fewer have been mapped. Of potential interest for discussions of social organization or cultural affiliation is Pilles's (1996a) observation that large sites in the MVRV are organized as nucleated pueblos exhibiting one of three basic configurations or layouts. The most common layout is that of a massed room block, as exemplified by the Honanki and Tuzigoot phase Jackson Ranch Ruin (also called Thoeny Pueblo by its current owner, The Archaeological Conservancy) and the Tuzigoot phase Spring Creek Pueblo (Figure 37). A second form is that of the plaza-oriented pueblo, and the Tuzigoot phase Sugarloaf Pueblo (also called Otten Pueblo by its present owner, The Archaeological Conservancy) and the Tuzigoot-age Perkins Pueblo are representative of this form (see Figure 37). Finally, a few sites are clustered room-block pueblos; the Honanki and Tuzigoot phase Tuzigoot and Hatalacva Pueblos, built on narrow ridgetops, serve as examples of this form (see Figure 37). In addition to these nucleated forms are strings or clusters of cavates and rockshelters that often occur with massed-room-block-type pueblos (e.g., Clear Creek and Oak Creek Pueblos and Mindeleff Cavate Lodge Group).

Assigning Sites to the Honanki Phase

Sites are assigned to the Honanki phase when they contain local plain wares in conjunction with one or more cross-dated extralocal types. The local plain wares may include Verde Brown, Verde Red, Tuzigoot Plain, and Tuzigoot Red. Colton (1946) suggested that Walnut Black-on-white, Tusayan Black-on-red, Citadel Polychrome, and Flagstaff Black-on-white were common decorated types of the Honanki phase. Other types frequently include Kayenta Black-on-white, Tusayan Polychrome, Tusayan Corrugated, and Moenkopi Corrugated.

Investigated Sites

In addition to the few excavated large sites listed in Table 36, there are a number of smaller sites with excavated features assigned to the Honanki phase. Among them are individual houses and small habitation sites that have been described and illustrated (Figure 38). Included in this group are Hidden House (NA3500) (Dixon 1956 [who reported a 1933 excavation by amateur Clarence King]); Panorama and Kittredge Ruins (NA5111 and NA4490) (Shutler 1951); Calkins Ranch, House 5 and Pit House F (NA2385) (Breternitz 1960a; Stebbins et al. 1981); the Swallet Cave site (NA4630) (Ladd 1964); Oak Creek Valley Pueblo (AR-03-04-06-341 [CNF]) (Williams

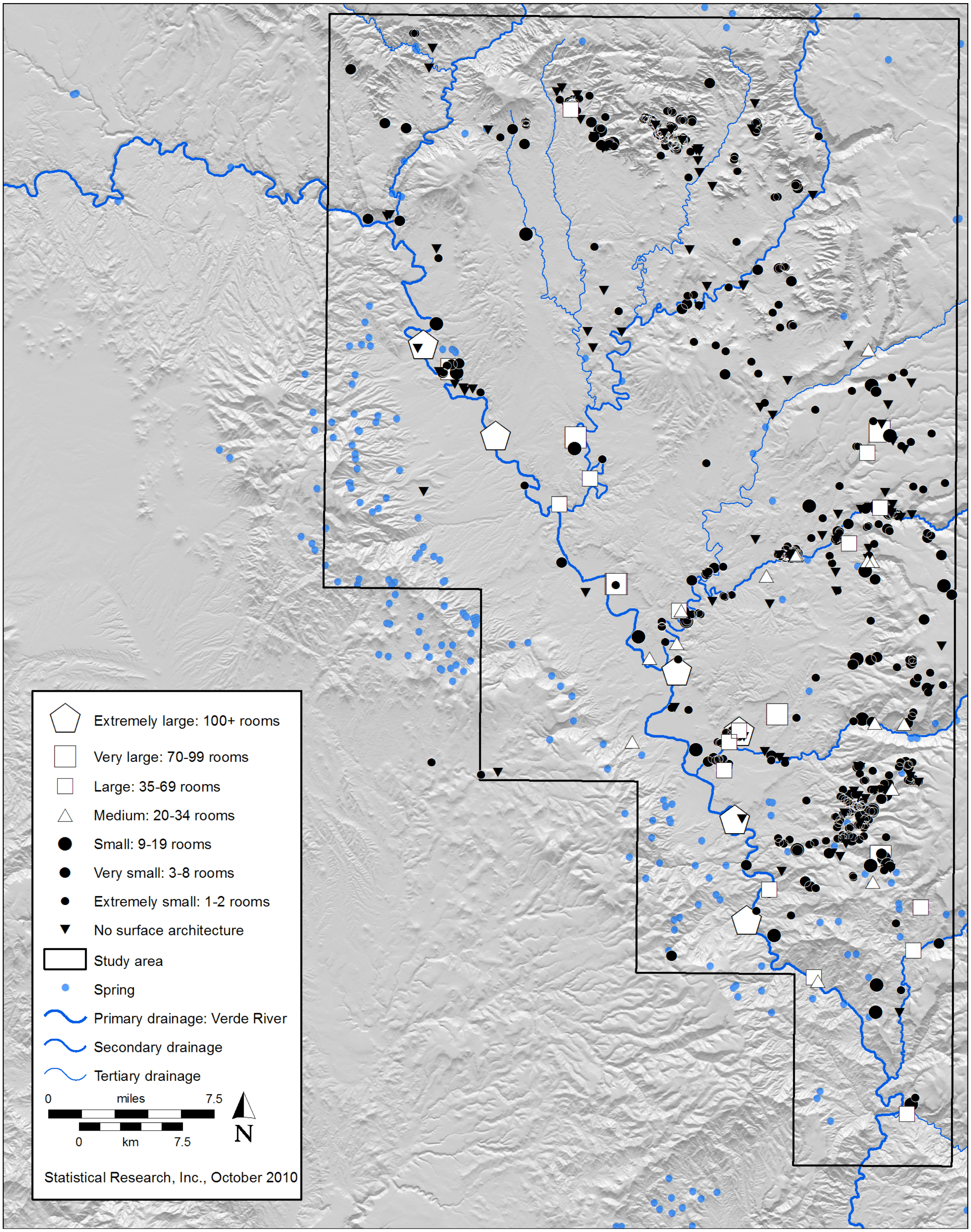

Figure 36. Map showing the locations of Honanki phase sites in the middle Verde River valley.

Table 36. Largest Honanki and Tuzigoot Phase Sites in the Middle Verde River Valley

Site Name	Site Nos.	Occupation Range (Ceramic Dates)	Total No. of Rooms (Estimated)	Site-Size Class	Defensible?[a]	Culture	Reference(s)
Big Cornville Ruin, Chandler Ruin	NA1268 A, NA1268B, NA1768; AR-03-04-06-43 (CNF); AZ O:5:95 (ASM)	Honanki-Tuzigoot, historical period	70	very large	X	Southern Sinagua, Euroamerican	Wilcox 2006 (database); Wilcox et al. 2001b
Boulder Canyon Ruin	NA19287; AR-03-04-01-255 (CNF)	Honanki-Tuzigoot	44	large	X		Wilcox et al. 2001b
Bridgeport Ruin, Simmons Ruin, All Nation's Ruin, Haydorn Hill Ruin	NA979, NA1258; AR-03-04-06-74 (CNF); AZ O:5:21 (ASM)	Honanki-Tuzigoot	237	extremely large	X	Southern Sinagua	Wilcox et al. 2001b
Brown Springs Ruin	NA5348; AR-03-09-05-201 (CNF)	Honanki-Tuzigoot	100	extremely large	X	Southern Sinagua	Wilcox and Holmlund 2007; Wilcox et al. 2001b
Bull Pen Ranch Ruin	NA2448, NA5390; AR-03-04-01-246 (CNF)	Honanki-Tuzigoot	24	medium			Wilcox and Holmlund 2007; Wilcox et al. 2001b
Bull Run Ruin	NA3518	Honanki-Tuzigoot	50	large	X		Wilcox et al. 2001b
Calloway No. 2 Ruin, Verde Ruins	NA3519, NA4093; AR-03-04-01-58 (CNF)	Honanki-Tuzigoot	100	extremely large		Southern Sinagua	Wilcox 2006 (database); Wilcox et al. 2001b
Casner Canyon Ruin	NA3617; AR-03-04-01-85 (CNF)	Honanki-Tuzigoot	40	large			Wilcox and Holmlund 2007; Wilcox et al. 2001b
Clear Creek Pueblo, West Clear Creek Ruin (and Cavates)	NA2806; AR-03-04-01-5 (CNF); AZ O:5:5 (ASM), AZ O:5:25 (ASM)	Honanki-Tuzigoot	150	extremely large	X		Hudgens 1975; Morris 1928
CV Hill Ruin	NA3520, NA3512?, NA4094; AR-03-04-01-59 (CNF)	Tuzigoot	30	medium	X		Wilcox and Holmlund 2007; Wilcox et al. 2001b
Doran Castle Ruins (in Hackberry Basin)	NA3604; AR-03-04-01-100 (CNF)	Honanki-Tuzigoot	75	very large	X	Southern Sinagua	Wilcox et al. 2001b
East Verde Ruin	NA3514; AR-03-12-04-45 (CNF)	Tuzigoot	38	large			Mindeleff 1896
Fort Lincoln (prehistoric component)	NA4633; AR-03-04-01-29 (CNF)	Honanki-Tuzigoot	20	medium			recorded by Schroeder; Breternitz and Wetheril; and Melot
Fossil Creek Ruin	NA3515; AR-03-04-01-521 (CNF)	Tuzigoot	26	medium			Wilcox and Holmlund 2007; Wilcox et al. 2001a, 2001b
Hatalacva Pueblo	NA1263, NA5225; AZ N:4:3 (ASM)	Honanki-Tuzigoot	125	extremely large	X	Southern Sinagua	Wilcox et al. 2001b

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Site Name	Site Nos.	Occupation Range (Ceramic Dates)	Total No. of Rooms (Estimated)	Site-Size Class	Defensible?[a]	Culture	Reference(s)
Honanki Ruin	NA1255, NA3205, NA3206; AR-03-04-06-58 (CNF); AZ O:1:8 (ASM)	Honanki-Tuzigoot	45	large	X		Fewkes 1896; Wilcox 2006 (database); Wilcox et al. 2001b
Horse Mesa Fort	NA18430; AR-03-04-06-185 (CNF)	Honanki-Tuzigoot	30	medium	X		Wilcox et al. 2001b
Jackson Ranch Ruin/ Thoeny Pueblo	NA1275A-D, NA1276, NA10025; AR-03-04-01-43 (CNF); AZ O:5:10 (ASM)	Honanki-Tuzigoot	30	medium	X		Wilcox and Holmlund 2007; Wilcox et al. 2001b
John Heath Ruin	NA18495; AR-03-04-01-68 (CNF)	Honanki-Tuzigoot, historical period	90	very large	X	Southern Sinagua, Apache	Wilcox et al. 2001b
Middle Verde Ruin (also Talbot Ranch Ruin)	NA3526A, NA3526B, NA3536, NA8959; AR-03-04-01-26 (CNF), AR-03-04-01-27 (CNF), AR-03-04-01-28 (CNF); AZ O:5:11 (ASM)	Honanki-Tuzigoot	75	very large	X	Southern Sinagua	Barnett 1965; Mearns 1890; Wilcox et al. 2001b
Mindeleff's Cavate Lodge Group	NA1511; AR-03-04-01-266 (CNF); AZ O:9:1 (ASM)	Honanki-Tuzigoot, protohistoric period	350	extremely large		Southern Sinagua, Apache	Hall 1992; Wilcox et al. 2001b
Montezuma Castle A (burned pueblo)	NA6383; AR-03-04-01-640 (CNF), AZ O:5:14 (ASM)	Honanki-Tuzigoot	57	large	X		Cutler and Kaplan 1956; Jackson and Van Valkenberg 1954; Wells and Anderson 1988; Wilcox et al. 2001b
Montezuma Castle B (visible cliff dwelling)	NA1278, NA6881, NA7277, NA7223, NA7224; AR-03-04-01-34 (CNF); AZ O:5:14 (ASM), AZ O:5:95 (ASM)	Honanki-Tuzigoot	20	medium	X		Wells and Anderson 1988; Wilcox and Holmlund 2007; Wilcox et al. 2001b
Montezuma Well	NA1273A; AR-03-04-01-304 (CNF); AZ O:5:90 (ASM)	Honanki-Tuzigoot, protohistoric period	24	medium			Jackson 1933; Wells and Anderson 1988
Montezuma Well (east rim)	NA1273C; AR-03-04-01-636 (CNF); AZ O:5:90 (ASM)	Honanki-Tuzigoot	24	medium			Wells and Anderson 1988; Wilcox 2006 (database)
Needle Rock Ruin	NA1273A; AR-03-04-01-646 (CNF)	Honanki-Tuzigoot	25	medium			Wilcox et al. 2001b
Oak Creek Ruin, Atkeson Pueblo	NA1500; AR-03-04-06-41 (CNF); AZ O:5:13 (ASM)	Honanki-Tuzigoot (only Tuzigoot?)	50	large			Fewkes 1912; Wilcox 2006 (database) ; Wilcox and Holmlund 2007; Wilcox et al. 2001b
Oak Creek Valley Pueblo	NA22515; AR-03-04-06-341 (CNF), NAU 2-0-5-7	Honanki-Tuzigoot	20	medium			Jeffers 1983; Taylor 1985; Williams 1985

Site Name	Site Nos.	Occupation Range (Ceramic Dates)	Total No. of Rooms (Estimated)	Site-Size Class	Defensible?[a]	Culture	Reference(s)
Packard Ranch Ruin	NA3501; AR-03-04-06-5 (CNF); AZ N:4:4 (ASM)	Tuzigoot	35	large			Caywood and Spicer 1935; Wilcox et al. 2001b
Page Springs Ruin (4645A, Simmons), plus Limestone Ruin (4645B, Simmons)	NA4645A, NA4645B; NA5223; AR-03-04-06-87 (CNF), AR-03-04-06-392 (CNF)	Tuzigoot	78	very large	X	Southern Sinagua	Wilcox 2006 (database); Wilcox et al. 2001b
Perkins Pueblo	NA2440, NA9469; AZ N:4:2 (ASU)	Tuzigoot	85	very large	X	Southern Sinagua	Alger 1968; Kayser and Whiffen 1965 ; Wilcox 2006 (database); Wilcox and Holmlund 2007; Wilcox et al. 2001b
Rarick Canyon Ruin, Riordan Canyon Ruin	NA3993A, NA3994, NA6296; AR-03-04-01-302 (CNF)	Honanki-Tuzigoot	53	large			Jackson 1933; Wilcox et al. 2001b
Rock Cone Ruin	NA4090; AR-03-04-01-31 (CNF)	Honanki-Tuzigoot	25	medium	X		Wilcox and Holmlund 2007; Wilcox et al. 2001b
Ruin Point	NA3995, NA10429, NA11267; AR-03-04-01-70 (CNF)	Honanki	75	very large	X		Wilcox and Holmlund 2007; Wilcox et al. 2001b
Sacred Mountain Pueblo, White Cliff Ruin, Ida Ruin	NA4626 A–F, NA3808; AR-03-04-01-80 (CNF); AZ O:6:8 (ASM)	Honanki-Tuzigoot	38	large	X		Schroeder 1949a; Wilcox and Holmlund 2007; Wilcox et al. 2001b
Salome Ruin, Sally May Ruin	NA19286; AR-03-04-01-254 (CNF)	Honanki-Tuzigoot	35	large	X		Wilcox and Holmlund 2007; Wilcox et al. 2001b
Salt Mine Pueblo	NA6662	Honanki	20	medium	X		Wilcox et al. 2001b
Sheepshead Ruin, Humbert's Crossing Pueblo	NA7327, NA9467; AR-03-04-06-160 (CNF)	Tuzigoot	30	medium	X		Wilcox 2006 (database); Wilcox et al. 2001b
Spring Creek Pueblo	NA26019; AR-03-04-06-1151 (CNF)	Tuzigoot	41	large			VVAS Survey Jerry Ehrhardt, personal communication and map
Sugarloaf Ruin, Chandler Ruin, Indian Dome, Otten Pueblo on Sugarloaf "Mountain"	NA1269; AR-03-04-06-78 (CNF); AZ O:5:20 (ASM)	Honanki-Tuzigoot (only Tuzigoot?)	53	large	X		Wilcox 2006 (database); Wilcox et al. 2001b
Tuzigoot Extension Pueblo	AZ N:4:26 (ASM)	Tuzigoot	20	medium	X		Caywood and Spicer 1935; Tagg 1986; Wilcox et al. 2001b
Tuzigoot Pueblo	NA1261, NA2733; AZ N:4:1 (ASM)	Honanki-Tuzigoot	93	very large		Southern Sinagua	Anderson 1992; Caywood and Spicer 1935; Hartman 1976; Wilcox 2006 (database); Wilcox et al. 2001b

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Site Name	Site Nos.	Occupation Range (Ceramic Dates)	Total No. of Rooms (Estimated)	Site-Size Class	Defensible?[a]	Culture	Reference(s)
Unnamed	NA3516; AR-03-04-01-25 (CNF)	Honanki-Tuzigoot	42	large	X		Wilcox et al. 2001b
Unnamed	NA18960; AR-03-04-01-499 (CNF)	Honanki-Tuzigoot	42	large	X		Wilcox et al. 2001b
Unnamed	NA18961; AR-03-04-01-498 (CNF)	Honanki-Tuzigoot	30	medium			Wilcox et al. 2001b
Unnamed	NA12533; AR-03-04-01-14 (CNF)	Honanki-Tuzigoot	23	medium	X		Wilcox 2006 (database); Wilcox et al. 2001b
Unnamed	NA26314; AR-03-04-01-1221 (CNF)	Honanki-Tuzigoot	20	medium			Shelby Coody, Lisa Hanson, and Jerry Ehrhardt surveys
Unnamed	NA5550; AR-03-04-01-69 (CNF)	Honanki-Tuzigoot	20	medium	X		Wilcox and Holmlund 2007; Wilcox et al. 2001b
Verde Hot Spring Ruin, Black Ridge Ruin	NA7187	Tuzigoot	25	medium			Wilcox and Holmlund 2007; Wilcox et al. 2001b
Walker Creek Ruin	NA5549; AR-03-04-01-114 (CNF)	Honanki-Tuzigoot	30	medium			Wilcox and Holmlund 2007; Wilcox et al. 2001b
Wingfield Mesa Ruin	NA2494, NA3521, NA3644, NA3664?, NA4624; AR-03-04-01-67 (CNF)	Tuzigoot	37	large			Wilcox and Holmlund 2007; Wilcox et al. 2001b
Total			2,919				

Note: Data from Pilles (1996b:257–258 [Appendix on Sinagua Region]), with additions, as of 2008.

Key: = ASM = Arizona State Museum; ASU = Arizona State University; CNF = Coconino National Forest; VVAS = Verde Valley Chapter of the Arizona Archaeological Society.

[a] An "X" in this column indicates that the site has been judged defensive by Wilcox et al. (2001b).

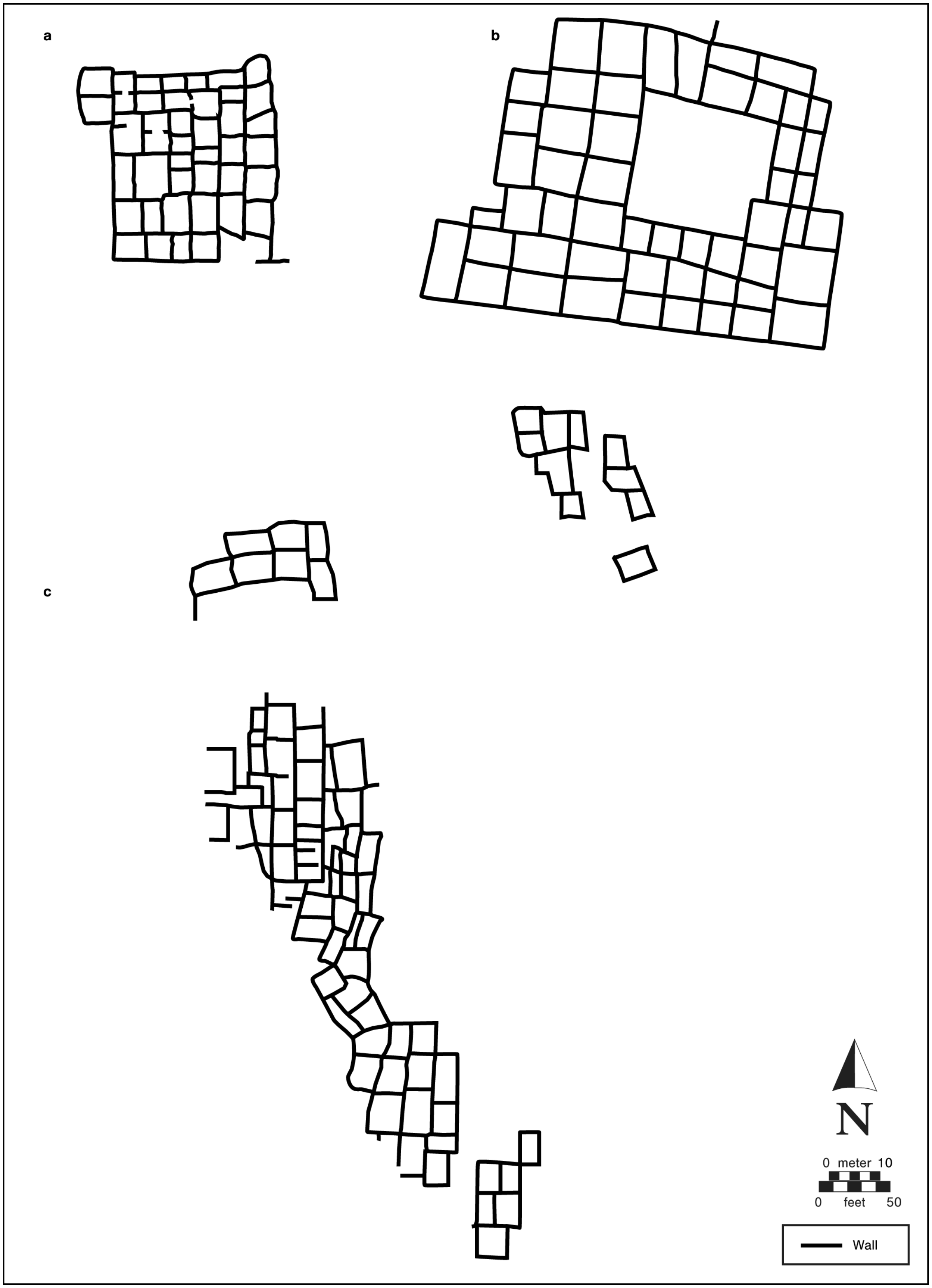

Figure 37. Sketches of Honanki and Tuzigoot phase pueblo layouts: (*a*) massed roomblock at NA26019, Spring Creek Pueblo (Jerry Erhardt and Verde Valley Archaeological Society notes on file at CNF Supervisor's Office, Flagstaff); (*b*) plaza-oriented pueblo at NA1269, Sugarloaf Pueblo/Otten Pueblo (after Pilles 1996a); and (*c*) clustered rooms, NA1261, Tuzigoot Pueblo (after Hartmann 1976).

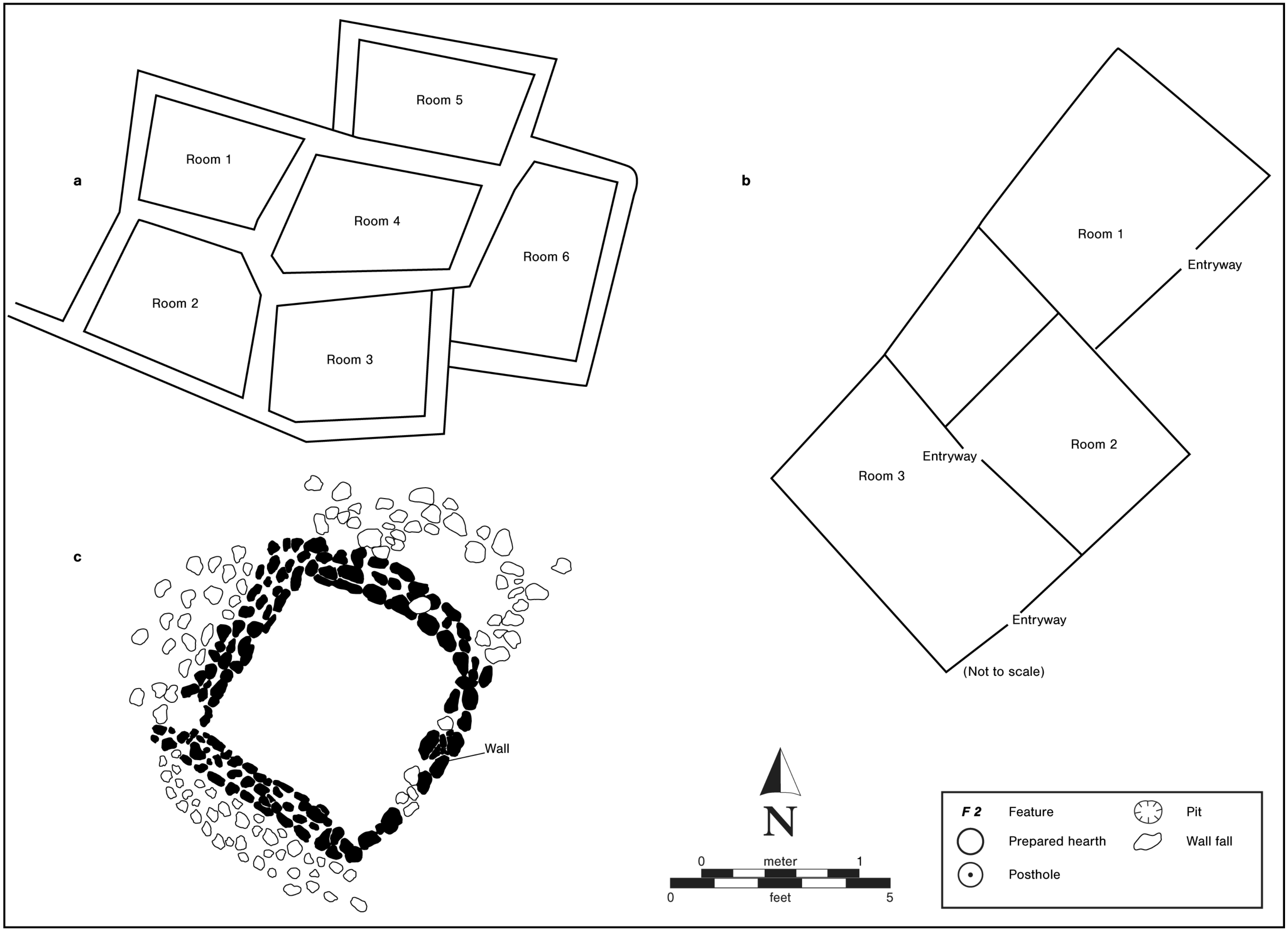

Figure 38. Sketches of small-scale Honanki phase architecture in the middle Verde River valley: (*a*) roomblock at AR-03-04-06-341 (CNF) and NA22515, Oak Creek Valley Pueblo (Williams 1985:Figure 3); (*b*) roomblock at AR-03-04-06-703 (CNF), Cross Creek Pueblo (Logan and Horton 2000, oversized site plan map); and (*c*) room at AR-03-04-06-536 (CNF) and AZ O:1:5 (ASM), Centruoides site (Weaver 2000:Figure 7).

1985); Christmas Tree and Centruroides House (AZ O:1:34 [ASM] and AZ O:1:5 [ASM]) (Weaver 2000); Cross Creek Pueblo (NA26505) (Logan and Horton 2000); the Talon site, Features 1 and 2 (AZ O:1:141 [ASM]) (Edwards 2004); and the Verde Ranger Station site (AR-03-04-01-1004 [CNF]) (Martine and Pilles 2005). Descriptions of sites reported by these authors can be found in Appendix C.

Features

Feature types recorded for the Honanki phase include a variety of habitation sites (single cavate rooms and multiple cavate room dwellings, free-standing masonry rooms and room blocks, pit structures, cliff dwellings, and rooms under rockshelters), field houses, artifact scatters, rock art exhibiting the Beaver Creek Peck style associated with Honanki and Tuzigoot phase land use, agricultural sites, burials, forts, and several special forms whose earliest occurrences were in the Honanki phase: plazas, community rooms, compounds, and "racetracks." In addition, a single ball court attributed to the Honanki phase (the Sacred Mountain Ball Court site, NA4626) has been recorded (Schroeder 1949a).

Archaeologists have long recognized that the first masonry pueblos in the MVRV were constructed during the twelfth century. Most of these early masonry surface structures have been assigned to the Honanki phase rather than the Camp Verde phase. Despite the predominance of masonry rooms in the open or under rockshelters and humanly enhanced cavate room complexes, a few pit structures assigned to the Honanki phase have been encountered and excavated (Table 37; see Figure 38; Appendix C). Only one of these (the Verde Ranger Station site, Pit House 1) was a true pit structure, and it was found more than a meter below the MGS and used the excavated pit as the structure's lower walls. The other two features identified as pit structures (the Calkins Ranch site, House 5 and Pit House F) were relatively shallow pit structures. Given revisions to the date range for the Honanki phase (i.e., beginning in A.D. 1150 rather than A.D. 1100), House 5 at Calkins Ranch may actually date to the late Camp Verde phase. Inspection of the floor plans of these three pit structures with similar floor areas suggested that considerable variability in house form, construction techniques, and internal features existed in the twelfth century.

More typical of Honanki phase architecture are the cliff-dwellings of the Red Rock canyons near Sedona and other canyon settings of the MVRV, as well as open-site masonry pueblos in a variety of landscape positions (see Figure 38; Table 37; Appendix C). A few of the canyon pueblos are large, multistory constructions under and adjacent to rockshelters. The Honanki phase type site, Honanki Pueblo, is the prime example of this type of village (Fewkes 1912; James 1994). Other habitation sites in the canyons are small cliff dwellings built in alcoves or on elevated prominences. Hidden House (Dixon 1956) in Sycamore Canyon and the Kittredge Ruin and the Panorama House ruins (Shutler 1951) in the Red Rock canyons are examples of these small cliff dwellings and cliff pueblos.

Open-site masonry dwellings may be small or large (see Figure 38; Table 37; Appendix C). One-room masonry structures and field houses, such as the Christmas Tree site (AZ O:1:34 [ASM]) (Weaver 2000) and the Centruroides site (AZ O:1:5 [ASM]) (Weaver 2000) have been excavated. Farmstead- or hamlet-sized pueblos, consisting of small room blocks of three or four masonry rooms, have been found in open landscape positions. Cross Creek Pueblo (AR-03-04-06-703 [CNF]) (Logan and Horton 2000) and portions of the Talon site (AZ O:1:141 [ASM]) (Edwards et al. 2004) are examples. (*Note:* It is possible that these are two loci of the same Honanki phase settlement.) Village-sized pueblos composed of several closely spaced room blocks exist, as well. Oak Creek Valley Pueblo, which was partially excavated by Williams (1985), may have had 20 rooms in multiple room blocks. Similarly, early occupation at Tuzigoot Pueblo (Caywood and Spicer 1935; Hartman 1976) indicated that at least a dozen rooms in two clusters date to the Honanki phase.

So, a hierarchy of site sizes, ranging from isolated one-room or one-house structures to settlements with a few to many rooms, is observable in the archaeological record by the Honanki phase. One of the many questions we may ask about this apparent hierarchy is whether these sites are elements of a single settlement system of a single cultural group or whether the different architectural forms (cliff dwellings in the canyons vs. open sites in both lowland and upland settings) were used by different populations living in contrasting settings of the MVRV. The answer to this question necessarily entails the recovery of archaeological data that will shed light on site function, duration and season of occupation, cultural affiliation, and tightly delimited dates of occupation.

Plazas, Community Rooms, Possible Kivas, and Possible Compounds

The MVRV ALD indicated that archaeologists have inferred the presence of plazas at 33 sites (only 3 sites tested), community rooms at 13 sites (none excavated), possible kivas at 6 sites (none excavated), and possible compounds at 3 sites (none excavated). Based on inspections of site maps available for a few of the larger pueblos, we feel confident that plazas and community rooms were features common to numerous settlements. Many of the larger, nucleated pueblos, whether they took the form of plaza-oriented, clustered rooms or massed room blocks (Pilles 1996a), have enclosed or open spaces defined by architecture or topography that likely served as community plazas (see site plans in Figure 38). Oversized rooms and rooms with particular subfeatures, like benches, may

Table 37. A Sample of Honanki-Phase Dwellings in the Middle Verde River Valley

Reference, by Dwelling Type	Site No.	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m^2)
Cliff dwelling, small						
Dixon (1956)	NA3500	Hidden House	1	3.6	2.9	10.2
Dixon (1956)	NA3500	Hidden House	2	3.6	2.6	9.2
Dixon (1956)	NA3500	Hidden House	3	3.0	2.4	7.3
Dixon (1956)	NA3500	Hidden House	4	2.7	2.6	7.0
Ladd (1964)	NA4630A	Swallet Cave	1	2.8	1.1	3.2
Ladd (1964)	NA4630A	Swallet Cave	2	3.3	2.8	9.1
Ladd (1964)	NA4630A	Swallet Cave	3	1.8	1.1	1.9
Ladd (1964)	NA4630A	Swallet Cave	4	3.2	1.7	5.5
Ladd (1964)	NA4630A	Swallet Cave	5	2.6	2.1	5.5
Ladd (1964)	NA4630A	Swallet Cave	6	4.0	3.0	11.9
Ladd (1964)	NA4630A	Swallet Cave	7	3.5	2.6	8.9
Shutler (1951)	NA5111	Panorama Ruin	1	4.0	2.7	10.6
Shutler (1951)	NA5111	Panorama Ruin	2	3.7	2.5	9.3
Shutler (1951)	NA5111	Panorama Ruin	F	2.7	2.5	6.6
Mean						7.6
Standard deviation						2.8
Field house or farmstead						
Weaver (2000)	AZ O:1:34 (ASM)	Christmas Tree	1	4	3.5	14.0
Weaver (2000)	AZ O:1:5 (ASM)	Centruroides House	1	3.1	3.0	9.3
Mean						11.7
Standard deviation						3.3
Hamlet or small (open-site) pueblo						
Edwards et al. (2004)	AZ O:1:141 (ASM)	Talon site	1	4.7	4.5	21.2
Edwards et al. (2004)	AZ O:1:141 (ASM)	Talon site	2.1	4.3	3.8	16.1
Edwards et al. (2004)	AZ O:1:141 (ASM)	Talon site	2.2	4.4	4.2	18.3
Edwards et al. (2004)	AZ O:1:141 (ASM)	Talon site	8	5.3	2.1	11.2
Logan and Horton (2000)	AR-03-04-06-703 (CNF)	Cross Creek Pueblo	1	6.5	5.3	34.1
Logan and Horton (2000)	AR-03-04-06-703 (CNF)	Cross Creek Pueblo	2	7.5	5.0	37.5
Logan and Horton (2000)	AR-03-04-06-703 (CNF)	Cross Creek Pueblo	3	7.5	5.0	37.5
Williams (1985)	AR-03-04-06-341 (CNF)	Oak Creek Valley Pueblo	1	4.6	3.4	15.7
Williams (1985)	AR-03-04-06-341 (CNF)	Oak Creek Valley Pueblo	2	5.1	4.1	20.5
Williams (1985)	AR-03-04-06-341 (CNF)	Oak Creek Valley Pueblo	3	5.0	4.7	23.3
Williams (1985)	AR-03-04-06-341 (CNF)	Oak Creek Valley Pueblo	4	5.7	3.4	19.6
Williams (1985)	AR-03-04-06-341 (CNF)	Oak Creek Valley Pueblo	5	5.1	3.0	15.4
Williams (1985)	AR-03-04-06-341 (CNF)	Oak Creek Valley Pueblo	6	5.7	3.5	19.9
Mean						22.3
Standard deviation						8.6
Pit house						
Breternitz (1960a)	NA2385	Calkins Ranch Ruin	5[a]	6.1	4.3	26.0
Martine and Pilles (2005)	AR-03-04-01-1004 (CNF)	Verde Ranger Station	1	6.1	3.8	23.3
Stebbins et al. (1981)	NA2385	Calkins Ranch Ruin	F	5.3	4.3	22.3
Mean						23.9
Standard deviation						1.9

Reference, by Dwelling Type	Site No.	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m²)
Pueblo, cliff						
Fewkes (1912); James (1994)	NA1255	Honanki Pueblo	22/100-room mean[b]			14.7
Fewkes (1912); James (1994)	NA3209	Palatki Pueblo	11/13-room mean[b]			15.4
Shutler (1951)	NA4490	Kittredge Ruin	3	5.0	3.5	17.5
Shutler (1951)	NA4490	Kittredge Ruin	4	4.5	3.0	13.5
Shutler (1951)	NA4490	Kittredge Ruin	5	4.5	3.0	13.5
Mean						14.9
Standard deviation						1.7
Pueblo, larger (open-site)						
Caywood and Spicer (1935); Hartman (1976)	NA1261	Tuzigoot Pueblo	15-room mean[b]			13.0
Fewkes (1912); James (1994)	NA1500	Oak Creek Pueblo or Atkeson Pueblo	17–50-room mean[b,c]			42.8
Mean						13.01
Standard deviation						7.60

Key: ASM = Arizona State Museum; CNF = Coconino National Forest.

[a] This site may date to the Camp Verde phase rather than the Honanki phase.

[b] It is unknown which rooms were measured.

[c] This floor-area measurement may be inaccurate; measurements were taken from an unexcavated-site map.

have been community rooms similar to those identified in the Northern Sinagua area.

Given the absence of detailed maps and the lack of excavation at sites with inferred kivas (an Ancestral Pueblo and Western Pueblo form) or inferred compounds (a settlement form associated with the Classic period Hohokam), however, we have no information with which to comment.

Racetracks

A new feature type in the MVRV associated with the Honanki phase but not with other phases is the "racetrack." Two sites in the MVRV ALD have been called racetracks; both are in the uplands of the southeastern portion of our 18-map study area. The first is the Hackberry Race Track site (NA5705), recorded by Harold Colton in 1939. It is a long, linear feature cleared of rocks in Hackberry Canyon. The second is an unnamed site (NA4614 or AR-03-04-01-97 [CNF]) recorded first by Albert Schroeder in 1947; it is a 200-foot-long, boulder-lined, linear feature north of Sycamore Creek. A third site that may represent a racetrack is AR-03-04-01-126 (CNF). Just how these features functioned is unknown; perhaps they were indeed racetracks for foot races. Too little is known about these rare features to speculate (but see Russell and Nez 2012). Yet another candidate for a racetrack is at a site on Wingfield Mesa, south of West Clear Creek (NA19664 or AR-03-04-01-616 [CNF]).

Forts and Fortified Sites

The MVRV ALD contains information for sites that are considered defensible, fortified, and/or forts. Within the 2,343-site database, some 115 entries are classified as "fortifications." Several of these are historical-period forts (e.g., Forts Verde, Lincoln, and Swetnam), but most are precontact-period sites. All of the precontact-period sites identified as fortified or defensible have been assigned to the Honanki, Honanki-Tuzigoot, or Tuzigoot phase based on the presence of stone masonry and decorated pottery types.

These sites are considered defensible (e.g., Wilcox et al. 2001a) by virtue of their locations on hilltops or cliff ledges, relatively inaccessible settings, surrounding walls, and, occasionally, features described as "loopholes." Many of the large pueblos listed in Table 36 are considered defensive or defensible by Wilcox and his associates; the Hatalacva, John Heath, and Sugarloaf/Otten ruins serve as examples. However, there are several-dozen smaller sites with one to a dozen rooms that have been considered "forts," "retreats," or "lookouts." Only two of these smaller sites have been excavated: the Panorama Ruin (NA5111)

(Shutler 1951) and the Twin Buttes site (NA11297) (no report). Shutler (1951:3–4) did not interpret the small cliff dwelling on Court House Butte as a defensive location, but it is listed as such in the MVRV ALD. The Twin Buttes site was investigated by Arthur Black in 1972, but we did not find a report describing his work. Wilcox et al. (2001b), who have visited the site, near the Chapel of the Holy Cross in Sedona, consider it a clear example of a small fortified retreat and lookout. Despite the dearth of data generated by excavation or intense mapping and surface recording, we find the arguments advanced by Wilcox and his colleagues (Wilcox and Holmlund 2007; Wilcox et al. 2001a, 2001b) concerning the social unrest of the post–A.D. 1150 period and the cultural responses to regional warfare quite compelling.

Subsistence Remains

Faunal, macrobotanical, flotation, pollen, and phytolith samples have included plant and animal remains dating to the Honanki phase. Archaeologists have recovered animal bone from at least six sites in the MVRV ALD: Panorama, Kittredge, Cross Creek Ranch Pueblo, the Talon site, Oak Creek Valley Pueblo, and Exhausted Cave (Hudgens 1975). (*Note:* Exhausted Cave has occupations dating to both the Honanki and the early Tuzigoot phases.) Although the compositions of these collections vary from setting to setting, all but Exhausted Cave produced evidence of jackrabbit, cottontail, and deer—the mainstay protein sources for all MVRV populations since the Archaic period. New to the archaeological record of faunal use in the MVRV are canids, bobcat, and the collection of many different types of birds. Two sites (Cross Creek Ranch Pueblo and Exhausted Cave) yielded turkey bone and turkey feathers. Three sites (Kittredge, Cross Creek Ranch Pueblo, and Oak Creek Valley Pueblo) produced coyote or unidentified *Canis* remains. If these unidentified remains from Oak Creek Valley Pueblo are dog rather than coyote or wolf, then these would represent the first definite evidence of the presence of domesticated dog in the MVRV. The recovery of turkey is an important find, potentially signaling group food preferences and subsistence intensification during a time of valleywide population growth.[16]

Also present in these six collections were pronghorn, woodrat, Botta's pocket gopher, prairie dog, chipmunk or squirrel, turtle or tortoise, freshwater clam, bony fish, and bird bone and shell. The roster of birds recovered from Oak Creek Valley Pueblo is particularly impressive and rivals the list of birds recovered from Tuzigoot Pueblo. From 6 rooms of a 20-room pueblo, archaeologists recovered remains of water birds (e.g., mallard ducks, blue-winged teal, and American coots), raptors (e.g., red-tailed hawks, Cooper's hawks, Swanson hawks, and American kestrels), ravens, mergansers, flickers, kingbirds, Mourning doves, quails, and roadrunners, among others.

Plant remains recovered for the Honanki phase are equally diverse. Archaeologists have identified economically important plant remains from at least nine sites in the MVRV ALD, ranging from field houses to small cliff dwellings and from cavate rooms to pueblos. These include Centruroides House, Christmas Tree, Hidden House, Panorama Ruin, Kittredge Ruin, Exhausted Cave, Cross Creek Pueblo, the Talon site, and Oak Creek Valley Pueblo. Evidence of domesticates was present in all but the field house at Centruroides House and a small Panorama Ruin cliff dwelling. As a group, they reveal that maize, two varieties of beans (common bean, *Phaseolus vulgaris,* and tepary bean, *P. acutifolius*), two varieties of hard-rind winter-type squash (*Cucurbita mixta* and *C. moschata*), little barley, bottle gourd (*Lagenaria siceraria*), and cotton were cultivated during the Honanki phase. Archaeologists also recovered processed agave from archaeological contexts. Although we suspect that agave was procured earlier than the Honanki phase, this phase is the first for which we have clear evidence of agave's having been used widely in the MVRV for food, fiber, and other artifacts. Wild plants recovered from Honanki phase components, including amaranth, morning glory, squawberry, prickly pear, cholla, yucca, beeweed, elderberry, lambsquarter, sunflower, juniper, Mormon tea, walnut, hackberry, acorns, wild grape, wild rose, cattail, globemallow, spiderling, evening primrose, devil's claw, four o'clock, and others (see Table 19, Chapter 5 of this volume). Wood used for fuel and construction materials included juniper, piñon pine, alder, maple/box elder, sycamore, crucifixion thorn, juniper, and saltbush; juniper, however, was the most ubiquitous taxon. Some plants were collected for other purposes, as well. These include agave for cordage, combs, needles, and boxes; ash and reed grass for arrow shafts; bear grass and devil's claw for matting and basketry; cottonwood for weaving battens and spindle whorls; agave and yucca for textiles, cordage, and sandals; and various grasses used for pot rests and for lining storage features.

The recovery or presence of bottle gourd, tepary bean, devil's claw, and perhaps pumpkin-type squash (*Cucurbita moschata*) may be new for this time period.

Correlates of Settlement

Figure 36 displays the distribution of sites with Honanki phase occupations. At least by the end of thirteenth century, we can see the advent of settlement-type hierarchies based on room count. Although we know that many of the larger Tuzigoot phase villages have Honanki phase components, data compiled for Table 36 suggested that only one Honanki phase settlement, Ruin Point (NA3995), had

[16] Spurr (2007) recovered turkey bone from a Hackberry phase component at AZ O:5:155 (ASM), and it may be the earliest turkey remains yet recovered in the MVRV.

more than 50 rooms before A.D. 1275 or 1300. If these data are correct, they suggest that the largest site class for the Honanki phase was "large" (35–69 rooms). Ball courts, as examples of integrative architecture that was formerly more public and inclusive, all but disappeared; the exceptions were Sacred Mountain Ball Court in the MVRV and the ball court at Perkins Pueblo, in the upper Verde River area. Seemingly, more private and exclusive gatherings took place in plazas and other spaces (perhaps including racetracks) within and adjacent to individual pueblos. Factors contributing to this change in architectural patterns may have included an influx of immigrants and new traditions (Colton 1946), regional unrest and defensive behavior (Wilcox et al. 2001a), and/or other environmental stresses leading to greater self-interest and inter-settlement competition.

Figure 39 shows a proliferation of Honanki-age sites in well-surveyed portions of the uplands between 4,000 and 6,000 feet AMSL in elevation, near springs, such as the Hackberry Basin, and the establishment of long-lived villages along the Verde River and the lower, perennial reaches of West Clear Creek, Beaver Creek, and Oak Creek below 3,500 feet AMSL. The aggregate elevation for sites with Honanki phase components is about 4,330 feet AMSL, some 90 feet lower than the sites with Camp Verde phase components, continuing a trend toward establishing sites in lower landscape positions. Figure 40 shows the distribution of sites relative to land units that currently support agave, and Figure 41 shows the distribution of sites relative to areas with the highest potential for either irrigation or runoff agriculture. The majority of Honanki phase sites with 19 or fewer rooms strongly correspond to land units where agave grows today and indicate a notable presence in upland settings. Many, but certainly not all, of these smaller settlements are associated with soils and settings suitable for runoff-type agriculture. The majority of sites with Honanki phase components assigned to the larger site-size classes are predominantly associated with the Verde River and its major tributaries and irrigable land, although there are some notable and likely significant exceptions.

Paleoenvironmental Correlates

The 150-year-long Honanki phase began during a time period when regional alluvial water tables were depressed but not at their longtime lows. Concomitant with this drop in groundwater was a widely manifested pattern of floodplain erosion and channel incision (Dean 1988a:Figure 5.7). This mid-twelfth-century pattern reversed sometime in the later 1100s, when alluvial groundwater tables rose and floodplain sediments began to accumulate. According to Huckleberry and Pearthree (see Chapter 9, Volume 2 of this report), "floods and channel dynamics began to emerge as a problem for the Sinagua about A.D. 1200, 200 years before they abandoned the valley." Huckleberry and Pearthree also noted that the period between A.D. 1200 and 1400, which straddled the Honanki and Tuzigoot phases, was an interval of numerous and extreme floods in central Arizona, including the middle Verde River. Radiocarbon-dated overbank flood deposits along the lower Verde River, the Phoenix Basin, and the middle Gila River support that contention.

From the perspective of climate, the Honanki phase, as temporally delimited here, began as a warm period with alternatively wet and dry conditions between A.D. 1146 and 1183 (see Chapters 4 and 5 of this volume). Within the long drought interval were a number of extremely dry years but no extremely wet years. At about A.D. 1184, a persistently cool and often cold period set in and continued, almost unbroken, through A.D. 1272. The turn of the thirteenth century (A.D. 1196–1206) was especially cold, and at least one flood took place in A.D. 1202. Precipitation varied considerably during this long period, but wet years predominated after A.D. 1220. The final quarter of the thirteenth century witnessed the return to generally warmer-than-normal conditions, but few years of extreme warmth were identified in our tree-ring reconstruction. Importantly, the "Great Drought" of A.D. 1276–1299 (Douglass 1929), which was experienced in many portions of the U.S. Southwest, seems *not* to have been a major drought in the MVRV. Although individual years within the famous 24-year drought were very dry (A.D. 1276, 1286, 1288, and 1299), 14 years were reconstructed as wet, and only 10 years were classified as dry. Instead of a long and relentless warm drought, the final years of the Honanki phase alternated between wet-warm and dry-warm years. These conditions persisted for some four decades, from A.D. 1274 to 1314.

The foregoing summary suggests that environmental conditions in the Honanki phase must have been unusually challenging for subsistence farmers living in the MVRV. Prolonged warm droughts, cool droughts, cool-wet spells, and at least 2 years when stream-flow discharge was unusually high (A.D. 1202 and 1275) likely encouraged the farmers of the MVRV to exploit a wide variety of upland and lowland settings to cultivate sufficient food to sustain the increased number of people who apparently migrated to the MVRV at that time. With its mild climate relative to the surrounding regions, perennial river and streams, and abundance of potentially arable land, the MVRV after A.D. 1275 would have been an attractive region for displaced groups looking to settle in arable valleys where the ability to grow food was still possible. We suspect that population increase and marked environmental variety during the Honanki period were factors in the deliberate cultivation of several agave species in the MVRV at that time.

Inferred Land-Use Patterns

According to Pilles (1996a:65), Honanki phase sites seem to be distributed in two contrasting environments: aggregated settlements along the watercourses of the Verde

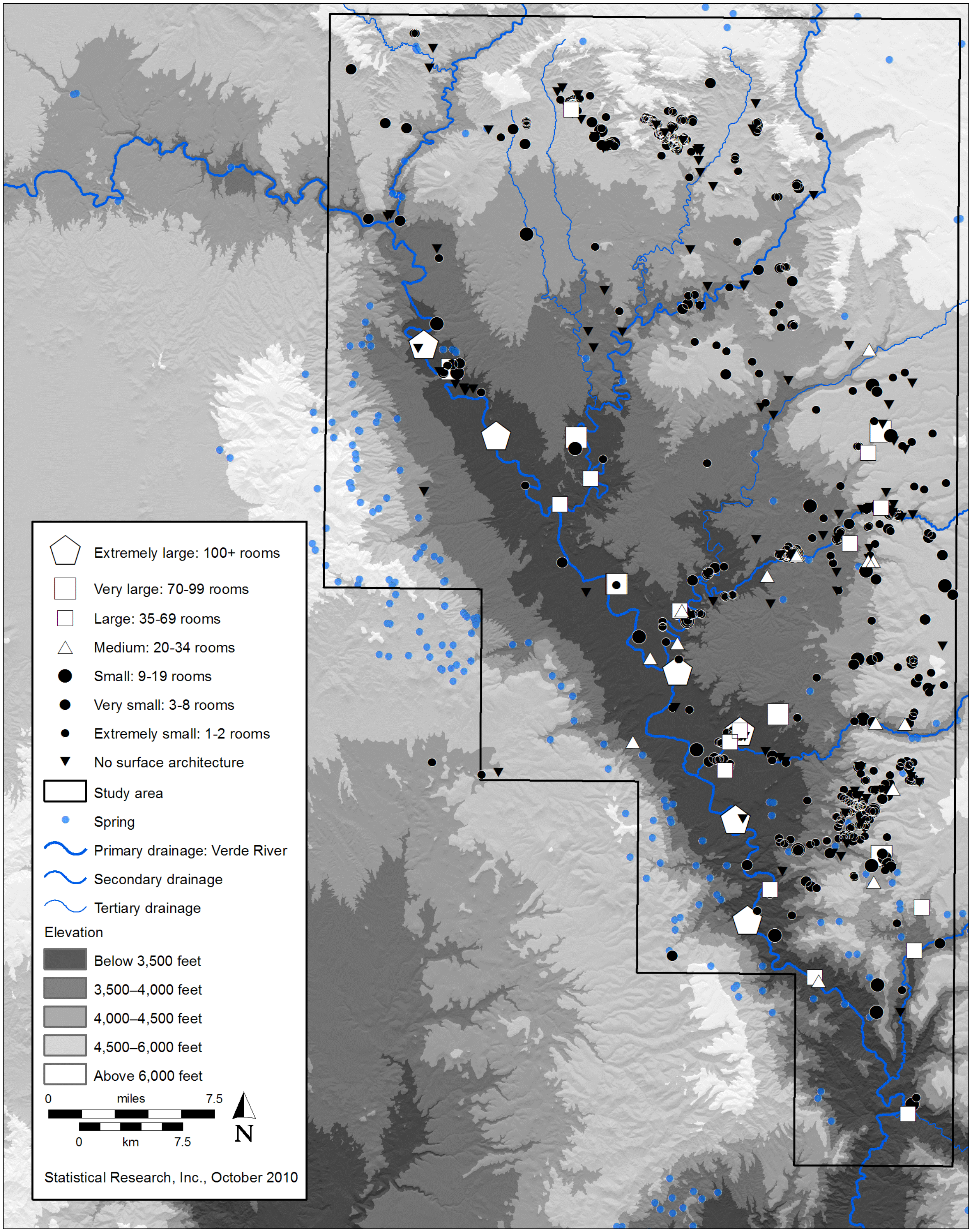

Figure 39. Map showing the elevational ranges of Honanki phase sites in the middle Verde River valley.

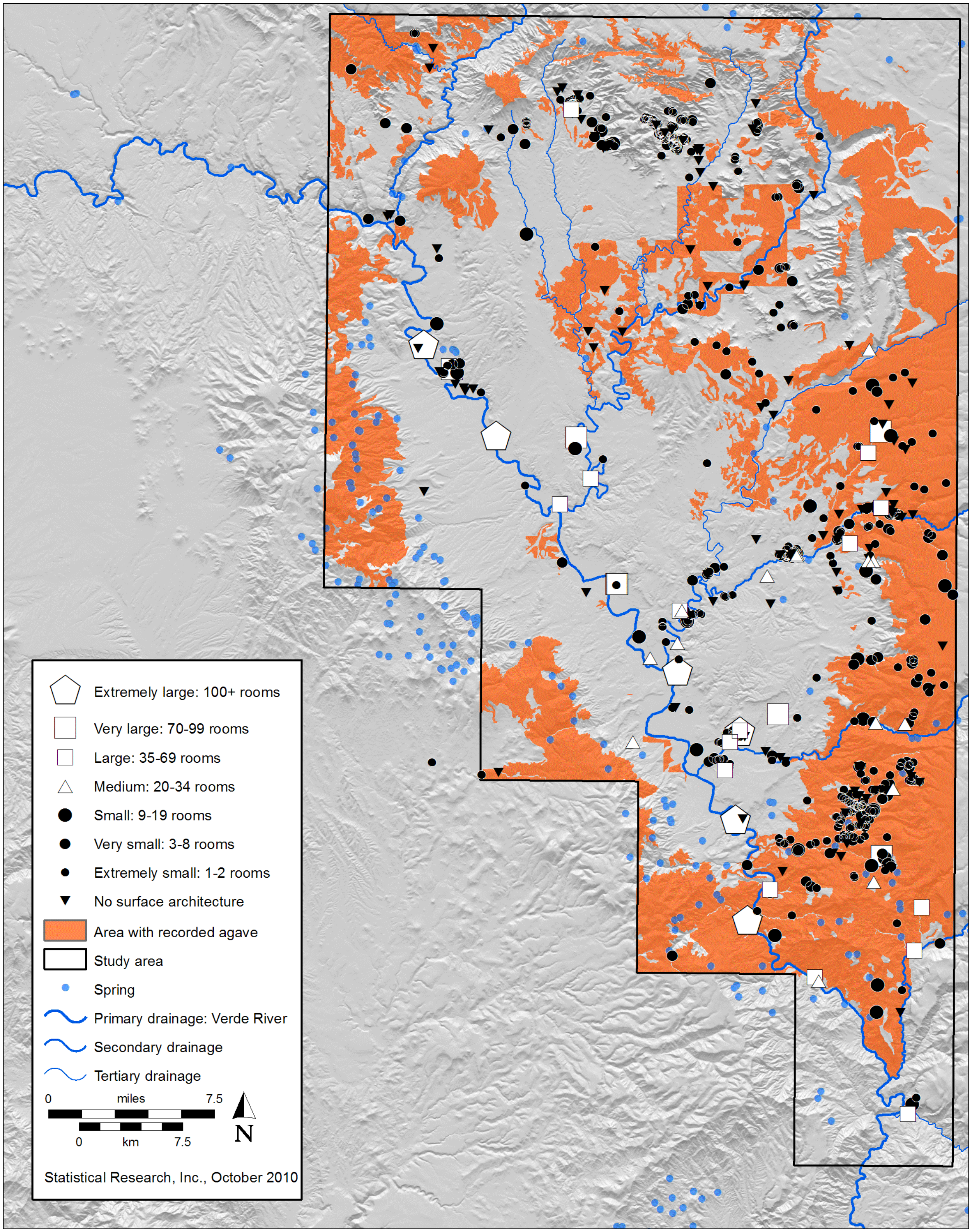

Figure 40. Map showing the locations of Honanki phase sites relative to agave-growing land.

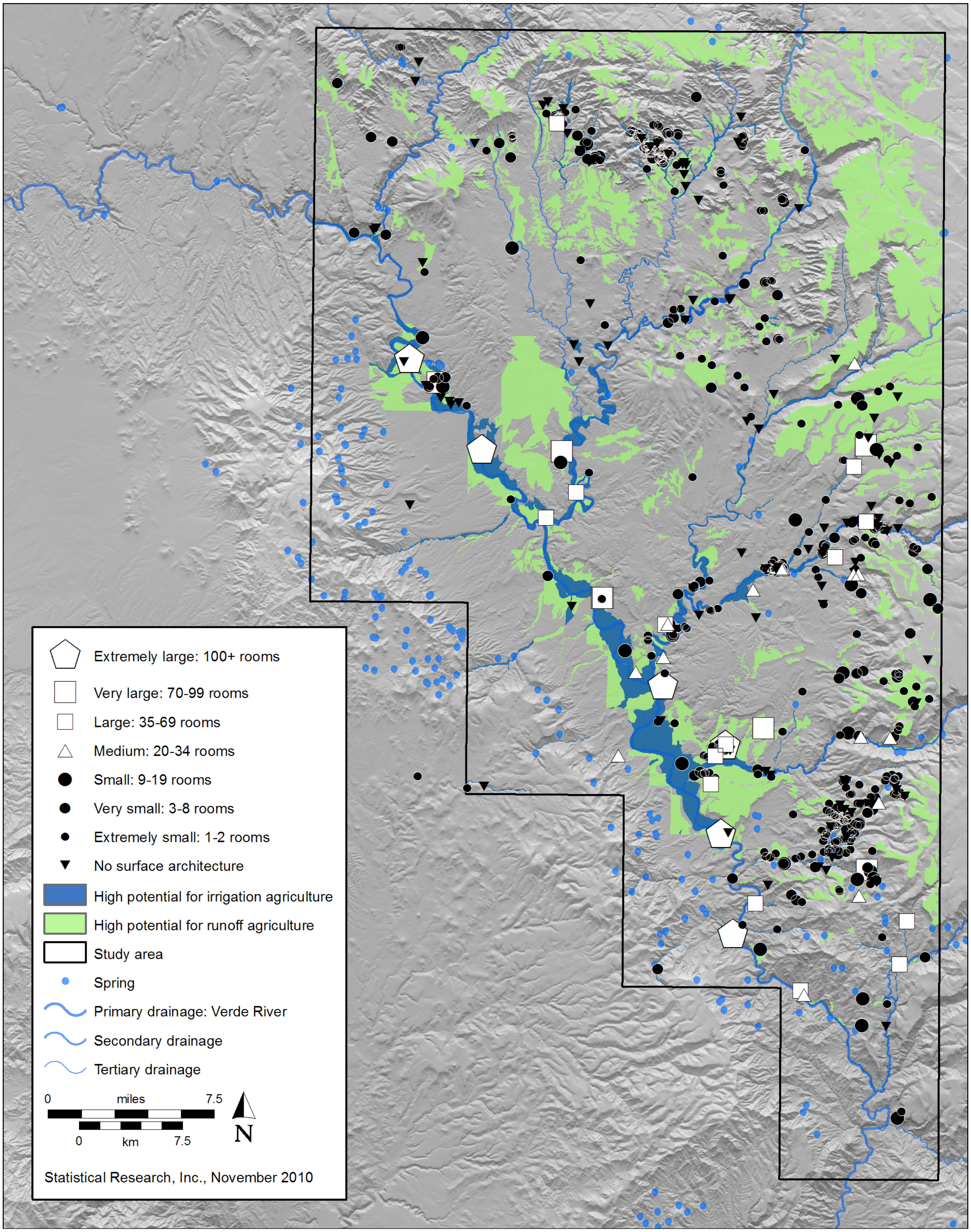

Figure 41. Map showing the locations of Honanki phase sites relative to lands with high potential for irrigation and runoff agriculture.

River and its major tributaries and smaller, more-dispersed sites in the canyons of the Verde River uplands. The data compiled in the MVRV ALD support that observation, but it is unclear whether the two zones were exclusive to different populations. Future analyses of architecture, artifacts, food preferences, human remains, and burial practices will shed light on this question. Generally speaking, the largest habitation sites with Honanki phase components are village-sized sites along the Verde River and lower reaches of perennial rivers below 3,500 feet AMSL. Adjacent to these larger villages are a number of smaller hamlets, farmsteads, and field houses. The balance of small villages, hamlets, farmsteads, and field houses are between 4,000 and 6,000 feet AMSL, in the uplands, where agave grows today. As is true for seemingly all time periods, the intervening elevational range between 3,500 and 4,000 feet AMSL contains few sites, and most of those are artifact scatters or extremely small sites characterized as field houses.

The many changes in material culture during this time period and the proliferation of architectural sites attributed to this time period suggest that new groups moved into the MVRV sometime during the Honanki phase (Wilcox and Holmlund 2007). The most predictable and productive settings for farming would have been along the Verde River and the lower reaches of its perennial tributaries, where irrigation systems and floodplain farming were possible. In several locations, runoff farming very nearby was also possible, and several of the largest villages were well positioned to access these arable settings, as well. Locations with dependable access to water would have been favored during the warm and often drier-than-normal mid-A.D. 1100s and late 1200s. Most of the time, lowland sites also would have been favored during the cool late 1100s and much of the 1200s (especially ca. 1195–1220, 1225–1245, and 1260–1270), but extended periods of exceptional coolness could have negatively impacted maize and cotton production. Access to the upland resources, intended to augment lowland economic resources through either direct access or exchange, was undoubtedly important. Deer, timber, agave, and other important plants and animals were located in upland plains, hills, and woodlands. The larger settlements in the uplands, such as Ruin Point and Doran Castle, may have been aggregated settlements established to take advantage of proximity to particularly desirable upland resources.

Regardless of what types of settlement systems may have been used during the 150 years of the Honanki phase, many of the large, lowland, riverine settlements persisted and grew during the subsequent Tuzigoot phase. Their persistence over more than two centuries is evidence that these locations represented the most attractive locations for sustainable settlements. We will return to these long-lived villages and their distribution in the next section, covering the Tuzigoot phase, in a discussion of communities.

Formative Period: Tuzigoot Phase

Recorded Sites

Although there are more individual sites attributed to the Honanki phase, the most visible and well-known sites in the Verde River valley date primarily to the Tuzigoot phase (A.D. 1300–1400/1425) (e.g., Montezuma Castle B and Tuzigoot Pueblo). A review of reports by Pilles (1996a), Wilcox et al. (2001a), and Wilcox and Holmlund (2007) suggested that most of the large village sites occupied in the Tuzigoot phase had earlier occupation dating to the Honanki phase and sometimes to the late Camp Verde phase (see Table 36). The MVRV ALD indicated that 365 sites had Tuzigoot phase components (Figure 42). Of the 365 sites, 39 have been investigated beyond initial recording. Only 11 of them are inferred to be single-component occupations; the rest have 2–5 components apiece. Sites attributed to the Tuzigoot phase appear as surface artifact scatters and sites with 1–350+ rooms. All site-size classes are represented in the Tuzigoot phase, ranging from extremely small (1–2 rooms) to extremely large (100+ rooms).

Archaeologists have observed that precontact populations in the MVRV after about A.D. 1300 seem to have coalesced into fewer but larger settlements along the major water courses in the valley. Colton (1946, 1968) was one of the first to suggest that the deleterious effects of the Great Drought constituted a major trigger for population movement from the Colorado Plateau to the Verde River valley, where irrigation agriculture from perennial rivers and streams was still possible. More recently, warfare and defensive requirements, in additional to environmental crises, have been seen as likely drivers of population aggregation, leading archaeologists like David Wilcox (Wilcox and Holmlund 2007; Wilcox et al. 2001a) to advance hypotheses concerning macro-regional interactions and sociopolitical tensions as important factors that influence settlement and land use.

Assigning Sites to the Tuzigoot Phase

Tuzigoot phase ceramic assemblages are composed of local utility wares (Tuzigoot Plain and Tuzigoot Red as well as Verde Brown and Verde Red) in association with cross-dated extralocal wares. Colton (1946) suggested that Jeddito Yellow Ware (Jeddito Black-on-yellow), Winslow Polychrome (presently called Homolovi Polychrome), and Prescott Black-on-gray were the typical decorated wares of the Tuzigoot phase. Other post–A.D. 1300 utility types found in the MVRV include Awatovi Yellow Ware (Jeddito

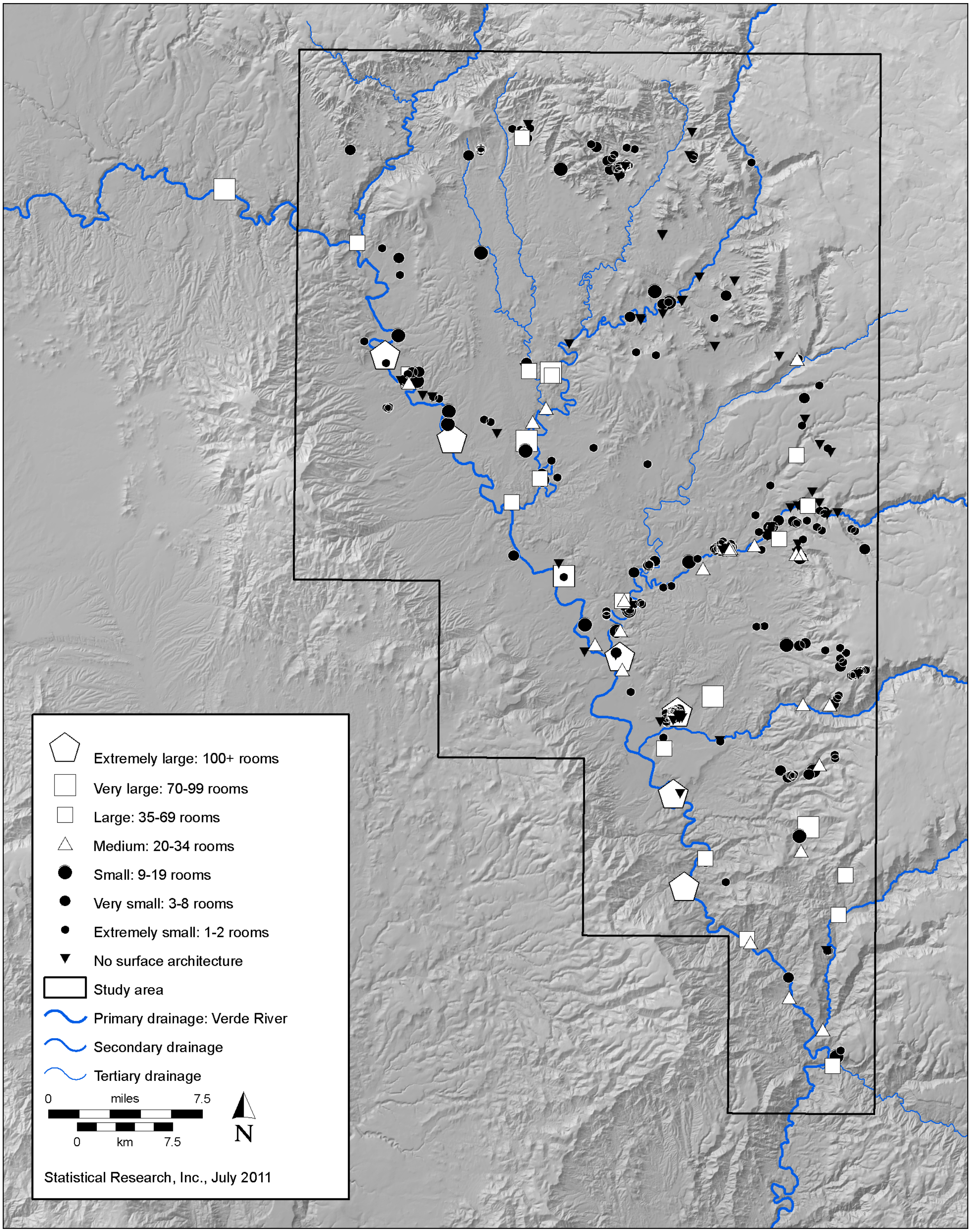

Figure 42. Map showing the locations of Tuzigoot phase sites in the middle Verde River valley.

Plain and Jeddito Corrugated) and some long-lasting types of Prescott Gray Ware (e.g., Aquarius Orange and Prescott Gray). Pilles (personal communication 2019) noted that the presence of Winslow Orange Ware recovered from sites within the MVRV indicates "early" Tuzigoot phase temporal associations and the presence of Jeddito Yellow Ware indicates "late" Tuzigoot phase temporal associations.

Investigated Sites

It has been many years since a large Tuzigoot phase or Honanki-Tuzigoot phase village has been investigated professionally through excavation (see Table 36). Surprisingly, few of these late sites have been mapped, documented, and described in reports. The most thoroughly reported excavations are those for Tuzigoot Pueblo (NA1261) (Caywood and Spicer 1935, reinterpreted by Hartman [1976]) and Montezuma Castle A (AZ O:5:95 [ASM]) (Jackson and Van Valkenburgh 1954; Kent 1954). Less well documented but no less important are the reports on the Middle Verde Ruin/Talbot Ranch Ruin (NA3526A and NA3526B) (Barnett 1965; Mearns 1890), the Mindeleff Cavate site (NA1511) (Mindeleff 1896, with new analysis by Hall [1992]), Tuzigoot Extension (AZ N:4:26 [ASM]) (Tagg 1986), Montezuma Castle B (AZ O:5:14 [ASM]) (Wells and Anderson 1988), Hatalacva Ruin (NA1263), and Jackson Ranch Ruin/Thoeny Pueblo (NA1275) mapped for The Archaeological Conservancy in the late 1990s.

Smaller and less-well-known sites with features assigned primarily to the Tuzigoot phase have been excavated in the MVRV, usually in response to compliance with NHPA Section 106. Among those features are seven individual structures that represent the lowest settlement level in the Tuzigoot phase settlement hierarchy—single-room surface or pit structures that often are described as field houses: NA15769, Structure 1, and the Calkins Ranch site, House 6 (NA2385) (Stebbins et al. 1981); SWCA's Verde Terrace site, Feature 1 (AZ N:4:23 [ASM]) (Greenwald 1989); NA18307, Feature 2, and NA18308, Feature 1 (Graff 1990); the Groseta Ranch Ruin site, Features 2 and 19 (AZ N:8:40 [ASM]) (Kwiatkowski 1999); and Site 105/838, Feature 13 (Site 105/838) (see Chapter 5 of this volume). Descriptions of these smaller excavations are found in Appendix C.

Features

Tuzigoot phase features in the MVRV include dwellings and storage structures in a variety of settings, agricultural features, roasting pits, rock art, artifact scatters, and burials. Among the dwellings and storage features are pit structures with and without masonry linings, free-standing masonry rooms and contiguous blocks of masonry rooms, individual cavate rooms and multiple cavate-room complexes, cliff dwellings, masonry rooms constructed under rockshelters, and fortified sites on prominences and overlooking arable land and water. Plazas and community rooms are regular features of larger sites with Tuzigoot phase components, and at least one isolated structure (AR-03-04-06-393 [CNF]) inferred to be a community room for two nearby settlements (the Page Springs/Limestone pueblo complex [NA4645A and NA4645B] and Spring Creek Pueblo [NA26019]). The possibility exists that a small number of Tuzigoot phase residential sites have kivas or compounds, but no definitive evidence is available, because none has been excavated.

Figure 43 illustrates architectural plans for the extremes in the Tuzigoot phase sites—pit structures and 1–2-room surface structures inferred to be field houses (vs. large nucleated pueblos). Table 38 provides floor dimensions and floor areas for a sample of Tuzigoot phase structures that have been illustrated in available reports. Pit structures assigned to the Tuzigoot phase include Feature 1 at SWCA's Verde Terrace site, two structures excavated by Graff at NA18307 (also designated AZ O-5-20 [NAU]), NA18308 (also designated AZ O-5-21 [NAU]), and the rock-lined room at Site 105/838 (see Chapter 5, Volume 1 of this report). Each was constructed quite differently, and few commonalities exist. The rock-lined structure at Site 105/838 and the unlined pit structure at NA18307 were both rectangular with steplike entries on one of the short walls (see Appendix C for description), and both were excavated relatively deeply into the prehistoric ground surface. The feature at NA18308 was described as a surface structure, but it appears to have been a house built in a pit with aboveground rock walls. The odd feature at SWCA's Verde Terrace site was a semi-rectangular pit room partially surrounded by a U-shaped masonry wall and posts along the open side. The two features identified as field houses at NA15769 and the Groseta Ranch Road site were rectangular or squarish surface masonry with few floor features.

Cavates, which are artificial cave-like rooms carved out of soft rock in cliffs and hills by humans, are common in the MVRV, especially in locations dominated by Verde Formation sediments. As Hall (1992) observed, cavates typically are secondary to more-extensive mesa-top pueblos in the Verde River valley (e.g., Oak Creek Ruin/Atkeson Pueblo, Middle Verde Ruin/Talbot Ranch Ruin, and West Clear Creek Ruin), but at the extensive Mindeleff Cavate Lodge Group site (Mindeleff 1896), the cavates dominate. Hall's study of the cavates at this site revealed that cavate dwelling units or cavate-room groups ranged in size from 1 to 10 rooms, although most dwelling units were composed of 2 to 5 rooms. Hall estimated that there were some 90 cavate-room groups present at the site, each likely representing a household. Single and isolated cavate rooms likely were not dwellings (e.g., Exhausted Cave [Hudgens 1975]); rather, they probably functioned as storage or special-activity locations, field houses, or even lookouts. Cavate dwellings, such as those as the Mindeleff Cavate Lodge Group, have hearths, storage features, niches, room and space dividers,

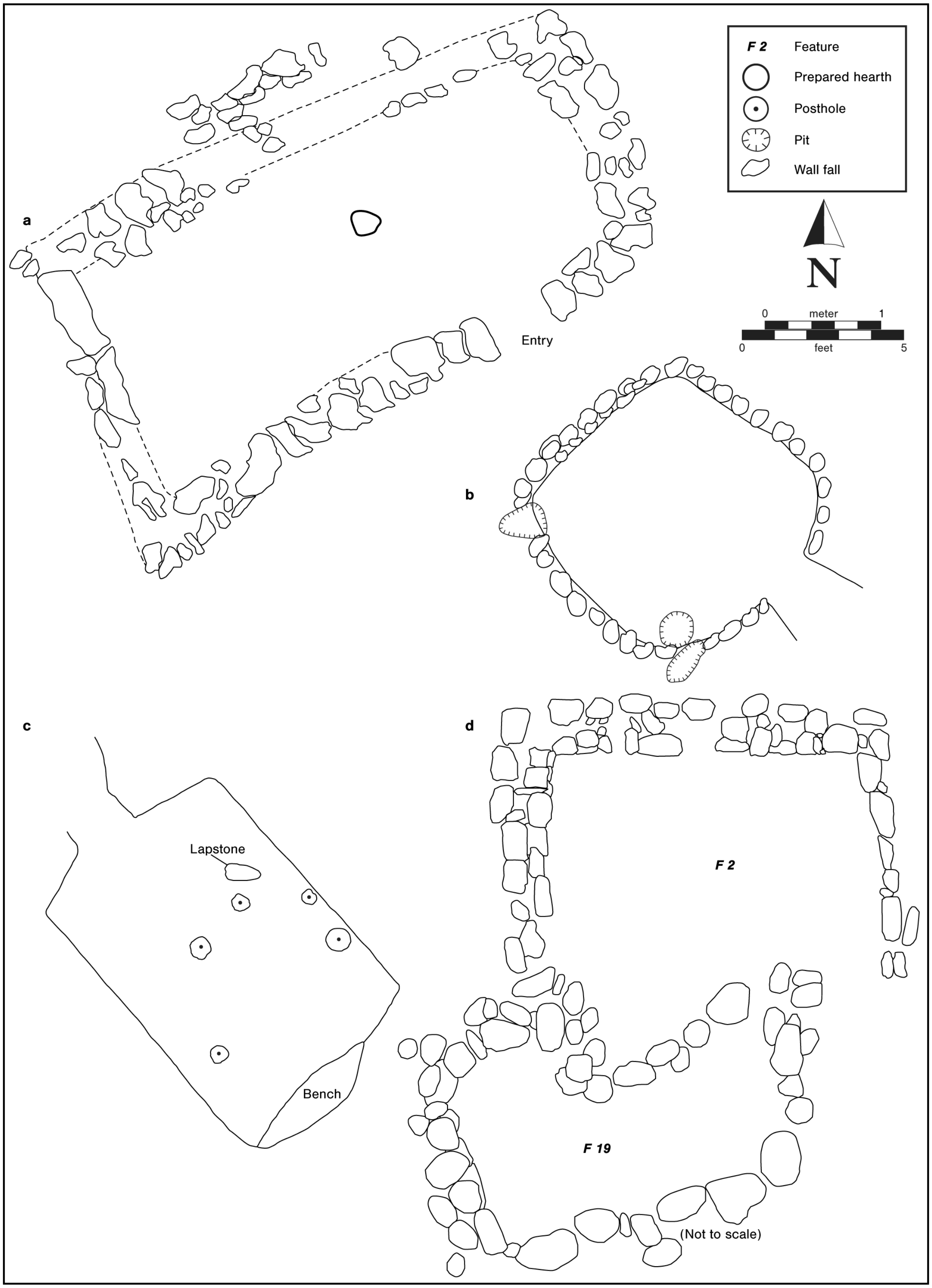

Figure 43. Sketches of small-scale Tuzigoot phase architecture in the middle Verde River valley: (*a*) room at NA15769, Structure 1 (Stebbins et al. 1981:Figure 7); (*b*) structure at NA18307/AZ-O-5-21 (NAU), Feature 2 (Graff 1990:Figure 22); (*c*) structure at NA1328/AZ-05-20 (NAU), Feature 1 (Graff 1990:Figure 11); and (*d*) rooms at AZ N:8:40 (ASM), Grosetta Ranch site, Features 2 and 19 (Kwiatkowski 1999:Figure 16.1D).

Table 38. A Sample of Tuzigoot-Phase Dwellings in the Middle Verde River Valley

Reference, by Dwelling Type	Site No.	Site Name	Feature No.	Length (m)	Width (m)	Floor Area (m^2)
Cavate associated with a pueblo						
Hall (1992)	NA5111	Mindeleff Cavate Lodge Group	median multiroom-dwelling floor area[a]			23.7
Hudgens (1975)	NA10769	Exhausted Cave; part of Clear Creek Ruins	one room[a]			15.0
Mean						19.4
Standard deviation						6.2
Cliff dwelling						
Jackson and Van Valkenburgh (1954); James (1994)		Montezuma Castle B	20-room mean[a]			9.61
Field house or single-room dwelling						
Graff (1990)	NA18307	unnamed; pit structure with step entry	2	3.0	1.9	5.7
Graff (1990)	NA18308	unnamed; surface structure with entryway	1	2.0	2.0	4.0
Greenwald (1989)	AZ N:4:23 (ASM)	SWCA's Verde Terrace site	1	2.5	1.7	4.1
Kwiatkowski (1999)	AZ N:8:40 (ASM)	Groseta Ranch Road site	2	3.7	3.6	13.1
Kwiatkowski (1999)	AZ N:8:40 (ASM)	Groseta Ranch Road site	19	3.5	2.0	7.0
Stebbins et al. (1981)	NA15769	unnamed	1	4.8	1.9	9.1
Vanderpot (Chapter 6, Volume 1 of this report)	AZ:O:105/AR-03-04-06-838 (ASM/CNF)		13	3.9	2.9	11.3
Mean						7.8
Standard deviation						3.5
Pueblo with 20+ rooms						
Alger (1968); James (1994)	NA2440	Perkins Pueblo	5/43-room mean[a]			20.3
Barnett (1965)	NA3536	Middle Verde Ruin or Talbot Ranch Ruin	10-room sample mean[a]			27.4
Erhardt 2008 (site map)	NA26019	Spring Creek Pueblo	41-room mean[a]			18.9
Hartman (1976)	NA1261	Tuzigoot phase occupation of Tuzigoot Pueblo	29-room sample mean[a]			22.5
Jackson and Van Valkenburg (1954); James (1994)	NA6383	Montezuma Castle A	8/45-room mean[a]			20.7
James (1994); Tagg (1986)	AZ N:4:26 (ASM)	Tuzigoot Extension Pueblo	5/20-room sample mean[a]			20.0
The Archaeological Conservancy map	NA1269	Sugarloaf Pueblo or Otten Pueblo	52-room mean[a]			33.6
The Archaeological Conservancy map	NA1276	Jackson Ranch Ruin or Thoeny Pueblo	26-room sample mean[a]			27.1
Mean						23.82
Standard deviation						5.09

Key: ASM = Arizona State Museum; CNF = Coconino National Forest; SWCA = SWCA Environmental Consultants.

[a] It is unknown which rooms were measured.

and so forth. Because there is a small Tuzigoot phase masonry pueblo on the mesa above the cavates, archaeologists have inferred that the Mindeleff Cavate Lodge Group cavates were used primarily in the Tuzigoot phase, but they certainly could have been constructed and used earlier. The MVRV ALD assigns a Honanki-Tuzigoot phase age association to this settlement, based on recovered pottery types.

Although other dwellings were built into cliffs and under natural rockshelters of the MVRV, the most famous such dwelling is Montezuma Castle (Structure B), now protected as an NPS National Monument. It is the best-described and illustrated site of its kind (Wells and Anderson 1988).

Room-size dimensions and calculated floor areas of the sites listed in Table 39 as 20+-room pueblos were either taken from published data (e.g., Hartman 1976; Jackson and Van Valkenburgh 1954; James 1994) or measured from available maps.

Site Clusters and the Recognition of Communities

An inspection of Figure 42 reveals the distribution of sites with Tuzigoot phase components in the MVRV. Several patterns are of interest. The existence of seven site classes based on estimated room counts suggests that a settlement hierarchy was present during the fourteenth century, if not before. The largest sites had more than 100 rooms, and at least 50 sites had 20 or more rooms (see Table 36); presumably, most of the population had dwellings in one of the larger residential settlements. That there are still a large number of sites that we classify as extremely small (1–2 rooms) and very small (3–8 rooms) suggests that one of several arrangements existed: (1) seasonally occupied field houses and farmsteads were components of the settlement system; (2) a portion of the valleywide population lived, not in the main village, but within the community's boundaries; (3) some groups were unaffiliated with the established villages and lived in the "hinterlands"; or (4) some combination of these three settlement patterns existed.

Another pattern is the presence of several site clusters and the location of many of the larger sites along drainages. In an effort to envision which sites may have been part of the same community, we created Figure 44, which displays the distribution of the sites with 20 or more rooms, with suggested community boundaries, around 11 site clusters. Figure 44 is a site-density map created by drawing a polygon around clusters of sites with 3 or more rooms (i.e.,

Table 39. Community Site Clusters in the MVRV and Associated Sites with 20+ Rooms

Cluster No.	Community-Site-Cluster Name	Associated Sites with 20 or More Rooms Occupied Sometime within the Honanki and/or Tuzigoot Phase	Total No. of Rooms at Sites with 20+ Rooms
1	Loy and Boynton Canyons	Honanki	45
2	Lower Sycamore Creek	Packard Ranch Ruin	35
3	Cottonwood-Clarkdale	Hatalacva, Tuzigoot, Tuzigoot Extension, Bridgeport Ruin	475
4	Lower Oak Creek	Spring Creek Ruin, Page Springs/Limestone, Oak Creek Valley Pueblo, Sheepshead Ruin, Big Cornville Ruin, Sugarloaf Pueblo/Otten Pueblo, and Oak Creek Pueblo/Atkeson Pueblo	342
5	Upper Wet Beaver	Ruin Point, Rarick Canyon Ruin, Casner Canyon Ruin, Walker Creek Pueblo, AR-03-04-01-69 (CNF), Sacred Mountain Pueblo, 2 Montezuma Well pueblos, Jackson Ranch Ruin/Thoeny Pueblo	334
6	Lower Wet Beaver	Montezuma Castle A and B, Rock Cone Ruin, Calloway No. 2, CV Hill Ruin, Middle Verde Ruin/Talbot Ranch Ruin, Fort Lincoln (prehistoric component)	327
7	West Clear Creek	John Heath, West Clear Creek Ruin, Wingfield Mesa Ruin, Mindeleff Cavate Lodge Group	627
8	Brown Springs	Bull Run Ruin, Brown Springs Ruin	150
9	Hackberry Basin	Bull Pen Ranch Ruin, AR 03-04-01-14 (CNF), AR 03-04-01-1221 (CNF), Doran Castle in Hackberry Basin Ruin, Needle Rock Ruin, Boulder Canyon Ruin, Salome Ruin	246
10	Towel Peaks	AR 03-04-01-498 (CNF), AR 03-04-01-499 (CNF)	72
11	Lower East Verde	East Verde Ruin	38
Total			2,691

Note: Large sites in the MVRV without associated habitation clusters of three or more rooms: Horse Mesa Fort, Salt Mine Pueblo, Verde Hot Springs Ruin, Fossil Creek Ruin, and AR-03-04-01-25 (CNF). Perkins Pueblo is technically not in the MVRV; it is within the upper Verde River watershed, as defined for this report. These six sites have an estimated 228 rooms combined (see Table 36).
Key: CNF = Coconino National Forest; MVRV = middle Verde River valley.

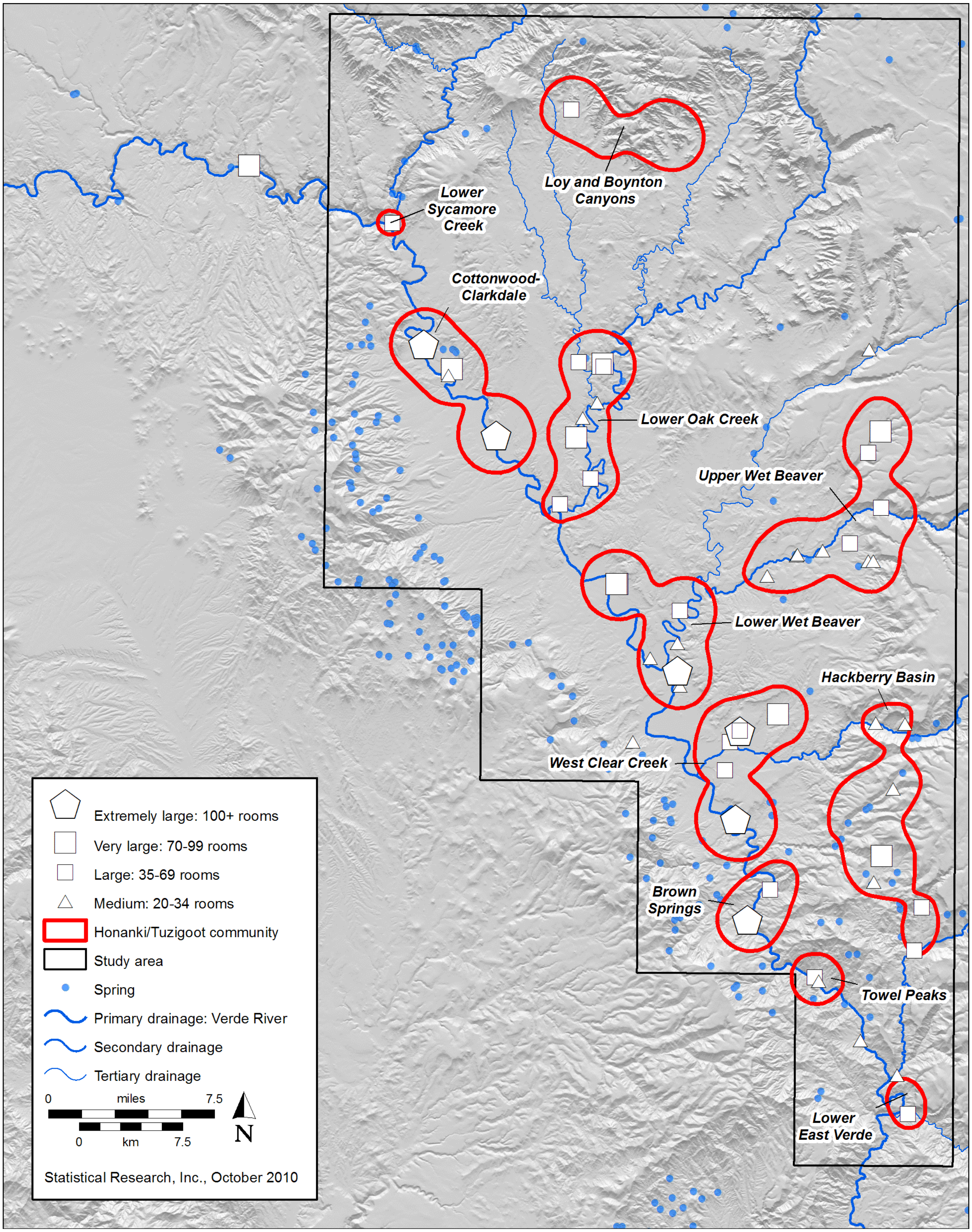

Figure 44. Map showing the locations of Honanki-Tuzigoot phase community catchments in the middle Verde River valley.

predominantly habitation sites) within 5 km (Euclidian distance) of each other. In so doing, 11 site clusters were identified (see Table 39), which we refer to here as "communities" or "community catchments," and we assigned each a name.[17] Had we used different criteria—7 km from one 3+-room site to another, for example—our community catchments would have been larger, likely resulting in fewer community catchments. For example, the Cottonwood-Clarkdale community that has Bridgeport as its largest settlement may have merged with the Lower Oak Creek community, which has Big Cornville Ruin as its largest settlement. Nonetheless, these site clusters are useful constructs for exploring some of the ways that settlements may have related to each other. We are aware that not all sites within each site cluster were contemporaneous, but we suggest that many of these localities were occupied over many generations and may represent the locations of persistent communities through time.

The 11 communities are of unequal size and are located in both upland and lowland positions with variable access to arable land and stands of agave. Most, but not all, of the largest sites are included in these site-density clusters. Eight of these 11 communities have two or more large sites within their polygon areas; the other 2 contain a single large site each. This pattern suggests that one or more large sites were members of the same community and that they had ready access to nearby economic resources, including arable land. Interestingly, the small Lower Sycamore Creek community at the extreme northwest (and Perkins Pueblo, in the Upper Verde River area) and two small communities we have called Towel Peaks and Lower East Verde at the extreme northwest and southeast, respectively, are currently believed to date only to the Tuzigoot phase. All of the other communities contained sites that were occupied in both the Honanki and Tuzigoot phases, if not longer. If that is true, then this map more correctly shows the distribution of Tuzigoot phase communities. A map of Honanki phase communities would have shown the communities extending only from the Hatalacva sites within the Cottonwood-Clarkdale community to the Brown Springs site in the Brown Springs community. Table 36 provides our current understanding of when each site within these specific communities was occupied.

The site-density analysis used to define these 11 communities was largely supported by a nearest-neighbor analysis undertaken on the same 20±-room sites used to create Figure 44 (Table 40). The Loy and Boynton Canyons community, with Honanki as its sole 20+-room habitation site, stands isolated from its two closest community neighbors—the Lower Sycamore Creek community and the Lower Oak Creek community. Similarly, the Lower Sycamore Creek community, with Packard Ranch Ruin as its sole 20+-room site, is nearly midway between Hatalacva, in the Cottonwood-Clarkdale community, and Perkins Pueblo, in the Upper Verde area. The four sites of the Cottonwood-Clarkdale community are nearer to each other than any site in nearby communities. That is also true for all the large sites in the other communities, with the exception of the isolated site cluster we have called the East Verde community, with the East Verde Ruin at its core. The nearest site of 20+ rooms from the East Verde community is the Fossil Creek site.

[17] We assigned names based on the site cluster's proximity to named streams, springs, upland geography, or modern town names.

Table 40. Nearest Neighbors for Sites with 20+ Rooms in the Middle Verde River Valley

Cluster No.	Site Designation	Distance to First Nearest Neighbor (m)	Site Name/No.	Distance to Second Nearest Neighbor (m)	Site Name/No.
0	AR 03-04-01-25 (CNF)	114,216	Honanki	125,254	Packard Ranch
0	Fossil Creek	2,944	East Verde	3,638	Verde Hot Springs
0	Horse Mesa Fort	6,035	Ruin Point	7,530	Rarick Canyon
0	Perkins Pueblo	11,220	Packard Ranch	18,118	Hatalacva
0	Salt Mine Pueblo	5,305	CV Hill	6,066	Calloway No. 2
0	Verde Hot Springs	3,638	Fossil Creek	5,288	AR 03-04-01-498 (CNF)
1	Honanki	15,330	Packard Ranch	18,309	Spring Creek Pueblo
2	Packard Ranch	9,068	Hatalacva	11,220	Perkins Pueblo
3	Bridgeport	5,567	Tuzigoot Extension	5,771	Tuzigoot
3	Hatalacva	2,730	Tuzigoot	2,864	Tuzigoot Extension
3	Tuzigoot	511	Tuzigoot Extension	2,730	Hatalacva
3	Tuzigoot Extension	511	Tuzigoot	2,864	Hatalacva
4	Big Cornville	1,528	Sheepshead	2,969	Oak Creek Valley Pueblo
4	Oak Creek Pueblo/ Atkeson Pueblo	2,877	Sugarloaf/Otten	6,822	Bridgeport

Cluster No.	Site Designation	Distance to First Nearest Neighbor (m)	Site Name/No.	Distance to Second Nearest Neighbor (m)	Site Name/No.
4	Oak Creek Valley	1,521	Sheepshead	3,193	Spring Creek Pueblo
4	Page Springs	1,528	Oak Creek Valley Pueblo	1,722	Spring Creek Pueblo
4	Sheepshead	1,521	Oak Creek Valley Pueblo	1,528	Big Cornville
4	Spring Creek Pueblo	1,722	Page Springs Pueblo	3,193	Oak Creek Valley Pueblo
4	Sugarloaf/Otten	2,877	Oak Creek Pueblo/ Atkeson Pueblo	3,149	Big Cornville
5	AR 03-04-01-69 (CNF)	375	Walker Creek	2,095	Sacred Mountain
5	Casner Canyon	3,452	Sacred Mountain	4,077	Rarick Canyon
5	Montezuma Well	109	Montezuma Well East	2,584	Jackson Ranch Ruin/Thoeny Pueblo
5	Montezuma Well (east rim)	109	Montezuma Well	2,666	Jackson Ranch Ruin/Thoeny Pueblo
5	Rarick Canyon	1,780	Ruin Point	4,077	Casner Canyon
5	Ruin Point	1,780	Rarick Canyon	5,521	Casner Canyon
5	Sacred Mountain	1,805	Walker Creek	2,095	AR 03-04-01-69 (CNF)
5	Jackson Ranch Ruin/ Thoeny Pueblo	2,564	Montezuma Well	2,666	Montezuma Well (east rim)
5	Walker Creek	375	AR 03-04-01-69 (CNF)	1,805	Sacred Mountain
6	Calloway No. 2	1,083	CV Hill	2,016	Rock Cone
6	CV Hill Ruin	1,083	Calloway No. 2	2,945	Fort Lincoln
6	Fort Lincoln	2,191	Calloway No. 2	4,022	Montezuma Castle
6	Middle Verde Ruin/Talbot Ranch Ruin	69	Middle Verde Ruin/Talbot Ranch Ruin	4,950	Montezuma Castle
6	Montezuma Castle A	176	Montezuma Castle B	4,925	Middle Verde Ruin/Talbot Ranch Ruin
6	Montezuma Castle B	176	Montezuma Castle A	2,396	Rock Cone
6	Rock Cone	2,016	Calloway No. 2	2,396	Montezuma Castle
6	Middle Verde Ruin/Talbot Ranch Ruin	69	Middle Verde Ruin/Talbot Ranch Ruin	3,991	Montezuma Castle
7	AR 03-04-01-904 (CNF)	1,100	West Clear Creek	1,114	Clear Creek
7	John Heath	3,003	West Clear Creek	4,043	Clear Creek
7	Mindeleff Cavates	3,612	Wingfield Mesa	5,693	Bull Run
7	West Clear Creek	14	West Clear Creek	3,016	John Heath
7	West Clear Creek	14	Clear Creek	3,003	John Heath
7	Wingfield Mesa	3,058	West Clear Creek	3,612	Mindeleff Cavate Group
8	Brown Springs	2,718	Bull Run	6,442	AR 03-04-01-499 (CNF)
8	Bull Run	2,718	Brown Springs	5,693	Mindeleff Cavate Group
9	3040100014	2,109	Bull Pen Ranch	4,776	AR 03-04-01-1221 (CNF)
9	3040101221	4,776	AR 03-04-01-14 (CNF)	4,925	Bull Pen Ranch
9	Boulder Canyon	3,170	Salome	3,971	Needle Rock
9	Bull Pen Ranch	2,109	AR 03-04-01-14 (CNF)	4,925	AR 03-04-01-1221 (CNF)
9	Doran Castle	1,954	Needle Rock	4,762	Boulder Canyon
9	Needle Rock	1,954	Doran Castle	3,971	Boulder Canyon
9	Salome	3,170	Boulder Canyon	5,802	Needle Rock
10	AR 03-04-01-498 (CNF)	375	AR 03-04-01-499 (CNF)	5,288	Verde Hot Springs
10	AR 03-04-01-499 (CNF)	375	AR 03-04-01-498 (CNF)	5,660	Verde Hot Springs
11	East Verde Ruin	2,944	Fossil Creek	6,341	Verde Hot Springs

Figure 45 depicts the locations of sites with features or architecture inferred to have attracted diverse populations (e.g., ball courts) and integrated local populations (e.g., community rooms). Interestingly, 8 of the 11 community site clusters contain one or more integrative structures apiece, including ball courts and mounds inferred to date to the earlier, Cloverleaf and Camp Verde phases, as well as community rooms, possible kivas, and racetracks inferred to date to the Honanki or Tuzigoot phase. This distribution supports the argument that the locations of the majority of these residential site clusters that we have identified as communities were favored locations for hundreds, if not thousands, of years. For example, the cluster of ball courts and mounds near the West Clear Creek community and the Upper Wet Beaver community likely were part of earlier, Cloverleaf and Camp Verde phase communities in the same general locations.

Subsistence

Plant and animal remains have been recovered from Tuzigoot phase components in the MVRV, but the record of plant use is better than that of animal use. The only record of nonhuman animal bone recovered from a predominantly Tuzigoot phase pueblo is from Tuzigoot Pueblo, itself. Given that the pueblo was excavated in the 1930s by local labor paid through Depression-era programs, it is not surprising that this list is largely a presence/absence account gleaned from room descriptions. The usual species—jackrabbits, cottontail, deer, pronghorn, prairie dog, and freshwater clam—were recovered, but other animals less commonly found in earlier sites were encountered, including beaver, muskrat, bobcat, bear, badger, and raccoon. Canid remains were recovered but were not identified to species. As with the Honanki phase Oak Creek Valley Pueblo, many different species of bird were recovered. Among the bird remains identified were western grebe, mallard duck, American coot, Canada goose, red-breasted merganser, wood ibis, red-tail hawk, Swanson hawk, peregrine falcon, and raven. In addition, the remains of scarlet macaw were found, representing the first instance of this important colorful and talkative import in the MVRV. Notably absent from the roster of avian remains from Tuzigoot Pueblo was turkey.

Plant parts have been recovered more frequently. Site reports for six sites provided the following minimal list of recovered species. Among the six sites are three field houses, AZ O:5:20 (NAU), AZ O:5:21 (NAU), and NA15769; a pit house at SWCA's Verde Terrace site; and two pueblos, Tuzigoot Pueblo and Montezuma Castle A. Although maize was recovered from each of the six sites, cultigens other than maize were recovered only from the pit house and the rooms at the two villages. Besides maize, cucurbit (likely squash), and cotton pollen were recovered from the pit house. Common beans and maize were recovered from Tuzigoot Pueblo. Montezuma Castle A (i.e., the burned pueblo below the cliff-dwelling castle) produced not only maize, common beans, squash, and cotton but also little barley. As a group, these six sites provided evidence of the collection and use of wild plants. Among the identified species were amaranth, *Chenopodium*, spiderling, beeweed, hackberry, plantain, purslane, wild grape, yucca, agave, wild gourd, and beargrass. Only one of the field houses reported on hearth firewood; juniper was used as fuelwood at NA15769.

Textile fabrics and bags woven from cotton and yucca (*Yucca baccata, Y. elata, Y. macrocarpa,* and *Y. mohavensis*) were regularly recovered from Montezuma Castle A (Kent 1954) during the 1933–1934 excavations at the site by Jackson and Van Valkenburgh (1954). Skirts, braids, cords/ropes, sandal heel ties, and nets were fashioned with cotton, yucca, and agave (identified as *Agave parryi* but possibly another species), sometimes singularly or in combination. Matting was manufactured from common sotol (*Dasylirion wheeleri*) and juniper bark. Wells and Anderson (1988:147–148) reported that roofing materials observed at Montezuma Castle B (i.e., the cliff dwelling visible today) included oak, ash, juniper, catclaw acacia, hackberry, sycamore, desert willow, cottonwood, common reed, feather grass, Sacaton grass, and narrow-leaf yucca. They also indicated that roof beams were constructed of juniper, piñon, cottonwood, and sycamore.

Correlates of Settlement

Figure 46 shows that the majority of sites with Tuzigoot phase components were located below 4,000 feet AMSL, marking the first time when most of the valley's population maintained residences in settlements close to permanent water. The average elevation for all sites with Tuzigoot phase components is about 4,040 feet AMSL, indicating that the downward trend in elevational settings continued into the fourteenth century. As in the previous Honanki phase, the generally smaller upland sites correspond to locations where agaves grow and runoff-type agriculture is possible (Figures 47 and 48). In contrast to the Honanki phase settlement pattern, there are many fewer sites with components attributed to the Tuzigoot phase in the uplands. Based on available data, we conclude as others have, that the distribution of settlement changed dramatically during the Tuzigoot phase.

Paleoenvironmental Correlates

The environmental conditions of the fourteenth century were undoubtedly challenging to MVRV populations (see Chapters 4 and 5 of this volume). As had happened at least twice before in the long occupation of the MVRV, regional alluvial water tables dropped to their long-term low levels

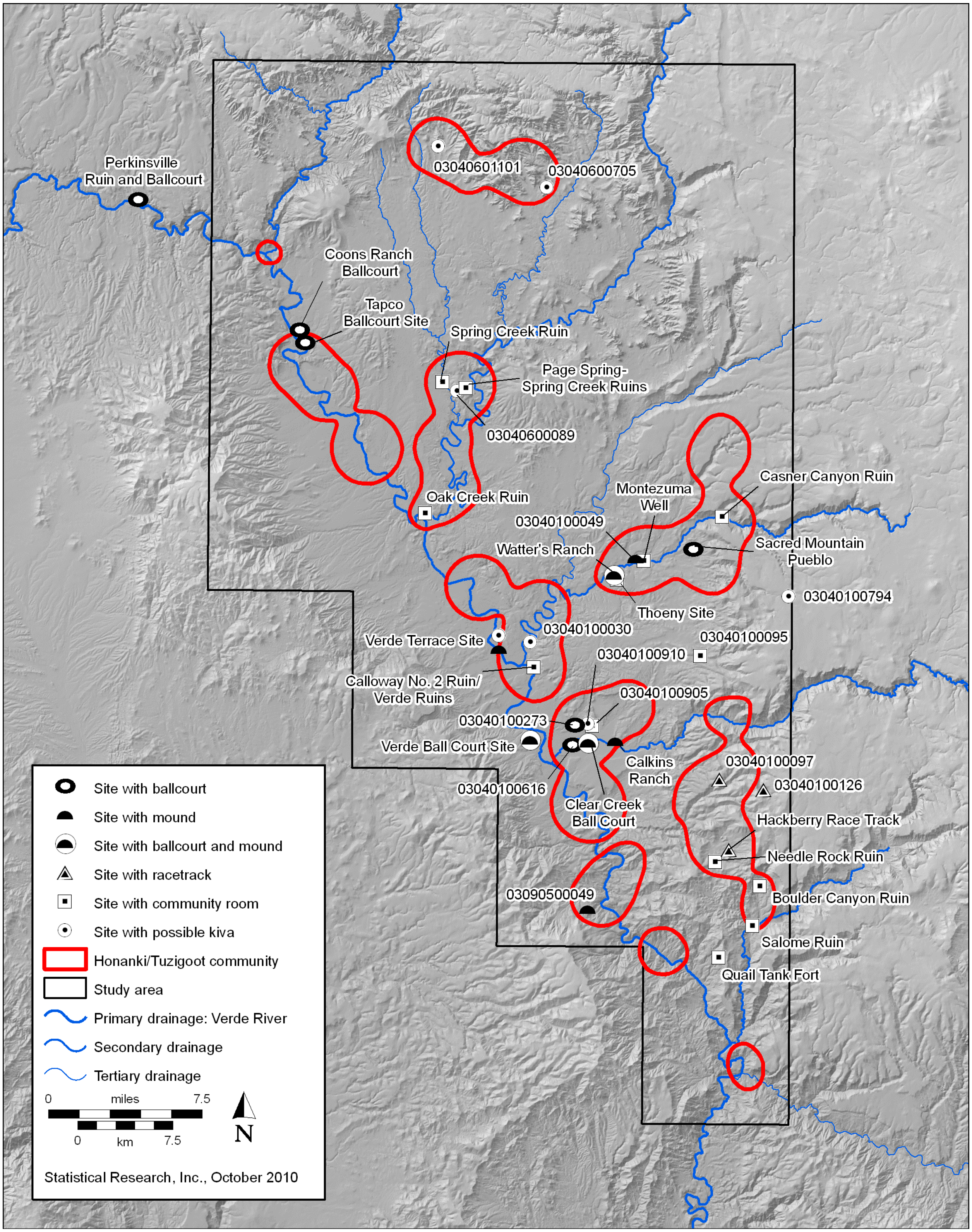

Figure 45. Map showing the locations of public architecture in the middle Verde River valley relative to Honanki-Tuzigoot phase community catchments.

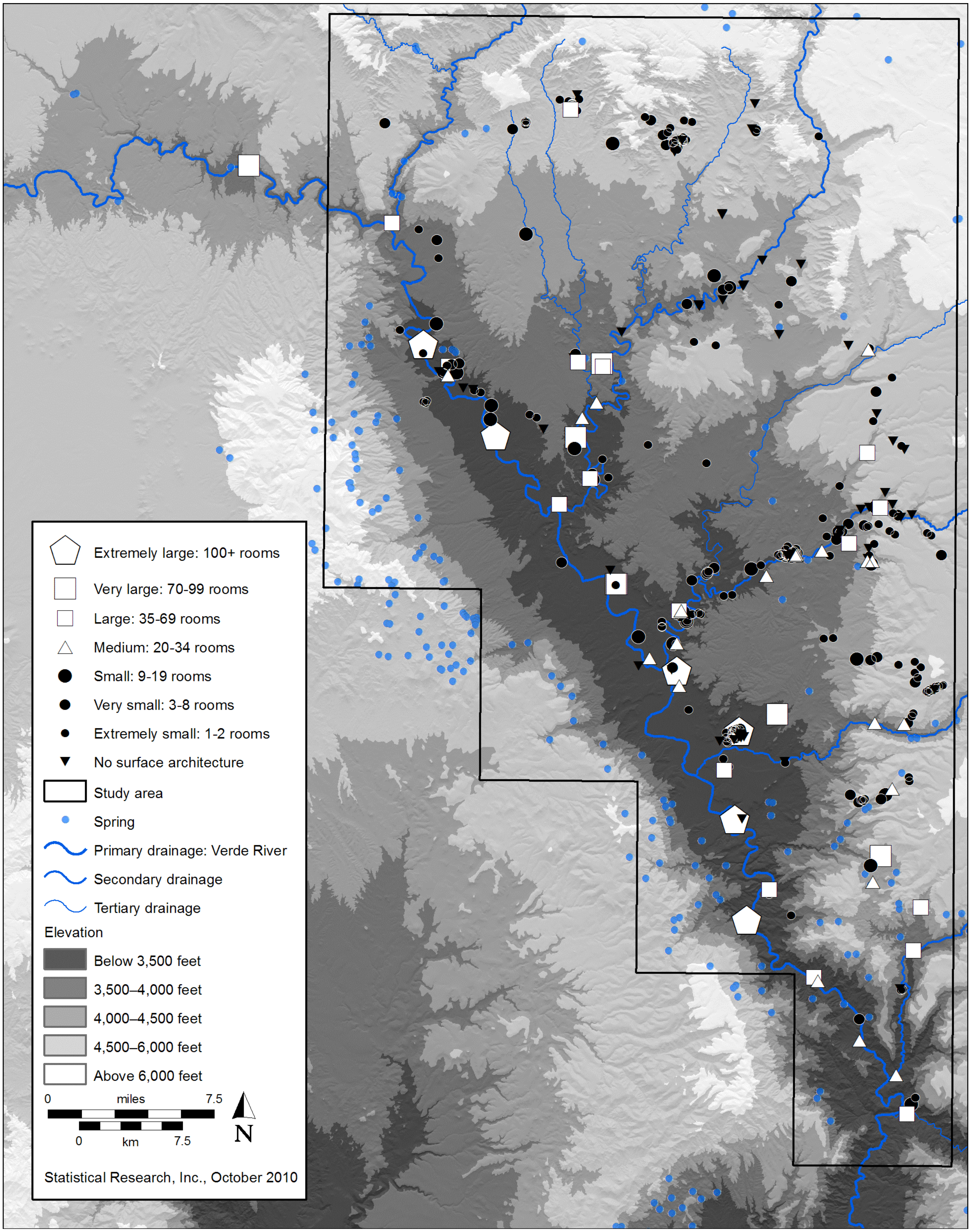

Figure 46. Map showing the elevational ranges of Tuzigoot phase sites in the middle Verde River valley.

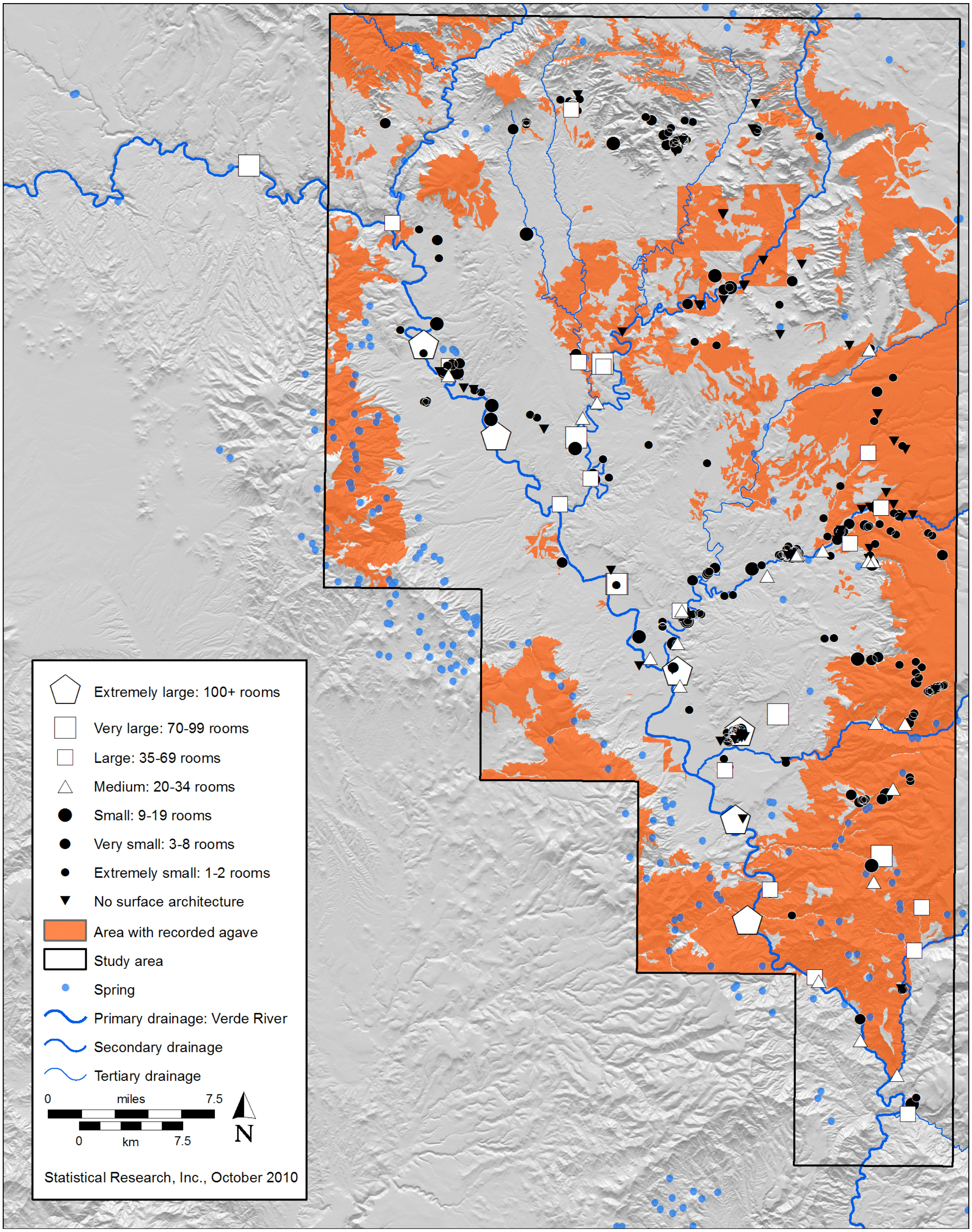

Figure 47. Map showing the locations of Tuzigoot phase sites relative to agave-growing land.

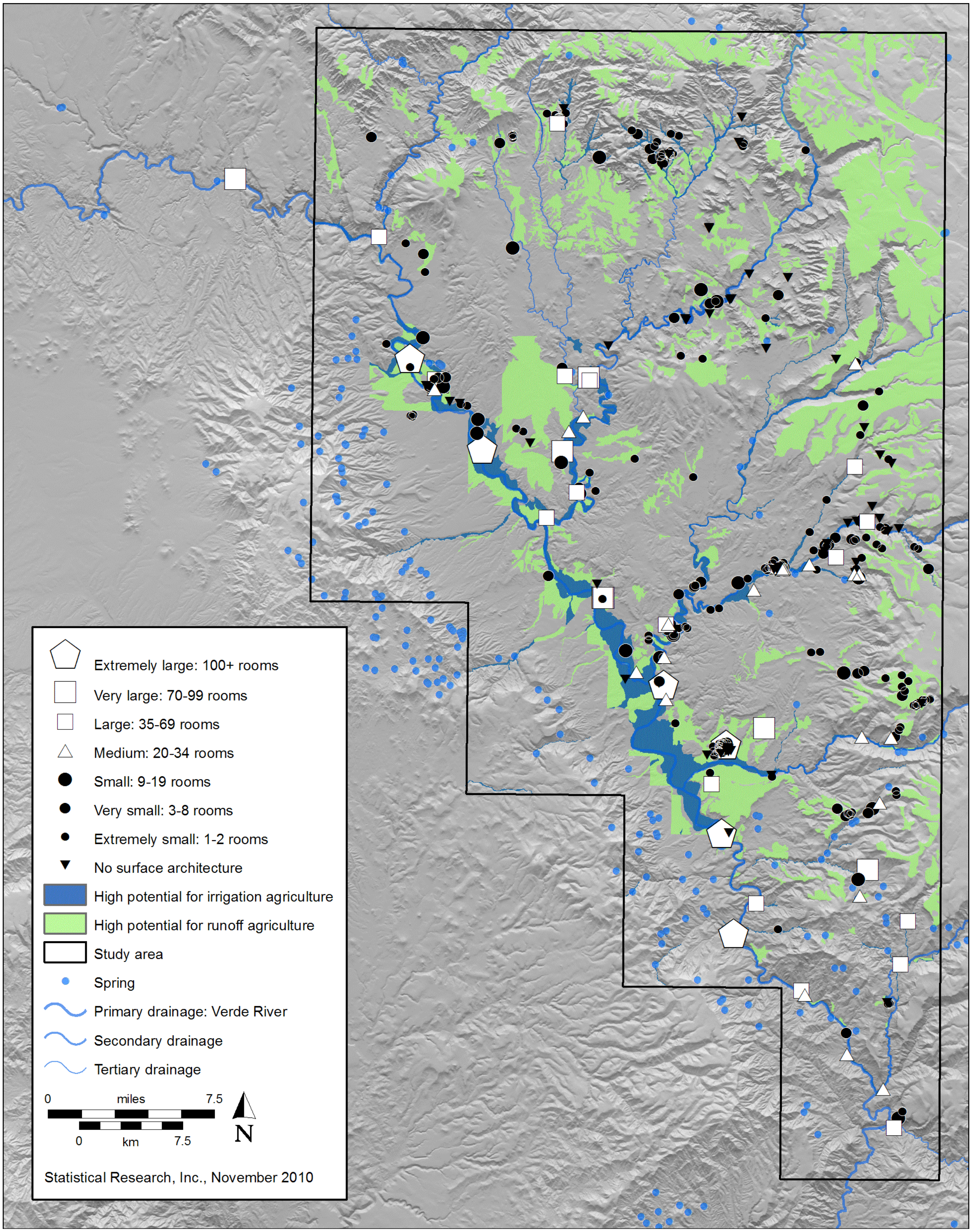

Figure 48. Map showing the locations of Tuzigoot phase sites relative to lands with high potential for irrigation and runoff agriculture.

(Dean1988a:Figure 5.7). Concomitantly, floodplain sediments were actively eroding, and streams were incising into their channels, causing major changes to floodplain morphology (width, depth, and sinuosity). The paleostream-flow record indicated that two episodes of very high discharge along the Verde River took place in the Tuzigoot phase. The first occurred in the late 1350s; the second took place in the early 1380s. Whereas the floods of 1357–1359 were notable, the floods of 1382–1384 were extreme. The year 1382 experienced the fifth-highest discharge in the entire 1,413-year stream-flow-reconstruction record (A.D. 572–1985). The extraordinary flood of A.D. 1382, which took place within an episode of higher-than-normal stream flow, has often been invoked as a forcing event in the destruction of the irrigation systems in the Phoenix Basin and the decline of Hohokam society (e.g., Abbott 2003:226; Graybill 1989). It is very likely that the 1380s floods were also destructive locally in the MVRV.

Although the period between A.D. 1300 and 1400 or 1425 was slightly wet and cool overall, considerable variability in both precipitation and temperature conditions took place. The thirteenth century also witnessed the return of a long interval of high temporal variability that continued into the fifteenth century, signifying a time period when future climate conditions were not easily predicted from past conditions. The phase began as a moderately warm and dry period that started in the late Honanki phase and persisted until about A.D. 1329. Thereafter, a long, persistent, and often extremely cool spell set in, between A.D. 1330 and 1364. The 1358 flood occurred during this pronounced cool period. With the exception of a short wet spell between A.D. 1365 and 1384, which culminated in the extreme floods of 1382 and 1384, the remainder of the Tuzigoot phase was warmer than normal. Two exceedingly warm years, A.D. 1423 and 1425, occurred at the end of the phase as it is currently dated.

Inferred Land-Use Patterns

The patterns of settlement and, presumably, land use noted for the Honanki phase continued into the Tuzigoot phase. The most obvious differences are that fewer sites, a greater number of large sites—especially those along the Verde River and the lower reaches of its major tributaries, and a greater range of site sizes, which we refer to as site hierarchies, have been assigned the Tuzigoot phase. Table 41 presents data concerning the estimate area and percentage of arable land and land with agave, as well as their respective ranks, along with corresponding ranks for community site-cluster sizes and room counts for the largest sites. Although it is important to remember that these numbers are modeled estimates rather than confirmed totals, these tabular data do suggest which communities likely emphasized which resources associated with riverine and upland resources.

Figure 49 plots the percentages of agave and arable land associated with each of the communities for which we have data. The three communities at the graph's upper left—Towel Peaks, Hackberry Basin, and Brown Springs—had the greatest access to agave and other upland resources but the least access to arable land. All three are in the

Table 41. Honanki-Tuzigoot Phase Communities Relative to the Distribution of Arable Land and Agave

Site-Cluster Name	Total (ha)	No Data (ha)	Arable (ha)	Arable (%)	Agave (ha)	Agave (%)	Cluster-Size Rank	Room Count and Rank	Arable Rank	Agave Rank
Loy and Boynton Canyons	59,378	—	11,689	19.7	2,447	4.1	7	45 (9)	6	7
Lower Sycamore Creek	3,243	9	859	26.6	553	17.1	11	35 (11)	5	5
Cottonwood-Clarkdale	74,124	11,120	32,704	51.9	—	0.0	6	475 (2)	1	10
Lower Oak Creek	74,730	—	28,132	37.6	9,310	12.5	5	342 (3)	4	6
Upper Wet Beaver	109,085	—	19,978	18.3	54,450	49.9	1	334 (4)	7	4
Lower Wet Beaver	79,050	—	33,022	41.8	310	0.4	4	307 (5)	3	9
West Clear Creek	84,322	1	39,832	47.2	1,195	1.4	3	627 (1)	2	8
Brown Springs	33,368	3	2,315	6.9	28,554	85.6	8	150 (7)	9	2
Hackberry Basin	89,118	117	8,651	9.7	78,894	88.6	2	246 (6)	8	1
Towel Peaks	13,678	5,078	501	5.8	7,346	85.4	9	72 (8)	10	3
Lower East Verde	9,859	9,859					10	38 (10)		

Note: No Terrestrial Ecosystem Survey or National Resources Conservation Service data were available for the Lower East Verde Community. Only partial data are available for land units within the Cottonwood-Clarkdale, Towel Peaks, Hackberry Basin, Brown Springs, and West Clear Creek communities, because of the limits of ecological surveys. Modern development in the Cottonwood-Clarkdale area precluded systematic soils and land-unit surveys and resulted in many cells with no data.

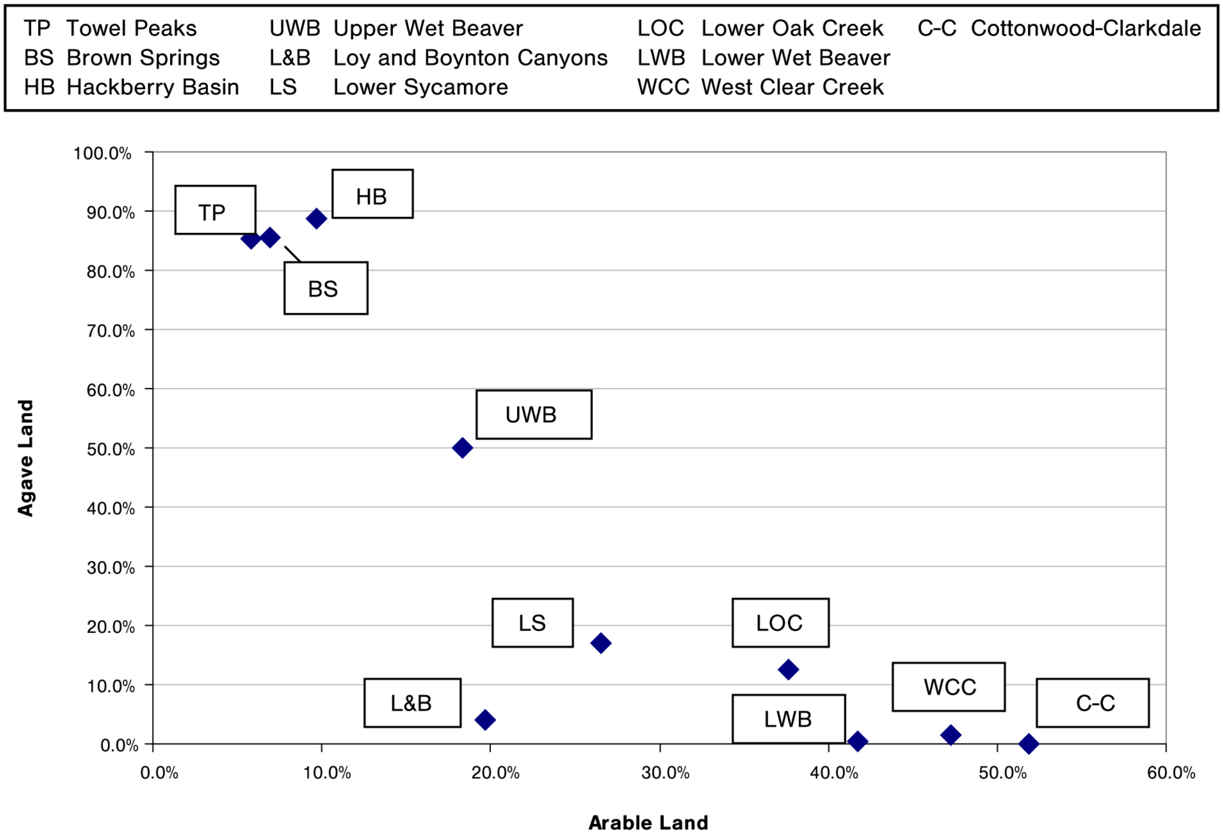

Figure 49. Abundance of agave and arable-land units, by Honanki-Tuzigoot phase community.

southeastern portion of the MVRV. The three communities at the graph's bottom right—Cottonwood-Clarkdale, West Clear Creek, and Lower Wet Beaver—had the opposite characteristics relative to agave and arable land and are along or close to the Verde River. The Cottonwood-Clarkdale community, with the Bridgeport, Hatalacva and Tuzigoot pueblos, had the greatest access to arable land of all the communities, if we consider that many unmapped hectares (11,120 ha under and adjacent to modern Cottonwood) would have been classified as suitable for irrigation and runoff agriculture. The West Clear Creek community, with Mindeleff Cavate Group, Clear Creek Pueblo, and John Heath Ruin, would have been a close second. Following close behind was the Lower Wet Beaver community, which included the Calloway No. 2, Montezuma Castle, and Middle Verde Ruin/Talbot Ranch Ruin settlements. Between these two extremes were the remaining four communities with variable access to both arable land and agave. The Lower Oak Creek community (including Page Springs/Limestone Ruin, Cornville, Sugarloaf/Otten, Oak Creek/Atkeson, and Spring Creek) contained many hectares of arable land but had considerably less access to agave and other nonriverine resources. The tiny Lower Sycamore Creek community (Packard Ranch), the Loy and Boynton Canyons community (Honanki), and Upper Wet Beaver (including the Casner Canyon, Jackson Ranch Ruin/Thoeny Pueblo, Sacred Mountain, and Montezuma Well settlements) had increasing access to agave lands relative to arable lands.

These patterns suggest future research related to land use as well as cooperation and competition for access to the products of each zone. When archaeologists can demonstrate that certain lowland and upland settlements had contemporaneous occupations and also had certain economic specializations (agave procurement and processing, for example), then it will be possible to develop testable models for upland-lowland cooperation or conflict based on the ability to grow crops or barter for them with desirable commodities, such as processed agave products. It is possible that certain analyses, such as strontium-isotope analysis, might detect the sources of maize that were recovered from large sites in upland communities like the Hackberry Basin community or isolated lowland communities like Towel Peaks or Brown Springs that had only limit access to arable land. We suggest that limited access to arable land and very likely agave, among other useful upland resources (e.g., piñon nuts, beargrass, deer, and wild turkey), was important in community relationships during the Tuzigoot phase, if not before. If regional warfare and fear of raids and retaliation were present during the late

Honanki and Tuzigoot phases, as has been suggested by David Wilcox and his associates (Wilcox and Holmlund 2007; Wilcox et al. 2001b), constraints on movement and resource acquisition may have forced new intraregional relationships and significantly altered settlement and land-use patterns.

Protohistoric and Early Historical Periods

Recorded Sites

The MVRV ALD indicated that 134 recorded sites[18] may have had protohistoric-period components (A.D. 1300/1400–1848) (Figure 50).[19] A site is listed as potentially having a protohistoric-period component when the "Culture" field lists "Yavapai," "Apache," "Yavapai or Apache," or "Hopi" or when the "Phase Name" field lists "protohistoric." Very often, these designations are accompanied by a question mark, reflecting the difficulty of identifying components associated with this time period (Keller and Stein 1985; KenCairn and Randall 2007; Whittlesey and Benaron 1998). The MVRV ALD showed that 18 of the 134 sites had received some sort of attention beyond initial inventory, with half of those 18 recorded as single-component sites. However, we identified several more sites with investigated protohistoric-period components than were indicated in the MVRV ALD.

Assigning Sites to the Protohistoric Period

Archaeologists working in the MVRV assign archaeological materials to the protohistoric period when one of more of the following are present: (1) artifact scatters containing one or more pottery types and/or projectile points considered diagnostic of this time period (Breternitz 1960b; Pilles 1981a, 2010; Pilles and McKie 1998); (2) pictographs created with charcoal, red clay, and crayon and petroglyphs created by light scratches, deep incisions, or pecking, depicting specific elements and themes (Pilles 1981a, 1994, 2010); (3) large roasting pits (Pilles 2010; Pilles and McKie 1998); (4) suspected wickiup clearings or outlines; (5) aceramic artifact scatters containing lightly used ground stone implements, "nutting stones" (possibly used as anvils for bipolar core reduction), lapstones, and/or obvious manuports (Pilles 2010); and (6) features, especially roasting pits, that produce radiocarbon, AM, TL, and obsidian-hydration dates that fall within the A.D. 1400–1900 interval (Pilles and McKie 1998). Pilles and McKie (1998) observed that material culture presumably associated with Yavapai sites often is associated with Hopi yellow ware, especially Jeddito Black-on-yellow pottery, which dates after A.D. 1300 (Hays 1991).

Ceramic vessels believed to have been manufactured by Yavapai groups are types within two brown ware series: Tizon Brown Ware (Euler and Dobyns 1985; Pilles 1981a) and Yavapai Brown Ware (Pilles 1981a). Tizon Wiped is the most commonly encountered Tizon Brown Ware in the MVRV, but other members of this series, such as Cerbat Brown and Aquarius Brown, have been attributed to Yavapai culture. Orme Ranch Plain (Breternitz 1960b) and "Yavapai Plain Ware" are the two types of Yavapai Brown Ware found in the MVRV. According to Dobyns and Euler (1958), Tizon was manufactured from about A.D. 700 to 1890, but the beginning date could be much later.

In contrast, fingernail-indented Rimrock Plain (Schroeder 1960), presumed to be an Apache Plain Ware, is the ceramic type believed to be manufactured by Northern Tonto Apache groups who lived in the MVRV. Apache Plain is a thin, dark (brown or black) protohistoric-period type with rough, unsmoothed, or irregularly wiped surfaces on which irregular scratches or wiping marks are often visible (Gifford 1980:163–164); the temper consists of abundant small, angular quartz fragments. Schroeder (1960:141–142) named the Verde Valley variety of this type Rimrock Plain, and the diagnostic trait is a series of vertical fingernail or sharp-tool impressions encircling the neck, as a band. Apache Plain is poorly dated but probably was manufactured after A.D. 1750.

Other artifacts considered "diagnostic" of a Yavapai presence are Desert Side-notched points with deeply concave bases (Pilles 1981a), reworked points with serrated margins, and projectile points and other tools manufactured from historical-period materials, such as metal and glass. Basin-type metates (milling stones) and basin-type one-handed manos (hand stones), as well as thin ground stone slabs used as lapstones and slabs with a number of pecked depressions interpreted as "anvils" for bipolar core reduction, are found at sites considered Yavapai. Grinding slicks also have been recorded at sites suspected to have been protohistoric-period camps.

The 134 sites in the MVRV ALD assigned to the protohistoric period on the basis of survey data included 54 sites

[18] After this chapter section was drafted and before final publication, we learned that Pilles (2017) had described another site (NA10946, the Orme School site) as Yavapai. Although this site number or name was not contained within the MVRV ALD when we conducted our research, it clearly should be added to our list of protohistoric sites.

[19] Deats (2011:3.57–3.61) reported on the excavation of a historical-period *owah* or wickiup (Feature 2) at the Grey Fox Ridge site (AZ N:4:110 [ASM]). Historical-period artifacts dated the construction and use of the circular structure to the period between the late A.D. 1880s and the early 1900s. Prehistoric sherds (Prescott Gray) as well as buttons, glass, and a metal can lid were recovered from the floor of the structure.

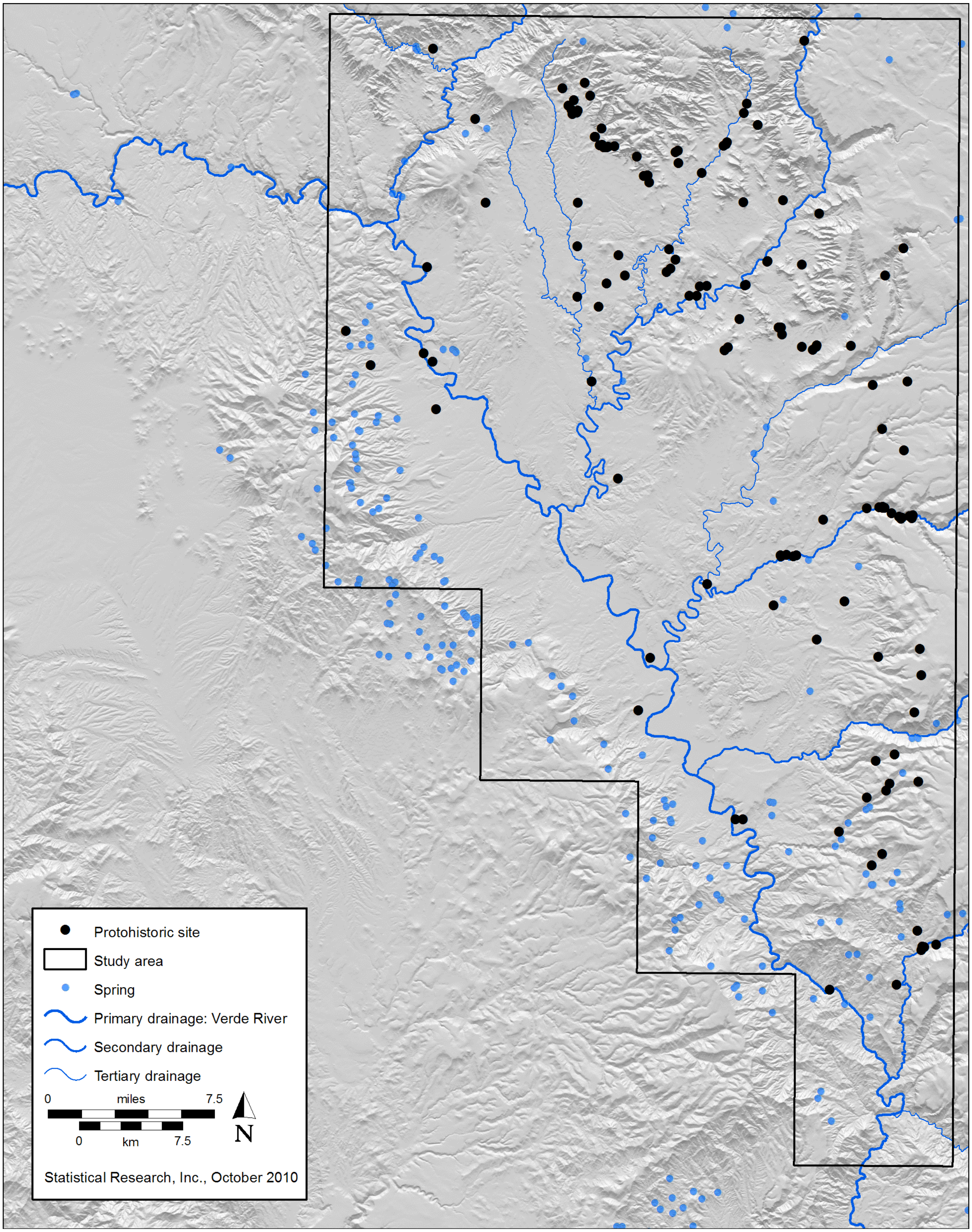

Figure 50. Map showing the locations of protohistoric-period sites in the middle Verde River valley.

with roasting pits, 52 sites with diagnostic artifacts, 20 with pictographs, 13 with petroglyphs (including glyphs that are not Yavapai or Apache), and 6 with suspected wickiups; a few sites contain more than one of these attributes.

Investigated Sites

Few unambiguous protohistoric-period campsites have been excavated in the MVRV (see Appendix C). Of the 18 sites in the MVRV ALD that are recorded as excavated, at least 9 contained at least one roasting pit, 7 had diagnostic artifacts, 1 contained possible wickiups (AZ:O:53/AR-03-04-06-745 [ASM/CNF] [Site 53/745]), and 1 had both pictographs and petroglyphs (AR-03-04-01-1042 [CNF]). In addition to this minimal list, we are aware of several more sites with protohistoric-period components, including the as-yet-unreported excavation and dating of a large roasting pit on Crescent Moon Ranch (AR-03-04-06-840 [CNF]) and the newly reported Grey Fox Ridge site (AZ N:4:110 [ASM]). Table 42 lists all recorded sites with protohistoric-period components that we currently know have been investigated beyond initial recording. At least 2 of these were sites suspected to contain protohistoric-period occupations, but excavation did not confirm that inference; instead, radiocarbon dates on materials recovered at two roasting features at NA16943 and AR-03-04-06-428 (CNF) suggested Early Formative period use.

Features

Features are inferred to have been protohistoric-period dwellings (wickiups and wickiup clearings or outlines), roasting pits, hearths, rock art ascribed to either a Yavapai or Apache presence, and artifact scatters containing at least one diagnostic artifact type.

Dwelling Sites

The MVRV ALD indicated that at least 12 recorded sites (Table 43) may have been protohistoric-period camps where wickiups once stood. Four of these have been investigated. Hallock and the members of the VVAS excavated 4 small, circular structures and associated extramural features at the Wood site (NA13394) (see Appendix C). Unfortunately, Hallock's (1984) report did not describe what artifacts or subsistence remains were recovered from these structures, and no samples were recovered for chronometric dating. Motsinger and Mitchell (1994b) investigated a site (AZ N:4:72 [ASM]) with at least one suspected wickiup for the Clarkdale Pipeline Project. As with the Wood site, no chronometric dates were obtained from that excavation. Deats (2011) excavated a historical-period wickiup at the Grey Fox Ridge site (AZ N:4:110 [ASM]); analysis of historical-period artifacts on the floor dated the occupation to the period between the 1880s and the early 1900s. Finally, the voluntary fieldwork undertaken by Pilles and VVAS at Site 53/745 revealed the presence of 11 suspected wickiups, 3 of which were excavated. They appeared on the surface as subtle clearings partially surrounded with basalt cobble and sometimes light artifact scatters. Although none of these features could be absolutely confirmed as a wickiup, and none contained materials from which to derive chronometric dates, Pilles contended that sufficient evidence existed to infer the presence of protohistoric Yavapai. The evidence consisted of two clusters of suspected structures, numerous basin-metate-type manos, sandstone slabs, pecked tabular sandstone slabs likely used in bipolar flake production, an agave knife, and diagnostic Yavapai pottery associated with Jeddito Yellow Ware.

Roasting Features

Of the 33 investigated sites listed in Table 42, 14 contained roasting pits. After excavation, analysis, and receipt of results from the radiocarbon assays of the submitted samples, roasting features at 2 of these 14 sites (NA16943 [Weaver et al. 1982] and Site 85/428 [see Chapter 7, Volume 1 of this report]) dated, not to the protohistoric period, but to the Early Formative period. Of the remaining 13 sites with roasting features, only 5 reported sites contained organic remains that were submitted for radiocarbon assay (Table 44). Of those 5, only 4 authors reported the derived radiocarbon ages in such a way that they could be calibrated, but in each case, the material submitted for analysis was charred fuelwood rather than the charred annual-plant parts roasted in the earth oven. As a result, all of these dates must be considered minimal ages for dating the use of the features, because dried wood—potentially decades to centuries old—was likely used as fuel. The single most securely dated roasting pit is Feature 2 at the Jack's Canyon site, AR-03-04-06-304 (CNF). Based on the two dates, and assuming they represent a single roasting event rather than multiple roasting events, this roasting pit was used sometime after A.D. 1690 and before 1920, long after the Tuzigoot phase came to an end. Charred agave was recovered from Feature 2.

Rock Art

Weaver (1986) seems to have been the first researcher to distinguish Yavapai rock-art styles from earlier precontact-period (prehistoric) and later postcontact-period (historical-period Euroamerican) styles. Pilles (1994) refined this typology for the Red Rock area near Sedona, the Loy Canyon site and the Red Cliffs site near Palatki, Honanki, and Hartwell Canyon. He identified six application techniques associated with Yavapai rock art: charcoal, red crayon, scratched and abraded, pecked, painted, and mud. The most common is the application of charcoal to a rock surface near large agave-roasting pits, where Yavapai pottery and projectile points are commonly encountered. Images painted on or rarely pecked into the rock usually

Table 42. Investigated Sites with Suspected Yavapai Components

Reference	Site No.	Site Name	Feature No. or Locus Identifier	Comment	Secure Date?
Bergland (1981)	NA19887 (AR-03-04-06-306 [CNF])			lithic scatter	no
Dosh (1985)	NA18191 (AR-03-04-06-457 [CNF])		4	roasting pit with reported radiocarbon ages on unreported material (assumed charcoal)	maybe
Dosh (1985)	NA18192 (AR-03-04-06-458 [CNF])			artifact scatter with Orme Ranch Plain	no
Dosh (2003)	AR-03-04-06-72 (CNF)		AA, 1B, 6	3 roasting pits; wood charcoal submitted for radiocarbon date; only the Feature 6 sample was secure	maybe
Dosh (2003)	AR-03-04-06-194 (CNF)		4	artifact scatter	no
Deats (2011)	AZ N:4:110 (ASM)	Grey Fox Ridge	2	wickiup (2.25 × 1.85 m) with floor artifacts, including a historical-period button, clear glass, and a metal can lid dating to the 1880s–1900s	yes
Greenwald (1989)	AZ N:4:28 (ASM), Loci A and B		Locus B, 1	roasting pit, good map; wood charcoal submitted for radiocarbon analysis, but reported data cannot be replicated or verified	maybe
Hallock (1984)	NA13384 (AZ O:1:29 [ASM], and AR-03-04-06-134 [CNF])	Wood	Structures 1–4, Roasting Pits 1–20	features excavated but artifacts not reported; no absolute dates; charred agave recovered from one of the larger sandstone-lined pits	no
Logan and Horton (1996)	AR-03-04-06-265 (CNF), AR-03-04-06-293 (CNF), AR-03-04-06-296 (CNF), AR-03-04-06-304 (CNF), and AR-03-04-06-306 (CNF) (Locus B)		2	protohistoric-period pottery at Sites 265, 269, 293, and 306; Site 304, Feature 2, roasting pit; 2 wood-charcoal samples submitted for radiocarbon analysis; same features yielded charred agave	yes
Logan and Horton (2000)	AR-03-04-06-703 (CNF)		8 and 10	Feature 8 roasting pit; 1 wood-charcoal sample for radiocarbon analysis	yes
Motsinger and Mitchell (1994a)	AZ N:4:72 (ASM) (AR-03-04-05-279 [CNF])		1, possibly 2 and 3	wickiup circles?; no chronometric information	no
Northern Arizona University Archaeological Laboratory excavated in 1981 (no report)	AR-03-04-06-420 (CNF)			roasting pit	no information
Pilles did detailed recording in 2000 and 2002 (no report)	AR-03-04-01-1042 (CNF)			petroglyphs and pictographs	no
Pilles excavated in 1995 (no report)	AR-03-04-06-883 (CNF)	Dry Creek Roasting Pit		large roasting pit	maybe

Reference	Site No.	Site Name	Feature No. or Locus Identifier	Comment	Secure Date?
Pilles recovered in 1976	NA27445 (AR-03-04-06-45 [CNF])			pottery cache: broken Orme Ranch Plain	no
Powers (1978)	NA14450 (AR-03-04-06-40 [CNF])	Verde Valley School Road	1	larger roasting pit, no radiocarbon samples taken	no information
Schroeder excavated in 1948 (no report)	NA46,38A (AR-03-04-01-76 [CNF])			roasting pit	no information
Statistical Research, Inc., this report	85/428		1–4	not Yavapai; roasting features, dated to the Early Formative period	no
Statistical Research, Inc., this report	53/745		8–10, 12–14, and 17	wickiups, Yavapai pottery	maybe
Statistical Research, Inc., this report	133/561		Locus C	roasting pit, Yavapai pottery	maybe
U.S. Forest Service excavation (no report)	NA19288 (AR-03-04-06-256 [CNF])			roasting pit excavated	no information
Weaver (2000)	AZ O:1:20 (ASM)	Scorpion Pit	1	roasting pit and artifact scatter with Desert Side-notched point	maybe
Weaver (2000)	AZ O:1:39 (ASM)	Cross Creek Bridge	?	unreported provenience and sample, presumed wood charcoal; also obsidian-hydration date reported: A.D. 1362	no
Weaver (2000)	AZ O:1:45 (ASM) (AR-03-04-06-434 [CNF], NA19327)	Coors Light		roasting pit	no information
Weaver (2000)	AZ O:1:43 (ASM) (AR-03-04-06-229 [CNF], NA19788)	Nathanael		artifact scatter	no
Weaver and Spaulding (1999)	NA19793 (AR-03-04-06-238 [CNF])			not Yavapai	no
Weaver and Spaulding (1999)	NA27680 (AR-03-04-06-758 [CNF])			artifact scatter, no diagnostic Yavapai artifacts	no
Weaver and Spaulding (1999)	AZ O:1:106 (ASM) (AR-03-04-06-759 [CNF])			artifact scatter with 18 Rimrock Plain, 2 Orme Ranch Plain	no
Weaver et al. (1982)	NA16943 (AR-03-04-06-335 [CNF])			small roasting pit; wood charcoal submitted for radiocarbon date yielded early dates (1390 ± 120 B.P. and 1545 ± 140 B.P.; clearly not Yavapai; possible Squaw Peak phase	no
Weaver et al. (1995)	AZ O:1:65 (ASM)		?	possible wickiup areas, roasting pit	no

Table 43. Sites with Known or Suspected Protohistoric-Period Wickiups in the Middle Verde River Valley

Site No.	Site Name	Investigated?
AZ N:4:110 (ASM)	Grey Fox Ridge	Deats (2011)
AR-03-04-01-041 (CNF) (NA4643)	Watters Ranch	unknown
AR-03-04-01-253 (CNF) (NA19285)		unknown
AR-03-04-01-258 (CNF) (NA19214)		unknown
AR-03-04-01-508 (CNF)		unknown
AR-03-04-01-985 (CNF)	Thirteen Mile Rock	unknown
AR-03-04-05-279 (CNF) (AZ N:4:72 [ASM])		Motsinger and Mitchell (1994a)
AR-03-04-06-266 (CNF) (NA19901)		unknown
AR-03-04-06-427 (CNF) (NA19905)		unknown
AR-03-04-06-587 (CNF)		unknown
AR-03-04-06-882 (CNF)		unknown
AR-03-04-06-134 (CNF) (NA13384, AZ O:1:29 [ASM])	Wood	Hallock (1984)
AZ O:1:54 (ASM) (AR-03-04-06-745 [CNF]) (Site 54/745)		see Chapter 10, Volume 1 of this report

Table 44. Dated Roasting-Pit Features in the Middle Verde River Valley Described in Available Reports

Project and Reference	Site No.	Feature No.	Dimensions	Sample No. and Radiocarbon Age	Calibrated-Date Range (2σ)
Red Rock Loop Road FLEX project (Dosh 1985)	NA18191	4	1.20 m in diameter, 0.33 deep; slab lined	UGa-5325: 755 ± 80 B.P. on charcoal	reported as A.D. 1195; calibrated here as A.D. 1047–1398
				UGa-5326: 1025 ± 120 B.P. on charcoal	reported as A.D. 925; calibrated here as A.D. 725–1255 (old wood?)
Verde Valley Ranch Project (Greenwald 1989)	AZ N:4:28 (ASM), Locus B	1	2.75 m in diameter, 1.37 m deep; stone lined	not reported	reported as A.D. 1380 ± 80 (not calibrated?)
Jack's Canyon sites (Logan and Horton 1996)	AR-03-04-06-304 (CNF)	2	1.80 by 1.50 m, 0.76 m deep; unlined	Beta-75540: 30 ± 50 B.P. on charcoal	reported as A.D. 1690–1730 and A.D. 1820–1920
				Beta-75541: 220 ± 80 B.P. on charcoal	reported as A.D. 1485–1950 (old wood?)
Cross Creek Ranch FLEX project (Logan and Horton 2000)	AR-03-04-6-703 (CNF)	8	2.00 by 1.80 m, 0.63 m deep; slab and cobble lined	Beta-71147: 590 ± 60 B.P. on charcoal	reported as A.D. 1290–1440
Testing of Two Sites along Dry Creek north of Sedona (Dosh 2003)	AR-03-04-06-72 (CNF)	6	1.10 by 0.70 m, 0.30 m deep; slab lined	Beta-171337: 740 ± 80 B.P. on charcoal	reported as A.D. 1160–1400

Key: FLEX = federal land exchange.

depict animals, mounted riders, warriors, large-fingered and head-dressed *akaka* figures (spirit helpers), and a variety of undecipherable shapes. Yavapai also incorporated earlier Sinagua rock art into their imagery. Armitage et al. (2000) suggested that one of the two shield-like pictographs dated via AMS radiocarbon techniques was altered by individuals who used the Red Cliffs sites after the Sinagua had departed the area. One of many white pigment dots painted over a large black shield (Shield 1) at AR-03-04-06-287 (CNF) yielded a radiocarbon age of 550 ± 100 B.P. that produced a 2σ calibrated date range of A.D. 1280–1620. Table 45 is a list of sites with Yavapai or Apache rock art in the MVRV; it is undoubtedly an incomplete list. Illustrations of some of these Yavapai rock-art styles may be found in the work of Zoll (2011).

Sites with Diagnostic Artifacts and No Features

Perhaps the most ubiquitous pieces of evidence of occupation and land use during the protohistoric period are diagnostic artifacts (pottery, projectile points, and, in one rare case, basketry) associated with Yavapai and Apache material culture. Pottery usually takes the form of potsherds in an artifact scatter, but at least two "caches" containing whole or reconstructible vessels have been found. USFS archaeologists recovered an Orme Ranch Plain jar at AR-03-04-06-45 (CNF) and a Tizon Wiped jar with mend holes at NA19971 (AR-03-04-06-462 [CNF]). USFS archaeologists also recovered a basket in a "cache" at NA19389 (AR-03-04-01-64 [CNF]), and the basket is now curated at the MNA.

One of the patterns that emerged from a review of descriptions of sites with inferred protohistoric-period components is that material remains associated with Yavapai tend to be located on the western side of the MVRV, whereas remains associated with Apache culture tend to be located on the eastern side of the valley. Wells and Anderson (1988:103), in their report on the Archaeological Survey and Architectural Study of MOCA, wrote that fingernail-indented ceramics identified as Apache Plain–Rimrock Variety were recovered from four sites in the Well Unit. MOCA 88A-7 and MOCA 88A-22 are rockshelters with masonry rooms. MOCA 88-23 is a collapsed rockshelter with retaining walls. MOCA 88A-27 is an artifact scatter on top of the cliff, above MOCA 88A-22 and MOCA 88A-23. Reuse of rockshelter sites by Apache is highly likely. Nonetheless, Tagg (1986:103) also wrote that a single sherd of Tizon Brown—a type often attributed to Yavapai groups—was collected from MOCA 88A-38, a masonry room structure in the arable land southeast of Montezuma Castle. Recovery of Apache Plain ware and "Yavapai Plain Ware" from the same site in the western portion of the valley has occurred, as well. Greenwald (1989:82, 93, Table 6-1) recovered three types of Apache Plain Ware and "Yavapai Plain Ware", in addition to four sherds of Hopi Yellow Ware and one sherd of Jeddito Black-on-yellow, from a surface scatter at AZ N:4:28 (ASM), along the Verde River, south of Hatalacva Pueblo.

Another pattern that emerged is that protohistoric-period groups often camp in or on Southern Sinagua sites, presumably to take advantage of the shelter and usable materials found in these locations. In 1983, the installation of a subterranean drainage system in 20 rooms at Tuzigoot Pueblo was monitored (Tagg 1986). Evidence of possible protohistoric-period occupation of Southern Sinagua rooms was encountered. Small, side-notched obsidian projectile points, especially one with a concave base that could be described as Desert Side-notched, were recovered in Room I-10, suggesting Yavapai presence. Two other small, side-notched obsidian points were recovered from Rooms I-11 and III-16. Similarly, Tagg (1986) reported on a survey at the Montezuma Castle/Well Unit prior to a road-widening project. Two Apache Plain sherds, among 81 sherds, were

Table 45. Sites with Yavapai or Apache Rock Art in the Middle Verde River Valley

Site No(s).	Site Name
AR-03-04-01-1042 (CNF)	
AR-03-04-01-250 (CNF)	
AR-03-04-06-057 (CNF), NA4489	
AR-03-04-06-058 (CNF), NA1255	Honanki Pueblo
AR-03-04-06-284 (CNF), NA15767, NA20032	Red Cliffs
AR-03-04-06-285 (CNF), NA20033	Red Cliffs
AR-03-04-06-286 (CNF), NA15767, NA20034	Red Cliffs
AR-03-04-06-287 (CNF), NA15767, NA20035	Red Cliffs
AR-03-04-06-326 (CNF), NA19966	
AR-03-04-06-363 (CNF), NA19892	
AR-03-04-06-802 (CNF), NA27530	Loy Canyon Pictographs

recovered by Schroeder, who had previously recorded this site (NA4609G, also MOCA 86-2) (Schroeder 1960:169, Figure 1), which is a small rockshelter with 4–6 masonry rooms. Finally, Ferg and Tessman (1998:Table 7.1) identified several sites in central Arizona that were recorded as Apache sites by the Gila Pueblo Foundation in 1937.[20] One of these, Jackson Ranch Ruin/Thoeny Pueblo (also designated Goodwin-Sayles 4 and NA1275), had a wickiup on its hilltop summit.

Subsistence Remains

Plant and animal remains attributed to protohistoric-period occupation have been recovered from a few roasting pits in the MVRV. Although excavations at the Crescent Moon Ranch Roasting Pit site and the Dry Creek Roasting Pit site have not yet been reported in print, Pilles (personal communication, April 2010) stated that agave remains were recovered. To date, reporting on two sites by archaeologists from Southwest Environmental Consultants, Inc., has provided the only descriptions of plant remains identified in post–A.D. 1290 roasting features. The large roasting pit excavated at AR-03-04-06-304 (CNF) (Logan and Horton 1996) contained 87 charred agave-tissue fragments, a catclaw-pod seed, and beeweed seeds. Fuelwood included juniper or cypress and barberry. Another large roasting feature at AR-03-04-06-703 (CNF) (Feature 8) (Logan and Horton 2000) contained charred and uncharred animal bones but no identifiable plant remains. Fuelwood included juniper or cypress, sycamore, and saltbush. Feature 10 from the same site contained charred goosefoot seeds; juniper or cypress and ash wood were used for fuel.

Correlates of Settlement

Figure 50 depicts the locations of all sites with protohistoric-period components in the 2,343-site MVRV ALD. These 134 sites are on a variety of landforms ranging from low elevations (below 3,500 feet AMSL) near the Verde River to upland elevations in the Red Rock country and along the Mogollon Rim above 6,000 feet AMSL, but most have been encountered between 4,000 and 6,000 feet AMSL (Figure 51). Superficially, the distribution of protohistoric-period sites resembles the distribution of Cloverleaf phase sites. Many sites with protohistoric-period components are within the agave zone (Figure 52), but that is clearly a function of elevation and associated biotic communities. Protohistoric-period sites are more often associated with lands suitable for runoff-type agriculture (Figure 53), but sites located along minor and major streams would have had access to flowing water and potentially high water tables on lands suitable for irrigation-type farming.

Paleoenvironmental Correlates

Environmental conditions varied considerably over the course of 450 years (see Chapters 4 and 5 of this volume). Alluvial groundwater levels remained very low throughout the 1400s and began to rise again in the 1500s and 1600s. As with the previous cycles of groundwater depletion and increase (ca. A.D. 200–750 and 750–1300), this third cycle (ca. A.D. 1300–1850) had pronounced effects on floodplain dynamics.

Years of very high discharge (i.e., greater than two standard deviations from the long-term annual mean stream flow) along central Arizona's major watercourses, including the Verde River, have been reconstructed. These include five fifteenth-century floods in A.D. 1457, 1462, 1482, 1484, and 1490; two back-to-back sixteenth-century floods in 1549 and 1550; two seventeenth-century floods in 1618 and 1680; nine eighteenth-century floods in 1718, 1726, 1746, 1749, 1764, 1784, 1787, 1792, and 1793 (the year of the highest stream flow in the entire 1,418-year reconstruction); and four nineteenth-century floods in 1828, 1838, 1866, and 1868 (the second-highest reconstructed stream flow). In regard number and frequency of high-discharge years, the 1500s and 1600s were relatively benign, but the second half of the 1400s, the 1700s, and the mid-1800s were periods when many floods occurred.

Periods of high temporal variability (ca. A.D. 1350–1560 and 1730–1825) (Dean 1988a:138), indicating low interannual persistence of climate conditions, alternated with periods of low temporal variability (ca. A.D. 1560–1730 and 1825–2000), when year-to-year conditions persisted for longer intervals. The fifteenth century was slightly dry and moderately warm overall, with few years when extremes in climate occurred. Only two droughts took place in this century (A.D. 1406–1416 and 1427–1434), but neither was a high-ranking drought. The sixteenth century was more variable. Slightly more years were dry and cool overall, but the century began with a cooler-than-normal period early, was persistently dry in the middle, and was fairly continuously warm and dry at the end. The seventeenth century was one of the coolest centuries in the 1,400-year record. It rivaled the coolness of the thirteenth century for its overall pattern of coolness. The seventeenth century also experienced many extreme conditions and many exceptionally cool to cold years. In marked contrast, the eighteenth century was a

[20] Of the 11 sites listed in Ferg and Tessman's report (1998:Table 7.1), 6 are listed in our MVRV ALD: AR-03-04-01-37 (CNF) (also NA4642 and Goodwin-Sayles 1); AR-03-04-01-84 (CNF) (also NA6285, AZ O:5:122 [ASM], and Goodwin-Sayles 2); AR-03-04-01-797 (CNF) (also Goodwin-Sayles 3); AR-03-04-01-43 (CNF) (also Jackson Ranch/Thoney, NA1275, AZ O:5:10 [ASM], and Goodwin-Sayles 4); AR-03-04-01-308 (CNF) (also NA25345 and Goodwin-Sayles 5), and AR-03-04-01-800 (CNF) (also MOCA 88A-10, AZ O:5:45 [ASM] and Goodwin-Sayles 6).

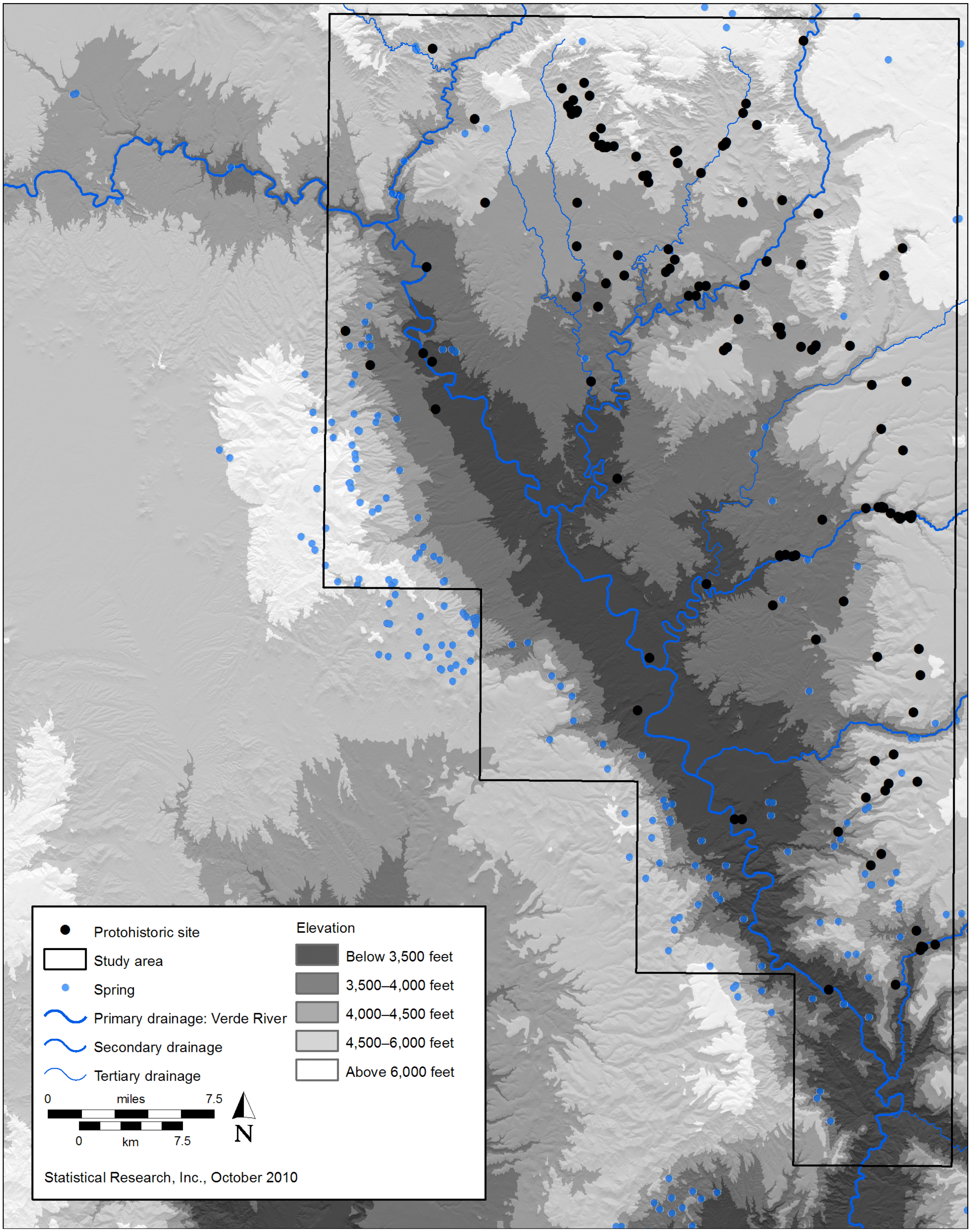

Figure 51. Map showing the elevation ranges of protohistoric-period sites in the middle Verde River valley.

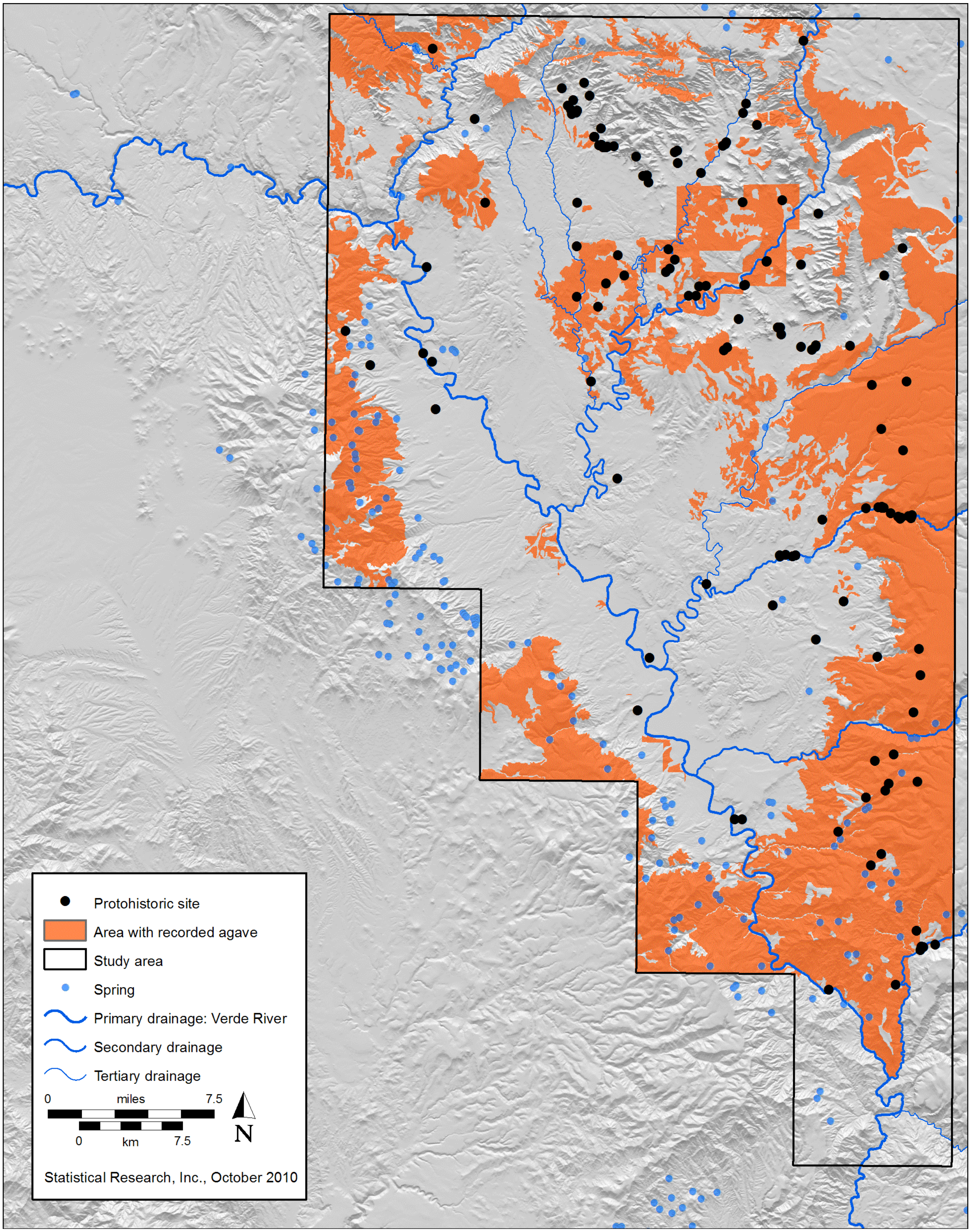

Figure 52. Map showing the locations of protohistoric-period sites relative to agave-growing land.

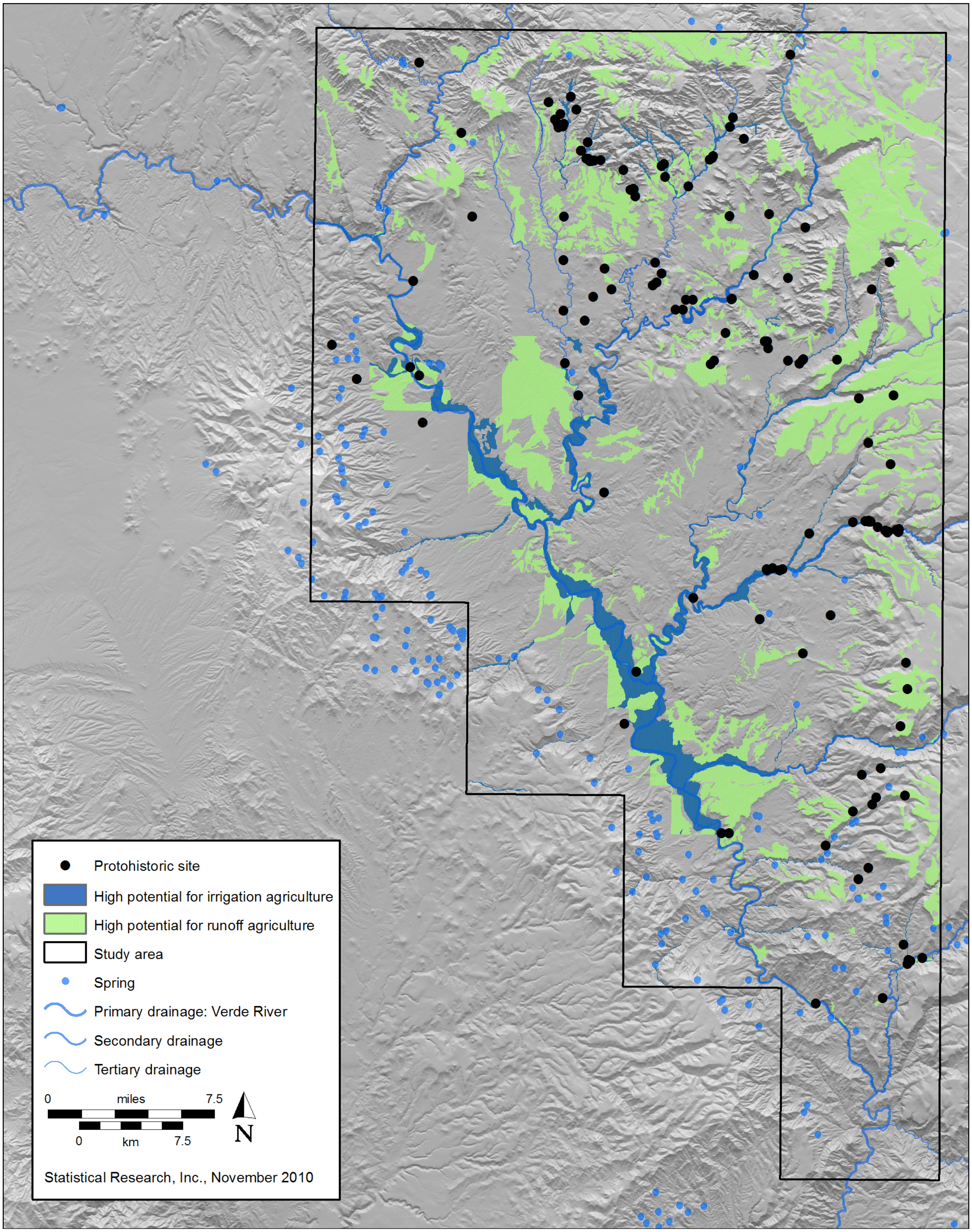

Figure 53. Map showing the locations of protohistoric-period sites relative to lands with high potential for irrigation and runoff agriculture.

period dominated by persistent warmth and many extremes in annual temperature and precipitation values. The nineteenth century reverted to cooler and wetter conditions, but interannual variability in climate for the early 1800s was as high as it had been in the eighteenth century, and periods of drought were not uncommon.

Land-Use Practices

A small body of literature has emerged on the land-use practices of the Yavapai and Western Apache that pertains, in some cases, specifically to the MVRV. The interested reader is referred to the following references for in-depth discussions of Yavapai and Western Tonto Apache land-use practices. In chronological order of publication, these essential and informative sources are Gifford (1936); Goodwin (1942); Schroeder (1952, 1974); Pilles (1981a); Stein (1981); Basso (1983); Khera and Mariella (1983); Whittlesey and Benaron (1998); Whittlesey et al. (1998); Ferg and Tessman (1998); Bratz (2003); and KenCairn and Randall (2007).

Formative Period Trends in the MVRV

Site Location Relative to Environmental Variables

Harold Colton (1946:304, 1960:74) was the first archaeologist to suggest that the early pottery-producing settlers of the MVRV occupied two different environmental niches, which he characterized as the Verde Uplands and the Verde Lowlands. Between them, there was a zone that was more or less unoccupied and infrequently used. On the basis of contrasting frequencies of utility and trade pottery, house form, presence or absence of public architecture (e.g., ball courts and mounds), mortuary customs (cremations vs. inhumations), and other material evidence, Colton proposed that the early Southern Sinagua populations occupied the uplands and used dry-farming techniques to raise crops, and Hohokam populations occupied the lowlands and used irrigation technology to raise crops.

In 1946, Colton (1946:303–304) offered the following preliminary outline of MVRV-settlement history based on archaeological surveys undertaken by researchers associated with the MNA, which we have slightly altered below. His upland-lowland distinction applies to the Hackberry, Cloverleaf, Camp Verde, and Honanki phases, or from about A.D. 700 to 1125. His unnamed upland people were the early Southern Sinagua. Because so little excavation had taken place before 1946 (only Tuzigoot and Montezuma Castle had been excavated), the described sites were mostly surface artifact scatters with and without pottery.

- Pre–A.D. 500: Aceramic sites are found on the east side of the MVRV near the escarpment [Mogollon Rim].

- A.D. 500–700: The earliest ceramic-bearing sites are found in and near the sandy parks at the base of the escarpment on the west side of the MVRV in the juniper zone. The utility pottery was a crude, paddle-and-anvil brown ware similar to Alameda Brown Ware and Tizon Brown Ware from western Arizona. Contemporary sites on the Colorado Plateau are assigned to the Cinder Park and Lino foci. The complex suggests relationships between the Sinagua and the Patayan cultures of western Arizona at the level of Basketmaker III.

- A.D. 700–900: Sites of this period are rare in the MVRV and appear in two groups occupying two different physiographic regions. One group of sites found at elevations between 4,500 and 5,000 feet AMSL near the sandy parks at the base of the escarpment where annual precipitation is greater than 15 inches exhibits a brown utility ware. The other group of sites found at elevations between 3,000 and 3,500 feet AMSL (near the Verde River) where annual precipitation is less than 10 inches a year, is equivalent to the Santa Cruz phase of the Hohokam culture. The discovery of a Hohokam ball court like those found at Snaketown near Clear Creek supports this identification. A space of 10–12 miles of uninhabited land separated the Hohokam by the river from the upland people.

- A.D. 900–1125: Sites of this period are like the sites of the previous period; they are located by the [Verde] river and in the uplands separated by the same stretch of uninhabited county. The upland people practiced dry farming and changed little from earlier times; the inhabitants of the river terraces practiced irrigated farming and built Casa Grande-type ball courts. In this period, the Hohokam reached their greatest extension into the MVRV but soon would be replaced by invaders from the northeast.

- A.D. 1125–1300: Sites of this period with period with Alameda Brown Ware utility pottery are found below the escarpment as cliff pueblos; their inhabitants practiced dry farming. Later they invade the [lowland] area occupied by the Hohokam, displacing them, but accepted their methods of irrigation. Early occupations of the large [late] pueblos seem to belong this period.

- A.D. 1300–1400: Large and small masonry pueblos associated with Alameda Brown Ware utility pottery are common along the Verde River and its major

> tributaries (e.g., Oak Creek, Beaver Creek, and Clear Creek). During this period, the uplands were abandoned by pueblo people [Colton 1946:303–304].

Although much fieldwork has taken place in the 66 years that have passed since Colton published these words, it is amazing to note how much of his basic framework remains valid. Clearly, the history of settlement is more complicated than what Colton proposed, but Colton and his colleagues were keen observers and made insightful inferences concerning the history of settlement in the MVRV.

Given our present ability to map and describe certain aspects of site location relative to elevation and environmental resources, we offer the follow observations relative to a set of environmental variables contained in our MVRV ALD.

Elevation

Table 46 summarizes the average elevation of all identifiable site components in the MVRV ALD (n = 1,400), organized by temporal period and site-size class. These data are drawn from the 2,343-site MVRV ALD.[21] We have calculated the average elevation for all sites with identified temporal components (site-size classes 0–7) and for sites with rooms only (site-size classes 1–7). Figure 54 displays the average elevations for all sites, by temporal period. It is important to note that the sample size for the Early Formative period (Squaw Peak phase) and the Hackberry phase was very small—only 16 sites contained components assigned to both of these periods—therefore, the existing data may not be representative of actual trends. Furthermore, assignment of sites and site components to the Late Archaic period is often problematic (see the discussion of the Archaic period, above). Consequently, the data associated with site components assigned to the Cloverleaf phase through the Tuzigoot phase are likely better reflections of where sites are located relative to elevation, as well as all other variables discussed in this section. These data suggest that land-use patterns per phase were focused on lower-elevation settings from at least the A.D. 800s through the 1300s.

Site components in the MVRV ALD assigned to the Late Archaic period (n = 139 components) are located at elevations primarily between about 1,100 and 1,500 m (roughly 3,600 and 5,000 feet) AMSL. An inspection of Figure 15 indicates that sites assigned to the Late Archaic period or the Dry Creek phase cluster in the area near Sedona, not far from the type site on Dry Creek. Colton's observation that many aceramic sites were on the eastern side of the MVRV, at the base of the escarpment, then, is still largely accurate though undoubtedly biased by existing survey coverage.

Components assigned to the Early Formative period (n = 16) range from about 1,000 to 1,300 m (roughly 3,200 to 4,200 feet) AMSL in elevation. As with the Late Archaic period/Dry Creek phase, the sites shown in Figure 19 are clustered near Oak Creek and Sedona. A number of sites assigned to the Early Formative period are indeed in the juniper woodlands, but not exclusively. Because Colton did not recognize that phase, sites assigned to this time period would have been grouped with aceramic sites prior to A.D. 500.

In 1946, as in 2012, sites assigned to the earliest ceramic-bearing components were rare in the archaeological record of the MVRV. If, in fact, these sites are Hackberry phase sites, however, dated possibly as early as A.D. 500 and as late as 800, only a very few sites assigned to this phase have been identified (n = 16). Figure 23 illustrates the locations of sites containing Hackberry phase components. Most are in the eastern portion of the MVRV, where sites are between about 1,100 and 1,400 m (roughly 3,600 and 4,500 feet) AMSL, but a few are at higher and lower elevations. Colton's suggestion that most of these early ceramic sites were in the juniper zone and on the western side of the MVRV appears to be outdated in light of current data.

Colton's suggestion that two different cultural groups lived in the MVRV, in two contrasting elevation zones, after A.D. 700 applied to what we now recognize as the Cloverleaf phase (and possibly the late Hackberry phase) and continued through the Honanki phase. Most of these occupations are above 1,372 m (about 4,500 feet) AMSL, but a small number of Cloverleaf phase occupations are indeed in lowland positions near the Verde River, below 1,067 m (about 3,500 feet) AMSL, as Colton suggested in 1946. Figure 28 indicates that sites with Cloverleaf phase components (n = 109) are primarily on the eastern side of the MVRV. Site elevations range from a low of about 950 m to about 1,750 m (roughly 3,100–5,700 feet) AMSL.

Components assigned to the Camp Verde phase (n = 244) are widely distributed across the MVRV. As with the earlier, Cloverleaf phase, most sites with Camp Verde phase components are on the eastern side of the MVRV. Figure 33 shows several clusters of sites in the uplands, away from the major drainages, as well as individual sites and site clusters along those same drainages. Elevations range from a low of about 825 m to a high of above 1,825 m (roughly 2,700–6,000+ feet) AMSL. The majority of currently known sites with Camp Verde phase components, however, are located between about 1,200 and 1,800 m (roughly 4,000 and 5,900 feet) AMSL. Insofar as the distribution of sites appears to be in riverine locations (most below 1,200 m AMSL), as opposed to nonriverine locations (most above 1,200 m AMSL), Colton's dichotomy remains valid, but the absolute elevation contrasts are not. Because more sites with Camp Verde phase components have been identified in riverine settings, the average for Camp Verde phase sites is lower than the average for the Cloverleaf phase.

[21] This larger data set, which includes sites that cannot be typed to a specific Formative period time period, has the following characteristics relative to elevation. Elevational range: 762–2,336 m (2,500–8,202 feet) AMSL; mean and standard deviation: 1,311 ± 258 m (5,301 ± 846 feet); median value: 1,269 m (4,163 feet).

Table 46. Average Elevations of Site Components in the MVRV ALD

Phase/Period	Average Elevation, by Size Class (No. of Rooms)								Average Elevation, All Sites	Average Elevation, Sites with Rooms
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)		
Late Archaic	1,281	1,279[a]	1,199[a]						1,279	1,262[a]
Early Formative	1,241	996	1,146[a]						1,187	1,096
Hackberry	1,346	1,259	1,358	1,132[a]					1,302	1,276
Cloverleaf	1,349	1,413	1,382	1,426					1,381	1,410
Camp Verde	1,304	1,395	1,344	1,409		962[b]			1,353	1,381
Honanki	1,285	1,352	1,359	1,222	1,182	1,125	1,124[c]	1,017[c, d]	1,320	1,329
Tuzigoot	1,217	1,280	1,253	1,165	1,122	1,101	1,143	1,017[d]	1,232	1,236

Note: All figures are given in meters above mean sea level. Meters-to-feet conversion: meters*3.2808 = feet; feet-to-meters conversion: feet*0.3048 = meters (e.g., 3,500 feet = 1,067 m; 4,500 feet = 1,372 m).

Key: ALD = Archaeological Landscape Database; MVRV = middle Verde River valley.

[a] Earlier components without architecture are listed as portions of sites with architecture; this is a function of the design of the MVRV ALD and does not mean that sites with the given number of rooms are present for a given phase.

[b] The presence of Camp Verde phase components at large sites dating to the Honanki or Tuzigoot phase does not mean that *settlements* dating to the Camp Verde phase contained 35 or more rooms.

[c] The presence of a Honanki phase component at large Tuzigoot phase pueblos does not mean that *settlements* dating to the Honanki phase contained 70 or more rooms.

[d] This estimate is based on five sites with 100+ rooms in the MVRV ALD, although we are aware of six sites in this size class. A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Consequently, the following tables do not include data from that site in these estimates. Were data associated with the West Clear Creek Ruin classified correctly, it would alter the average-elevation estimate only slightly (1,024 m) and would not affect the overall trend.

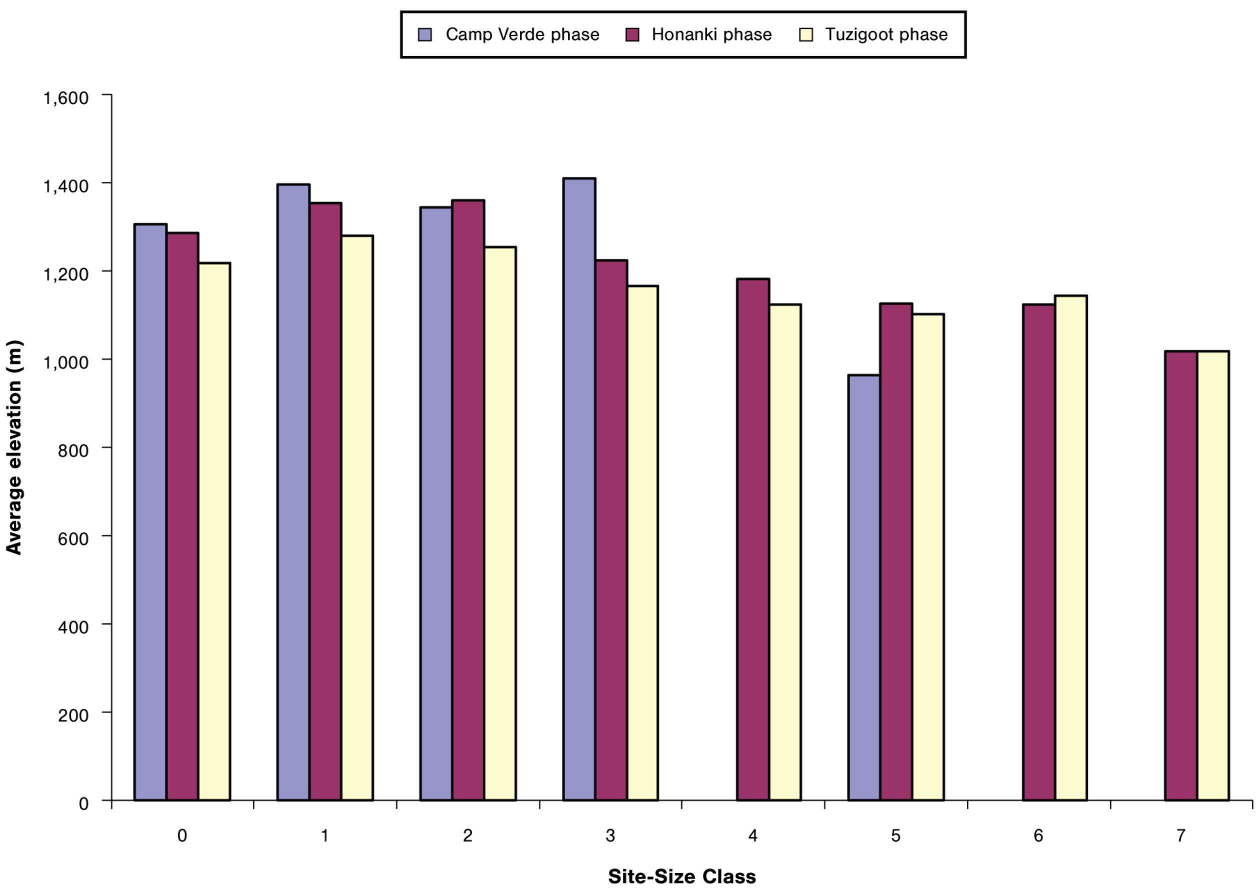

Figure 54. Graph of the average elevations of site components in the middle Verde River valley Archaeological Landscape Database, by temporal phase.

Site occupations assigned to the Honanki phase (n = 650) are everywhere in the MVRV. Sites proliferate, both in riverine settings below 1,200 m (about 4,000 feet) AMSL and in nonriverine settings above 1,200 m (about 4,000 feet) AMSL. Figure 39 displays the distribution of Honanki phase components in the MVRV. As is true of all figures showing the distributions of sites, this figure likely overstates the size of the largest sites during the Honanki phase. Because few large sites have been systematically excavated and analyzed and most habitations are believed to be multicomponent settlements, the numbers of rooms assigned to Honanki phase sites are undoubtedly overestimated. Nevertheless, Figure 39 does convey the distribution of settlement for that time period. Site elevations range from a low of about 800 m to a high of about 1,800 m (roughly 2,600–6,000 feet) AMSL. Honanki phase components within larger Tuzigoot phase pueblos are increasingly located in lower, riverine settings. Few single-component Honanki phase sites with 20 or more rooms have been identified. One of these, Ruin Point Ruin, has been estimated to contain some 75 rooms; it is located near an upland drainage, at an elevation of about 1,475 m (4,839 feet) AMSL. The location of Ruin Point suggests that sometime during the 150-year-long Honanki phase, use and occupation of the uplands were important factors in the dynamic settlement history of the MVRV. Colton's interpretation that invaders who first lived in the uplands in cliffside pueblos later drove out or assimilated the existing Hohokam populations in the lowlands has not yet been demonstrated.

The number of components assigned to the Tuzigoot phase (n = 365) is dramatically lower than the number assigned to the Honanki phase. Although Tuzigoot phase sites continue to be recorded in the uplands, the majority of sites are close to the major drainages of the MVRV. Figure 44 illustrates the distribution relative to elevation zones. Colton was incorrect to postulate that the uplands were abandoned in the Tuzigoot phase, but he was correct to note the strong association with perennial waterways. Many of the largest sites are below 1,067 m (3,500 feet) AMSL along the Verde River and below 1,219 m (4,000 feet) AMSL along its major tributary drainages. As with the Honanki phase, site elevations associated with Tuzigoot phase settlement and land use range from a low of about 800 m to a high of about 1,800 m (roughly 2,600–6,000 feet) AMSL. Because a larger percentage of Tuzigoot phase components is associated with drainages, the average elevation of Tuzigoot phase sites is lower than that of Honanki phase sites.

In short, the upland-lowland dichotomy is best demonstrated for the Cloverleaf and Camp Verde phases. The suggestion that there was an elevational band at 3,500–4,500 feet AMSL where few sites were located, between two zones of occupation, seems not to be valid. Nonetheless, Colton's use of elevation in the MVRV as a proxy variable for the environmental characteristics associated with rainfall, agricultural technologies, and differences in archaeological materials between riverine and nonriverine settings was inspired. His proposal concerning where different farming technologies would have been successful remains an essential understanding about settlement patterns in the MVRV and elsewhere in the U.S. Southwest.

Site Slope Relative to Local Terrain

Table 47 summarizes the average slope of all identifiable site components in the MVRV ALD, organized by temporal period and site-size class. We suggest that the

Table 47. Average Percentages of Slope per Temporal Period, by Size Class

Phase/Period	Average Slope (%), by Size Class (No. of Rooms)								Average Slope (%), All Sites	Average Slope (%), Sites with Rooms
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)		
Late Archaic	8	7[a]	11[a]						8	8
Early Formative	9	15	7[a]						9	10
Hackberry	16	12	8	7[a]					12	10
Cloverleaf	8	8	13	5					8	8
Camp Verde	9	12	12	12		5[a]			11	12
Honanki	23	35	47	32	33	57	25[a]	22[a, b]	35	37
Tuzigoot	24	28	37	35	31	43	25	22[a, b]	30	31

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] This estimate is based on five sites with 100+ rooms in the middle Verde River valley Archaeological Landscape Database, although we are aware of six sites in this size class. A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Consequently the following tables do not include data from that site in these estimates. Were this site classified correctly, it would alter the slope estimate only slightly (25 percent) and would not affect the overall trend.

data here indicate that sites of the Honanki and Tuzigoot phases were located on significantly greater slopes than sites before that time. Secondly, we note that the largest settlements of the Honanki and Tuzigoot phases (sites with 70 or more rooms) were situated on lower, less-steep landforms than other, smaller architectural sites. If defense was a consideration for these large residential sites, it would appear that the largest and most impressive villages used their greater size, rather than their positions in high places, as a deterrent for conflict.

Table 48 and Figure 55 present data on average-slope and elevation values for all sites of each temporal period, relative to the average slope and elevation of the 1-km-radius "catchment" around these same sites. We suggest that these data indicate that the sites currently assigned to the Late Archaic and Early Formative periods, as well as the Hackberry phase, were located on slightly elevated landforms that were lower and less rugged than the surrounding terrain (1-km-radius catchment). Sites of the Cloverleaf and Camp Verde phases were located on slightly elevated landforms with an immediate locality that was low in relief and fairly open. In contrast to these earlier time periods, sites of both the Honanki and Tuzigoot phases were on prominences above the level of the local terrain, which was of somewhat less relief.

Distance to Major and Minor Streams

For this study, major streams include not only the Verde River but also its major tributaries as it flows through the MVRV. These major tributaries include Sycamore Creek, Oak Creek, Beaver Creek, West Clear Creek, Fossil Creek, and the East Verde River. The lower reaches of these streams, particularly those below Sycamore Creek, were and are perennial streams. Minor streams are all other drainages that are tributary to these major streams.

Generally speaking, two different measures of distance are used in simple archaeological descriptions: Euclidian distance and cost distance. Euclidian distance is calculated as a straight line between two points, whereas cost distance takes slope into consideration, to derive a travel "cost" between two points. Algorithms to calculate both are simple tasks for GIS technology. Prior to the regular use of GIS in archaeological research, distance was usually reported as Euclidian distance ("as the crow flies"). With GIS, however, calculations of cost distance provide more realistic measures of the effort needed to reach a given resource. These estimates are usually greater than straight-line estimates. We use cost-distance estimates here to quantify and compare distance measures.

Tables 49 and 50 summarize the average cost distances to major and minor streams for all identifiable site components in the MVRV ALD (n = 1,400), organized by temporal period and site-size class.[22] Figure 56 graphically illustrates the trends in distance for all site classes. To us, these data indicate that sites are closer to minor streams than major streams or springs at all times. Not surprisingly, these data also indicate that the larger residential sites for most time periods tended to be closer to both major and minor streams.

Distance to Springs

Access to potable water and water for other domestic purposes is, of course, necessary for all living beings. Given our understanding of climate variation, we wondered if proximity to springs would influence site location, particularly during episodes of prolonged aridity, or be associated with particular types of sites (e.g., resource-procurement and processing locales, hunting camps, and spring-irrigated fields) other than residential sites. For this study, we calculated the average cost distance to the closest spring from the site centroids (Table 51). Given the distribution of springs, as depicted on all our site-distribution maps, we are not surprised to note that springs tend to be more than 2 km away from sites, often more than 7 km, even from the larger sites in each time period. Nevertheless, precontact- and early-historical-period populations at the largest sites likely used stream water more than spring water to fulfill their needs (see Figure 56).

Given the unevenness of survey in the MVRV, we concluded that we did not have a sufficient sample of sites to examine the relationship of sites of various inferred function to the locations of springs as they are currently known and plotted on our maps.

Arable Land

Our goal was to characterize site location relative to arable land and potential changes in agricultural technologies through time. To do that, we used intersection techniques with GIS layers for irrigation potential, runoff potential, and the distribution of archaeological sites that could be assigned to one of the ceramic-bearing Formative period phases. Because the sample of Early Formative period and Hackberry phase sites was small and unlikely to be representative (represented by 16 sites each), we present data only from the Cloverleaf through Tuzigoot phases, to chart changes through time (Table 52).

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[22] Statistics for the 2,343-site MVRV database (range: 0–22.7 km) indicate that the mean and standard-deviation distance from a major stream for all sites are 4.8 ± 4.4 km (median: 3.9 km), whereas the mean distance from a minor stream (range: 0–7.0 km) for all sites is 657 m (median: 448 m). The average distance to the closest spring (range: 4–22.7 km) in our database is 5.2 km (median: 4.4 km).

Table 48. Average Site Slopes and Elevations per Temporal Period Relative to the Local Terrain

Phase/Period	Average Site Slope (%)	Average Site Elevation (m)	Average 1-km-Radius Slope (%)	Average 1-km-Radius Elevation (m)
Late Archaic	8	1,279	16	1,292
Early Formative	9	1,187	13	1,202
Hackberry	12	1,302	17	1,315
Cloverleaf	8	1,381	16	1,381
Camp Verde	11	1,353	20	1,352
Honanki	35	1,320	30	1,308
Tuzigoot	30	1,232	22	1,213

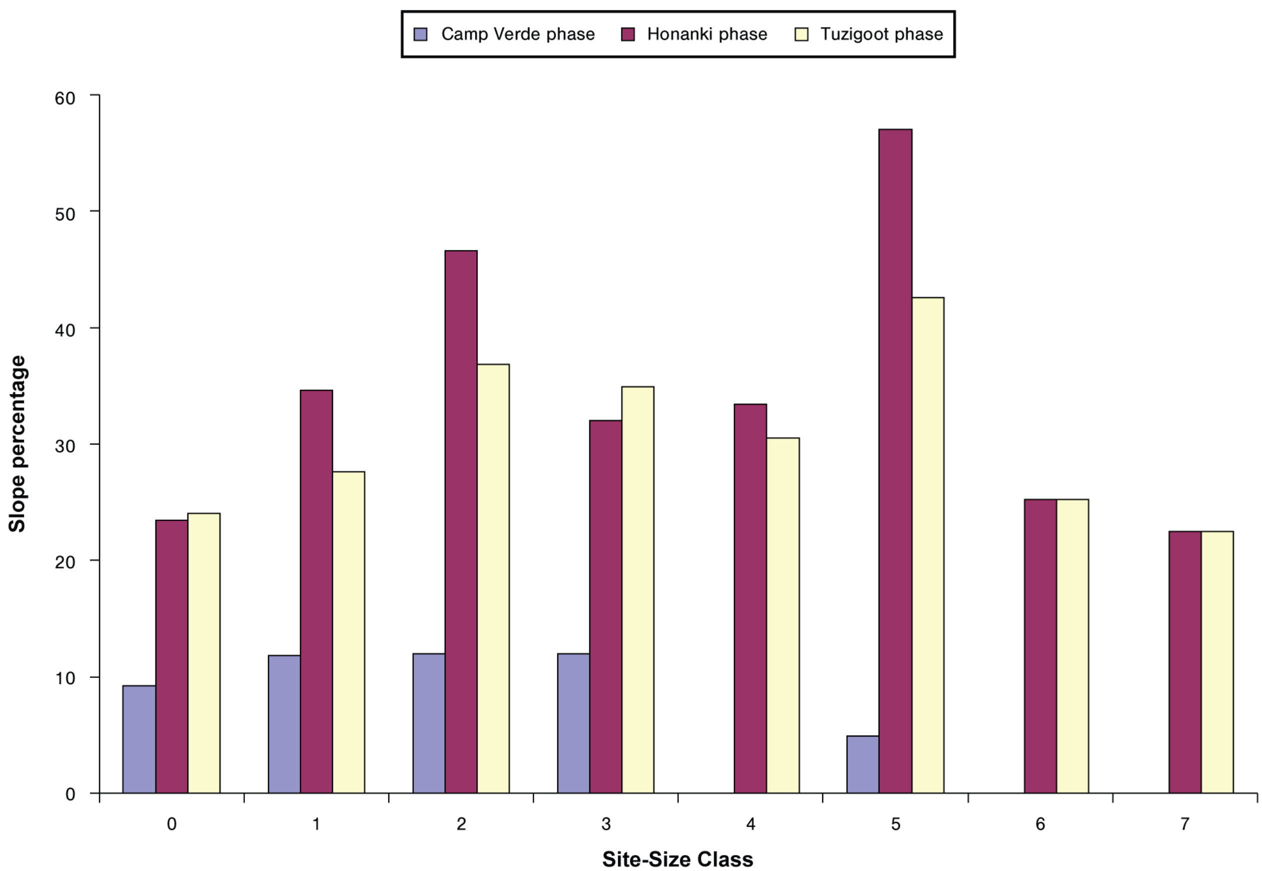

Figure 55. Graph of the average slopes of sites within the 1-km-radius catchment, by temporal phase.

Table 49. Average Cost Distances to Major Streams per Temporal Period, by Size Class

Phase/Period	Average Cost Distance, by Size Class (No. of Rooms)								Average Cost Distance, All Sites	Average Cost Distance, Sites with Rooms
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)		
Late Archaic	4,237	2,939[a]	177[a]						4,039	2,325[a]
Early Formative	1,982	886	740[a]						1,535	789
Hackberry	6,419	3,965	3,237	7,456[a]					4,967	4,096
Cloverleaf	5,524	5,860	4,523	5,832					5,603	5,672
Camp Verde	3,716	3,642	3,856	4,506		456[a]			3,714	3,713
Honanki	3,544	4,350	3,953	3,138	1,970	1,542	2,442[a]	815[a, b]	3,901	3,987
Tuzigoot	1,800	2,626	2,544	2,053	1,439	1,283	2,214	815[b]	2,254	2,353

Note: All figures given in meters.

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] This estimate is based on five sites with 100+ rooms in the middle Verde River valley Archaeological Landscape Database, although we are aware of six sites pertaining to this size class. A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Were the data for the West Clear Creek Ruin classified correctly, the value for Class 7 sites would rise to 950 m, but the overall trend would not change.

Table 50. Average Cost Distances to Minor Streams per Temporal Period, by Size Class

Phase/Period	Average Cost Distance (m), by Size Class (No. of Rooms)								Average Cost Distance, All Sites	Average Cost Distance, Sites with Rooms
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)		
Late Archaic	363	211[a]	360[a]						351	244
Early Formative	190	205	288[a]						217	260
Hackberry	397	239	261	358[a]					310	257
Cloverleaf	509	593	848	446[a]					564	613
Camp Verde	653	781	653	665		260[a]			710	743
Honanki	702	940	948	599	623	638	328[a]	771[a, b]	856	893
Tuzigoot	615	899	870	687	491	678	481	771[b]	785	821

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] This estimate is based on five sites with 100+ rooms in the middle Verde River valley Archaeological Landscape Database, although we are aware of six sites pertaining to this size class. A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Were data for this site classified correctly, the value for Class 7 sites would rise to 906 m, but the overall trend would not change.

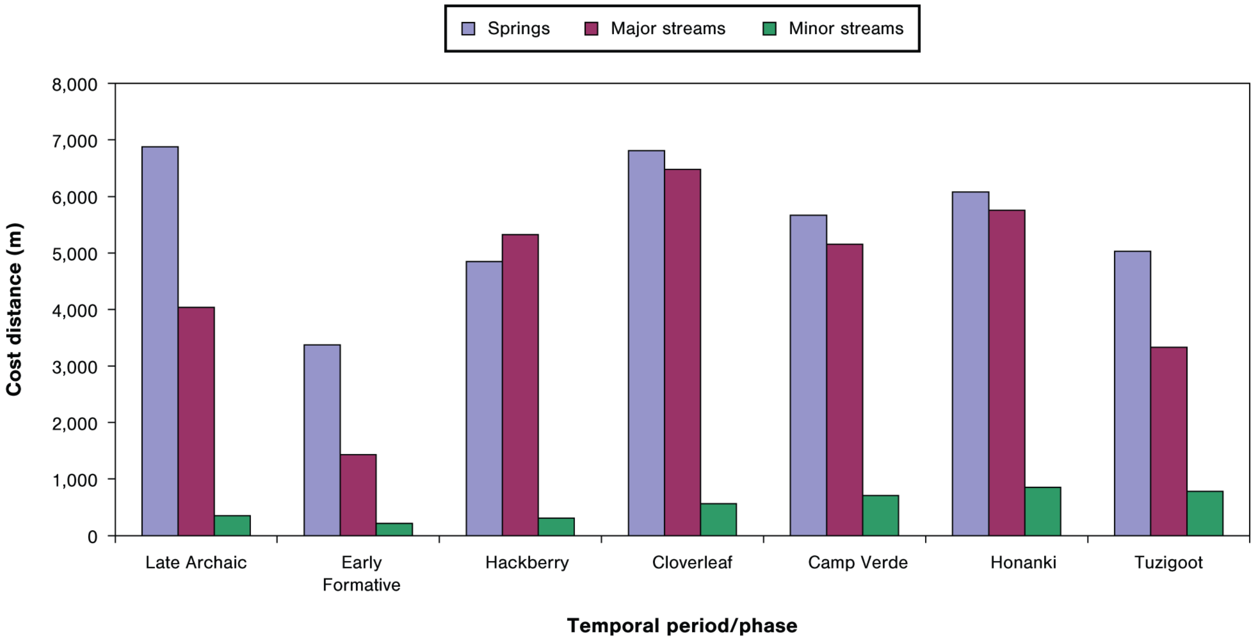

Figure 56. Graph of the average cost distances to springs, major streams, and minor streams, by temporal period/phase.

Table 51. Average Cost Distances to Springs per Temporal Period, by Size Class

Phase/Period	Average Cost Distance (m), by Size Class (No. of Rooms)								Average Cost Distance (m), All Sites
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Late Archaic	7,308	6,185	5,487[a]						6,877
Early Formative	3,695	2,328	3,086[a]						3,372
Hackberry	7,130	2,700	5,847	1,039[a]					4,848
Cloverleaf	7,661	5,991	5,320	7,574					6,810
Camp Verde	5,462	5,821	5,720	5,800		3,029[a]			5,664
Honanki	5,676	6,512	6,650	4,351	3,472	4,599	3,492[a]	2,128[a]	6,079
Tuzigoot	5,165	5,577	5,059	4,168	3,328	4,293	3,038	2,128	5,029

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

Table 52. Distributions of Site Components Used to Estimate Arable Land, by Size Class

Phase	No. of Components, by Size Class (No. of Rooms)								No. of Components, All Sites
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	49	40	8	6					103
Camp Verde	81	107	31	8		1[a]			228
Honanki	121	330	109	34	14	10	7[a]	5[a, b]	630
Tuzigoot	62	161	52	22	18	14	8	5[b]	342

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases at the time that these statistics were generated.

To estimate the amount of arable land immediately accessible to a given site, we calculated the total number of hectares available in a 1-km-radius catchment surrounding each site's centroid, in order to estimate the average number of arable hectares per temporal period and site-size class (Figure 57; Table 53). Interestingly, but not surprisingly, the sites classified as belonging to size classes 1 and 2, which archaeologists often assume are field houses and farmsteads, appear to have been situated to access nearby arable land more than any other type of settlement during the Cloverleaf and Camp Verde phases and, partially, the Honanki phase. In contrast, the largest sites of the Tuzigoot phase are associated with the greatest access to arable land.

We also estimated the amount of land classified as suitable for irrigation and runoff agriculture. For land classified as suitable for irrigation, we included land units classified as high (4) and very high (7) (see Tables B.1–B.3, Appendix B of this volume). For land classified as suitable for runoff agriculture, we included land units classified as medium (4), medium/high (5), high (6), and very high (7) (see Tables B.1–B.3, Appendix B of this volume). Tables 53–55 and Figures 58 and 59 present these data. We suggest that the data contained in Tables 54 and 55 indicate that both runoff techniques and irrigation methods were likely used from the Cloverleaf phase through the Tuzigoot phase. We also note that the locations of the largest sites of each time period were selected to have access to an increasing number of arable hectares suitable for runoff and irrigation methods. However, we interpret the data contained in Tables 54 and 55 to mean that crop production using irrigation technology may have been favored during the Honanki and Tuzigoot phases, given its inherent greater productivity, particularly during low-rainfall and runoff years (Table 56).

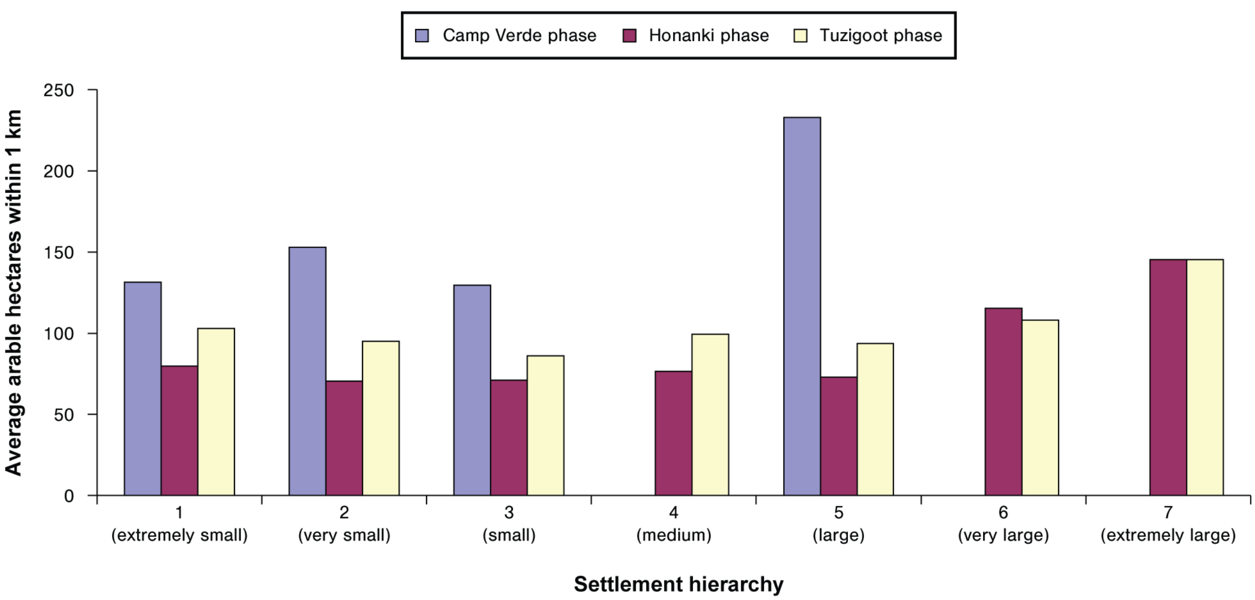

Figure 57. Graph of the average numbers of arable hectares within a 1-km radius of sites with rooms, by site-size class.

Table 53. Average Arable Hectares in a 1-km-Radius Catchment, by Size Class

Phase	Average Arable Hectares, by Size Class (No. of Rooms)								Average Arable Hectares
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	106	142	127	166					125
Camp Verde	110	131	153	129		233[a]			127
Honanki	79	80	70	71	76	73	115[a]	145[a, b]	78
Tuzigoot	96	103	95	86	99	94	108	145[b]	100

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Were data for this site included, the value for Class 7 sites would fall to 139 ha, but the overall trend through time would not change.

Table 54. Average Runoff-Suitable Hectares in a 1-km-Radius Catchment, by Size Class

Phase	Average Runoff-Suitable Hectares, by Size Class (No. of Rooms)								Average Runoff-Suitable Hectares
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	103	140	119	166[a]					122
Camp Verde	105	129	150	129[a]		233[a]			124
Honanki	77	79	69	71	76	73	115[a]	145[a, b]	77
Tuzigoot	91	102	93	82	99	94	108	145[b]	98

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Were data for this site included, the value for Class 7 sites would fall to 139 ha, but the overall trend through time would not change.

Table 55. Average Irrigation-Suitable Hectares in a 1-km-Radius Catchment, by Size Class

Phase	Average Irrigation-Suitable Hectares, by Size Class (No. of Rooms)								Average Irrigation-Suitable Hectares
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	21	11	27	49[a]					19
Camp Verde	34	30	27	49[a]		90[a]			32
Honanki	33	29	32	43	54	34	61[a]	111[a, b]	33
Tuzigoot	45	39	47	61	72	41	60	111[b]	46

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Were data for this site included, the value for Class 7 sites would fall to 97 ha, but the overall trend through time would not change.

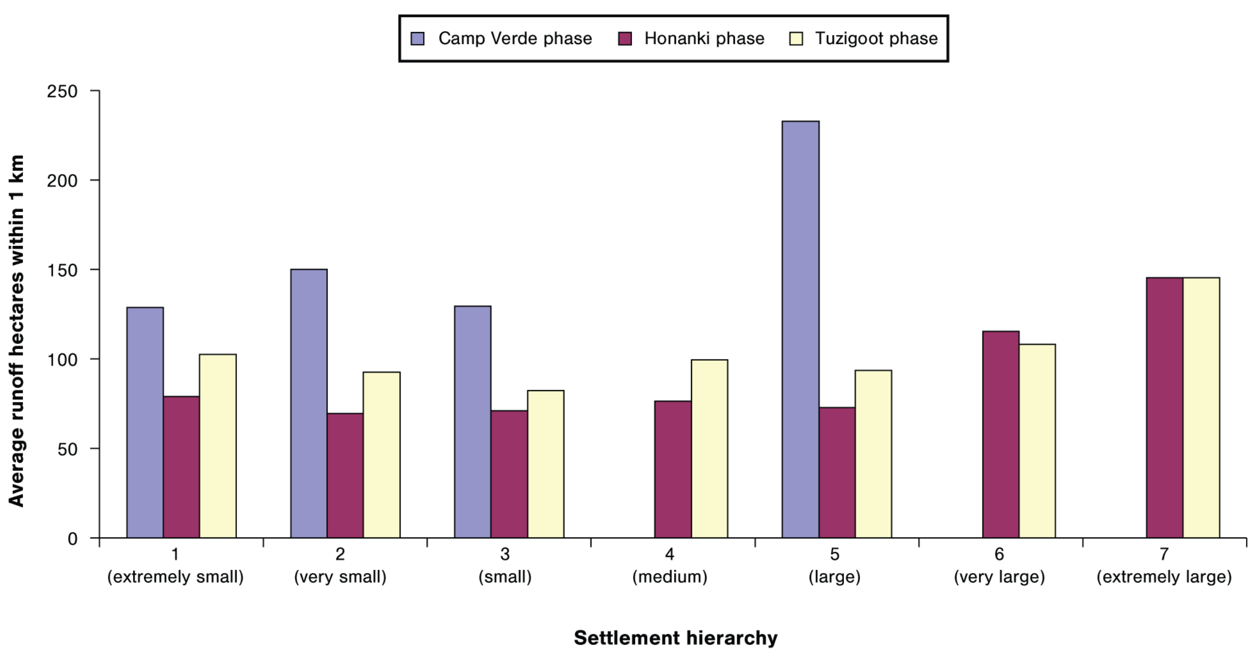

Figure 58. Graph of the average numbers of runoff-suitable hectares within a 1-km radius of sites with rooms, by site-size class.

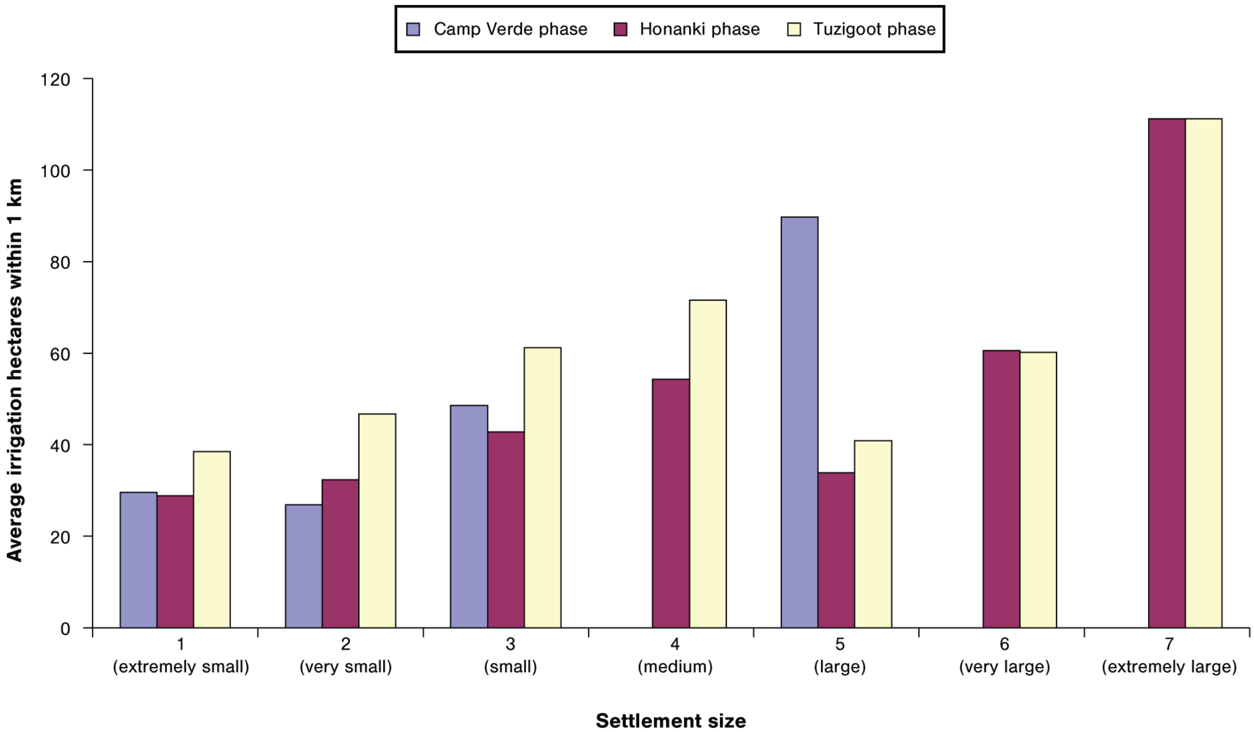

Figure 59. Graph of the average numbers of irrigation-suitable hectares in a 1-km radius of sites with rooms, by site-size class.

Table 56. Ratio of Runoff to Irrigation Hectares in a 1-km-Radius Catchment, by Size Class

Phase	Ratio of Runoff to Irrigation Hectares, by Size Class (No. of Rooms)								Ratio of Runoff to Irrigation Hectares
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	4.9	12.4	4.5	3.4[a]					6.32
Camp Verde	3.1	4.4	5.6	2.7[a]		2.6[a]			3.90
Honanki	2.3	2.7	2.1	1.7	1.4	2.1	1.9[a]	1.3[a, b]	2.36
Tuzigoot	2.0	2.7	2.0	1.3	1.4	2.3	1.8	1.3[b]	2.14

Note: The larger the ratio value, the greater the likelihood that runoff-farming techniques were more widely used than irrigation techniques.

[a] Occupations are present at multicomponent sites with rooms associated with later temporal period(s); these data do not indicate that there are sites of this size class.

[b] A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Were data for this site included, the value for Class 7 sites would rise to 1.9, but the overall trend through time would not change.

Agave Land

As with our examination of arable land, our goal was to characterize site location relative to land units containing a resource of interest and observe the changes through time. We used the agave data layer and the site-distribution layer to determine which sites were actually located within a land unit containing agave (Figure 60; Tables 57–58). We also calculated the number of hectares with a 1-km radius around each site's centroid (Figure 61; Table 59). It is important to note that these values do not reflect absolute amounts of agave; rather, they represent the presence of TES land units in which agave is a component of the biotic community. These data, then, are proxies for the presence and abundance of land units where agave is present or likely to be present today. As before, we used data from the Cloverleaf phase forward.

These tables and corresponding figures suggest to us that the presence or absence of agave "on-site" and "near-site" correlates strongly to elevation (Figure 62) (r = 0.78, overall), with the least highly correlated patterns occurring in the Tuzigoot phase.

Perhaps the most interesting pattern we observed derived from inspection of our agave data layer (see Figure 12). Whereas various agave species appear to be endemic to the MVRV at elevations above about 1,100 m (about 3,600 feet) AMSL, there are a few patches of agave in the lowlands near the Verde River. Given our current understanding that native agave are not endemic to lowland vegetation communities in the MVRV, the presence of agave near lowland sites raises the possibility that agave plants were gathered from upland settings or imported into the MVRV, replanted close to human settlements in low-elevation settings, and cultivated by local populations. Hodgson's discovery that domesticated agaves are present in the MVRV, often near some of the larger, late, residential sites, provides an exciting new avenue for future researchers.

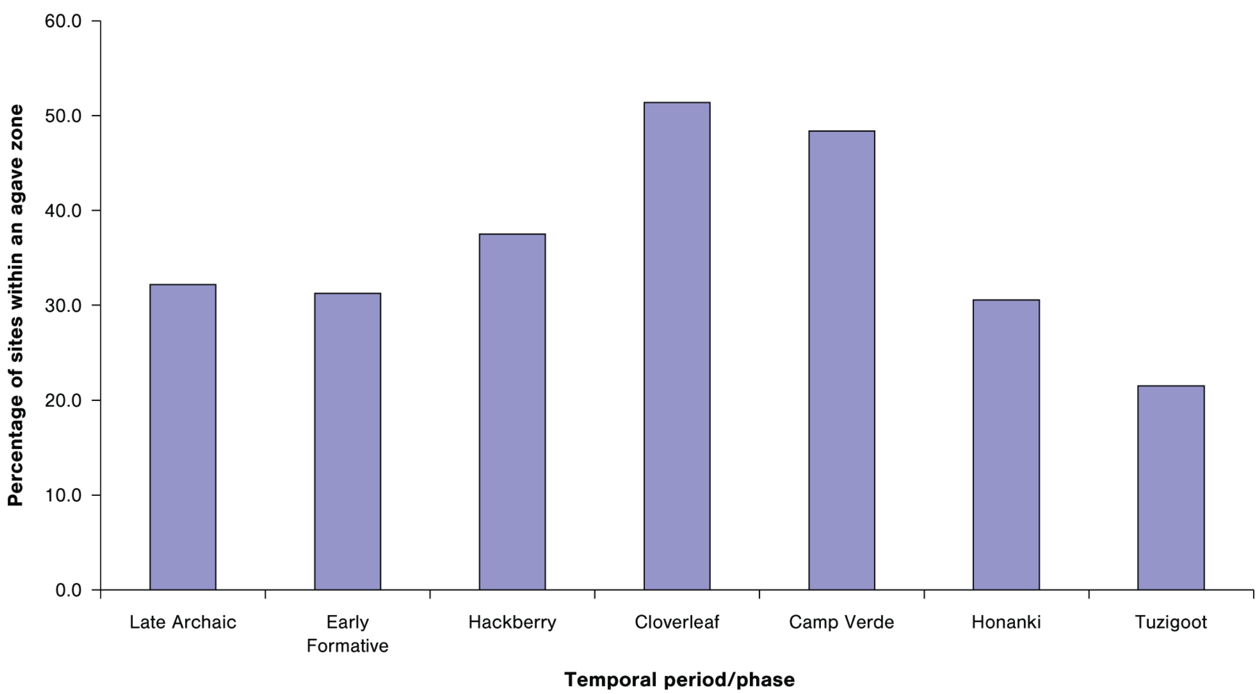

Figure 60. Graph of the percentages of sites located within land units containing agave, by temporal period/phase.

Table 57. Numbers of Sites Located within Land Units Containing Agave, by Size Class

Phase	No. of Sites in the Agave Zone, by Size Class (No. of Rooms)								Total No. of Sites in the Agave Zone
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	16	31	5	4					56
Camp Verde	43	55	16	4		—			118
Honanki	37	101	36	14	3	4	2	1	198
Tuzigoot	17	35	8	6	4	4	3	1	78

Table 58. Percentages of Sites Located within Land Units Containing Agave, by Size Class

Phase	Percentage of Sites in the Agave Zone, by Size Class (No. of Rooms)								Percentage of Sites in the Agave Zone
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	31.4%	70.5%	62.5%	66.7%					51.4
Camp Verde	48.3%	49.1%	47.1%	50.0%		0.0%			48.4
Honanki	29.4%	30.0%	32.4%	40.0%	20.0%	33.3%	28.6%	20.0%	30.6
Tuzigoot	26.2%	20.7%	15.1%	24.0%	19.0%	23.5%	37.5%	20.0%	21.5

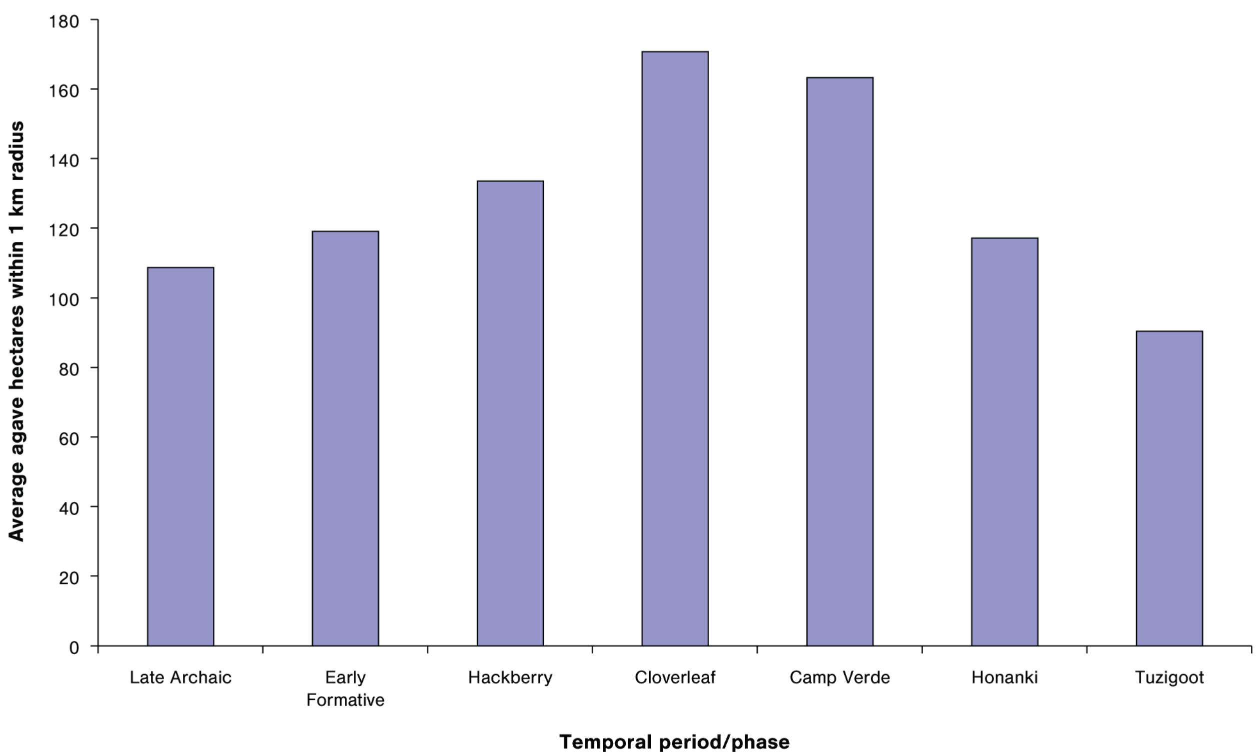

Figure 61. Graph of the average numbers of hectares containing agave within a 1-km radius of sites, by temporal period/phase.

Table 59. Average Agave Hectares within a 1-km-Radius of Sites, by Size Class

Phase	Average Agave Hectares, by Size Class (No. of Rooms)								Average Agave Hectares
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Cloverleaf	130	213	149	233					171
Camp Verde	166	163	158	177		—			163
Honanki	119	116	111	146	115	144	77	54	117
Tuzigoot	111	84	73	80	115	134	79	54	90

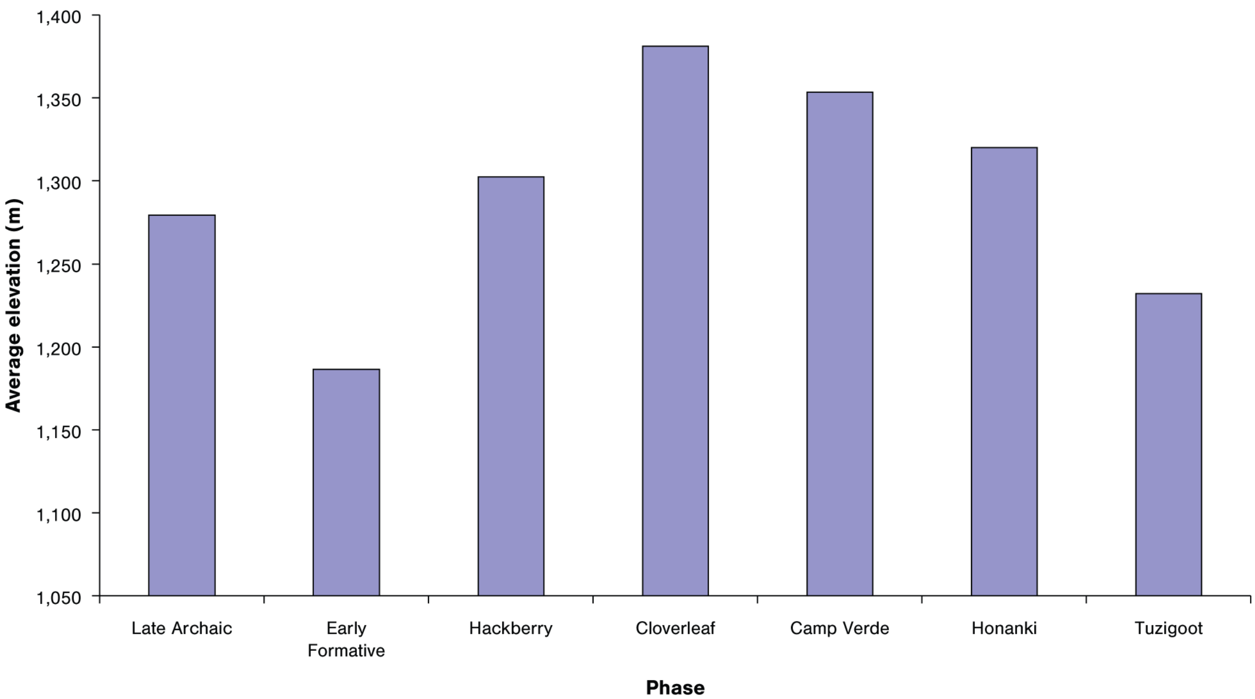

Figure 62. Graph of the average site elevations in the middle Verde River valley, by temporal period/phase.

Archaeological Patterns

Site Size Hierarchies

One of our initial queries of the MVRV ALD concerned site size as measured by the number of rooms, including pit structures counted as single rooms. After our review of site data as described in archaeological reports and the database, we established a range of site-size classes that appear to have been present during the Formative period in the MVRV (Figure 63; Table 60). Based on the existing evidence, it appears that prior to the mid-twelfth century, habitations represented by pit structures and associated extramural features were small dwelling sites that supported only a few contemporary households. These habitations would be classified as farmsteads or small hamlets. Sometime during the Honanki phase, the number of size classes increased dramatically and culminated with the greatest range of size classes in the Tuzigoot phase. By the end of the Honanki phase and throughout the Tuzigoot phase, a significant number of habitations were large hamlets and village-sized settlements. Although that change was partially conditioned by the fact that the majority of sites assigned to the Honanki (A.D. 1150–1300) and Tuzigoot (A.D. 1300–1400) phases were aboveground rooms rather than buried pit structures and therefore were more visible, archaeological evidence strongly suggests that population size and settlement behavior changed dramatically in late prehistory.

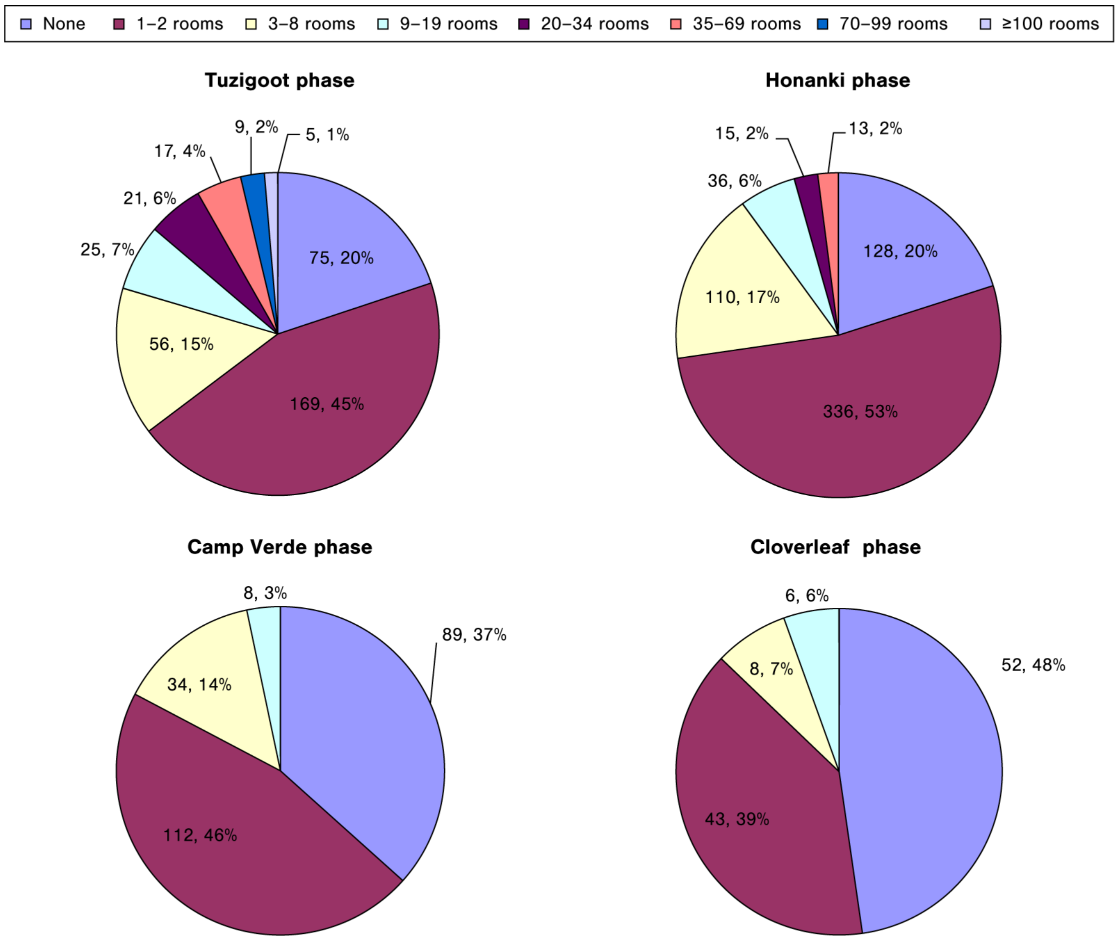

Figure 63. Charts showing the distributions of Formative period site-size classes, by temporal phase.

Table 60. Distributions of Formative Period Temporal Components, by Size Class

Phase/Period	No. of Temporal Components, by Size Class (No. of Rooms)								No. of Temporal Components
	0 (None)	1 (1–2)	2 (3–8)	3 (9–19)	4 (20–34)	5 (35–69)	6 (70–99)	7 (≥100)	
Early Formative	10	2	X[a]						16
Hackberry	6	6	3						16
Cloverleaf	52	43	8	6					109
Camp Verde	89	112	34	8		Xa		Xa	244
Honanki	128	336	110	36	15	13	Xa	Xa	650
Tuzigoot	75	169	56	25	21	17	9	5b	365

[a] An "X" indicates that a small number of sites with multiple temporal components contained an occupation assigned to the given temporal period, but evidence of the given size is lacking.

[b] A sixth site, the West Clear Creek Ruin (AR 03-04-01-5 [CNF], NA2806), was not coded for the Honanki and Tuzigoot phases; rather, it was coded for the Formative period. Were it classified correctly, there would be 6 sites in this size category.

Dwelling Size Based on Pit-Structure and Room Dimensions

During our review of available site reports, we collected information on floor area associated with pit structures and rooms. We recorded that information not only to describe the range of variation encountered during each temporal period but also to suggest the size of the household that might have occupied such a dwelling. The individual structure measurements were reported in the discussion of each temporal period (see Table 34). We have compiled these data to observe trends and patterning. We do not know how representative the values for the earliest phases may be; so few structures dated to those time periods have been excavated and reported.

The overall trend was a reduction in the size of individual dwelling spaces through time (Figures 64 and 65; Table 61), but that pattern does not depict our assumption that dwellings in surface pueblo rooms were multiroom spaces or room suites that included connecting rooms with hearths (habitation rooms) and without hearths (storage rooms). The data compiled in Table 61 also include quite small and unusually large structures that may have served special functions, such as seasonal field houses or communal dwellings. For this reason, we calculated the median value to represent the floor area for each temporal phase and dwelling type.

Using the median value to represent floor area, we used ethnographically derived estimates of floor area per person to approximate the number of individuals living in a household. Cook and Heizer (1968:Table 2) used a sample of 30 California Native American groups to suggest that mean floor area per individual ranged between 1.26 and 7.7 m^2. Weissner (1974:349) used a sample of 16 !Kung huts derived from Yellen's (1977) fieldwork to suggest that for settlements of about 10 individuals, the mean floor area per person was 5.9 m^2, whereas for settlements of about 25 individuals, the mean floor area per person was 10.2 m^2. Table 62 presents the results of that exercise.

Given our current understanding that most settlements were no larger than small hamlets before the mid- to late Honanki phase, we used Weisner's suggested value of 5.9 m^2 per person for pit structures. The estimated household size for a pit structure, then, ranges from about four to six individuals, with an average of five. We used Weisner's suggested value of 10.2 m^2 per person for the village-size settlements of the Honanki and Tuzigoot phases. These estimates suggest two individuals per room. Given our assumption that an average dwelling in a pueblo is composed of three rooms, we suggest that the average household size was six individuals (see Cameron [1996] for a lengthy discussion of the wide range of Pueblo Indian household sizes recorded ethnographically in the U.S. Southwest). We used these estimates in our next study.

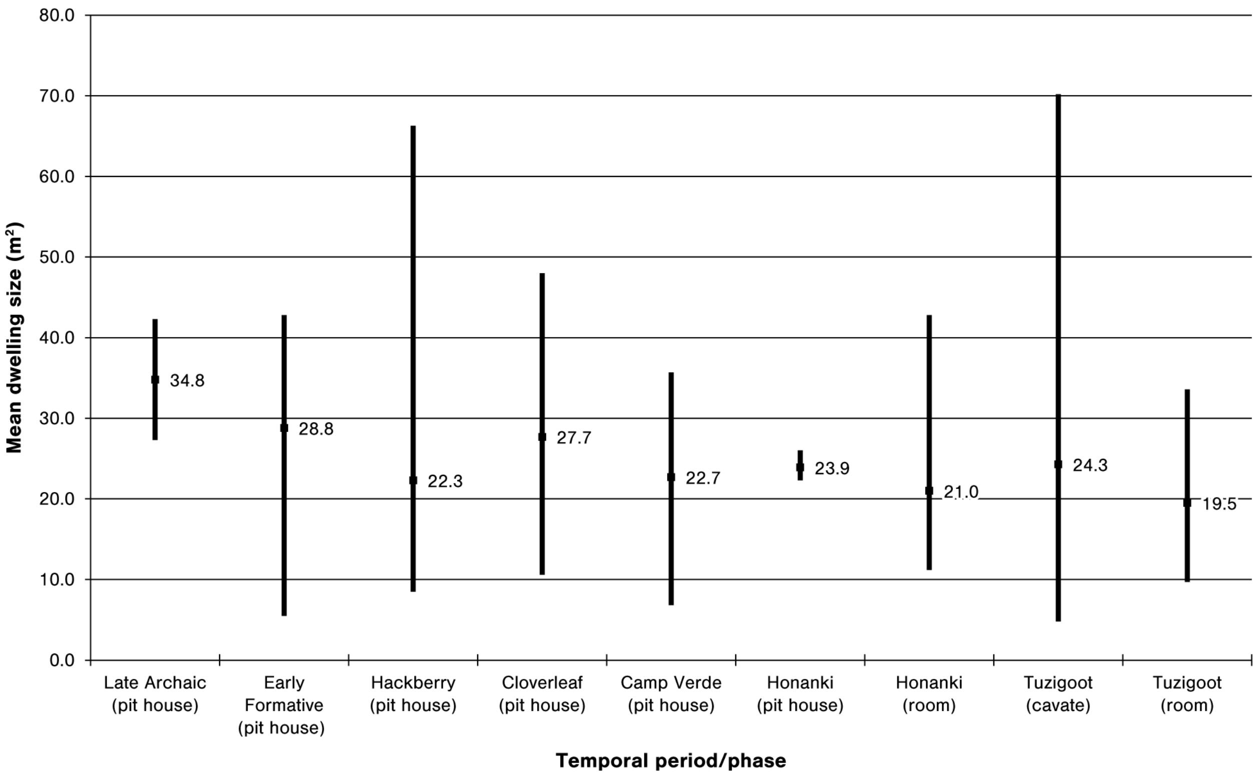

Figure 64. Graph of the minimum, maximum, and mean room sizes, by dwelling type and temporal period/phase.

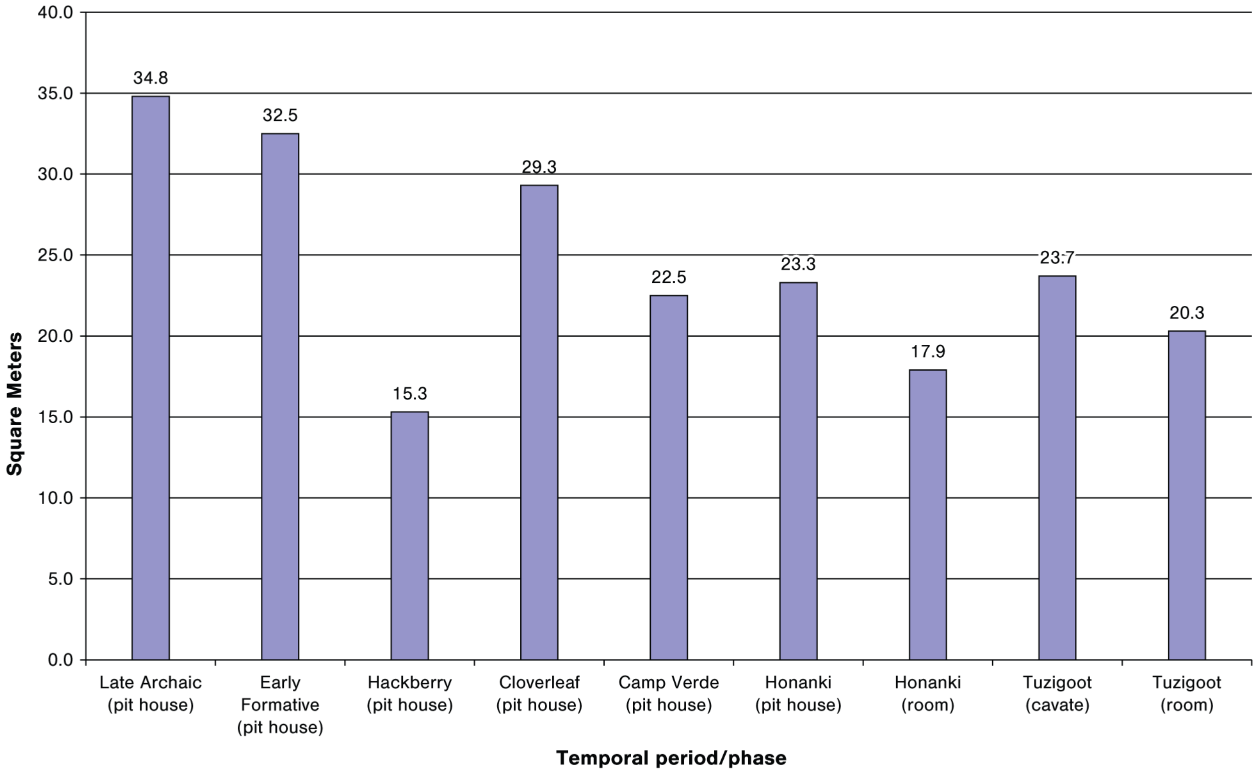

Figure 65. Graph of the median room sizes, by dwelling type and temporal period/phase.

Table 61. Floor Areas of Dwelling Spaces through Time

Period/Phase	Sample (No. of Structures)	Minimum	Maximum	Mean	Standard Deviation	C.V.[a]	Median
Late Archaic (pit houses)	2	27.3	42.3	34.8	10.6	30.5	34.8
Early Formative (pit houses)	7	5.5	42.8	28.8	13.2	45.8	32.5
Hackberry (pit houses)	6	8.5	66.3	22.3	22.0	98.7	15.3
Cloverleaf (pit houses)	12	10.6	48.0	27.7	11.7	42.2	29.3
Camp Verde (pit houses)	36	6.8	35.7	22.7	9.7	42.7	22.5
Honanki (pit houses)	3	22.3	26.0	23.9	1.9	7.9	23.3
Honanki (rooms)	71	11.2	42.8	21.0	9.3	44.3	17.9
Tuzigoot (cavate groups)	82	4.8	70.2	24.3	NA	NA	23.7
Tuzigoot (rooms)	196	9.7	33.6	19.5	8.6	44.1	20.3

Note: All values are given in square meters (m^2); NA = not available. The Honanki room counts include rooms in both cliffside and open pueblos. The Tuzigoot room counts include only larger cliff dwellings and open pueblos.

[a] C.V. is the coefficient of variation; it is the ratio of the standard deviation to the mean. Here, we have multiplied the C.V. by 100 and rounded it to nearest tenth, for ease of comparison. The greater the number, the larger the variation.

Table 62. Household-Size Estimates Based on Ethnographically Observed Dwelling-Floor-Area Measurements

Period/Phase	Median	Per Person: 5.9 m² [a]	Per Person: 7.7 m² [b]	Per Person: 10.2 m² [a]
Late Archaic (pit houses)	34.8	5.9	4.5	3.4
Early Formative (pit houses)	32.5	5.5	4.2	3.2
Hackberry (pit houses)	15.3	2.6	2.0	1.5
Cloverleaf (pit houses)	29.3	5.0	3.8	2.9
Camp Verde (pit houses)	22.5	3.8	2.9	2.2
Honanki (pit houses)	23.3	3.9	3.0	2.3
Honanki (rooms)	17.9	3.0	2.3	1.8
Tuzigoot (cavates)	23.7	4.0	3.1	2.3
Tuzigoot (rooms)	20.3	3.4	2.6	2.0

[a] Weissner (1974).
[b] Cook and Heizer (1968).

Population Estimates Based on Room Count

A useful data field in the MVRV ALD derived from the CNF site files (as of December 2011) is "Total of Rooms." We have compiled this information per temporal phase (Table 63). We are aware that these room counts are estimates based on a variety of methods that rarely include actual room counts. To make a preliminary estimate of population size per phase based on these room counts, we needed to make a series of assumptions. Our goal was not to produce realistic population estimates but to generate trends that would allow us to evaluate whether or not population increase during the Honanki phase was substantial and exceeded reasonable natural population-growth rates. Our contention, based on this modeling exercise, is that immigration into the MVRV likely took place during the Honanki phase, which supports Colton's hypothesis. Such a migration probably occurred in the thirteenth century. This exercise also suggests that immigrants augmented the local MVRV population during the ninth-century Cloverleaf phase.

For each temporal period, beginning with the number of living rooms, we made the following assumptions to derive momentary-population-size and population-growth-rate estimates.

- First, we used the room counts presented in Table 63 as first approximations of the number of living rooms present in each temporal period. We considered assigning a multiplier for each temporal phase, to account for undiscovered buried sites; seasonal occupation of special-use sites away from the primary habitation; and the number of undiscovered or unoccupied pit structures and surface room pueblos. Because we did not have an empirical method to justify a number, we chose not to do this. However, it might be useful in the future to estimate how many undiscovered or abandoned rooms might exist in each phase, to better approximate the number of living rooms present, if room count is used to estimate population. For example, a future researcher might multiply the number of known Early Formative period sites by 50 and the number of Hackberry, Cloverleaf, and Camp Verde phase sites by 20, 10, and 10, respectively, to account for visibility and recognition based on surface scatters and the presence of diagnostic pottery types. Similarly, a future researcher might multiply the number of rooms counted in a Honanki phase pueblo by some number, say 1.2, to account for undiscovered rooms and the number of rooms in a Tuzigoot phase pueblo by 0.8 to account for abandoned rooms.

- Second, we estimated the room life span or the use life of a dwelling space. Here, we assumed that the life span of round to oval Early Formative period pit structures and square to rectangular Hackberry, Cloverleaf, and Camp Verde phase pit structures was 12 years, based on research undertaken by Ahlstrom (1985) and Schlanger (1986). We assumed that the life spans of rooms in masonry pueblos typical of the Honanki and Tuzigoot phases were considerably longer, and we assigned a use life of 25 years to these habitation units. We were guided by a general understanding that a pit structure was the seasonal dwelling of an individual household, and a three-room unit within a masonry pueblo or cavate (not oversized rooms or very small rooms) was the dwelling for an individual household. We did not have data to consider rebuilding frequency as Schlanger (1988:783) did for sites in southwestern Colorado based on the presence of structural floors in a single structure, although we believe that this would have resulted in longer use lives for pit structures and pueblo rooms.

- Third, we assigned the number of individuals per household to a pit structure or set of rooms. Here, we assumed that a household living in a pit structure

Table 63. Temporal Distributions of Formative Period Sites with and without Rooms

Temporal Period/ Phase	Time Range	No. of Years in Time Range	No. of Sites	No. of Sites with Rooms	No. of Sites without Rooms	Room Count	No. of Rooms per Site	No. of Sites with/ without Rooms	Room Type(s)
Early Formative	A.D. 1–650	650	16	6	10	17	2.83	0.60	pit structures
Hackberry	A.D. 650–800	150	16	10	6	26	2.60	1.67	pit structures
Cloverleaf	A.D. 800–900	100	109	58	51	138	2.38	1.14	pit structures
Camp Verde	A.D. 900–1150	250	244	155	89	440	2.84	1.74	pit structures
Honanki	A.D. 1150–1300	150	650	524	126	3,821	7.29	4.16	surface rooms, cavates, cliff rooms, pit structures
Tuzigoot	A.D. 1300–1400	100	365	300	65	3,693	12.31	4.62	surface rooms, cavates, cliff rooms, pit structures
Total			1,400	1,053	347	8,135			

was composed of five individuals (five people per living room), whereas a three-room household living in a surface pueblo or cavate complex was composed of six individuals (i.e., two people per living room). Our choice of numbers follows ethnographic research undertaken by previous researchers (Cameron 1996; Hassan 1981; Hill 1970; Longacre 1976; Schlanger 1986), which has suggested that an ethnographically informed value ranging from an average of four to six persons per household in the U.S. Southwest is justified.

- Fourth, we derived a momentary- (average annual-) population-size estimate in the MVRV, per phase. The formula for deriving a momentary population estimate is as follows: momentary-population size = ((number of living rooms × living-room life span) / length of period) × people per living room. We modified an equation used by members of the Dolores Archaeological Project to derive this estimate (Schlanger 1988:783).

- Fifth and sixth, we calculated a population-growth rate for the Hackberry through Tuzigoot phases. The formula for calculating the population-growth rate from one temporal phase to the next temporal range is as follows: $r = ln$ (N2 / N1) / t, where ln is the natural logarithm, N1 is the population estimate of an earlier period, N2 is the population estimate of a later period, and t is the elapsed time or number of years between the two periods. As described by Schlanger (1986:510), there are two ways to calculate the time between periods. One way is to determine the number of years from the earlier-period midpoint to the later-period midpoint (e.g., Hackberry and Cloverleaf phases: A.D. 850–725 = 125 years). A second way is to determine the number of years from the beginning of the earlier period to the end of the later period (e.g., Hackberry and Cloverleaf phases: A.D. 900–650 = 250 years). We list these calculations as Population-Growth Rate No. 1 and Population-Growth Rate No. 2.

- Seventh, and finally, we re-expressed the population-growth rates as population-growth percentages. We list these as Population-Growth Percentage No. 1 and Population-Growth Percentage No. 2.

Table 64 presents the assumptions, formula, and calculations. Of course, all these assumptions can and should be challenged and altered. The momentary-population estimates for the Early Formative period and Hackberry phases are surely too low. For example, Wobst (1974) suggested that the minimum size of a sustainable hunting-gathering band ranged from 175 to 475 individuals; our study does not approach these numbers until the Honanki phase. Nevertheless, our analysis of the MVRV ALD data suggests that population-growth-rate percentages in in the Cloverleaf and Honanki phases exceeded the annual internal population-growth value of 0.52 person that Hassan (1981:140) suggested is the probable maximum natural growth rate for prehistoric groups. It is likely that human groups from outside the MVRV settled portions of the MVRV during the Cloverleaf phase (0.83–1.66 percent population-growth increase, depending on the amount of time reckoned) and Honanki phase (0.62–1.24 percent population-growth increase, depending on the amount of time reckoned).

Settlement and Land Use in the LOCAP Study Area

With the preceding review in mind, we are now able to describe the settlement history of our LOCAP study area. The LOCAP is equivalent to three adjacent USGS 7.5-minute topographic maps: Sedona, Cornville, and Cottonwood. It represents 16.7 percent of the 18-quadrangle MVRV study area (approximately 47,612 ha or 477 km^2, equivalent to some 117,649 acres or 184 square miles). It includes the lower reach of Oak Creek from Sedona southwestward to its conjunction with the Verde River, as well as the lower reaches of two significant tributary drainages, Dry Creek and Spring Creek, which have their origins along the Mogollon Rim/Coconino Plateau to the north and northwest of Sedona. The LOCAP also encompasses several different biotic communities and physiographic features and has a long history of land use extending back to at least the Middle Archaic period, if not the Paleoindian period, through the early twenty-first century.

Table 65 provides a comparison of the number of sites in the MVRV ALD with components assigned to specific temporal components. Although the total number of assignable components (257, or 15.8 percent) is similar to the areal proportion of the smaller LOCAP study area (about 16.7 percent), a disproportionally high number of components has been recorded for the Late Archaic and Early Formative periods and the Hackberry phase, and a disproportionally low number of components has been recorded for the Honanki phase. We suspect that these differences are, in part, a function of how much more archaeological survey has taken place in the LOCAP area than in other areas (see Figure 9). However, the specific environmental and physiographic characteristics of the LOCAP area also contribute to the differences.

Table 66 provides the data, per temporal phase, that allow us to suggest how the smaller LOCAP area differs in basic environmental characteristics from the larger MVRV area. Figure 66a–h graphically displays these contrasts.

Table 64. Formative Period Population Estimates Based on Room Counts

Temporal Period/Phase	Time Range	Length of Period (Years)	No. of Sites	No. of Living Rooms[a]	Living-Room Life Span (Years)[b]	No. of People per Living Room[c]	MPS[d]	Time between Periods No. 1[e]	PGR No. 1[f]	PGP No. 1[g]	Time between Periods No. 2[h]	PGR No. 2[f]	PGP No. 2[g]
Early Formative	A.D. 0–650	650	16	17	12	5	2	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.
Hackberry	A.D. 650–800	150	16	26	12	5	10	400	0.0047	0.47	800	0.0024	0.24
Cloverleaf	A.D. 800–900	100	109	138	12	5	83	125	0.0166	1.66	250	0.0083	0.83
Camp Verde	A.D. 900–1150	250	244	440	12	5	106	175	0.0014	0.14	350	0.0007	0.07
Honanki	A.D. 1150–1300	150	650	3,821	25	2	1,274	200	0.0124	1.24	400	0.0062	0.62
Tuzigoot	A.D. 1300–1400	100	365	3,693	25	2	1,847	125	0.0030	0.30	250	0.0015	0.15

Key: MPS = momentary-population size; N.O. = no observation possible; PGP = population-growth percentage; PGR = population-growth rate.

[a] The number of tallied pit structures and/or surface rooms from the Middle Verde River Valley Archaeological Landscape Database.

[b] The average lifespan of a pit structure is 10–12 years (Ahlstrom 1985, Schlanger 1986). Remodeling (measured by the number of floor surfaces) and extended use lives of living rooms were not considered in this exercise. We have used 12 years to represent the use life of a pit structure and 25 years to represent the use life of a masonry surface room.

[c] Values of five persons per pit structure and two persons per surface room (Cameron 1996; Longacre 1976; Schlanger 1986, 1988).

[d] Momentary-population size = (number of living rooms × living-room life span) / length of period) × people per living room (modified from Schlanger 1988:783).

[e] Time between Periods No. 1 is the number of years from the previous-period midpoint to the next-period midpoint.

[f] The natural logarithm is $r = ln$ (N2 / N1)/ t, where N1 = the momentary-population size of the earlier period, N2 = the momentary population of the later period, and t (time) = the number of years between period midpoints (Hassan 1981:139; Schlanger 1986: 510).

[g] The probable maximum natural growth rate for prehistoric groups is 0.52 percent (Hassan 1981:140); thus, values greater than 0.52 percent suggest population growth through immigration.

[h] Time between Periods No. 2 is the number of years from the beginning of the previous period to the end of the next period.

Table 65. Numbers of Recorded Temporal Components in the MVRV and LOCAP Study Areas

Temporal Period/Phase	No. of Components, by Study Area		Percentage of Components in the LOCAP Study Area
	MVRV	LOCAP	
Late Archaic	92	64	69.6
Early Formative	16	12	75.0
Hackberry	16	5	31.5
Cloverleaf	109	20	18.3
Camp Verde	244	31	12.7
Honanki	650	49	7.5
Tuzigoot	365	49	13.4
Protohistoric	134	26	19.4
Total no. of components	1,626	257	15.8

Key: ALD = Archaeological Landscape Database; LOCAP = Lower Oak Creek Archaeological Project; MVRV = middle Verde River valley.

Table 66. Comparison of Environmental Attributes in the MVRV and LOCAP Study Areas, by Temporal Period/Phase

Environmental Attribute	Study Area, by Temporal Period/Phase													
	Late Archaic Period		Early Formative Period		Hackberry Phase		Cloverleaf Phase		Camp Verde Phase		Honanki Phase		Tuzigoot Phase	
	MVRV	LOCAP	MVRV	LOCAP	MVRV	LOCAP	MVRV	LOCAP	MVRV	LOCAP	MVRV	LOCAP	MVRV	LOCAP
No. of site components	139	64	16	45	16	5	109	20	244	31	650	49	365	49
Average Site elevation (m AMSL)	1,279	1,252	1,179	1,205	1,302	1,303	1,381	1,256	1,353	1,234	1,320	1,237	1,232	1,149
Average elevation, 1-km-radius catchment (m AMSL)	1,292	1,266	1,193	1,222	1,315	1,326	1,381	1,264	1,352	1,242	1,308	1,231	1,213	1,140
Average site slope (%)	8	7	9	7	12	9	8	9	11	8	35	21	30	19
Average slope, 1-km-radius catchment (%)	16	15	12	13	17	20	12	15	20	17	30	18	22	14
Average cost distance to major streams (m)	3,039	3,214	1,548	1,657	4,967	2,716	5,603	2,374	3,714	1,732	3,901	2,263	2,254	1,304
Average cost distance to minor streams (m)	,351	341	209	199	310	167	564	475	710	563	856	634	785	603
Average cost distance to springs (m)	6,877	5,941	2,885	3,373	4,848	4,892	6,810	5,121	5,664	4,541	6,079	4,120	5,029	3,735
Average arable land, 1-km-radius catchment (ha)	—	—	88	89	73	71	125	71	127	75	78	83	100	115
Average runoff-suitable land, 1-km-radius catchment (ha)	—	—	69	65	61	45	122	54	124	48	77	71	98	103
Average irrigation-suitable land, 1-km-radius catchment (ha)	—	—	45	35	26	26	19	26	32	36	33	40	46	62
Average agave land, 1-km-radius catchment (ha)	109	142	118	156	134	164	171	153	163	157	117	114	90	71

Key: AMSL = above mean sea level; LOCAP = Lower Oak Creek Archaeological Project; MVRV = middle Verde River valley.

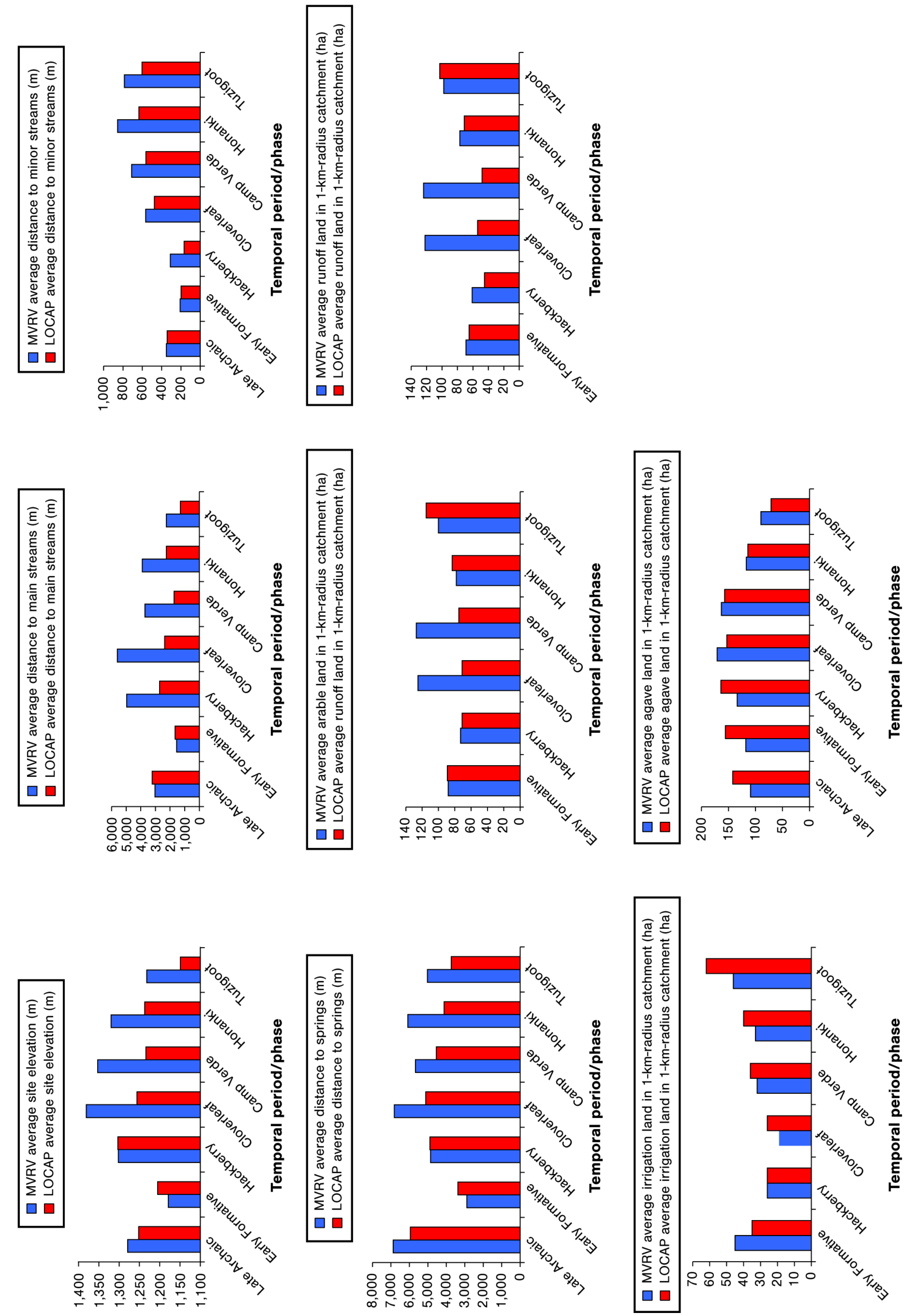

Figure 66. Graphs comparing environmental attributes in the middle Verde River valley and Lower Oak Creek Archaeological Project study areas, by temporal phase.

Although there are a few notable exceptions, the overall trends are as follows: (1) The average elevation of site components in the LOCAP area is lower than that in the MVRV; (2) The average cost distance from sites to water of all types—main streams, minor streams, and springs—is shorter (closer) in the LOCAP area than in the MVRV; (3) the average amount of arable land within a 1-km radius of a site in the LOCAP area is less than that of the MVRV, but the average amount of land suitable for irrigation-type agriculture is greater in the LOCAP area than in the MVRV; and (4) the average amount of agave-growing land within a 1-km radius of a site is initially greater in the LOCAP area than in the MVRV but is less after the Hackberry phase than in the MVRV and corresponds to the predominance of settlement at lower elevations in these later time periods.

Figure 67a–e displays the temporal trends presented in Table 66 for the LOCAP area. These graphics compare well with those developed for the MVRV as a whole (see Figure 54 for elevation; Figure 55 for slope; Figure 56 for distance to water; Figures 57 and 58 for arable and runoff land, respectively; and Figures 59 and 60 for irrigation and agave-growing land). The overall trends within the LOCAP area are as follows, keeping in mind that sample sizes were uneven and quite small for both the Early Formative period (Squaw Peak phase) (n = 12) and the Hackberry phase (n = 5).

Figure 67a reveals that the average elevation of LOCAP site components assigned to the Late Archaic period through the Honanki phase was higher than that of the Tuzigoot phase. Whereas the average elevation of the earlier phases ranged from 1,205 to 1,290 m AMSL, the average elevation of components assigned to the Tuzigoot phase is just 1,149 m AMSL (see Table 66). Figure 67a also indicates that sites tend to be located within immediate 1-km-radius catchments that were somewhat higher than where the sites were located, until the Honanki phase. In both the Honanki and Tuzigoot phases, sites were located on higher terrain than their immediate catchments.

Figure 67b depicts the average percentage of slope for sites within their immediate 1-km-radius catchments. Corresponding to elevation, the average slope for LOCAP site components from the Late Archaic period through the Camp Verde phase is fairly gentle and considerably lower than the surrounding terrain. In contrast, sites with Honanki and Tuzigoot phase components tend to be located on steeper landforms than the terrain that surrounds them. That applies to sites with Honanki phase components that tend to be located at higher elevations, away from major drainages, as well as Honanki phase components near and in lowland and riverine settings. Because sites with Tuzigoot phase components tend to be located in lower-elevation and riverine settings, the steep slopes on which these late sites are located are usually hills and promontories.

Figure 57c portrays the relationships of average distances to springs, major streams, and minor streams in the LOCAP area during the Late Archaic and Formative periods. As with the larger MVRV area, the sites in the LOCAP area were always closer to minor streams than major streams and closer to streams of all sizes than springs. Nevertheless, the presence of two prominent spring locales in the LOCAP area, one on Spring Creek and the other at Page Springs, along Oak Creek, provided an important source of potable water and a draw for wildlife during the past. Sites with Tuzigoot phase components were, on average, closer to major drainages and springs than sites at any time in the past.

Figure 67e, which illustrates the average amounts of runoff and irrigation land within a 1-km radius of sites, and Figure 67e, which shows the relationship between the amount of arable land (i.e., the total area of land suitable for either runoff or irrigation technologies) and the amount of agave land within a 1-km radius of sites, tell a story for the LOCAP area similar to that of the MVRV as a whole. Honanki and Tuzigoot phase sites were positioned in locations with greater access to runoff-potential lands and away from locations that naturally supported agave. Data depicted in Figure 67d and e also indicate that Tuzigoot phase settlements were situated in lowland and riverine locations that contained considerably more land suitable for irrigation-type farming, which dramatically altered the relationship between immediate access to arable land and immediate access to agave land.

Observations on Settlement Patterns in the LOCAP Area

Figures 68–75 (Late Archaic period through the Formative and protohistoric periods) show the distribution of sites in the three-map LOCAP area, per temporal period. Each displays the same data presented earlier for the 18-map MVRV area (see Figures 13, 17, 22, 26, 31, 36, 42, and 50 for the Late Archaic period; the Squaw Peak, Hackberry, Cloverleaf, Camp Verde, Honanki, and Tuzigoot phases; and the protohistoric period, respectively).

Site Distribution

Aside from the differences in numbers of sites recorded per temporal period, all figures share a similar distribution of sites of all types, with the majority situated in the "uplands" (locally defined as above 1,100 m/3,600 feet and mostly below 1,340 m/4,400 feet AMSL) and a minority in the "lowlands" (locally defined as below 1,100 m/3,600 feet AMSL to the Verde River, at about 970 m/3,200 feet AMSL near the Middle Verde Ruin/Talbot Ranch Ruin). Beginning at least as early as the Camp Verde phase and culminating in the Tuzigoot phase, our

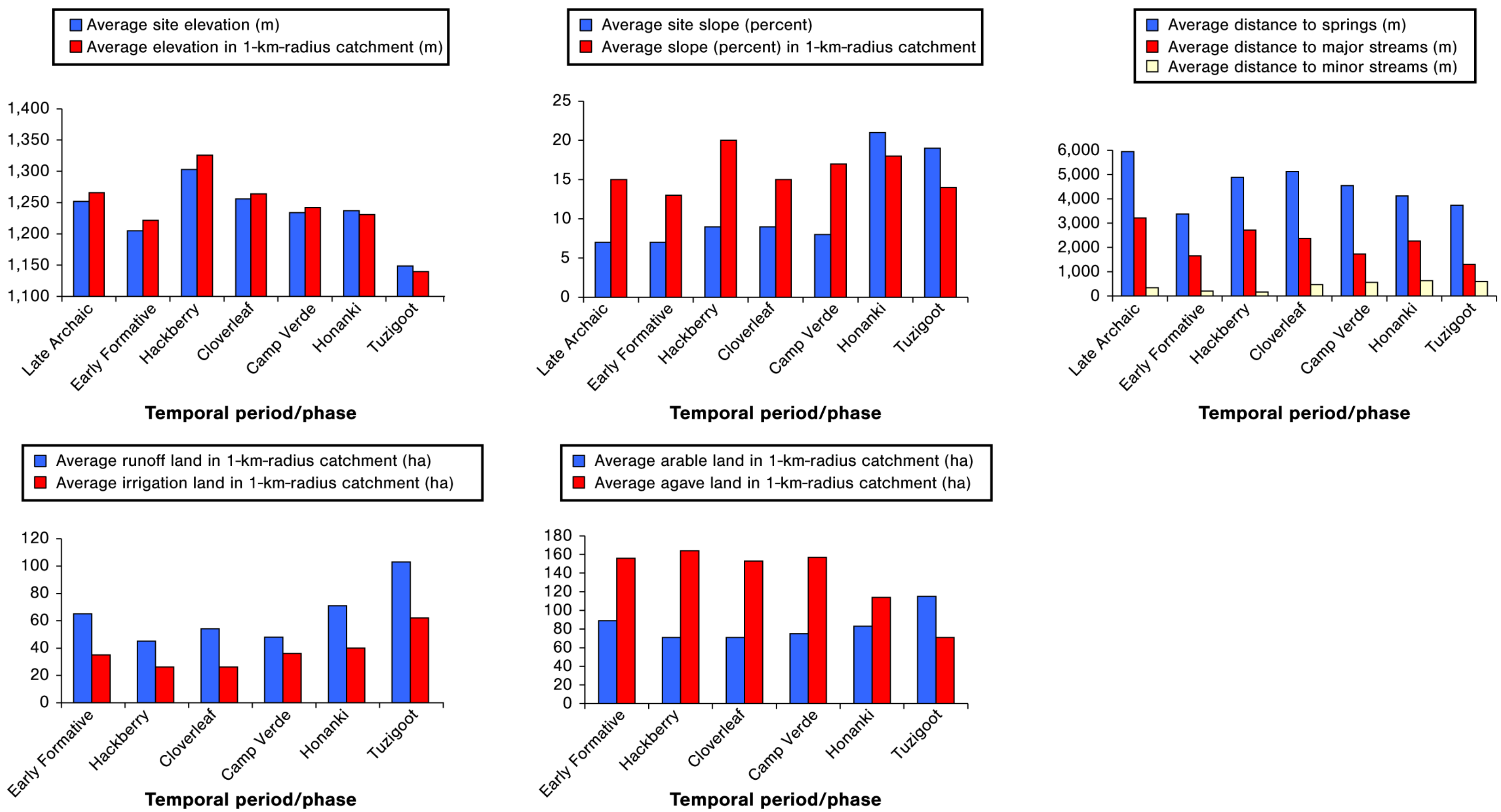

Figure 67. Graphs comparing environmental attributes in the Lower Oak Creek Archaeological Project area, by temporal phase.

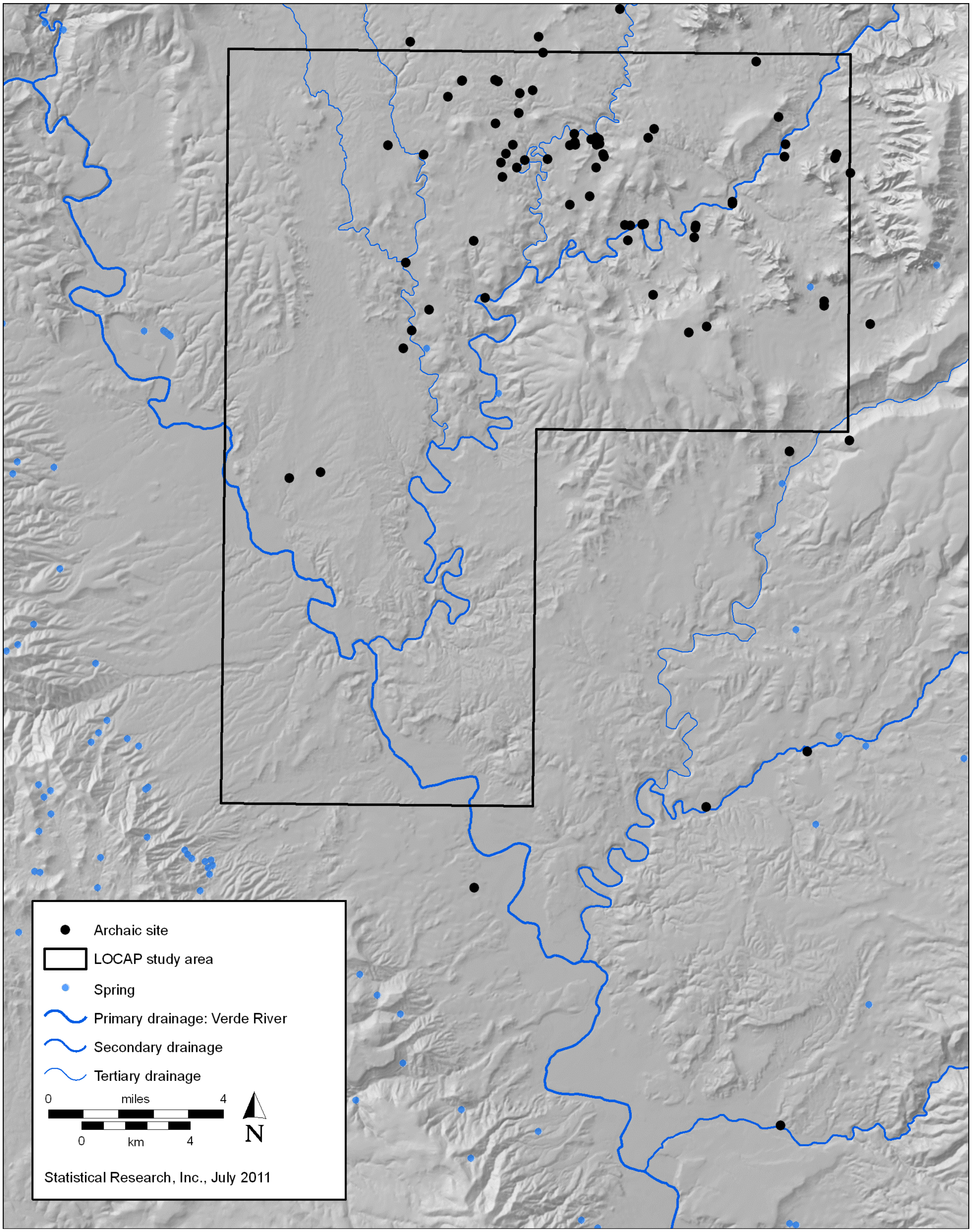

Figure 68. Map showing the locations of Archaic period sites in the Lower Oak Creek Archaeological Project area.

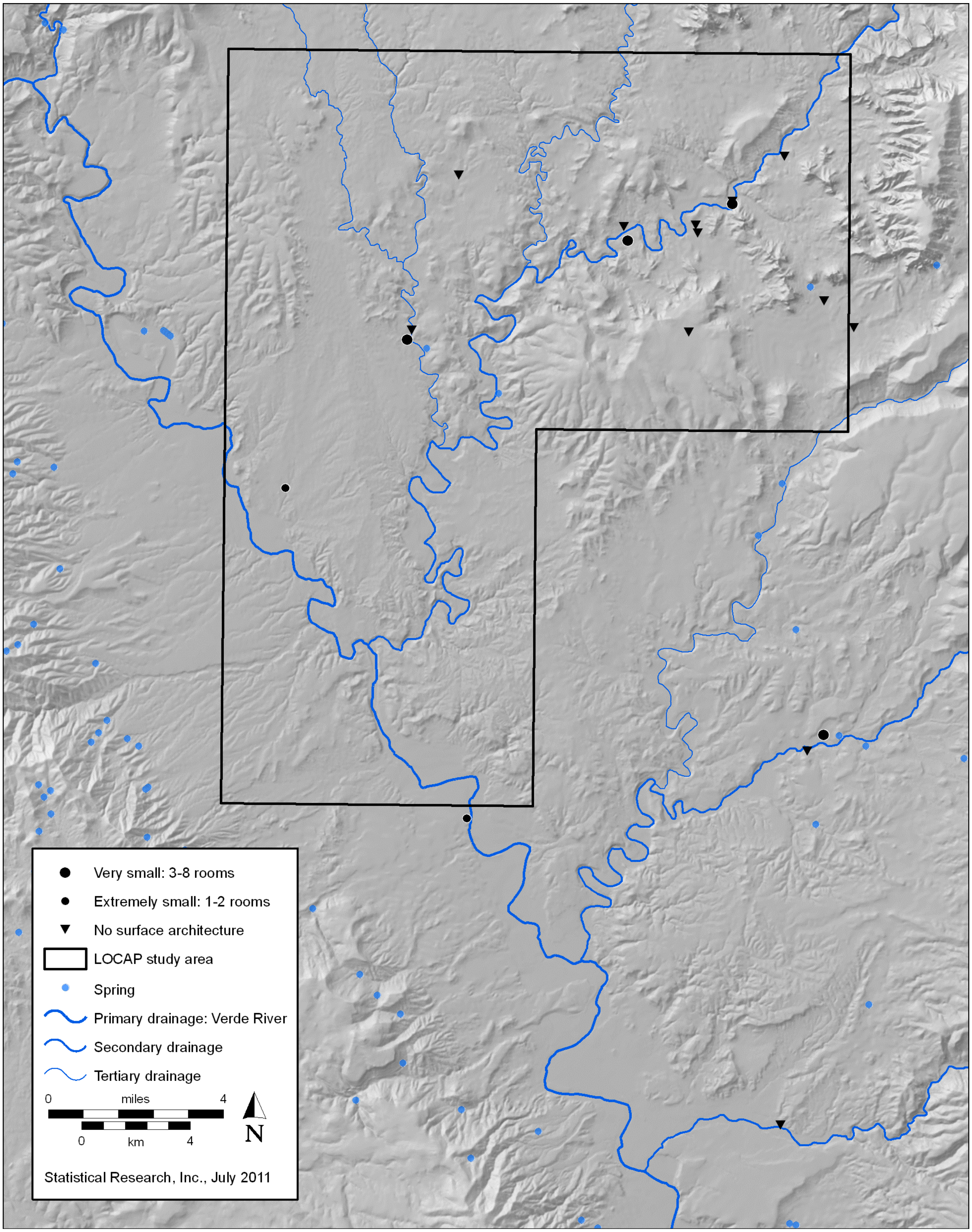

Figure 69. Map showing the locations of Squaw Peak phase sites in the Lower Oak Creek Archaeological Project area.

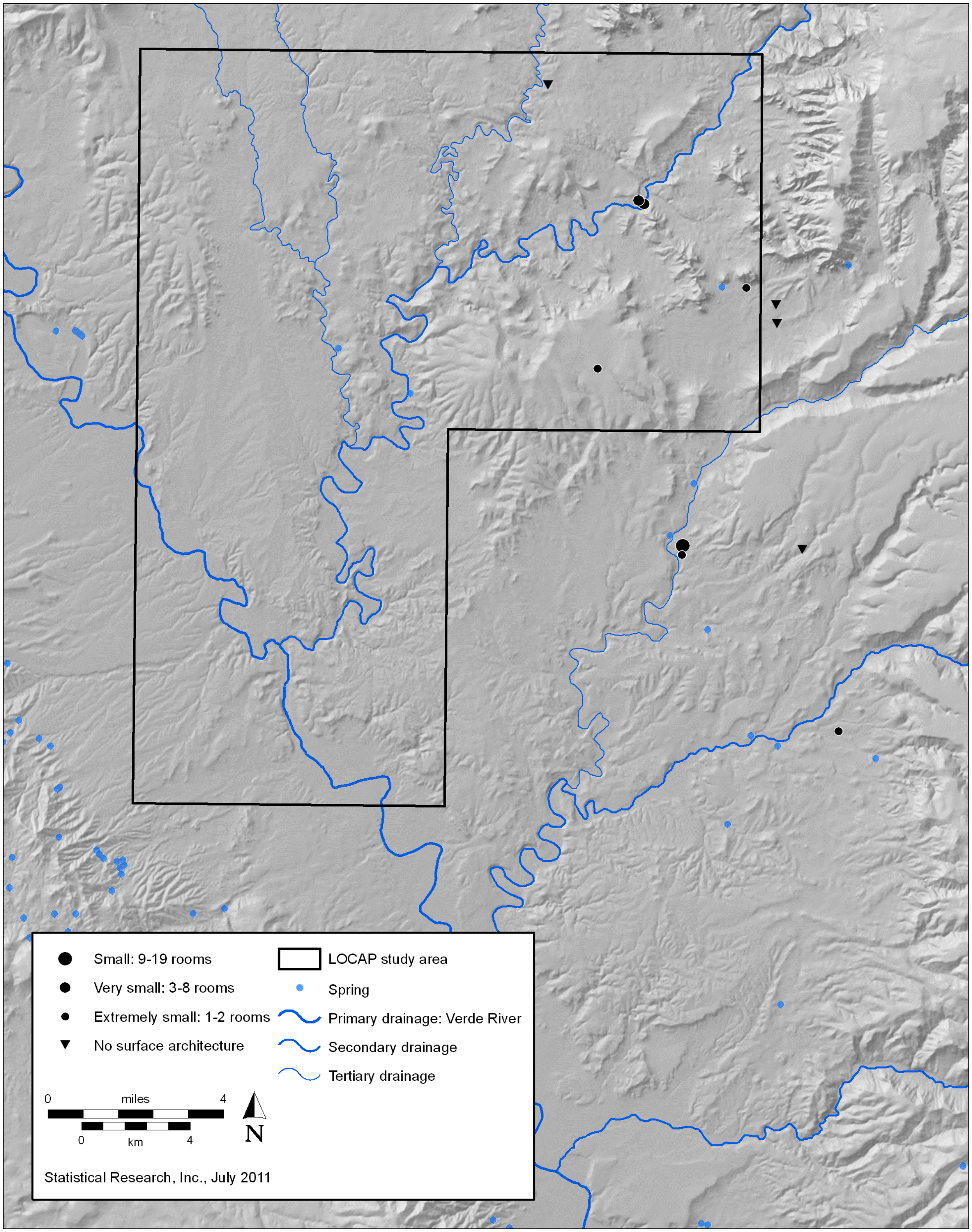

Figure 70. Map showing the locations of Hackberry phase sites in the Lower Oak Creek Archaeological Project area.

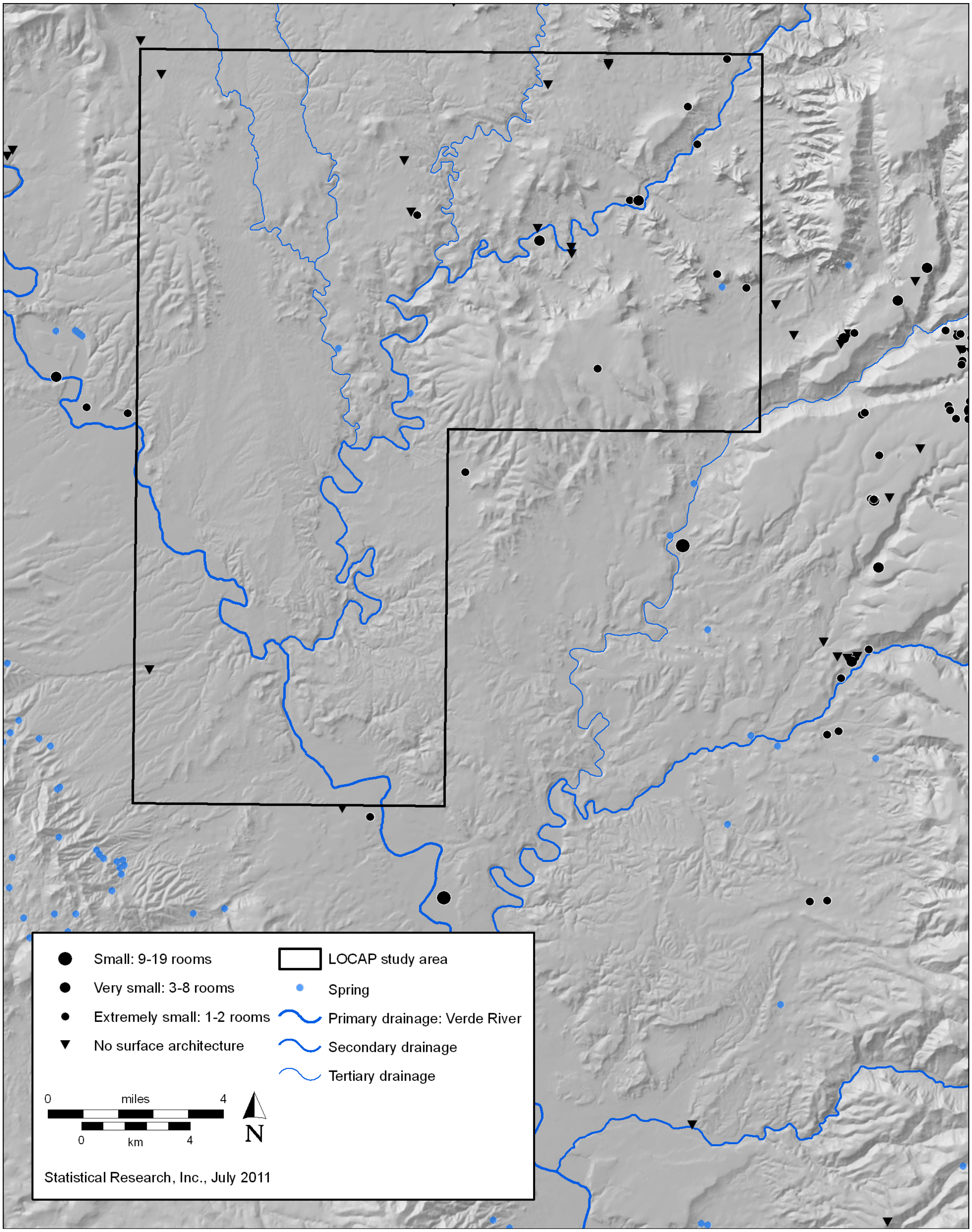

Figure 71. Map showing the locations of Cloverleaf phase sites in the Lower Oak Creek Archaeological Project area.

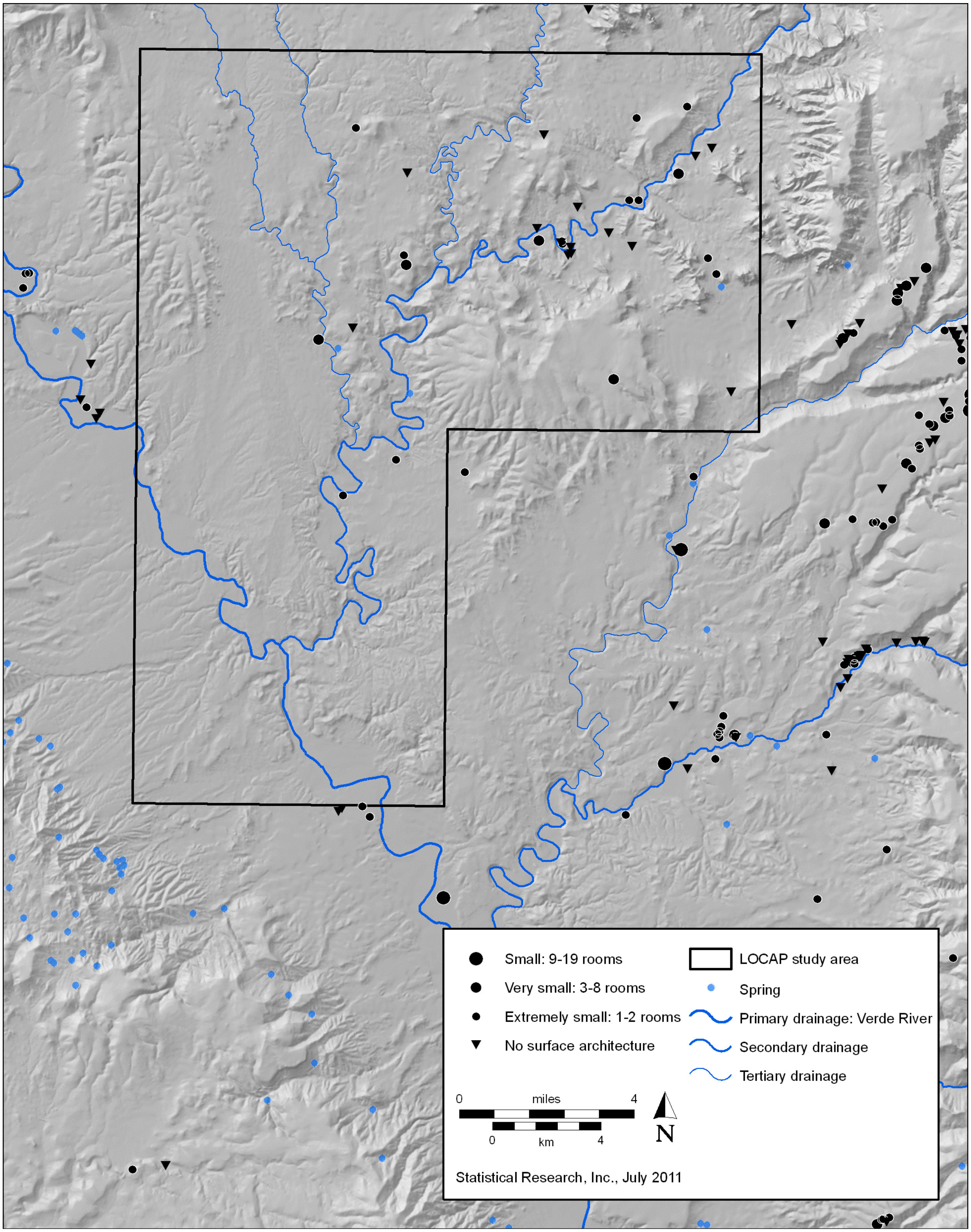

Figure 72. Map showing the locations of Camp Verde phase sites in the Lower Oak Creek Archaeological Project area.

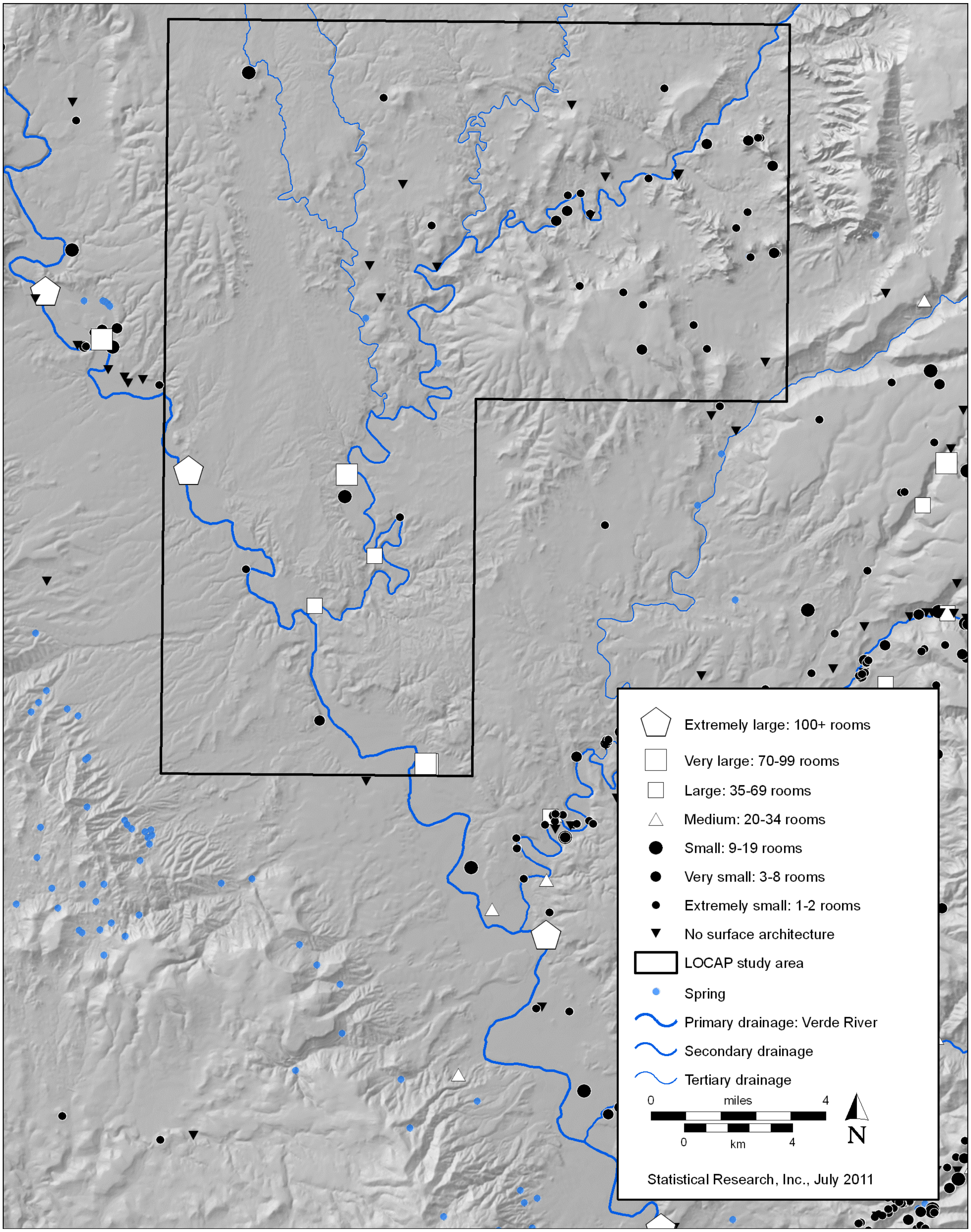

Figure 73. Map showing the locations of Honanki phase sites in the Lower Oak Creek Archaeological Project area.

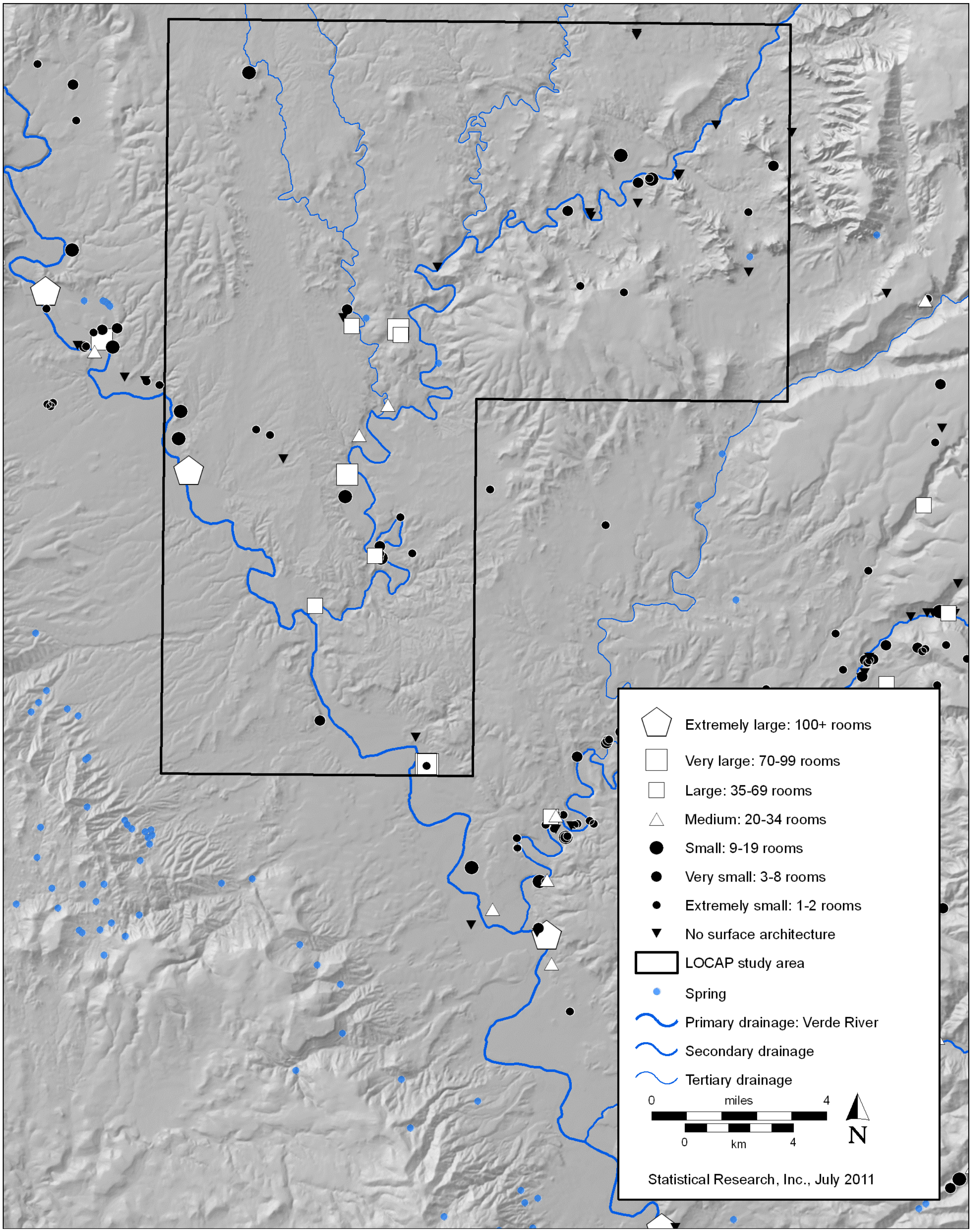

Figure 74. Map showing the locations of Tuzigoot phase sites in the Lower Oak Creek Archaeological Project area.

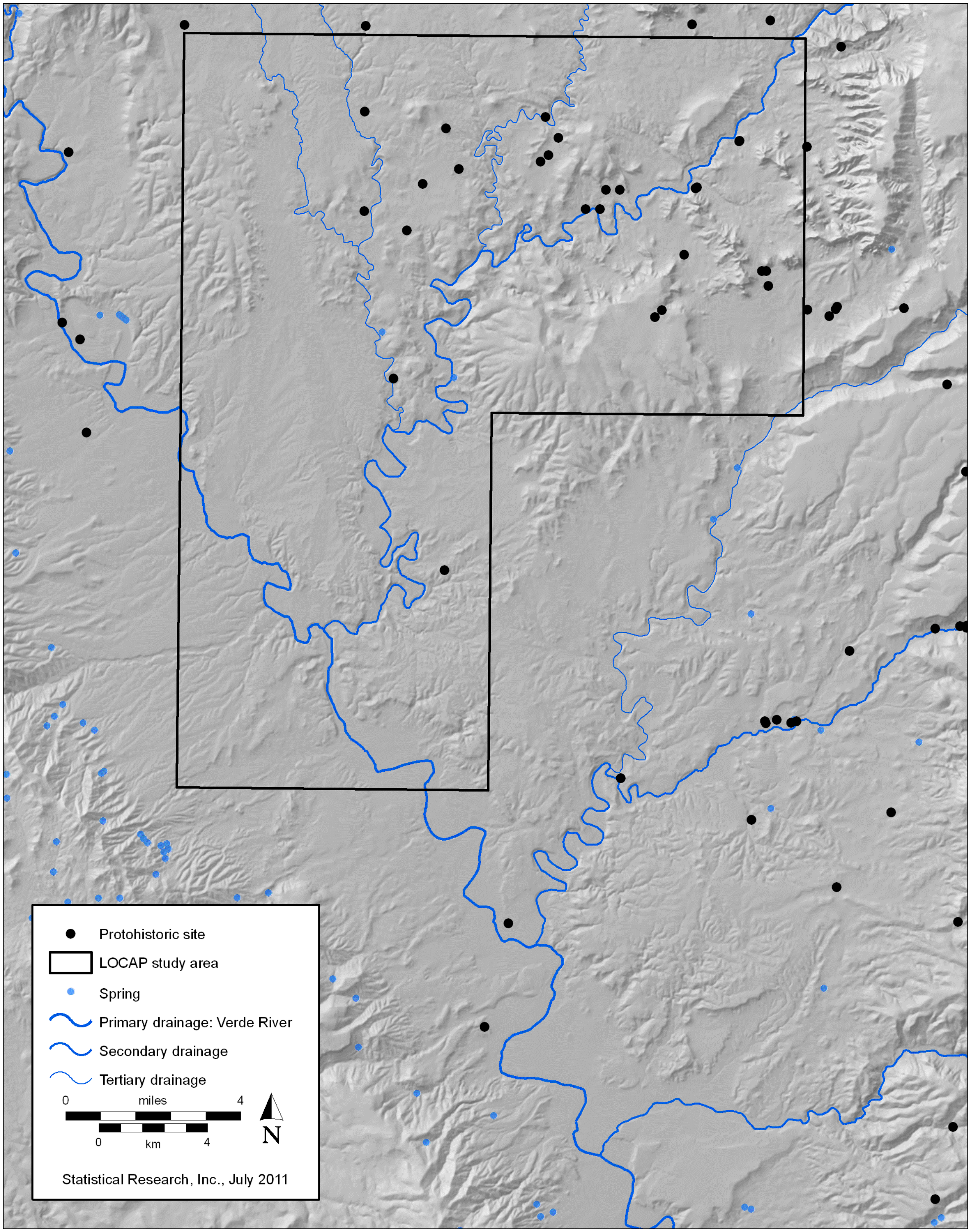

Figure 75. Map showing the locations of protohistoric-period sites in the Lower Oak Creek Archaeological Project area.

figures show that a second and smaller focus of settlement took place along the lower reach of Oak Creek and along the Verde River. Although this lowland settlement in the Honanki and Tuzigoot phases is undeniable, we strongly suspect that sites of *all* time periods were along the Verde River and the lowest sections of Oak Creek, creating a bimodal-type settlement pattern in the LOCAP area.

Since the 1870s, this private-land portion of the MVRV has been altered considerably through settlement and modern land use, resulting in few opportunities to professionally record and explore archaeological deposits near the Verde River. A recent opportunity to archaeologically investigate a 23-acre private-land parcel scheduled for the Grey Fox Ridge housing development resulted in the discovery of a large, multicomponent site with prehistoric occupation components dating to the Late Archaic and Early Formative periods as well as the Hackberry through Honanki phases and the historical period (Deats 2011). This investigation demonstrated to us that below the fertile Verde River floodplain and the river terraces that underlie modern Clarkdale, Cottonwood, Bridgeport, and Verde Villages are many multicomponent sites with similar settlement histories.

Land Use

Some portions of the LOCAP landscape were more attractive for settlement than others, although all portions were used as resource areas. For example, the lowland plains, composed of Verde Formation sediments between the Verde River and the beginning of the uplands around Spring Creek, were rarely places of enduring settlement. Only those few hills and prominences within the Verde Formation but adjacent to arable sediments and perennial water were inhabited, and habitation seems to have occurred late in the Formative period sequence. This swath of Verde Formation sediments was Colton's (1946:303–304) "uninhabited zone." We now know that this zone was used by various populations of the LOCAP area, though not for permanent habitation.

At least five distinct biotic communities can be distinguished in the LOCAP area: two different riparian communities (a "lowland" riparian community along the Verde River and an "upland" riparian community the middle reach of Oak Creek), a semidesert grassland community developed on ancient Verde Formation sediments, a conifer woodland in the vicinity of Sedona, and a transition zone between the semidesert grasslands and the conifer forest. Each was home to a variety of plants, animals, geological resources, and water resources of interest to precontact human populations. Drawing on data presented in Chapter 2, Volume 1 of this report (project setting), as well as data presented in analytic chapters of Volume 2 (especially chapters on shell, macrobotanical remains, pollen, faunal remains, and geomorphology), we suggest what resources may have been of economic interest (Table 67).

Riparian communities are home to the greatest diversity of useful trees, water-loving shrubs, and grasses in the LOCAP area and support more edible and desirable animals than other biomes. Especially attractive were the fish and birds. The terrain bordering the Verde River was also where the greatest expanse of arable land was located, especially land that could be irrigated through gravity-flow canal-and-ditch systems to adjacent terraces. Not surprisingly, many locales along these riparian corridors were used as dwelling sites, agricultural fields, and resource-procurement and processing locations. Access to potable water and tool stone in the channel gravels (e.g., chert, chalcedony, and rounded cobbles for hand stones) also would have drawn people to this rich resource corridor. Given differences in elevation, geology, topography, channel width and depth, stream flow, and adjacent biotic communities, the resource potential of different riparian settings varies considerable. The intensity and duration of human exploitation of different riverine settings and their riparian communities seems to have varied, depending on the persistence and diversity of resources associated with a given drainage.

The semidesert grasslands, despite their generally low potential for maize cultivation, did have patches of arable soil that were in landscape positions that could receive surface runoff in particularly favorable years. In the LOCAP area, the semidesert grasslands developed on Verde Formation soils. Although we mapped only the most likely and productive land units as arable in this study, we are aware that small arable patches were likely overlooked during the USFS ecological survey. It is not surprising, then, to discover that a small number of archaeological features inferred to have been field houses have been recorded in this grassland environment. The persistent attractions of the semidesert grasslands in the LOCAP area, however, were its plant resources, which drew in both animals and their human hunters. Despite the fact that we list only those grasses that humans actively exploited in Table 67, many more grasses do grow in this biome (see Table 12, Chapter 2, Volume 1 of this report) and they were forage for grazing animals, including the pronghorn, deer, jackrabbit, and prairie dog frequently found in archaeological faunal collections. Aside from the grasses, numerous shrubs and forbs tolerated the calcium-rich sediments of the Verde Formation. We know from numerous ethnographic studies that many of these plants were gathered as items for food and drink, medicine, fuel, and elements of manufactured items (see Table 11, Chapter 2, Volume 1 of this report). Artifact scatters dominated by flaked stone are typically found in this zone.

The dominant trees of the conifer woodlands (i.e., the Great Basin Conifer Woodland) were piñon and juniper, with at least three species of juniper represented. The nutritious and caloric piñon nut, piñon pitch, and piñon wood were highly desirable commodities, along with the long-lasting and pitch-free wood of the juniper tree and its bitter

Table 67. Economic Resources Typical of the Major Biotic Communities in the LOCAP Area

TES Unit Nos.	Biotic Community; Elevational Range; TES Landform(s)	Sample of Plant Resources Recorded by TES That are Useful to Humans (Food, Drink, Medicine, Dye, Manufactured Item, Construction Material, or Fuel)	Sample of Endemic Animal Species	Agricultural Potential
33, 34	riparian (Verde River–channel deposits and floodplain of the Verde River and lower Oak Creek); 850–1,100 m AMSL; valley plains	**trees:** cottonwood, alder, sycamore, ash, net-leaf hackberry, walnut; one-seed juniper, box elder, velvet ash **shrubs:** coyote willow, desert broom, desert hackberry, graythorn, canyon grape, false mesquite, desert willow, velvet mesquite, yucca, prickly pear, catclaw acacia **forbs:** sunflower, paintbrush, Indian wheat/plantain, vetch, globemallow, goldenrod, locoweed, broom snakeweed, shrubby buckwheat **grasses:** sedge, horsetail, sideoats grama, sand dropseed, sandhill muhly, June grass	**mammals:** jaguar, beaver, raccoon, pocket mouse **birds:** white-wing dove, mourning dove, many others **fish:** squawfish, Gila sucker, Sonora sucker, roundtail chub **shellfish:** *Anodonta* **amphibian:** mud turtle	**irrigation:** M–VH **runoff:** M–H
280, 350, 381, 385	semidesert grasslands (Verde Formation sediments); 900–1,400 m AMSL; hills and escarpments, lowland plains, valley plains, elevated plains, and alluvial fans	**trees:** redberry juniper, Utah juniper **shrubs:** crucifixion thorn, red barberry, catclaw acacia, brickellbush, banana yucca, soaptree yucca, Mormon tea, prickly pear, threeleaf sumac, creosote bush, velvet mesquite, white brittlebush, winterfat, wolfberry, four-wing saltbush **forbs:** broom snakeweed, paintbrush, penstemon, four o'clock, shrubby buckwheat, Indian wheat/plantain, dock, globemallow, hedgehog cactus, lupine, locoweed **grasses:** needle-and-thread grass, threeawn, sideoats grama, sand dropseed, June grass, Indian ricegrass	**mammals:** pronghorn, mule deer, white-tailed deer, black-tailed jackrabbit, black-tailed prairie dog, mountain lion, bobcat, coyote, gray wolf, badger, ground squirrel, wood rats, pocket mouse, white-footed mouse **birds:** Gambel's quail, scaled quail, mourning dove, and others	**irrigation:** L–M **runoff:** L, M, H
402, 420	transition from semidesert grassland to conifer woodland; 1,050–1,500 m AMSL; volcanic hills and elevated plains	**trees:** redberry juniper, Utah juniper **shrubs:** turbinella oak, velvet mesquite, red barberry, hollyleaf redberry, catclaw acacia, crucifixion thorn, threeleaf sumac, banana yucca, soaptree yucca, Mormon tea, prickly pear, whipple cholla, pincushion cactus, and agave (on volcanic hills, Land Unit 420) **forbs:** wild buckwheat, shrubby buckwheat, Indian wheat/plantain, broom snakeweed, paintbrush, globemallow, spurge, locoweed **grasses:** needle-and-thread grass, threeawn, sideoats grama, sand dropseed, June grass, Indian ricegrass	elements of above and below	**irrigation:** L **runoff:** L

TES Unit Nos.	Biotic Community; Elevational Range; TES Landform(s)	Sample of Plant Resources Recorded by TES That are Useful to Humans (Food, Drink, Medicine, Dye, Manufactured Item, Construction Material, or Fuel)	Sample of Endemic Animal Species	Agricultural Potential
45, 46	riparian (Dry Creek– and middle Oak Creek–channel deposits and floodplain); 1,100–1,500 m AMSL; valley plains	**trees:** piñon pine, alligator juniper, Utah juniper, one-seed juniper, Emory oak, white oak, sycamore, cypress, cottonwood, netleaf hack-berry, velvet ash, box elder, walnut **shrubs:** turbinella oak, manzanita, threeleaf sumac, desert willow, catclaw acacia, cliffrose, silktassel, Arizona grape, hollyleaf redberry, prickly pear, brickellbush **forbs:** wild buckwheat, shrubby buckwheat, groundsel, thistle, broom snakeweed, penstemon, aster, locoweed, dock, mullein, flax, cattail **grasses:** sideoats grama, sand dropseed, June grass, threeawn	**mammals:** black bear, white-tailed deer, cottontail, pocket gopher, gray squirrel, raccoon, skunk **birds:** wild turkey, hawks, many others **fish:** roundtail chub, longfin dace, Sonoran sucker, desert-mountain sucker **shellfish:** *Anodonta* **amphibian:** mud turtle	**irrigation:** M **runoff:** M
403, 457, 458	conifer woodlands (Sedona area); 900-1,600 m AMSL; lowland plains, elevated plains, and hills	**trees:** piñon pine, Utah juniper, redberry juniper, one-seed juniper **shrubs:** turbinella oak, Manzanita, red barberry, mountain mahogany, beargrass, prickly pear, threeleaf sumac, banana yucca, soaptree yucca, agave, Mormon tea, winterfat, four-wing saltbush, wolfberry, hollyleaf redberry, Whipple cholla **forbs:** shrubby buckwheat, broom snakeweed, Indian wheat/plantain, *Chenopodium*/lambsquarters, globemallow, paintbrush, sagewort **grasses:** sideoats grama, sand dropseed, threeawn, needle-and-thread grass	**mammals:** elk, deer, mountain lion, gray fox, coyote **birds:** piñon jay, many others	**irrigation:** VL, M **runoff:** VL, M

Key: AMSL = above mean sea level; H = high; L = low; LOCAP = Lower Oak Creek Archaeological Project; M = medium; TES = Terrestrial Ecosystem Survey; VH = very high; VL = very low.

but useful berries. Although economically useful grasses grow in this biome, its greatest attractions were likely its trees, shrubs, and forbs and the animals that found food and shelter in this environment. Agave, beargrass, and mountain mahogany are common components of this zone and are species rarely found in other zones. Small habitation sites, field houses, rock-art sites, and artifact scatters have been recorded in this zone.

The transition zone between the semidesert grasslands and the conifer woodland carried elements of both zones, depending on bedrock, soil cover, elevation, aspect, and moisture. It is not unusual to observe agave growing on well-drained basaltic hills within this transitional biotic community. Many artifact scatters representing resource-procurement and processing activities (e.g., plant gathering, hunting or trapping locations, short-term encampments, and toolstone quarries) have been recorded in the transition zone.

Settlement History

The settlement history for the LOCAP area is much the same as that for the MVRV as a whole. Evidence of human presence in the LOCAP area certainly began by the Middle Archaic period, if not considerably earlier, and continued unbroken through the protohistoric and historical periods to the present day. Subsistence remains recovered from archaeological sites (see Chapters 6–8, Volume 2 of this report; Appendix C) suggest that most human groups living in the LOCAP area were foragers whose mainstays were wild plants and animals, even after domesticated crops and farming were added to the suite of economic pursuits. Crop production became increasingly important after A.D. 800 for some segment of the total population and undoubtedly reached its greatest emphasis in the Tuzigoot phase. Maize and cotton were likely the major crops in the LOCAP area, although botanical evidence of several types of squash and dry beans, as well as little barley, exists. Three domesticated agave species have been identified in the LOCAP area, near the Page Springs and Oak Creek/Atkeson ruins (see Table 24) (Hodgson 2007, n.d.), and it is likely that these species were cultivated during the Tuzigoot phase, if not before.

Formative period sites were relatively small and dispersed in the LOCAP area from the Late Archaic period through the Camp Verde phase and probably into the early Honanki phase. Evidence of territory-based communities is not detectable until sometime in the Honanki phase, when many of the sites that would grow to settlements containing 50+ rooms were established along perennial water courses. We suspect that the development of large streamside settlements was a response to complex interactions between rapidly changing and often challenging climate conditions, increased frequency of floods, immigration from less productive and politically less cohesive regions, regional conflict, and opportunistic leadership. By at least the Tuzigoot phase, the densities of sites around larger communities permitted us to suggest that community catchments or territories likely existed. We refer to the site cluster of large and small sites within 3 km of each other in the LOCAP area as the Lower Oak Creek community. We presume that several generations of community members remained in this region until the late 1300s or early 1400s, when the region was abandoned by puebloan people. Precisely when the ancestors of contemporary Yavapai and Western Tonto Apache people arrived in the MVRV and what their relationship to the pueblo peoples who preceded them was are unknown.

Paleoindian

The oldest evidence of human presence in the LOCAP area is a heavily patinated basal fragment of a Clovis spear point manufactured from Hardscrabble Mesa dacite that was recovered from an excavation-unit level 90–100 cm below MGS at a site on the Crescent Moon Ranch (AZ O:1:88 [ASM]) near Sedona. The fact that the broken but temporally distinctive point was manufactured from locally available stone and was recovered from a buried context strongly suggests to us that the tool was broken during use and deposited not far from where it fell. The prey animal is unknown. Elsewhere in the U.S. Southwest, Clovis points have been recovered with the remains of mammoths (Haury 1953; Haury et al. 1959; Haynes and Huckell 2007). Although mammoth remains have not been found in the MVRV, the fossilized remains of a gomphothere—a relative of mammoths and elephants—has been recovered (Jacobs 1981:5). Might this point have been intended for such a beast? It is possible. Clovis points in the U.S. Southwest were manufactured about 11,200 years ago, or about 9200 B.C.

Archaic

Archaic period hunters and gathers lived in and passed through the LOCAP area as early as 6,000 years ago. Spear or dart points thought to date to the Middle Archaic period (ca. 4200–2000 B.C.) and Late Archaic period (ca. 2000 B.C.–A.D. 1) have been recovered from numerous sites in the LOCAP study area, particularly near Dry and Oak Creeks and the vicinity of Sedona. As yet, no dwellings dating to the long Archaic period (ca. 6500 B.C.–A.D. 1) have been found anywhere in the MVRV, but other evidence, in the form of hearths, roasting pits, rock art, and a flexed human inhumation burial, has been recovered and assigned to this era.

The type site for the Dry Creek phase—the Dry Creek site (NA5005, or AR-03-04-06-48 [CNF])—is located in the LOCAP study area and is considered representative of the Late Archaic period. Several of the sites described earlier under a revised culture history for the MVRV are located in the LOCAP study area, including the two Rancho del Coronado land-exchange sites (Graff 1990), the Offield land-exchange sites (Horton and Logan 1996), and several sites from Red Rock State Park (Weaver 2000). Ten of the

13 sites investigated during the SR 89A project yielded evidence of having been created during either the Middle or Late Archaic period, including one site (AZ:O:28/AR-03-04-06-903 [ASM/CNF]) that contained a Late Archaic period hearth.

Most archaeologists presume that small bands of highly mobile Archaic period hunter-foragers took advantage of the wide variety of environmental resources available in the LOCAP area. Their former presence is most often detected through the recognition of surface artifact scatters in which morphologically distinct stone tools and the debris of stone quarrying or toolmaking represent locales where plant and animal resources were obtained through hunting and gathering and subsequently processed. Less often, buried features, such as hearths used at short-term campsites for food preparation and warmth, are encountered during excavation projects, and organic hearth deposits can be dated. Although there are currently few absolutely dated Archaic period sites in the LOCAP area, there is no doubt that Archaic period populations inhabited this portion of the MVRV, at least for some portion of the year, intermittently, over many generations.

Sites with Late Archaic period components (n = 64) (see Figure 68; Table 66) in the LOCAP study area are found at elevations from as low as 1,030 m (3,380 feet) AMSL to as high as 1,459 m (4,786 feet) AMSL, with most in an elevation zone between about 1,200 and 1,400 m (roughly 4,000–4,600 feet) AMSL. Many are near small drainages, on modest slopes on fan terraces, elevated plains, ridges, hills, and buttes, where agaves and other upland resources are found in the conifer woodlands and semidesert grasslands.

Early Formative: Squaw Peak Phase

Who introduced agricultural methods to the MVRV and when that first took place are as yet unknown. Also unknown is how maize agriculture arrived. Receptive individuals and groups needed to know how, when, and where to plant a particular variety of maize; how to promote its growth and protect it when it was most vulnerable to predation; when to harvest it; how to prepare it; and how to preserve it. Was maize cultivation learned through contact with others who had already raised this domesticated plant and acquired through the process of diffusion? Or were maize kernels carried to the MVRV by pioneering settlers as a result of migration? Where both processes involved? Elsewhere in the United States, agricultural beginnings can be dated to end of the Middle Archaic period, ca. 2100 B.C.[23] In the MVRV, the earliest directly dated maize derives from two sites within the LOCAP study area—SR 89A Sites 105/838 and 85/428—and they are considerably later and surprisingly recent. Archaeologists submitted maize kernels recovered from the floor of a circular pit structure at SR 89A Site 105/838 and from the fill of a roasting pit at Site 85/428. Both samples yielded calibrated radiocarbon dates with a 95 percent probability of dating between A.D. 410 and 600. AM dates derived from the same contexts supported these radiocarbon assays with an optional date range of A.D. 585 and 690. Our best guess is that this maize dates to the late 500s.

Because so few sites dating to the period between about A.D. 1 and 650 have been investigated anywhere in the MVRV, it is interesting to learn that 12 of the total 16 sites in our database assigned to the Squaw Peak phase period have been found in the LOCAP study area. Just west of the LOCAP area, archaeologists dated wood from the hearth of an early pit structure associated with maize that returned an earlier calibrated radiocarbon date that fell into the A.D. 391–535 range (Logan and Horton 2000). Even more recently, archaeologists excavating a site north of Cottonwood submitted construction materials from a pit structure for radiocarbon analysis and learned that it was built as early as A.D. 260 and as late as A.D. 570 (Deats 2011). Collectively, then, it would appear that the first farmers in the LOCAP area—and perhaps the MVRV as a whole—were cultivating maize by no later than the A.D. 500s. Who they were is unknown, but a reasonable hypothesis might be that they were the indigenous Late Archaic period peoples of the MVRV who acquired maize through contact with outside maize-growing groups. Despite the presence of a clearly introduced domesticate, these early-first-millennium forager-farmers were hunters and gatherers of wild foods first and cultivators of maize and possibly other crops second. They desired the same wild resources, sought out the same range of raw materials for stone tools, used the same lithic technology, and practiced the same burial customs as did their Late Archaic period ancestors and non-farmer neighbors. Because no ceramics have been recovered from these few early pit structures,[24] thermal features, and burials, archaeologists

[23] See Huber (2005) for a summary of sites and dates, including sites with directly dated maize from the Tucson Basin, the eastern Gila River valley, Black Mesa, and the Chinle Valley in Arizona; Carrizo Wash, the St. Andres Mountains, and the Plains of San Agustin in New Mexico; and northwestern Chihuahua, Mexico. Recently, maize-pollen aggregates from Chaco Canyon were dated with AMS radiocarbon methods (Hall 2010) and produced date ranges older than those summarized by Huber (2005).

[24] It is possible that evidence has been produced, but questions remain. Deats (2007) dated a well-preserved rectangular pit structure (Feature 7) at AZ O:5:155 (ASM) with a side entry, a hearth, a deflector, four roof-support postholes, and a variety of floor artifacts, including 174 sherds of various types. Small elements of roof-closing material were dated by radiocarbon methods and returned a 2σ calibrated date range of A.D. 540–680. We think this pit structure likely dates to the Hackberry phase, based on its shape and artifact assemblage. We remain hopeful, however, that plain ware will be found that dates to the Early Formative period.

currently do not have evidence to claim that these Early Formative period people used pottery containers to store or cook foodstuff.

Several of the sites with Early Formative period components described in our updated culture history of the MVRV are located with the LOCAP area. These are the two Long Bow Ranch sites (Weaver et al. 1982); AR-03-04-06-722 (CNF), near Cross Creek Ranch (Logan and Horton 2000); the Crescent Moon Ranch site (Shepard et al. 1998); and the Talon site (Edwards et al. 2004). Two of the SR 89A sites, Sites 105/838 and 85/428, also had components that likely date to the sixth century A.D.

Sites with Early Formative period components (n = 12) (see Figure 69; Table 66) in the LOCAP study area are found in many of the same general locations as Late Archaic period sites, although the Early Formative period sites are somewhat lower and closer to streams. Site elevations range from 1,027 to 1,453 m (3,370–4,766 feet) AMSL, with most located in an elevational zone roughly between 1,100 and 1,220 m (3,600–4,000 feet) AMSL. More than half these sites were along Oak or Spring Creek, with ready access to arable land. Ten of the 12 sites were within semidesert-grassland and conifer-woodland communities that contained agave and other upland plant resources.

Hackberry Phase

The dates for the Hackberry phase are currently being revised by archaeologists working in the MVRV (e.g., Deats 2011; Hall and Elson 2002). Rather than the A.D. 700–800 time period assigned to the earliest locally manufactured plain ware (Verde Brown) by Breternitz (1960a), recent excavations and analyses suggest that the earliest pottery-bearing sites actually date to the A.D. 500s. If future archaeological investigations also reveal the presence of early pottery manufacture in the sixth century, then archeologists need to rethink the various chronological schemes for the early temporal periods used for the MVRV, including our own. Regardless of the calendar dates associated with this early ceramic period, locating and identifying site components representative of this developmental phase is notoriously difficult. Only five sites in the LOCAP area have been assigned to this period in our database, and we are not confident about the phase assignments for any of them.

One intriguing characteristic of the few excavated sites outside the LOCAP area that have been assigned to the Hackberry phase is that domestic structures are shallow, rectangular pit structures (Breternitz 1960a:Figure 10; Deats 2007:Figure 7, 2011:Figures 3.5, 3.7, and 3.9) rather than the shallow, round surface pit structures or surface structures encountered in the Early Formative period Squaw Peak phase (Breternitz 1060a:Figure 17; Deats 2011:3.2) (see Figure 48, Chapter 6, Volume 1 of this report). Just what this signifies is open to question. Some anthropologists and archaeologists associate expediently constructed round houses with populations who move frequently and more substantial rectangular houses with populations who move less frequently. If a greater commitment to farming and food storage and processing in ceramic containers took place in the Hackberry phase, then this change in house form may have been a response to changes in settlement and mobility patterns. It is also possible that the new architectural form came with migrants who moved to the MVRV from regions with different building traditions. Studies of artifact assemblages, technological characteristics, raw-material sources, burial customs, and subsistence resources dating to this time period, along with comparative analyses of house forms and similar materials from adjacent regions, will provide the necessary data to explore this question.

Sites with inferred Hackberry phase components (n = 5) (see Figure 70; Table 66) in the LOCAP study area are frustratingly few. Site elevations range from 1,215 to 1,303 m (3,987–4,735 feet) AMSL, with an average elevation of 1,303 m (4,275 feet) AMSL. Three of the five sites were along Oak and Dry Creeks, and all are in or near land units containing agave and other upland resources.

Cloverleaf Phase

When artifact scatters contain ceramics, particularly decorated pottery types, archaeologists are more successful in assigning phases to these surface deposits. If the scatters are near water sources and alluvium and on landforms that may have accumulated sediments, archaeologists are better able to suggest the probability that buried features may be present. After A.D. 800 or so, with the developments we have assigned to the Cloverleaf and later phases, archaeologists have had greater success in identifying and dating archaeological occupation in the MVRV and the LOCAP area.

It is for the Cloverleaf phase that the upland-lowland dichotomy first described by Colton becomes obvious throughout the MVRV and the LOCAP study area. Multiple household settlements exist near the Verde River and its major tributaries, and generally, smaller dwelling sites, field houses, resource-procurement and processing sites, and other special-use sites are predominantly in the uplands. Only a few sites with Cloverleaf phase components have been excavated and reported in the LOCAP area. The most substantial remains include a pit structure at Lazy Bear No. 1 (James and Black ca. 1974), two pit structures at the Crescent Moon Ranch site (Pilles 1991), a stone-lined hearth that contained charred maize kernels and purslane seeds (Weaver 2000), and several burials (Pilles 1991; Shepard et al. 1998). Neither of the dwelling sites had more than two or three contemporary dwellings (Pilles 1991).

It is also during the Cloverleaf phase, for which we have a much larger sample of sites from throughout the MVRV, that pit structures took one of four forms: round with ramp entries, irregular ovals, and rectangular, with and without floor grooves, like many Hohokam houses-in-pits. The pit structures of the LOCAP area were rectangular without floor grooves. Human burials were inhumations, not cremations.

Material items recovered from excavated contents rarely produce distinctive Hohokam or Hohokam-like items. No evidence of public or integrative architecture, such as ball courts or sites with formal trash middens, has been found within the Oak Creek drainage or the LOCAP area. The closest ball courts thought to date to the Cloverleaf phase are the Tapco and Coons Ranch ball courts along the Verde River north of modern Clarkdale, and they are at least 20 km of straight-line distance from the dwellings along Oak Creek, near Red Rock State Park.

Based on current information, we suggest that the LOCAP area was inhabited by dispersed local populations who farmed and foraged for their livelihood, not so different from their Hackberry phase ancestors. Sites with Cloverleaf phase components in the LOCAP area (n = 20) (see Figure 61; Table 66) range in elevation from 980 m (3,214 feet) AMSL near the Verde River to 1,443 m (4,735 feet) AMSL on uplands closer to Sedona. At least half these sites are near arable land, and almost all are within land units containing agave and other upland resources.

Camp Verde Phase

The distribution of sites with components assigned to the Camp Verde phase is quite similar to that described for the Cloverleaf phase. Currently, more sites with Camp Verde phase occupations have been recognized than with Cloverleaf phase occupations. In comparison to the preceding Cloverleaf phase, Camp Verde phase occupations tend to be located at slightly lower elevations and closer to major streams, where occupants had slightly greater access to lands suitable for irrigation techniques. Nevertheless, the overall pattern in regard to environmental characteristics changed little from previous time periods.

Camp Verde phase dwellings in the LOCAP area are predominantly rectangular with rounded corners and an entry on one of the longer sides. Excavated examples in the LOCAP area include Features 23 and 29 at SR 89A Site 105/838 (see Figures 21 and 34, Chapter 6, Volume 1 of this report), Feature 1 at the Allredge site (Logan et al. 1992), House 1 at the Wood site (Hallock 1984), and Feature 1 at the Volunteer site (Halbirt 1984). Round to oval pit structures, including one with a ramp entryway, also have been found. Houses 2 and 5–7 at the Wood site (Hallock 1984) are examples. As with the Cloverleaf phase, no Hohokam-like houses-in-pits with perimeter floor grooves have been identified in the LOCAP area. Also as with the Cloverleaf phase, no individual site is inferred to have had more than two or three contemporary pit structures.

Although there are a number of Camp Verde phase occupations in the LOCAP area, we do not see one or more site clusters to suggest the existence of a territory-based community prior to the Honanki phase. In contrast, Figure 31, which displays the distribution of sites across the MVRV assigned to the Camp Verde phase, does suggest that small site clusters east of the Verde River, along upland and lowland drainages, may exist. There is a hint of this pattern in Figure 26, which displays the distribution of known Cloverleaf phase sites. No clusters of closely spaced Cloverleaf phase sites are present in the LOCAP area. We infer from this pattern that dispersed Camp Verde phase settlements in the LOCAP area were composed of scattered farmsteads and small hamlets unaffiliated with any particular local community.

Sites with Camp Verde phase components in the LOCAP area (n = 31) (see Figure 62; Table 66) range in elevation from 1,023 to 1,425 m (3,356–4,677 feet) AMSL, with most between 1,067 and 1,372 m (3,500–4,500 feet) AMSL. At least half these sites are near arable land, and almost all are within land units containing agave and other upland resources.

Honanki Phase

Archaeologists and amateurs have had little trouble locating surface pueblos, cliff dwellings, and cavate structures in the MVRV from the time period after the advent of precontact-period masonry construction techniques, particularly when distinctive plain wares, decorated pottery, and more diverse artifact scatters are encountered. More challenging to locate are the less substantial dwellings and burial features that include isolated field houses, farmsteads, and thermal features.

Although the upland-lowland dichotomy in the LOCAP area seems to have carried through into the Honanki phase, the existence of five sites in the LOCAP area along the Verde River and Lower Oak Creek that eventually grew to pueblos of 50+ rooms strongly suggests that something quite different took place in regard to settlement patterns after A.D. 1150 and probably after 1250 (Wilcox and Holmlund 2007; Wilcox et al. 2001b). The five sites thought to be occupied in both the Honanki and Tuzigoot phases[25] are Bridgeport Ruin and Middle Verde Ruin/Talbot Ranch Ruin, along the Verde River, and Big Cornville, Sugarloaf/Otten Pueblo, and Oak Creek Ruin/Atkeson Pueblo, along Oak Creek. Of these five, only Middle Verde Ruin/Talbot Ranch Ruin has been partially excavated and reported, and the work took place many years ago (Barnett 1965; Mearns 1890). Archaeologists have also drawn generalized plan maps for Oak Creek Ruin/Atkeson Pueblo (Mindeleff 1896) and Sugarloaf Pueblo (also known as Otten Pueblo [Pilles 1996a]). None of these other settlements has been excavated or reported. Consequently, the size of the Honanki phase occupation is unknown;

[25] On the basis of inspected pottery recovered from or observed at the site, Wilcox (personal communication, April 2010) suggested that Sugarloaf and Oak Creek Pueblos may date only to the Tuzigoot phase.

ceramics associated with the A.D. 1150–1300 time period constitute the prime evidence of inferred Honanki phase settlement in these settings.

Despite the presence of these larger riverine sites in the lowland below 1,100 m (3,600 feet) AMSL in elevation, most Honanki phase sites in the LOCAP area are in the uplands, at elevations above 1,200 m (4,000 feet) AMSL, but we do not know precisely when they were occupied. Excavations in the Sedona portion of the LOCAP area have produced some of the best recent evidence of small-habitation-site archaeology dating to the Honanki phase. Among them are two small surface pueblos on Cross Creek Ranch (Cross Creek Pueblo [Logan and Horton 2000] and the Talon site [Edwards et al. 2004]) and two masonry field houses near Red Rock State Park (Centruroides House and the Christmas Tree site [Weaver 2000]). An older excavation of a small cliff dwelling (Panorama Ruin [Shutler 1951]) provided an example of another type of site strongly associated with the Honanki phase. Farther south along Oak Creek, near its junction with Spring Creek, was Oak Creek Pueblo, now largely lost to development (Williams 1985).

Sites with Honanki phase components in the LOCAP area (n = 49) (see Figure 63; Table 66) range in elevation from 967 to 1,596 m (3,171–5,237 feet) AMSL. The Honanki phase components of the five large sites were along the perennial drainages, at elevations from 967 to 1,067 m (3,171–3,051 feet) AMSL; the balance of small habitation sites and field houses were located above 1,200 m (3,937 feet) AMSL.

Tuzigoot Phase

As mentioned in earlier sections, the distribution of Tuzigoot phase sites is noticeably different from those of the previous phases. For the first time, there were as many sites in the lowlands as in the uplands, there were fewer sites overall, and there were a small number of village-sized settlements with many rooms. Included within the boundary of our LOCAP area are Bridgeport Ruins and Middle Verde Ruin/Talbot Ranch Ruin, although neither is part of the Lower Oak Creek community. Bridgeport Ruin, with an estimated 200 rooms, was the central site in the site cluster we call the Cottonwood-Clarkdale community. Bridgeport Ruin and its nearest sizable neighbors to the north (Stone House Flat, White House Pueblo, Tuzigoot Extension, Tuzigoot Pueblo, and Hatalacva Pueblo) had access to the largest extent of arable land in the entire Verde River valley. Middle Verde Ruin/Talbot Ranch Ruin contains some 75 rooms distributed between two room blocks on either side of an arroyo, less than 70 m apart. Cavate dwellings across a narrow canyon were likely associated with this dual room-block village. The nearest neighbors to this village are to the east and sites along Lower Beaver Creek and the main stem of the Verde River. This community also had access to many arable soils and was well positioned to utilize gravity-fed canals to irrigation crops.

Between these two communities is the Lower Oak Creek community, with its string of villages stretching from Page Springs/Limestone Ruin (78 rooms together) and Spring Creek Pueblo (41 rooms) on the north to Oak Creek Ruin/Atkeson Pueblo (53 rooms) on the south. Between these extremes are several villages and large hamlets, including Oak Creek Valley Pueblo (20 rooms), Sheepshead Ruin (30 rooms), Big Cornville Ruin (70 rooms), and Sugarloaf/Otten Pueblo (53 rooms).The distance between any two neighbors ranges from 1.5 to 3.2 km—a distance so short that we presume that if they were occupied simultaneously, they were noncompetitive neighbors engaged in community matters. The Lower Oak Creek community was situated to access many hectares of arable land.

Not far from any of these larger settlements were farmsteads and field houses, including a stone-lined, rectangular pit structure (Feature 13) at SR 89A Site 105/838 interpreted as a field house. This unusual structure was only a few-hundred meters west of Spring Creek Pueblo; presumably, it was built and used by residents of that compact pueblo. At least one isolated structure inferred to be a community room is located midway between Spring Creek Pueblo and the Page Springs/Limestone ruin complex, each of which may also have had a community room. The only other village currently inferred to have had a community room was at Oak Creek Ruin/Atkeson Pueblo, at the confluence of Oak Creek and the Verde River.

Some 10 km upstream, a cluster of small sites is distributed along both sides of Oak Creek. Several sites with petroglyph panels attributed to Tuzigoot phase inscribers are within 4 km of this cluster. Beyond this site cluster are a few dispersed habitations and artifact scatters that appear to be IOs. Given the general visibility of sites dating to this time period, it is tempting to affirm Colton's observation that the uplands were largely depopulated during the 1300s.

Sites with Tuzigoot phase components in the LOCAP area (n = 49) (see Figure 64; Table 66) range in elevation from 967 to 1,465 m (3,171–4,806 feet) AMSL. As in the Honanki phase, the larger sites along the Verde River and the lowest reach of Oak Creek were located in or adjacent to riparian zones at elevations ranging from 967 to 1,074 m (3,171–3,524 feet) AMSL. The larger sites along Oak Creek, above its confluence with Spring Creek, were located at 1,192 m (3,911 feet) AMSL (Page Springs/Limestone) and 1,101 m (3,612 feet) AMSL (Spring Creek Pueblo), perhaps indicating the establishment of colonies in the uplands to secure arable land, water, and access to other important upland resources. The cluster of small sites in the vicinity of Sedona is above 1,200 m (3,937 feet) AMSL in elevation and appears to have been tethered to Oak Creek.

Concluding Remarks

In this long and data-rich chapter, we have endeavored to describe the history of precontact-period settlement in the MVRV, as a way to better understand how the sites investigated along the SR 89A transportation corridor may have functioned in a larger environmental and cultural context. We now have a better appreciation of how our 13 small, rural sites fit into a larger human story of regional settlement and land use and how every data recovery investigation can make substantive contributions to a larger narrative. As part of this study, we created a GIS-compatible database and several environmental data layers that can be searched, augmented, and incorporated into future research efforts. We conducted a number of exploratory studies with these data and found a number of interesting patterns and relationships among sites and environmental variables. Some of these little studies confirm previous intuitive understandings; others suggest new questions and research approaches.

In the process of creating a geospatial database, we encountered all the usual problems that any researcher encounters with a complex inventory created over many years. When we could, we worked with the USFS to identify site coordinates, rectify multiple site numbers, distinguish temporal components, and estimate room numbers. The cooperation of the USFS and the volunteers of the VVAS who support their archeological staff was astounding and gratifying. That we could even attempt the studies presented here is a tribute to the effectiveness and detail included in the original site-inventory files. Today, these files have been entered into spreadsheets and databases and are being actively maintained and managed by USFS staff, through their own GIS systems. When we began this process, however, that capability was in the future. At the conclusion of this project, all data-set and ArcGis project files will be shared with the USFS, so that they can incorporate our data into theirs.

However useful these databases and GIS-compatible data layers, they are no substitute for well-documented fieldwork, thoughtful analysis, and comprehensive reports. Too often, reports are hard to find and access. With the recent emphasis on entering all types of archaeological information into tDAR ("the Digital Archaeological Record"), we are hopeful that locating relevant reports and data sets will make the process of comparison and synthesis all the more possible. One of our early problems was not having ready access to often limited distribution reports and unpublished data that would have allowed us to more quickly grasp what we had found.

Perhaps our greatest frustration was that there were so few large sites and special-function sites that had been mapped and excavated using modern techniques and a rigorous program of sampling. Some of these late sites are likely to be multicomponent and possess great potential for refining chronologies and addressing questions regarding community formation, community composition, intraregional and interregional relationships, and economic sustainability. But that is also true for smaller sites with discreet single-period occupations and sites with thermal features that can be can be dated with a variety of new dating techniques. For example, we are excited by recent advances in AMS radiocarbon dating that have recently permitted paleobotanists to successfully date organics as small as pollen aggregates (Hall 2010) and to confirm that maize was present in Chaco Canyon more than 2,000 years ago.

What we have been able to do here is just a beginning, and we hope that future researchers will take what we have prepared and correct entries, add data, and ask questions to better illuminate the fascinating and complex history of north-central Arizona.

CHAPTER 7

Native American Perspectives on Historical-Period Land Use in the Verde River Valley

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Most of the previous chapters in this report have focused on the importance of the Verde River valley to prehistoric populations, with copious evidence provided by archaeological and other scientific data obtained from our project sites. But the valley has *always* been important for Native Americans, and *still* is so—from "time immemorial" to the present. Though not as strong, evidence was gleaned from our project sites that a small number of Ancestral Yavapai traversed, camped, and acquired resources in the project area (see Chapter 6, this volume). It has been long known that the Northeastern Yavapai and the Northern Tonto Apache peoples used the Verde River valley extensively in historical-period times (Goodwin 1942). The tribes generally coexisted as two culturally distinct, but also intermingling and intermarrying, groups in the lands surrounding the river.

The Yavapai consider Montezuma Well in the MVRV to be their origin place, and the red-rock country near Sedona is a sacred place to which they migrated (Khera and Mariella 1983:38; Stein 1981:18). There are several different Yavapai creation or origin stories. For the Southeastern Yavapai, all beings—human and animal—ascended to this world on the first maize plant (Gifford 1932). The hole through which they entered the world is Montezuma Well, one of the most sacred places for the Yavapai, its water carrying a special blessing (Gifford 1932:243; Harrison and Williams 1977:40). The Northeastern Yavapai people emerged from the previous (under)world through a big hole—Montezuma Well—by climbing up a pine tree encircled with wild grapevines (Gifford 1933:349–364). Although their homeland was in the MVRV, Yavapai also feel kinship with the Colorado River Valley, because it was an important place in their (and Yuman) mythology (Hayden 1999). Avikwame or Spirit Mountain, part of the Newberry Mountains in Nevada, is recognized by all Yuman tribes as their origin place. The Gila Mountains—near the confluence of the Colorado and Gila Rivers—is another religious place, because this is where Coyote went after stealing the heart of Kwikumat, the Creator, as he was being cremated.

Like the Yavapai, the Northern Tonto Apache regard Montezuma Well as their origin place. The Oak Creek band ranged along the river and traveled as far north as Flagstaff (Goodwin 1942:Map 1). Both the Yavapai and Apaches regularly traded with the Hopi. Hopi clan-migration stories place Palatkwapi, the Place of the Red Rocks, somewhere in the red-rock country of the region. Fleeing the eventual destruction of Palatkwapi, Hopi peoples traveled northward along the route that Byrkit (1988) called the Palatkwapi Trail. The San Francisco Peaks, so integral to the Hopi sacred landscape, can be seen rising high above the Verde River valley.

The research design for the LOCAP included "Historic Native American use of the study area" as a critical research domain (SRI 1998). Members of the Hopi, Yavapai, and Northern Tonto Apache were invited to contribute their own perspectives on the region. This chapter presents narratives of these peoples' relationships with the Verde River valley, as shared through the voices of three elders: Leigh Kuwanwisiwma (Hopi), David Sine (Yavapai), and Vincent Randall (Tonto Apache). All narratives were submitted to SRI in 2005. Chris Coder (archaeologist for the Yavapai-Apache Nation in Camp Verde) provided an introduction to the Yavapai/Apache narratives.

Sakwaskyavi: The Place of the Blue-Green Valley, the Verde Valley, a Time and Place in Hopi History

The project area is located in the Verde River valley, which lies within the cultural setting of the ancient Sinagua. The Hopi Tribe, through Hopi Tribal Council Resolution H-70-94, formally declared its cultural affinity with various southwestern cultures, including the Salado, Sinagua, Mogollon, and Hohokam. With this in mind, the present part of the chapter offers a Hopi cultural history within the theme of the "emergence" and the migration eras of certain clans. The traditions of these clans are presented in a manner that is respectful of privacy yet substantial enough to contribute to a greater and deeper understanding of the "footprints" of ancestral Hopi people who are called the Hisatsinom, the people of long ago.

Research Approach

The cultural horizon of the Hopi people can best be described as a coalescing of varied and unique clan histories, their life experiences, and even religiosity as they define it. Simply put, there is no "tribal" history until the Hopi villages were established some 1,000 years ago. Even then, the Hopi culture was in evolution. Hence, certain conflicts have arisen among old-school western scholars, a new school of academic critical thinkers, and Hopi people who have challenged non-Hopi versions of "Hopi history." At a very minimum, this new research paradigm has evoked more questions than answers.

Among the factors that have caused this era of critical thought is the fact that many tribes, including the Hopi Tribe among them, have chosen to take the research lead on many projects. This has produced new conclusions and has placed at center stage a new, nontraditional view of many tribal histories. Another factor is that the Hopi Tribe has insisted on research designs that combine ethnographic and archaeological views and consideration of non-tangible elements, such as life philosophies and history in a religious context.

Shaped by traditional western schools, past research has chosen to separate modern indigenous cultures from their past, resulting in a two-dimensional view that does not facilitate a good understanding of cultural continuity. These dimensions of anthropology and ethnography, long treated as two distinct disciplines, have thus contributed to a corpus of information that simply builds on a vast amount of data that do little to guide academia toward a deeper understanding of modern societies and their place and time in history. Acceptance of traditional knowledge, including oral traditions, could clearly provide three-dimensional, living perspectives on current cultures and their relationships to their past.

The present narrative seeks to combine scientific data and information from past and current scholarly work with a perspective that captures intimate insights into Hopi social, religious, and philosophical thinking. It also offers personal emotions—as a Hopi would feel and express them—that convey knowledge gained through many years of interaction with male and female cultural experts.

Let us begin.

Aliksa'i (Hark, Listen!)

Since time immemorial, traditions of the Hopi clans have been transmitted from generation to generation. Indeed, today's Hopi cultural vitality is yet dependent on this transmission of knowledge within 34 living clans and 18 religious societies. Cultural knowledge continues to rely on these memories as contained in a variety of traditional forms, ranging from simple folk stories to specific esoteric information and contained in ritual. As Ferguson and Loma'omvaya (1999:1) have stated:

> The Hopi paradigm of their tribal history entails a long period of migrations during which multiple clans engaged in a complex series of journeys to reach their ultimate destiny on the Hopi Mesas. Hopi as a philosophical approach to life based in humility, agriculture, and commitment to attaining spiritual ideals has existed from time immemorial.

Hopi life is shaped by its human life experience. Expressed in religious teachings, philosophy, prophecy, and actual accounts of places and time, Hopi culture is defined in both spatial context and real events still told in clan traditions, ritual liturgy, songs, and rituals. The Hopi are also defined by how they collectively prepare for a foretold future of all humanity. This is referred to as the "life plan," and it includes every physical and spiritual element that coexists with the Hopi people.

This life journey—from the time of creation to the second, third, and fourth eras of the human experience—has produced a world view that continues to guide the Hopis' perception of who they are, where they came from, and what is yet to happen. Courlander (1971:12 [emphasis added]) described this well:

> These legends at heart are not for entertainment, but to keep alive a sense of human continuity. Though myth is often interwoven with legend, and legend with history, the stories must be reckoned as the

> repository not only of events, but of purpose and attitudes toward life and living things.

Apart from the excavations and conclusions of the anthropologist, the oral tradition is the only instrument we have for penetrating into the Hopi past. But is it is a more revealing instrument in some ways than the archaeologist shovel. For out of the oral tradition we get insights *about values and motivations* that are not visible in potsherds.

Here, we will concentrate on the fourth era (popularly referred to as the "fourth world" of the Hopi).

Palatkwapi . . . The Great Red-Terraced Place of the South

The very name of this fabled village evokes hesitation among contemporary Hopis. Palatkwapi features significantly as a place that was the heart and soul of a great culture. Scholars have debated as to where this village is located or if it even exists. In Hopi traditions, Palatkwapi is real and should not be talked about except in certain settings, such as in ritual ceremonies. General knowledge about this place concludes that it was ultimately destroyed by a great flood from which clans fled.

But Palatkwapi was more than a single place. Properly defined, this village represents a time and an era. Palatkwapi, however, was a distinct central locale from which rule and order emanated. Was Palatkwapi a culmination of various cultural histories? Hopi thinks it is. Was the era of Palatkwapi geographically encompassing? Hopi thinks it was. Was there social dominance by more powerful clans over others? Hopi traditions say there was. Did this mythical city and era ultimately collapse under its own political weight? Traditions say it did.

So how does this place and era relate to the focus of this chapter, which is the Verde Valley, or Sakwaskyavi . . . The Place of the Blue-Green Valley?

Hoopoq'yaqam . . . Those Who are Going to the Northeast

The complexity of Hopi clan histories may never be truly understood in its totality—even by Hopi people themselves. Much has to do with the way clans and religious societies protect their respective knowledge. Privacy and respect for other clan traditions have evolved Hopi into a non-inquiring society. A "need to know" or "right to know" is not a Hopi social or religious standard. Thus, the information shared is selective, and it is a privilege and an honor if an individual gains it.

Palatkwapi eventually collapsed, and many of the clans either fled or settled elsewhere on the landscape. Often described as somewhere "below," or culturally defined as directionally south, Palatkwapi was (and is) the primary context and setting for (and foundation of) contemporary collective Hopi history. For the purpose of this study, it is surmised that the physical location of this place is somewhere in Mesoamerica, perhaps within the great Mayan, Aztec, and Toltec horizons. This is premised on several recent studies by the Hopi Cultural Preservation Office (CPO), which documents, for example, cultural affiliation through common linguistic connections. As a member of the large family of Uto-Aztecan speakers, the Hopi language is spoken by members in the northern reaches of its broad geographic range (Miller 1983:Figure 1)—a range that extends as far south as modern Panama.

Nevertheless, the traditions of Hopi clans who came from the south and from a place called Palatkwapi continue to play an important role in Hopi society.

Current Hopi research into the Salado and Hohokam cultures, undertaken to argue Hopi cultural affiliation under the Native American Graves Protection and Repatriation Act (NAGPRA), clearly presents significant documentation on this question. For example, the traditions associated with the "south" delivered a Hopi term for those clans who settled and lived in the southern areas of Arizona. Many Hopi informants referred to these people as Hopi clans called "Hoopoq'yaqam," translated to mean "those who are still going to the northeast." Northeast is called *hoopoqw* in Hopi. Clearly this term implies Hopi clans still journeying to their final destiny—the Hopi mesas—an area directly northeast from the Hohokam heartland. Could the modern term "Hohokam" (or its Piman-language equivalent) have come from this Hopi word?

Southern Arizona is thus seen as an important place for the Palatkwapi people as they searched for a new way of life. Among the clans that migrated out of Mesoamerica were the Rattlesnake, Bow, Greasewood, Water, Sand, Parrot, Sun, Sun Forehead, Squash, Flute, Agave, and Sparrow Hawk, to name a few.

Traditions talk about the first wave of "emergence" primarily by those clans who were subjected to subservient status. These clans, it is told, were clans who literally fled during the collapse of Palatkwapi and feared capture by ruling clans. Later, the more powerful clans regrouped, and they too began a journey northward. How these clans were defined and are currently regarded with respect to their place and roles in Palatkwapi society are protected in today's Hopi society.

As the clans migrated north, the first groups encountered a great agricultural society. These people were farmers and relied on a simple organizational law of order to govern them. These were people called the "Motisinom . . . The First People." Acknowledging these newcomers, the Motisinom received them with caution. The Motisinom granted these initial Palatkwapi clans areas to reside and farm. Thus renewed, the Palatkwapi clans decide to go farther north so as not to further intrude. This stay helped them understand the values of farming, humility, and environmental stewardship. Indeed, they had been exposed to the Hopi Way of Life—a principle that would later guide them throughout the migration era and to their final spiritual destiny, the Hopi mesas.

The Essence of Sakwaskyavi . . . The Place of the Blue-Green Valley

From the southern Southwest, then, the first groups of clans began their journey toward the northeast. The Parrot Clan chose to travel eastward into what has been defined as the Mimbres cultural area, eventually settling at Aztec National Monument and later at Chaco. Other clans, such as the Bow and Greasewood Clans, took a route that may have taken them through the San Pedro River and valley. These clans stopped in the White Mountain area and later traveled to the San Francisco Peaks. Kinishba Ruins, near White River, Arizona, was established by these clans and is called Ma'opovi . . . The Place of the Snakeweed.

The rest of the clans, including the Sun, Sun Forehead, Eagle, Bear, Bearstrap, Bluebird, and Water, chose to follow the Verde River. They established villages in the Tonto Basin area, near modern Roosevelt Dam and Payson. Later, the Sun, Sun Forehead, and Water Clans separated and migrated into the Chavez Pass and Homol'ovi areas, while the Eagle and Sparrow Hawk Clans traveled to a place called Kwayovi . . . The Place of the Eagle, recorded as the ruin called Casa Malpais, near the town of Springerville, Arizona. The Rattlesnake and Sand Clans took to the west, toward Baja, California, and, much later, went north to the greater Hopi homeland.

The Bear, Bearstrap, and Bluebird Clans decided to travel along the Verde River to a place they called Sakwaskyavi, named for its abundance of turquoise, azurite, malachite, and salt deposits hued blue. The Bearstrap Clan was the first to arrive in this area and established the village of Tawaapavi . . . The Place of the Sun Spring (Montezuma Castle). The village was named after Montezuma Well, Tawapa . . . Sun Spring. Still cautious of other dominant Palatkwapi clans, they built their village high on the cliff wall, for defensive reasons. Indeed, their traditions speak to a siege by an enemy, but they managed to ward them off. The Bluebird Clan was the second to arrive. They established a village called Tsorsovi . . . The Place of the Bluebird (Tuzigoot Ruins). They allied themselves with the Bearstrap people and were responsible for the mining of valued gemstones. Like Tawaapavi, the village was located on a high knoll for security reasons. Some years later, the Bear Clan arrived from the Tonto Basin area and founded the village of Sakwaskyavi in honor of the valley's enormous natural resources, including the river they called Hotsikvayu . . . The Winding River. Sakwaskyavi (the Bridgeport Ruin) is also located on a huge hill on the outskirts of the town of Cottonwood, Arizona, partially on USFS and private lands.

Consolidating their presence, they developed into a highly organized farming community utilizing technologies learned from the Motisinom, particularly irrigation techniques. Maize and varieties of squash were the primary crops. As textile weaving was already an established cultural tradition, the Bearstrap, Bluebird, and Bear Clans grew cotton and became very skilled and greatly recognized for their intricate kilts and blankets. The three clans maintained contact with other clans, especially the Eagle, Sparrow Hawk, Water, Sun, Sun Forehead, and Squash Clans, who by then occupied the Mogollon Rim country. Several routes were used to maintain that contact, including a trail adjacent to Beaver Creek that ran northward to a place called Kwalava . . . The Place of the Boiling Water (hot springs).

Later, another small clan arrived in the valley. They requested acceptance and were assigned lands near the river, with instructions to farm and supply annual harvests. This clan was later known as the Greasy Eye Socket Clan, as they found the carcass of a bear with the eye cavity covered with its fat. They became good farmers, supplying much-needed fall harvests, and earned their right to stay.

With settlements established and trading networks in place, the people began to explore their new lands. They learned about other people (the Sinagua) still to the north, near some great mountains. These mountains were later named Nuvatukya'ovi . . . The Place of the Snow on the Peaks, now known as the San Francisco Peaks, near the city of Flagstaff, Arizona.

It was about that time that another group of people arrived from the northwest. They called themselves the Spider Clan. They came from the western desert lands, near a watershed referred to as Stivokvi'kya . . . The Basin of the Floods. Recent interviews identified this place near Parker, Arizona, which, prior to the construction of Hoover Dam, was prone to summer and winter flooding. In years past, the Spider Clan had met the Rattlesnake Clan at this place. The Snake people had followed Pisisvayu (the Colorado River) from the north to find out where it would lead them.

Arriving in Sakwaskyavi, the Spider people met the Bear, Bluebird, Bearstrap, and Greasy Eye Socket Clans. Surprisingly, the Spider Clan found out that the Bear Clan had a similar flute ceremony. Hoping to gain friendship, the Spider Clan offered to perform their flute ceremony by which a good life would come about. All the clans agreed to witness this event. As the ceremony unfolded, the sky filled with gray clouds, and cool showers fell. This was a good sign. For 16 days, gentle rains visited the parched earth. At the end of the ceremony, the Spider people were asked to remain and become a part of their society. The success of their flute ceremony motivated them to call their ceremony the Gray Flute ceremony. A significant site in the Verde River valley called the Spirit Mountain site may very well be the ancestral home of the Spider Clan.

Drawn to find out where their final destiny was, they began to visit the higher lands of the Colorado Plateau. Indeed, a majestic mountainous landscape greeted them. Scouts also reported that ruling clans from Palatkwapi had arrived down south, and a conflict had developed, driving out the Motisinom. Urgency enveloped the people of Sakwaskyavi.

The Bear Clan was the first to leave. They headed northward to a spring near the present town of Williams. They settled there and named the spring Hoonawpa . . . Bear Springs. A clan shrine is still visited today by Bear Clan members. In visits to the nearby mountain (Bill Williams Mountain) they called Tusaqtsomo . . . The Hill near the Grassy Area, they discovered valuable medicinal plants abundant on the mountain. They called this medicinal plant *hon'ngyapi* . . . bear root medicine plant. This plant is still harvested by Hopis for medicinal and ceremonial use.

The Bearstrap Clan left as well and settled in a place called Wupatupqa . . . The Long Canyon. This place is identified to be Walnut Canyon, currently under the protection of the NPS. The Spider and Bluebird Clans elected to stay back for a while. The Greasy Eye Socket Clan left for a place unknown and were never heard from again. Later, the Spider and Bluebird Clans traveled to the San Francisco Peaks to a place called Pasiw'ovi . . . The Place of Great Deliberations, a ruin called Elden Pueblo on the outskirts of Flagstaff, Arizona. There, they met up with the Bear and Bearstrap Clans again.

These original people of Sakwaskyavi had finally arrived in a place called Tuuwanasavi . . . The Earth's Spiritual Center: the land of Ma'saw (guardian spirit and caretaker of Earth) and the domain of the Katsinam (Kachinas), also known as the Motisinom.

For the Bear, Bearstrap, Bluebird, and Spider Clans, the final journey was just starting. The Hopi mesas were still thousands of footprints away.

Biographic Sketch of Leigh Kuwanwisiwma

Leigh Kuwanwisiwma was born on the Hopi Reservation in 1950. His parents were Marshall and Pauline Jenkins from the village of Bacavi, and Mr. Kuwanwisiwma is a member of the Third Mesa Greasewood Clan. Leigh established and served as director of the CPO of the Hopi Tribe, a position he held for 30 years, retiring in 2017. In this position, he has been instrumental in obtaining grants and contracts for cultural resource work on and off the reservation. His work on Hopi cultural affiliation has set the standards for documentation of affiliation under NAGPRA. Prior to establishing the CPO, he served as assistant director of the Hopi Health Department and as tribal treasurer. He is on the ASM's Native American Advisory Board and has been on the MNA's board. He has lectured on topics including repatriation efforts, intellectual property rights, Hopi cultural landscapes, and cultural conflicts among the Hopi people. He has also been involved in a collaborative project with the School of American Research, the Arizona Poison Control Center, and the ASM to identify methods to remove or neutralize chemical contaminants used by museum conservators on ceremonial materials now being returned to American Indian tribes under NAGPRA. Leigh has published several articles and papers on Hopi culture and recently coedited the book, *Footprints of Hopi History: Hopihiniwtiput Kukveni'at* (Kuwanwisiwma et al. 2018).

Yavapai (Abahjah) and Tonto Apache (Dilzhe'e) Perspectives

Tonto Apache (*Dilzhe'e*[1]) and Yavapai (*Abahjah*[2]) people's relationship to the landscape was intimate and existed on several levels—the practical and physical, the emotional, and, ultimately, the spiritual. All of these facts are, of course, intertwined and interdependent. A large part of all human experience prior to the twentieth century was based on this premise. The separation of people en masse from the landscape, depriving them of daily association with the natural world, is, as we all know, a modern phenomenon.

For the Yavapai-Apache people, in particular, a pinpoint site with a temporary domicile placed upon it was not home. Home encompassed more than where you slept, and there was no permanent address. Home was the entire

1 *Dilzhe'e* (also Dilzhę́'é) is a Western Apache name that may mean "People with High-Pitched Voices," although the exact etymology is unclear. Tonto Apache refer to themselves as Dilzhe'e, as do the San Carlos Apache. The term "Tonto" is considered offensive by some, because of its etymology and meaning in Spanish. Even so, it is still the most widely used term by non-Apache people, including anthropologists. Here, we prefer to use the name Dilzhe'e.

2 Although the Yavapai refer to themselves collectively as Abahjah ("People"), there is no indication that they ever considered themselves to be one politically united group with a single overarching tribal name (Braatz 2003:36–38; Khera and Mariella 1983:47). Instead, the principal social groups with which the Yavapai identify, in addition to their reservations, are the Wipukpaya, Yavepe, Kewevkepaya, and Tolkapaya (Khera and Mariella 1983:38, Figure 1). In the present chapter, we use the name Yavapai instead of the name Abahjah.

landscape you maneuvered on. So, the imposed disconnect between the people and their special landscape had irreversible, negative repercussions on traditional life. This traditional life, which was intact prior to 1870, was disrupted by a war of extermination waged by the federal government, culminating in the removal of most of the Verde Valley Apaches and Yavapais to the concentration camp at San Carlos in 1875.

After 25 years, many of the surviving people and their children returned to the area. The trip was generally made on foot, in small family groups, between 1900 and 1910. When they arrived back in the valley, they found their home(s) occupied or spoken for and new Anglo towns (Camp Verde, Clarkdale, Cottonwood, and Payson) where their camps had been a generation before. Because of these well-known disruptions to the old ways, traditional lifestyles began to fade away incrementally after 1875. By the time World War II ended, most of the old culture was gone, except for memories and the songs, stories, and place names kept alive by individual families.

Over the centuries, traditional life revolved around the complex and well-laid-out relationships between individuals, their families, and clans in conjunction with land. The ground each particular culture perceived as “home” reinforced the connection, which was intimate and pervasive. A lexicon of water sources, seasonal food areas, old family camps, sacred places, and locations of plant medicines and mineral pigments was cultural property specific to each tribe.

Places of geographic and or social significance were named, absorbed, and remembered by families and corporately by the wider culture, thus maintaining important lessons as well as connecting each to the past in a personal way. Passed down over the generations, these stories served as the people’s encyclopedia. This concept of the importance of place in the human experience, particularly the Native American one, was precisely articulated by Western Apache horseman Dudley Patterson’s observation in 1982 that wisdom sits in places, which is the basis for Keith Basso’s (1996) seminal essay titled verbatim from that wonderful quote.

With regard to Dilzhe’e place names, hundreds have survived by word of mouth into our own times. These names are a tangible connection to the distant and often misty past and represent more than a place on a map. Other native communities are not so fortunate and have lost this connection. Once that knowledge is gone, it is not coming back.

The Dilzhe’e and Yavapai people lived with virtually an unseen hand on the surface of the earth, leaving barely a discernable trace to mark their passing. The physical evidence is sparse, subtle, and easily overlooked. When it is encountered, it is often enigmatic or construed as archaic. The Apaches were especially proud of their ability to blend into the landscape—actually being physically and mentally absorbed by it. Hence, they are largely absent from the physical record and remain invisible to the archaeological hand-lens. This is especially true when compared to their more sedentary and materially prominent neighbors, the various prehistoric and contemporary Puebloans. Because of their mobility and perishable lifestyle, they are merely ghosts to western history. Nevertheless, the Apaches have been in the Verde Valley for several centuries, and the Yavapai, under other names, probably for several millennia (just look at a North American language map).

From My Perspective: A Yavapai Oral History

Today, I am an elder among the people known as the Yavapai, or in the Yavapai language, Ah-pai-ja. I was born in Clarkdale, in the Verde Valley. This was in 1921, when a few of our people were still drifting back from the San Carlos Reservation, where they had been interned since 1875. In 1901, my grandmother on my father’s side brought her family back from San Carlos to where they took her from. My mother’s family never left the valley, because my uncles from that side of the family were enlisted as the scouts under General Crook that drove the people to San Carlos.

At the time of my growing up, it looked like we were family oriented, and marrying into the same families, and living in groups. Our Indian camps, as they were called, consisted of wiki-ups and shacks set up among the cactus around Clarkdale, where our people worked in the copper smelter, and around Jerome, by the city dump, where our people worked underground for the Phelps Dodge Corporation. In growing up with my cousins, we all spoke the Yavapai language. Very few of the people knew English or could read. My father only finished second grade, so he understood very little English. My mother could read and speak English because she had gone to a school set up for Indian children at Fort Verde. Growing up for me and the other Indian children was not easy. Our camp was at the greatest distance from the water spigot. We had to carry buckets down to the spigot and then carry them back home.

The oral history of the Yavapai people had its beginning at Montezuma Well, known to our people as the most sacred place on this planet. Human sacrifices were made among our ancestors for our survival, according to my grandmother who lived with us during my learning time. She taught me the songs, rituals, and medicine ways, which are similar to the Apache because we lived with them for 30 years. Camp Verde was called the “salt ground of all the people” by all of the Indians: Yavapai, Apache, Hopi, Supai, and Hualapai.

According to our people, we have spread out into families for our survival. We roamed the vast region within the boundaries set by our warriors, who claimed certain areas for game and gathering of food items. If anyone was found in this area who did not belong there, they were destroyed by raids.

The Yavapai marked their area by surrounding high points. The north boundary was bordered by “Cold Mountain” (in Yavapai), known today as the San Francisco Peaks. All land to the northeast was known as Hopi land. To the west, the boundary extended to Bill Williams Mountain (northeast of this was Supai and Hualapai land); southwest to “Big Mountain” and farther south to Quartzsite, where the Yavapai saw the funny pack animals (camels). Even farther south, along the Colorado River, was Mohae and Cowpah (Mohave and Cocopah) land. Then going east again, the boundary extended to Four Peaks (south of this was considered the “sand people’s” [Pima and Tohono O’odham] land). Southeast of Four Peaks were the Chiricahua and Western Apache lands, and then, circling back north, the boundary extended to the San Francisco Peaks through Fossil Creek, known as “holes in the rocks.”

This we know from the oral history of the elders, and the written record of the Spaniards, who called us the “Viejas,” the old people (meaning we were here long before anyone else), when they came through the “hole in the rocks,” Fossil Creek. The Spaniards noticed the turquoise that the “Viejas” were wearing and knew that there was ore in the region. They then made a claim on the ore. They also thought the Yavapai were already Christianized because a lot of the jewelry was in the shape of a cross.

All three groups of Yavapais claim they come from the Colorado River Valley (Yuman) stock of people. We were all related and spoke the same language. We migrated in this way for the survival of each group. Today we are still intact as in the past generations. The people are known according to the area they are from. For example, the people of the Verde Valley are called “the people beneath the cliffs.” The Prescott band are called the “scrub oak” people, and the Fort McDowell band are called the “wherever they live” people.

According to our oral history, the valley was a trade center for all of the tribes in the area. The Hopi and the Navajo came to trade for turquoise, salt, and skins. They brought their pots and blankets that we needed. The Hualapai and Supai traded their skins and piñons for our squash, corn, etc. The Hopi still come for the holy water of the Montezuma Well, I hear. According to my father-in-law, a Tonto Apache from San Carlos and a graduate of the Carlisle boarding school, the Tontos or the Western Apache roamed the Payson and Long Valley area, around the plateau. Later, they filtered into the area around Fossil Creek, where my mother’s Apache relatives said they were from. The intermarriage between the Yavapai and the Tontos is one reason the U.S. Army thought all of the Indians were Apaches. The raiding and plundering done at that time were done by both tribes.

Two stories come to mind about this time. One, my aunt was taken captive by the Chiricahua Apache during acorn-gathering time and taken into Mexico. She later returned and told the story of the land and the people she was with at that time. The other story, which took place during the saguaro-gathering time, was about a young Yavapai man who was fleeing from some Pimas but stepped on a cholla cactus thorn. When he stopped to get the thorn off of his foot, the Pima captured him and sold him to a white man. The white man took him back east and sent him through his early schooling. Later, this young man educated himself in the white man’s way and became the first medical doctor among our people. Very few of our young people know this story. He returned home to his relatives of the “wherever they live people,” the Fort McDowell Yavapai, because he had tuberculosis. He was known as the “fighter for Indian rights” in his time. He was Wassaja, Dr. Carlos Montezuma, a Yavapai Indian. Carlos Montezuma saw reservations as prisons. He believed that the Bureau of Indian Affairs (BIA) should be abolished, that Indians should unite, and that they should obtain the best possible education in order to be self-sufficient. One of his most outstanding accomplishments is the obtaining of water rights for all of the Indians of Arizona. To me, this is the legacy we should follow. If one of our members could do it, any member can do it.

Most of what I have written here comes from my grandmother and was told to me before I left to serve in World War II.

Biographic Sketch of David Sine

David W. (Whirlwind) Sine (1921–2008) was an elder of the Yavapai-Apache Nation, a decorated combat veteran of World War II, a renowned artist, an Arizona Living Treasure, and a grandfather. Mr. Sine was born in 1921 in the upper Verde River valley and spent his first several years with his father and mother (Arthur and Mary-Quail Sine), sister, and paternal grandmother (Sally), living in a wickiup in the old style. Mr. Sine says his grandmother was his “trainer” and taught him what he needed to know about the old ways and how to live right. He went off to boarding school in Phoenix around 1930 and rarely came home after that. On one visit, his grandmother told him he needed to get out and see the world, that there was no future in the Verde River valley. So at 16, he joined the U.S. Army. During the Depression, that was one way “Indian fellows” could get ahead and “see the world.” After initial training at Fort Sill and in Texas, he was shipped off to Panama. During 1941, the U.S. government was anticipating war in the Pacific. So, Mr. Sine’s unit was separated out into a regimental combat team specializing in jungle warfare. Known as the Bushmasters, they attained a real reputation as shock troops in the reconquest of New Guinea and, later, the bloody invasion of the Philippines. He commented that “you had to be real sharp all the time

. . . you couldn't see anything. Everything was green and we dressed like the jungle. Those guys (the Japanese) would never give up. You had to dig them out. . . ." When the war finally ended, David was honorably discharged and found himself back in Clarkdale at the age of 25. He took 2 years of college business classes and got a job as a financial advisor to tribal governments with the BIA. He raised seven children, three of whom graduated from the Santa Fe School of Art.

To Be a Dilzhe'e (Tonto Apache)

Our people came to cultural consciousness in the Verde Valley. Montezuma Well is our place of origin in this world. When the initial blow to our way of life came in the 1870s, there were several (at least eight) clans of our people living between Payson and the Upper Verde Valley. These people were the western spearhead of a greater tribe known to white society as the Tonto Apache, which extended southward to Globe and eastward toward the White Mountains. Our ancestors produced goods which were mostly perishable. Items and tools were created from wood, bone, hides, plant fibers, hair, fur, bone, and sinew that melt away with time, leaving a few stone tools, rare sherds of Apache pottery, and a few thought-provoking Holy panels on the rock faces. Yet, despite the passing of most of our old lifestyle, we remain rooted in the Verde Valley. We remember the old names and keep many of the old stories alive. In our hearts, we consider the old lands still as Dilzhe'e land. This concept of knowledge extracts lessons from the landscape, personalizes the information, and perpetuates it over time and is explained by my good friend, Keith Basso, in his essay on Western Apache people titled, *Wisdom Sits in Places* (Basso 1996). This story outlines the way we feel about the importance of a place and why we remain connected to the land that others now call theirs.

In the Apache way, our clan structure is very important to us. It is the warp of our cultural fabric. I was born to the Yu'ane' Clan, which means the "Over the Rim People," who ranged along the Mogollon Rim from Showlow to Ashfork. I was born in the Kai'che'hi tiidn Clan, which means "Willows Growing Out of the Rocks People." Some of the clans within the Upper Verde are Yaa Go Hi Gain ("White Earth or White Rocks Coming Down People"), Tu do Tlis Ze'n (Blue Water People from Fossil Creek), Che'Hi'Chii Yen (Red Rock People around Sedona), and others from Mormon Lake, East Clear Creek, and the Perkinsville area, not to mention the Payson area.

Today, most of the old skills have been replaced with conveniences and Euroamerican ideas, but we still keep much of the knowledge inside of us. Many of the old songs we still know, and the old stories are still told—mostly as lessons that often translate poorly into modern times but still recall our history and reinforce our responsibility to keep the flame of culture alive. We still conduct the *Na I Es* or Sunrise Ceremony, celebrating a girl's transition to womanhood. We are presently documenting the old place names and traditional plants so future generations will have the knowledge. We are giving language classes to the children so they will be familiar with the plants, animals, and seasons in the old way. Being an Apache is not so much wrapped up in the way you look or dress but, more importantly, in how you think and the respect you keep in your heart for the land and those around you.

We were world-class hunters and basket makers. We moved freely, without fear or restriction, on the land, and we were proud of not leaving a trace. We did this out of respect for the earth and also out of a practical need, so our enemies would not know where we had been or how few of us there really were. Today, we are an amalgamation of two distinct peoples who survived the conquests and genocide of the nineteenth century in the Upper Verde Valley, namely my ancestors the Dilzhe'e (Tonto Apaches) and the Northeastern Yavapai People. Today, we live on less than 700 acres on several parcels in Middle Verde, Camp Verde, Clarkdale, and Rimrock. There are less than 2,000 Yavapai-Apache people, but we have survived the trials of the last two centuries and intend to remain a transformed but viable culture in the valley where our ancestors chose to live.

Biographic Sketch of Vincent Randall

Vincent Randall was born on March 29, 1940. He grew up in the Verde River valley and was taught by his mother and grandmother what it meant to be Apache and the old stories and songs. Mr. Randall speaks fluent Apache. He has traveled widely and has been interested in culture, history, and politics for as long as he can remember. He graduated from Arizona State Teachers' College (now Northern Arizona University) and was a teacher in the Clarkdale school district for 28 years (from 1963 to 1992). He coached his boys' basketball teams to five state wins and a girls' basketball team to a Division 2 Final Four. A lifelong Clarkdale resident, he lives there with his family today. Mr. Randall is currently director of the Apache Cultural Center and formerly chair of the Yavapai-Apache Nation. He remains a staunch advocate of Apache culture.

CHAPTER 8

Summary and Conclusions

Rein Vanderpot

This final chapter recaps the project results, highlighting the most obvious contributions to MVRV archaeology. The research design guiding the project is revisited, identifying the elements of the original research domains that were most adequately addressed by the investigations. Within the project's overarching research theme, the identification of cultural landscapes, we delineated three basic research domains: land-use practices, early agriculture, and Native American history (SRI 1998). Interwoven with these was a fourth domain, archaeology of mobile forager-farmers, which sought to discover solutions to the methodological and interpretive challenges presented by small sites, such as those of the project area, used for limited farming, resource procurement, and other specific purposes. In the following sections, the project's accomplishments are viewed through the lens of these research domains.

Settlement and Subsistence

The project corridor provides an environmental transect through the northern middle Verde River region, from Cottonwood to Sedona and from semidesert grasslands at the lower elevations to conifer woodland in the upper portions. Nearby drainages—Spring, Dry, Oak, and Coffee Creeks—host a variety of riparian plants and animals and would have provided people with all the water they needed, not just for drinking and cooking but, in a few places, also for farming. Pockets of arable land were available in selected areas—in particular, along Spring Creek, where AZ O:105/AR-03-04-06-838 (ASM/CNF) and AZ O:85/AR-03-04-06-428 (ASM/CNF) (Sites 105/838 and 85/428, respectively) were excavated. Overall, the project promised an excellent opportunity to study changes and consistency in settlement and land use in this environmental cross section over a long interval of human occupation.

SRI's (1998) research questions about land use focused on (1) subsistence practices, (2) farming technologies, (3) resources used, (4) degree of dependence on cultivated plant foods, (5) seasonality, (6) sedentism vs. mobility, (7) sustainability of the different land-use strategies, and (8) major climatic events and their effects on prehistoric people. To see how far the project has been able to address these questions, we start with a brief review of the project sites and features—in particular, the habitation structures and food-processing facilities—the primary contexts for our subsistence data.

Project Sites

SRI investigated 13 sites, together consisting of nearly 30 temporal components (Table 68). Seven sites—AZ O:28/AR-03-04-06-903 (ASM/CNF) (Site 28/903), AZ O:31/AR-03-04-06-244 (ASM/CNF) (Site 31/244), Site 105/838, AZ O:131/AR-03-04-06-37 (ASM/CNF) (Site 131/37), AZ O:135/AR-03-04-06-186 (ASM/CNF) (Site 135/186), AZ O:136/AR-03-04-06-663 (ASM/CNF) (Site 136/663), and AZ O:137/AR-03-04-06-482 (ASM/CNF) (Site 137/482)—represent either Archaic (ca. 6500 B.C.–A.D. 1) or Formative (ca. A.D. 1–1400/1425) period occupations. Three of these seven sites (Sites 105/838, 131/37, and 136/663) were used only during the Formative period. Six sites—AZ O:53/AR-03-04-06-745 (ASM/CNF) (Site 53/745), AZ O:77/AR-03-04-06-869 (ASM/CNF) (Site 77/869), Site 85/428, AZ O:104/AR-03-04-06-902 (ASM/CNF) (Site 104/902), AZ O:133/AR-03-04-06-561 (ASM/CNF) (Site 133/561), and AZ O:134/AR-03-04-06-189 (ASM/CNF) (Site 134/189)—had multiple components, each including Archaic and Formative

Table 68. Site Components, by Time Period and Culture

Period/Phase/Culture	Site Nos.	No. of Components
Middle Archaic	85/428, 31/244, 133/561, 134/189	4
Middle Archaic?	77/869, 137/482	2
Late Archaic	77/869, 53/745, 28/903, 31/244, 133/561, 134/189, 135/186	7
Archaic, unassigned	104/902	1
Early Formative (Squaw Peak phase)	105/838, 85/428	2
Formative (Sinagua, Camp Verde phase)	105/838, 131/37, 53/745	3
Formative (Hohokam, Sacaton phase?)	53/745	1
Formative (Sinagua, Honanki/Tuzigoot phase)	105/838 (Locus B)	1
Formative, unassigned	104/902, 77/869, 131/37, 133/561, 134/189, 136/663	6
Protohistoric (Yavapai?)	53/745, 133/561	2
Total no. of components		29

period occupations. Sites 53/745 and 133/561 each also had a protohistoric (ca. A.D. 1400/1425–1600) component. Sites 105/838 and 85/428 each included a Squaw Peak phase (or Early Formative period, ca. A.D. 1–650) component. The Southern Sinagua of the Camp Verde (A.D. 900–1150), Honanki (A.D. 1150–1300), and Tuzigoot (A.D. 1300–1400/1425) phases represented the Middle and Late Formative periods. Site 53/745 yielded sparse but firm evidence (ceramics and projectile points) of Hohokam use, probably during the Sacaton phase (A.D. 900–1100), when the Camp Verde phase Sinagua were also in the site area. We found no evidence of use by Paleoindians or Southern Sinagua people of the Hackberry or Cloverleaf phases. The various site components functioned as resource-procurement and processing locales, short-term encampments, and farmsteads or field houses.

The sites were parts of several different local settlement systems. At the southern end of the project area, Sites 105/838 and 85/428 were located side by side, immediately along—but on opposite sides of—Spring Creek (a tributary to Oak Creek), with arable land nearby. A series of springs just south of the two sites undoubtedly added to the attraction of the location. Multilocus Site 105/838 functioned as a farmstead as early as the Squaw Peak phase and was the only site with substantial architecture—pit structures from the Early and Middle Formative periods and masonry houses from the Late Formative period. Site 85/428 included a poorly defined Middle Archaic period hunting and animal-processing camp, but its main component was a food-processing camp focused on a Squaw Peak phase roasting area close to the creek bed. Together, the two adjoining Squaw Peak phase components formed a discrete, small settlement of early agriculturalists.

Although some ceramics from the time period between A.D. 650 and 900 (the Hackberry and Cloverleaf phases) were found at Site 105/838, no features were dated to this time, suggesting that the site was not occupied or was only sparsely occupied then. Site 105/838 may have reached its greatest extent during the Camp Verde phase, as suggested by ceramic evidence and the presence of two pit structures with associated extramural features in Locus A. If additional houses dating to this period were present, they were destroyed by the construction of SR 89A. Finally, during the Honanki and/or Tuzigoot phase, small masonry rooms were built on the Locus B hill, in Locus C (not-excavated Feature 20), and throughout the surrounding Spring Creek area, including at Site 104/902. Clearly tethered to Spring Creek Pueblo, some of these rooms served as field houses; others—given the investment in construction efforts evident in Feature 13 as well as the considerable density of artifacts, including projectile points—accommodated individual households. The Honanki/Tuzigoot phase inhabitants of the site were also responsible for a broad midden (Feature 27) in Locus A, overlying abandoned Features 23 and 29, as well as several thermal-pit features—in particular, Features 30 and 39—intrusive in the fill of Features23 and 29, indicating that this locus served as a kitchen area for people living upslope. Only a few of the Locus B features were excavated, and it is possible that additional structures remain buried in the area.

During the Tuzigoot phase, the focus of the Spring Creek settlement system was a large habitation site located near the springs: Spring Creek Pueblo (NA26019), a 41-room Tuzigoot phase pueblo on private land that has been mapped but not excavated (Erhardt 2008). Sites 104/902 and 105/838 were located 0.3 and 0.7 km, respectively, from this pueblo. Site 104/902 was less than 0.8 km southwest of Site 105/838 and included a Late Formative period field house that was likely also tethered to Spring Creek Pueblo. The field house was located outside the ROW and was not excavated. The only feature excavated at this site was a single rock cluster of unknown function (Feature 2).

Most of the project's excavation efforts were expended on Site 105/838, where SRI excavated three pit structures (Features 23, 29, and 37), eight thermal features (Features 21, 26, 30, 31, and 38–41) and the midden

(Feature 27) in Locus A, as well as two masonry structures (Features 13 and 15) and two rock clusters (Features 3 and 9) in Locus B. At Site 85/428, three thermal features (Features 2–4) were excavated.

In this southern portion of the project area, we also investigated Sites 77/869, 131/37, and 53/745, each between 1 and 2 km from Spring Creek, representing more dispersed settlement. Of these, Site 53/745 was the most complex and the largest by far, representing a long-lived and multiethnic (Archaic period, Hohokam, Sinagua, and protohistoric period) hunting/foraging/farming camp. Intriguingly, the site included a series of possible wickiup clearings with associated Orme Ranch Plain ceramic sherds, suggesting use by Yavapai groups. SRI excavated no features at the site, but volunteer efforts under the auspices of CNF resulted in the excavation/testing of nine features outside the ADOT ROW: three possible wickiups (Features 8, 14, and 17), a slab-lined pit possibly used for storage (Feature 15), a rock pile of unknown function (Feature 16), a rock wall possibly serving an agricultural function (Feature 18), a hearth or small roasting pit (Feature 19), and two masonry rooms (Features 20 and 21).

No features were excavated at the other two sites. Site 77/869 contained two temporally discrete prehistoric components. The first was an Archaic period hunting—and perhaps plant-collection—camp. The second component was more substantial and functioned as a plant-procurement and processing camp as well as a lithic-procurement and tool-manufacturing locale. Site 131/37 had two distinct functional components. Locus A was a small food-processing and hunting camp. The presence of a mano of the type used with a trough metate suggested that maize was one of the foods being processed. Locus B was a basalt-procurement area used for the manufacture of grinding implements.

In the northern half of the project area, sites were located along or near Dry Creek (Sites 28/903, 31/244, 134/189, 133/561, and 135/186) or at higher elevations farther away from the creek (Sites 136/663 and 137/482). These sites functioned as food-processing and/or hunting camps dating to the Archaic period (Sites 28/903, 31/244, 134/189, 135/186, 133/561 Locus A, and 137/482), the Formative period (Sites 134/189 and 136/663), and the protohistoric period (Site 133/561 Locus C). Site 134/189 contained a Late Formative period field-house locale focusing on wild-plant procurement; it was outside the ROW and remained unexcavated. Overall, most of the prehistoric activities in this upland zone appear to have occurred during the Late Archaic period. Late Archaic period Site 135/186 likely was contemporaneous with the nearby Dry Creek site (located on the opposite bank of Dry Creek), suggesting use by the same people. The Dry Creek site—a flaked stone and ground stone scatter with two excavated thermal features—is the type site for the Dry Creek phase (i.e., the Late Archaic period) in the MVRV (Shutler 1951; Shutler and Adams ca. 1949) and likely dates to ca. 2000–1500 B.C. (see Appendix C). The site was interpreted as a short-term encampment used primarily to procure and process plant foods and manufacture stone tools. The only feature excavated at the project area's northern sites consisted of a Late Archaic period slab-lined roasting pit and an associated activity area at Site 28/903. Unfortunately, none of the feature's three flotation samples submitted for analysis yielded preserved plant remains.

Structures

Five of the structures identified during the project were excavated, all at Site 105/838 (Table 69): Features 13, 15, 23, 29, and 37. Feature 37 dated to the Squaw Peak phase, Features 23 and 29 dated to the Camp Verde phase, and Features 13 and 15 dated to the Honanki and/or Tuzigoot phase. Features 13 and 15—located outside the ADOT ROW, in Locus B—were excavated by volunteers under SRI supervision. Except for Feature 15, all structures had rich archaeobotanical records. Radiocarbon and/or archaeomagnetic (AM) dates were obtained for Features 23, 29, and 37. The five structures are reviewed here in chronological order, along with their temporal correlates elsewhere in the MVRV.

Table 69. Structures Excavated at Site 105/838

Feature No., by Locus	Type	Shape	Size (m)	Comments	Age (Temporal Phase)
A					
23	pit structure	rectangular	5.5 × 4.5	east-facing entrance with slab	Camp Verde
29	pit structure	oval	6.0 × 3.4	east-facing entrance	Camp Verde
37	pit structure	round	6.0 × 6.0	no entrance found	Squaw Peak
B					
13	masonry structure	rectangular	4.3 × 3.4	built within a larger pit; stepped, west-facing entrance	Honanki/Tuzigoot
15	masonry structure	U shaped	3.5 × 3.0	open end faces east; pole-and-brush lean-to	Honanki/Tuzigoot

Squaw Peak Phase

Feature 37 was roughly circular, with fairly well-defined walls that sloped inward. No entrance or formal hearths were found. Floor features included two thermal pits and a small number of postholes. The floor contained a relatively large number of ground stone artifacts and a flaked stone assemblage reminiscent of the Late Archaic period, and it lacked ceramics. The presence of the thermal features, the ground stone on the floor, and a wealth of charred reproductive plant parts on the floor and in the thermal pits suggested that the structure functioned not just as a dwelling but also as a kitchen area. Importantly, a charred maize kernel collected from the floor yielded a 2σ calibrated date range of A.D. 410–600. Moreover, an AM sample also collected from the floor returned an optional date range of A.D. 585–690, with a best-fit date of A.D. 600. As if that were not enough, a maize sample *and* an AM sample from roasting-pit Feature 2 at neighboring Site 85/428 returned the exact same dates (see below). This is the earliest *directly* dated maize in the MVRV and the earliest evidence of agriculture in the region.

Five, or possibly six, other dwellings assigned to the Squaw Peak phase have been excavated in the MVRV (see Chapter 6 of this volume): House 4 at NA4616C, on the Montezuma Well property (Breternitz 1960a); House 1C at the Calkins Ranch site (NA2385) (Breternitz 1960a); Feature 2 at AR-03-04-06-294 (CNF), in Jack's Canyon (Logan and Horton 1996); Features 22 and 28 at the Gray Fox Ridge site (AZ N:4:110 [ASM]) (Deats 2011); and possibly Feature 7 at AZ O:5:155 (ASM) (Deats 2007). Where known, houses were round or oval, had informal hearths (firepits) and postholes, and, in most cases, one or more other kinds of floor pits.

Camp Verde Phase

Feature 29 was an oval pit structure with an east-facing entrance, two formal hearths, three floor pits, a series of intramural postholes, and two extramural postholes. Based on AM samples taken from the two hearths, occupation was in about A.D. 1000–1025, which was supported by the temporally diagnostic ceramics found on the floor. Feature 23 was a relatively well-preserved pit structure, rectangular in plan view, with squarish corners, vertical walls, and patches of plaster on the floor. Floor features included a plastered hearth overlying an earlier, unplastered hearth; two less-formal firepits; two central postholes surrounded by a fairly formal pattern of intramural and extramural postholes; and six large pits (some of which were bell shaped) that were apparently designed for storage but were used for trash disposal at the time the house was abandoned. A large, upright stone slab in the east wall of the structure served as an entrance-step support. Except for a break in the wall and the presence of this slab, no actual entrance was found. Two AM samples, two radiocarbon samples, and two restorable ceramic vessels suggested occupation between A.D. 1025 and 1050, slightly later than the proposed date for Feature 29.

Camp Verde phase pit structures have been excavated at 15 or more other sites (see Chapter 6 of this volume). None of these sites had more than three Camp Verde phase pit structures, with one or two the norm. The most common house form was rectangular with rounded corners and an entry on one of the longer sides. All had internal hearths and postholes (often indicating a gabled-roof system of centerline posts), and some had one or more interior storage pits. Some of these were houses in pits with floor grooves and perimeter posts in both the main chamber and the entryway, much like those built by the Hohokam. Others lacked floor grooves—like our Feature 29—or, less often, had stone-slab thresholds at the entryways like our Feature 23 (e.g., Feature 1 at the Allredge site [Logan et al. 1992] and Pit House 1 at the Wood site [Hallock 1984]).

Honanki/Tuzigoot Phase

Feature 13 was a rectangular, rock-lined room built within a nearly 1-m-deep, larger pit with sloping walls. This pit may have been a preexisting subterranean structure, or it was excavated for the sole purpose of containing the masonry room, which was built on a slight slope. The walls consisted of 8–10 courses of stones, most of which were basalt cobbles and slabs apparently selected for size and shape. The east and west walls sloped down slightly and had well-faced masonry, with many of the stones selected for their tabular shape. The north and south walls were perfectly vertical, with the masonry not well faced and the stones more rounded. A section of the wall adjacent to the southwest corner had a 1-by-1-m, stepped exterior entrance. At the lower section of the western end of the north wall, a 0.5-by-0.5-m portion remained unlined and was hollowed out to form a niche. Two floor pits were identified: one was a shallow, oxidized pit with ash and charcoal fill, and the other was a nonoxidized pit that perhaps served to contain clean-out materials from the first pit. Ceramics and projectile points placed Feature 13 in the Honanki and/or Tuzigoot phase. The considerable effort expended on building it, the numerous associated artifacts, and the great plant-species ubiquity and variability in the collected flotation samples suggested that it served as the dwelling for an entire household rather than as a field house.

Feature 15 was a masonry structure with post-enforced walls that was about 0.3 m deep. The eastern end of the feature was open, lending it a U shape. The structure's open-ended shape, low masonry walls, and post reinforcement were suggestive of a pole-and-brush lean-to rather than a masonry room. The paucity of immediately associated artifacts, including a dearth of ceramics, suggested that the structure was not used intensively, likely serving as an ephemeral field house, windbreak, or storage structure. Its location in the predominantly Honanki/Tuzigoot phase Locus B suggested that it dated to the same time.

Excavated individual rooms dating to this time period—such as Feature 13—are rare, with only a handful of examples known (see Appendix C). Deep, masonry-lined pit structures like Feature 13 are common in the Flagstaff area, appearing by about A.D. 1100 (Colton 1946:270–271), but few are known in the MVRV. As to shape, size, and overall construction, Feature 13 most closely resembled a Tuzigoot phase masonry-lined pit structure at AZ O:5:21 (ASM), only a few kilometers to the south (Graff 1990:72). This Tuzigoot phase room similarly had a stepped entrance, a firepit, and an associated trash pit, as well as a wall niche. To a lesser degree, Feature 13 resembled a Honanki phase stone-lined pit structure at the Christmas Tree site (AZ O:1:34 [ASM]) (Weaver 2000).

Food Processing

What can the project features tell us about local food processing? Can feature morphology be linked to specific plant foods? There is a considerable body of ethnographic and ethnobotanical literature describing plant use by Southwest hunter-gatherers and groups that practice limited agriculture (such as those passing through or living in the project area). From these studies, we can get an idea of what kinds of archaeological features may have been left behind as a result of plant processing. Some of the sources relevant to the current project include Hodgson (2001) for the Sonoran Desert; Castetter (1935) for the general Southwest; Castetter et al. (1938) for agave; Castetter and Bell (1942) for general O'odham; Castetter and Underhill (1935) and Austin (2010) for the Tohono O'odham; Rea (1997) and Russell (1908) for the Akimel O'odham; Nabhan et al. (1989) for the Hia C'ed O'odham; Gifford (1932, 1936) for the Yavapai; Kroeber (1935) and Watahomigie et al. (1982) for the Hualapai; Bailey (1940), Elmore (1944), Steggerda and Eckardt (1941), Vestal (1952), and Wyman and Harris (1951) for the Navajo; Colton (1974), Nequatewa (1954), and Whiting (1966) for the Hopi; Stevenson (1915) for the Zuni; Buskirk (1986), Castetter and Opler (1936), Gallagher (1977), and Reagan (1929) for the Apache; Gifford (1933), Kelly (1977), and Álvarez de Williams (1983) for the Cocopah; and Forde (1931) and Spier (1933) for the Maricopa. There are many other important studies not mentioned here. Casting this wide net of ethnographic and ethnobotanical sources, one is struck by the fact that most plant processing included use of fire and that the associated thermal features are critical to its study. Vanderpot (2017a, 2017b) has provided exhaustive ethnoarchaeological overviews of the various plant-processing steps and the resulting thermal and other features, and the reader is referred to those studies for more detail. Below, we look at the project features and then examine the plants and processing methods.

Features

Fifteen extramural features excavated in the project area were classified as food-processing features (Table 70). Fourteen of these (at Sites 105/838, 85/428, and 28/903) were fully or partially excavated; the fifteenth (at Site 133/561) was only sampled for dating purposes. The features dated to the Late Archaic period (n = 1), the Squaw Peak phase (n = 4), the Camp Verde phase (n = 5), the Honanki/Tuzigoot phase (n = 4), and the protohistoric/historical period (n = 1). Radiocarbon and/or AM dates were obtained from Feature 2 at Site 85/428 and Feature 1 at Site 133/561. Most features contained thermal materials (e.g., charcoal, ashes, or FCR) in their fill. As to type, they consisted of 3 thermal pits, 2 roasting areas, 2 rock-lined nonthermal pits, 2 paved surfaces, 1 nonthermal pit, 1 rock-ringed thermal pit, 1 rock-ringed nonthermal pit, 1 rock-lined thermal pit, 1 ash-filled nonthermal pit, and 1 horno. Seven of the features had oxidized walls, and only because of these are we certain that they had a true thermal function (fires were built in them to provide heat, charcoal, or ashes for food-processing purposes). Features without oxidization were classified as "nonthermal," even if thermal materials were present in the fill. As to the richness of preserved paleobotanical samples, 4 features stood out: Features 21 (a rock-lined thermal pit), 39 (a thermal pit), and 41 (a roasting area) at Site 105/838 and Feature 2 (a roasting area) at Site 85/428. The flotation samples collected from Features 3 and 31 at Site 105/838, Feature 4 at Site 85/428, and Feature 1 at Site 28/903 contained no reproductive parts. No samples were submitted from Features 9, 30, and 38 at Site 105/838, Features 1 and 3 at Site 85/428, or Feature 1 at Site 133/561.

Five intramural floor features at Site 105/838 also were classified as cooking facilities (see Table 70). These consisted of a trivet (Subfeature 1) in Feature 23, two thermal pits (Subfeatures 1 and 5) in Feature 37, and a thermal pit (Subfeature 1) and a nonthermal ash-/charcoal-filled pit (Subfeature 2) in Feature 13 (Locus B). All these subfeatures were small (less than 0.65 m in maximum diameter). The trivet consisted of three large cobbles placed in a circle on the house floor, with charcoal and oxidized soil forming a mound between them. The floor features had varied archaeobotanical records. The formal hearths in Features 23 and 29 might be classified as cooking features as well, although they also had other functions, such as providing light and heat.

The following paragraphs provide suggestions—as based on ethnographic evidence summarized below—regarding how some of these features may have functioned.

Roasting Areas

The two Squaw Peak phase roasting areas were located close to each other at adjoining sites, separated only by Spring Creek. Although we termed them "roasting areas," they likely served multiple cooking functions, such

Table 70. Food-Processing Features Excavated or Sampled in the Project Area

Feature No, by Site No.	Feature Type	Size[a]	Oxidized?	Age
		Extramural		
105/838 (Locus A)				
21	rock-lined thermal pit	medium-sized	yes	Camp Verde phase
26	thermal pit	small	yes	Camp Verde phase
30	ash-filled nonthermal pit	small	no	Camp Verde phase
31	rock-lined nonthermal pit	medium-sized	no	Camp Verde phase
38	nonthermal pit	small	no	Honanki/Tuzigoot phase
39	thermal pit	small	yes	Honanki/Tuzigoot phase
40	thermal pit	large	yes	Camp Verde phase
41	roasting area	large	yes	Squaw Peak phase
105/838 (Locus B)				
3	paved surface	large	no	Honanki/Tuzigoot phase
9	paved surface	large	no	Honanki/Tuzigoot phase
85/428				
1	rock-ringed nonthermal pit	large	no	Squaw Peak phase
2	roasting area	large	yes	Squaw Peak phase
4	rock-ringed thermal pit	large	yes	Squaw Peak phase
28/903				
1	rock-lined nonthermal pit	medium-sized	no	Late Archaic period
133/561 (Locus B)				
1[b]	*horno*	large	yes	protohistoric/historical period
		Intramural		
105/838 (Locus A)				
23, Subfeature 1	trivet	small	yes	Camp Verde phase
37, Subfeature 1	thermal pit	small	yes	Squaw Peak phase
37, Subfeature 5	thermal pit	small	yes	Squaw Peak phase
105/838 (Locus B)				
13, Subfeature 1	thermal pit	small	yes	Honanki/Tuzigoot phase
13, Subfeature 2	ash-/charcoal-filled nonthermal pit	small	no	Honanki/Tuzigoot phase

[a] Size classes: small < 0.65 m; medium-sized = 0.65–1.15 m; large > 1.15 m.
[b] This feature was not excavated, only sampled.

as roasting, baking, parching, and boiling (with the aid of hot stones). They provided an interesting window into the workings of kitchen areas used by early agriculturalists. Both features were similar, in that each consisted of multiple processing pits built on top of or alongside each other, and each was used intensively, likely over a long time. Feature 41 at Site 105/838 was intrusive into (but used not much later than) Squaw Peak phase pit-structure Feature 37, which first served a domestic function before being used as a kitchen area. The better preserved of the two roasting areas was Feature 2 at Site 85/428, which was a deep, multiple-episode, and probably long-term feature. It was used for plant processing but also for cooking game, given the presence of bones of deer and rabbit-/rodent-sized mammals. It included two discrete shallow pits at its bottom, each with a tight, single-layer rock cluster on its bottom (see Figure 79, Chapter 7, Volume 1 of this report). Abundant ground stone was found with both roasting areas, suggesting that the grinding of seeds and other plant materials was an important associated activity. Feature 41 had a rich macrobotanical record including maize, little barley, and a variety of small-seed-producing plants. Together with Feature 37 (see above), Feature 41 yielded the earliest-dated maize in the MVRV (A.D. 410–600).

Rock-Lined Pits and Paved Surfaces

Rock-lined pits and paved surfaces are common in the project area. Five extramural examples—Features 3, 9, 21, and 31 at Site 105/838 and Feature 1 at Site 28/903—were excavated; two others (Subfeatures 1 and 2) were excavated as parts of Feature 2 at Site 85/428. All features were medium-sized to large, shallow, basin-shaped pits or surfaces lined or paved with tightly clustered stones laid out in a single layer. These pits were so shallow that "saucer-shaped" would be a more appropriate term. In most cases, the stones were selected for shape and size, forming an even pavement (see Figure 55, Chapter 6, Volume 1 of this report). Usually, the stones showed only light thermal alteration, whereas the surface underneath was rarely oxidized. This suggests that the features were used for activities involving low heat, such as the parching of seeds. The only example with a true oxidized base was Feature 21, which also had a rich plant record including a wide variety of charred seeds and maize kernels. A pollen sample taken from its base had the highest grasses count of all the pollen samples from the project. Features 3 and 9 were paved surfaces excavated in Locus B at Site 105/838, two of a series of nine rock clusters (Features 2–9 and 11) found on the surface.

Thermal Pits

Five thermal pits (3 extramural and 2 intramural) were excavated. In previous chapters, some were labeled as firepits. All except one were small pits, and all were likely used to roast or bake plant foods and, in some cases, meat. They may also have provided charcoal embers for seed parching or hot stones for boiling purposes. A single, large, rock-ringed thermal pit (Feature 4) at Site 85/428 probably had a similar use.

Nonthermal Pits

Most of the excavated nonthermal pits had fills of ashes, charcoal, FCR, and artifacts, suggesting that their final use may have been as trash receptacles. Some, such as the (often bell-shaped) pits found in the floors of the two Camp Verde phase pit structures (Features 23 and 29), were storage pits reused as trash pits. Others (2 ash pits, 1 rock-lined pit, and 3 basic pits) may have had a plant-processing function that didn't require high or direct heat (see below).

Horno

Finally, a *horno* identified at Site 133/561, although only sampled for dating purposes, displayed all the traits of this feature type, even as seen just on the surface: over 1 m in diameter; heavily oxidized; coated with a thick, carbonized rind; and associated with a massive amount of FCR and charcoal. The feature postdated A.D. 1500 and was either protohistoric or historical period in age and was very likely Yavapai. Typically used for agave roasting, the feature provided the project's only evidence, albeit indirect, of use of this plant.

Plants and Processing

Given the different forms of the various features in Table 70, one would expect that different processing methods occurred. Let us review the evidence.

Food plants identified in the project's flotation and pollen samples included 5 domesticates and a variety of wild taxa (see Chapters 6 and 7, Volume 2 of this report). The domesticates are maize (*Zea mays*), kidney bean (*Phaseolus vulgaris*), cucurbits (squash or pumpkin; *Cucurbita*), cotton (*Gossypium*), and little barley (*Hordeum pusillum*). The wild plants found in the samples can be divided into three groups: (1) small-seed-producing plants, (2) legumes, and (3) cacti and other succulents. The first group is large and includes cheno-ams (goosefoot or pigweed), general grasses (Gramineae), spurge (*Euphorbia glyptosperma*), purslane (*Portulaca* sp.), plantain or Indian weed (*Plantago*), stickleaf (*Mentzelia albicaulis*), and Indian ricegrass (*Achnatherum hymenoides*) as the most common ones. Many of these are known garden weeds, thriving in disturbed habitats. Two weedy annuals, stickleaf and bugseed, were particularly well represented in the plant record. Also, the presence of 10 different grass types, including domesticated little barley and ricegrass, suggests that grassland resources were used intensively, with different types maturing throughout the growing season. Overall, the macrobotanical data exhibited a wider range of these economically important plant species than noted for most sites of similar type and size in the surrounding region (see Chapter 6, Volume 2 of this report).

Group 2 consists of just one identified taxon: mesquite (*Prosopis* sp.). Mesquite was used minimally, which is consistent with subsistence patterns for this region. Group 3 consists of four taxa: prickly pear (*Opuntia* sp.), cholla (*Cylindropuntia* sp.), hedgehog cactus (*Echinocereus* sp.), and banana yucca (*Yucca baccata*). No agave was recovered, which is no big surprise, because sites in the uplands (agave's native habitat) were hardly represented in the samples. Even so, agave was likely processed in at least one of the project features, a *horno* at Site 133/561.

Small Seeds

As a group, small-seed-producing plants outdo the other groups of wild plants, by far, in frequency in the project's archaeobotanical record and perhaps were as important as the group of domesticates (certainly during the Squaw Peak phase). Small seeds of grasses and various weedy annuals were a much-favored food of desert dwellers (Doebley 1984; Ebeling 1986). The following paragraphs provide a few examples of processing for some of the plants in the project's paleobotanical inventory.

Ethnographically, to prepare grass seeds for storage or grinding, they were first basket-winnowed and then parched and sun-dried in wide-mouthed bowls or baskets (Castetter and Bell 1951:188; Castetter and Underhill 1935:24–25; Russell 1908:68–69). Parching was prerequisite before grinding, and several parching methods have been recorded. A common method was to place a few embers in a container along with the seeds, with the container then shaken constantly to prevent burning (Russell 1908). The container could be a basket or a ceramic vessel. Another method was to place a container filled with seeds on top of a surface of hot stones, occasionally stirring the seeds. The stones were heated by burning a fire over them until only ashes remained; the ashes were then swept away. The parched grass seeds were ground into flour that was used to make a beverage, a cooked cereal, or baked foods (cakes). Baking was done by making dough, either by boiling the flour in water or by just adding water and forming the dough into cakes (with shapes including balls and bars), which were then baked in a pit with hot ashes.

The Akimel O'odham threshed and winnowed the Indianwheat seeds and then added water to make a beverage, or they toasted and ground the seeds to make gruel or cakes (Rea 1997; Russell 1908). O'odham people ate the seeds uncooked or toasted and ground them to make a pinole (Castetter and Underhill 1935). For the Yavapai, Hualapai, and Havasupai, in particular, we have ample evidence of the dietary importance of stickleaf (Gifford 1936; Hodsgon 2001:208; Kroeber 1935; Smith 1973; Spier 1928; Weber and Seaman 1985). People stored the dried threshed seeds in large baskets or parched the seeds with coals in a large winnowing tray before grinding them. Hualapai baked the meal into solid chunks that were eaten dry (Mekeel 1935). The Zuni gathered purslane plants when still in flower, placing them in large piles on mats to dry, after which they beat the pile of plants to release the mature seeds, which were then parched (Cushing 1920). The Yavapai parched goosefoot and pigweed seeds with coals in a basket, after which they were ground, boiled, and eaten (Gifford 1932, 1936). Kelly (1977:36) provides detailed descriptions of goosefoot and pigweed processing methods used by the Cocopah. The seeds were parched and ground into a meal, which was eaten uncooked, added to boiling water to make a mush, or made into cakes by mixing the flour with water. The cakes were about 2.5–5.0 cm (1–2 inches) thick and 17–25 cm (7–10 inches) in diameter.

Overall, although there were various methods to prepare the seeds or grains as food, processing steps after winnowing were the same (Vanderpot 2017a, 2017b). The first step was parching the seeds, most commonly done by (1) stirring them in a basket or pottery vessel set on hot rocks, or (2) tossing them in a basket, together with hot coals. The first method would leave an archaeological feature consisting of a formal platform of stones, much like the rock-lined pits and paved surfaces in our project area. The stones would have been selected for shape and size, so as to make an even pavement, and the platform would be circular rather than irregular in shape. The fire would have burned *on top* of the stones and was then swept away after the stones were hot enough, resulting in only slight or no thermal alteration of the stones and the soil underneath. The second method would create a small pit with associated FCR. The rock feature would result from putting rocks on top of the fire, to choke it, thereby maintaining a steady supply of coals. In this case, however, the rocks would be a haphazard collection of FCR in or next to a pit, not laid out in a formal, preconceived pattern. Depending on how long the fire was used, the pit would show no, slight, or much oxidation (as well as all grades in between).

Archaeologically, parching features are thus expected to have two forms: (1) formal paved platforms or shallow, rock-lined pits or (2) clusters of FCR in or next to oxidized pits. In all cases, a few charred seeds as well as fuelwood may be left, although for the shallow, rock-lined pits and platforms, preservation might be poor. Whatever the parching scenario, the parched seeds were then basket-winnowed and ground into flour using manos and metates. The flour could be mixed with a bit of water to make gruel for direct consumption or to make dough from which storable and transportable cakes could be formed. The cakes would be roasted on top of a hot rock surface or baked in ashes or coal, resulting in another set of thermal features, one with rocks and another without rocks. In contrast to parching, no botanical remains would be expected in cake-baking features.

Cultivars: Maize, Little Barley, Beans, and Cotton

Of the domesticates, little barley and cotton seeds were harvested and processed much as described for the small seeds above and were eaten roasted or incorporated into cakes or gruels. To process little barley seeds for food, the bract—a papery covering around the grain that has a sharp, hairlike attachment (awn)—was first separated from the grain (Bohrer 1987). The nutritious starchy seeds of little barley were parched, roasted, or boiled. The Akimel O'odham ate cotton seeds—which have high oil content—as a lower-choice food source in famine times (Castetter and Underhill 1935:37; Rea 1981:5).

Early maize is comparable to modern Chapalote and was typically popped or parched and ground into a meal but could also be eaten green (Vint 2018). Initial processing of maize by O'odham people involved roasting unhusked ears, which burned much of the husk away (Castetter and Bell 1942:181). The kernels would then be taken off the cob with a stone scraper, parched, and dried on stone platforms or on a mat on the roof; alternatively, whole ears might be roasted (Castetter and Underhill 1935:34–35). Roasting was done in several ways. One method was to put the ears in piles, cover them with brush, and then set them on fire, with green mesquite branches used to stir and turn the ears (Castetter and Bell 1942:181). In a slightly different scenario, the fire was made in an open pit, and when the fire had burned down, the ears were thrown on the embers to roast. The roasted ears were dried and beaten to remove the grains, which were then winnowed and stored in a basket to be ground into meal when needed (Castetter and Underhill 1935:34-35). Expected archaeological signatures for maize processing are manos and metates, scrapers, shallow but wide thermal pits (roasting and parching using an open fire), and perhaps small and shallow nonthermal pits (basket rests and milling equipment supports).

A charred fragment of *Phaseolus vulgaris* (common or kidney bean) was found in a flotation sample from Feature 29 (a pit structure) at Site 105/838. Beans are insect pollinated, and pollen is not usually expected in the archaeological record (Fish 1984:112). Beans almost always were boiled (Bohrer 1987:110). Because boiling is the preferred modern method of preparation, only small numbers of beans are recovered from archaeological sites. Boiling could have been accomplished by means of hot stones in baskets or ceramic vessels filled with water and beans. The corresponding archaeological feature would be a pit with associated FCR.

Succulents

Evidence also was found in the project samples for the use of prickly pear, cholla, hedgehog cactus, and banana yucca. Indirect evidence for agave processing was provided by a *horno* at Site 133/561.

Cacti provided edible buds, stems, fruits, and seeds. The plants were boiled or roasted (Castetter and Bell 1942:59; Gifford 1932, 1936; Rea 1997; Russell 1908). O'odham women took collected prickly pear fruit back to the village where they were eaten fresh or processed into syrup (Castetter and Underhill 1935:23). The latter activity required a hearth and ceramic containers or waterproof baskets (Fontana et al. 1962). Hedgehog cactus fruits were typically eaten raw but also dried or made into refreshing drinks (Hodgson 2001:116–118). Like for most cacti, seeds were also parched, ground into meal, and made into cakes.

Cholla buds have high calcium content, can be gathered in large quantities, and were baked and preserved for year-round use. To cook the buds, a pit was excavated and filled with rocks, and a fire of mesquite wood was burned over the rocks (Castetter and Underhill 1935:15). The usual pit size was 1 m (approximately 3 feet) in diameter with a depth of 0.5 m (20 inches). It was common to line the pit with rocks to avoid contamination with sand. Once the rocks were hot, the pit was emptied. It was then refilled in a series of layers: a lining of grasses or bush seepweed (*Suaeda nigra*), the cholla buds or fruits, and the hot rocks. This grass-cholla-rock layering was repeated until the pit was filled, and it was then covered with dirt and left to bake overnight. After baking, the cholla was spread out and dried. The dried buds were then boiled or ground into a meal, which was often used with other greens in a sort of vegetable stew (Castetter and Underhill 1935:16). Archaeologically, the presence of cholla-processing camps can be inferred from isolated, medium-sized to large roasting pits that are frequently rock lined and, on the surface, visible as piles of FCR (Goodyear 1975:65–76; Greenhouse et al. 1981).

Agave was an important cultivated resource for the Hohokam and other prehistoric people, including the Sinagua, and historically was a staple of lowland groups such as the O'odham and highland peoples like the Apache and Yavapai. The emerging flower stalks, caudex, and hearts of agave are edible after baking them. Typically, the plant was harvested by cutting off the heart at ground level, after which the leaves were removed. O'odham, Yavapai, and Apache (and other) people prepared agave by baking or roasting it—most commonly the heart but also the leaves and stalks—in large pit ovens (*hornos*). Although processing details vary depending on specific people or places, overall preparations were similar (Castetter et al. 1938:28–29). Just before flowering—usually in spring—plants were dug out with wooden sticks, and stone knives were used to chop off the leaves. The pits were up to 4 m (13 feet) in diameter and over 1 m (3 feet) deep, often lined with flat rocks, with a large rock in the center. Wood was placed on top of the rocks and set on fire. After the fire had died down, a layer of moist grass or other plants was placed on the burning coals to create a steam bed. Next, the agave hearts were placed in the pit, and another layer of steaming material put on the agave, followed by a layer of dirt to prevent steam from escaping. After baking for about 2 days and nights, the mescal was removed. The roasted crowns and leaves could be eaten immediately (having a sugary flavor) or were pressed into large, thin cakes, which were traded and could be kept for years (Castetter et al. 1938:38). Archaeological signatures, beside archaeobotanical remains and *hornos*, include the tabular knives or large primary flakes used for cutting the leaves.

Conclusions

Based on the types of edible plants recovered, seed parching and cake baking were some of the most common activities associated with the excavated food-processing features. The project's roasting areas, rock-lined pits, paved surfaces, and thermal and nonthermal pits can all be linked to such activities. Undoubtedly, food boiling (e.g., various gruels and beans) also occurred and would have resulted in small thermal pits with FCR, much like those used for parching. No pits of the size usually used for cholla baking were found; perhaps because processing was done closer to the source (buds are heavy to carry). Agave roasting would have been common at higher elevations in *hornos* such as the one recorded at Site 133/561. Of course, animals were also cooked, but given the relatively small amounts of bone encountered in the project samples, they were not as important. The exception was the Squaw Peak phase roasting area (Feature 2) at Site 85/428, which yielded copious amounts of burned animal bone. No doubt, some features—in particular the large roasting/kitchen areas—had multiple functions where parching, baking, boiling, and animal cooking took place.

Agriculture along Spring Creek

The project's archaeobotanical record spans the Early through Late Formative periods, its mix of cultivated and wild plants tracing from agricultural beginnings in the late A.D. 500s to the end of prehistoric times nearly 10 centuries later. The data came from Sites 85/428 and 105/838, and they show that people living along this portion of Spring Creek were agriculturists who always depended on a diverse suite of native small-seed-bearing plants to supplement their cultivated maize, kidney beans, cotton, little barley, and probably also squash or pumpkin. The most common wild plants were cheno-ams, stickleaf, grasses, and bugseed. This is a grasslands environment, and plants such as mesquite, cacti, and agave were sparse in or lacking from subsistence pursuits. Small game, such as cottontails and jackrabbits, and the occasional deer were hunted opportunistically to provide the needed protein.

Early Farmers

Like in most other places in the U.S. Southwest, the timing and circumstances of agricultural beginnings in the MVRV are shrouded in mystery. Research questions that SRI (1998) posed regarding the introduction of agriculture in the region focused on (1) when it occurred, (2) what the early cultigens were, (3) how the date of introduction compared to dates in other regions of the U.S. Southwest, and (4) what effects agriculture had on the established lifestyles of the Archaic period occupants of the region. Some, but not all, of these questions have been—if not answered—at least refined.

Little is known about the Early Formative period in the middle Verde River region, although the current project has added welcome new information. Breternitz (1960a:19, 21) described the Squaw Peak phase based on his work at the Calkins Ranch and Montezuma Well sites. Few good examples of the phase have been identified in the region, and even fewer have been excavated (see Chapter 6 of this volume). Dates are sparse. Not far from the project area, charcoal from a hearth at the Cross Creek Ranch site (AZ O:1:141 [ASM]) yielded a 2σ calibrated radiocarbon date of A.D. 430–660 (Edwards et al. 2004:213). A human burial at AR-03-04-06-722 (CNF) returned a 2σ date range of A.D. 360–580 (Logan and Horton 2000:96–98). Four samples from structural timber in a pit structure at AR-03-04-06-294 (CNF), in Jack's Canyon (near our project area), all fell within a 2σ date range of A.D. 245–655 (Logan and Horton 1996:41–45). Importantly, a hearth in this structure contained a charred maize kernel, which unfortunately was not submitted for radiocarbon dating. A better age estimate of cal A.D. 390–535 for the structure was obtained by pooling the multiple radiocarbon ages (see Chapter 2 of this volume), and this age is very similar to the cal A.D. 410–600 age of the two roasting areas at Sites 85/428 and 105/838. Because the date range for the house came from structural timber, which might already have been quite old when cut, the maize kernel may have been significantly younger. Nevertheless, these dates indicate that maize agriculture was practiced in the Verde Valley by A.D. 550/600, with the dates from our project providing the earliest *directly* dated maize in the MVRV.

The projectile point styles and overall lithic technology of Squaw Peak phase sites are similar to those of the preceding Dry Creek phase (Late Archaic period, ca. 2000 or 1500 B.C.–A.D. 1) (Logan and Horton 1996:105), suggesting the persistence of an Archaic period lifestyle. For this reason, Logan and Horton (2000:9, 106–108) considered the Squaw Peak phase to be the final or terminal stage of the Late Archaic period, rather than the earliest named phase of the Formative period. Almost all Squaw Peak phase sites are on or along plots of arable land suitable for runoff or floodwater farming. It appears, then, that by at least the sixth century, if not a century or two before, some Archaic period populations were logistically organized collectors who began to grow maize along the tributary drainages of the Verde River, using runoff-and high-water-table-farming methods. There, they established residential base camps, in some cases building pit structures, needing to live there in late spring/early summer, to prepare fields and sow seeds, and again in the early fall, to gather the harvest. Given the types of wild, warm-season-maturing plants encountered in flotation and pollen samples from sites such as ours (see above), these early farmers remained in these camps through the summer, to harvest and process the small seeds of grasses and other plants.

Based on the current data, it is reasonable to suggest that these early farmers were indigenous Late Archaic period peoples who acquired maize through contact with outside maize-growing groups. The late date at which maize is first encountered in the archaeological record of the region is surprising, because elsewhere in the U.S. Southwest, agricultural beginnings can be dated to the end of the Middle Archaic period, about 2100–2000 B.C. Perhaps, similar evidence from the MVRV still awaits discovery. Or perhaps environmental conditions were not cooperative until after A.D. 400, when significant climatic changes began effecting stream flow and water tables (see Chapters 4 and 5 of this volume). Likely by this time, the early farmers began to exploit the good opportunities afforded by the rising water tables, aggrading floodplains, and smaller, less-flood-prone drainages with fertile alluvium.

The occupants of Site 105/838 were clearly attracted to its location by the presence of arable land and available water. The same goes for the much larger, adjacent Spring Creek Pueblo site. Although stream-and spring-fed ditch systems may have been operated, in particular by the inhabitants of the 41-room Tuzigoot phase pueblo, we can assume that overbank floodwater and high-water-table farming at the margins of floodplains were practiced. An idea of the kinds of farming systems used in the region can be gained from those associated with Montezuma Castle, an area covered with waffle gardens, linear borders, check dams, and canals of the Beaver Creek field system in the period A.D. 1200–1350 (Fish and Fish 1984). Although no definite agricultural features (e.g., terraces, check dams, and rock piles) were found, runoff agriculture may have been possible in the general project area. Human landscape modification as a result of farming was likely minor, limited to creation of the field areas.

Persistence and Change

The early farmers along Spring Creek relied on agricultural products and annual plants that grew as weeds in their fields. Field areas were relatively small and were not used very intensively during the Early Formative period, as suggested by the pollen counts for cheno-ams, which were lower than those in later contexts (see Chapter 7, Volume 2 of this report). Macrobotanical analysis of materials from the Squaw Peak phase components at Sites 105/838 and 85/428 identified little barley (at Site 105/838) and maize (at both sites) as the only domesticates. In contrast, the Camp Verde phase samples also contained kidney bean and cotton. The Squaw Peak phase contexts contained fewer field weeds; only six were identified (as opposed to eight in the later samples). Samples from Tuzigoot phase Feature 13 in Locus B of Site 105/838 contained maize as the sole domesticate and five of the eight field weeds. Site 85/838 is interesting in that during each of the occupational episodes (the Squaw Peak, Camp Verde, and Honanki/Tuzigoot phases), it always remained a farmstead, never bigger and never smaller.

The project's plant record for the Spring Creek area indicated plant harvesting in cool as well as warm seasons. Many of the weedy annuals (e.g., cheno-ams, purslane, bugseed, and stickleaf), grasses, and maize are indicative of the warm season (midsummer through fall), whereas little barley and a number of native plants (e.g., Indian wheat and Indian ricegrass) can be classified as cool-season resources (winter spring). Year-round occupation cannot be conclusively confirmed, but it is clear that the farmers occupying Site 105/838 subsisted on a diverse diet centered on maize during extended stays.

Given the small degree of dependence on agriculture during the Squaw Peak phase, it is tempting to speculate that during the cold season, Site 105/838's incipient farmers moved to nearby upland locations to pursue a different subsistence economy focused on mountain resources, including members of the agave family, acorn, pine nuts, and game, among others. Because Squaw Peak and Dry Creek phase artifacts are so similar to each other, these upland procurement/processing sites would be indistinguishable from Late Archaic period sites. Thus, some of the Late Archaic period components in the project area may, in fact, have been created by the Squaw Peak phase inhabitants of Sites 105/838 and 85/428. To a lesser degree, this same seasonal pattern was probably also going on in the later periods.

Paleoenvironment and Settlement Changes

A major research component of the project was to assess environmental and climate change in the MVRV and to correlate the findings with fluctuations in local settlement (see Van West's Chapters 4–6 in this volume). The first task of this study was to identify climate episodes that influenced water availability and plant growth that, in turn, would have influenced agricultural potential, range conditions, and sustainable settlement. Van West presents a 1,418-year (A.D. 571–1988) tree-ring-based climate reconstruction applicable to the MVRV, identifying wet or dry and cool or warm episodes or various combinations thereof. The effects of these separate and combined conditions, along with their persistence or variability, magnitude, and duration, are then explored in the context of the relationship between climate and human settlement in the MVRV.

Episodes are organizes along the broad levels of centuries (seventh through twentieth) and archaeological phases/periods (Squaw Peak phase through late historical period), but also on a much finer scale of short episodes and intervals within these longer periods. Van West identifies eras with the most persistence in precipitation and temperature conditions. These were time periods when people could best predict what the coming year(s) would bring in terms of successful crops—for farmers, times of economic stability. These periods of certainty correspond to the extremely dry and moderately warm eighth century and the moderately dry and warm tenth century. Eras of least predictability (most uncertainty) were also identified, which were the slightly wet and cool seventh century and the slightly wet and moderately cool fourteenth century.

The numbers of sites, site visibility, and site distribution appear to have been greatest during the warmer- and wetter-than-normal time periods and lowest during time periods that were extremely or persistently dry, cold, or excessively variable. Interestingly, the periods of greatest uncertainty on what to expect from the climate correspond to both the beginning, and ending periods of the Sinagua culture. Absolutely no evidence was found for the "Great Drought" (A.D. 1276–1299) in the MVRV: the final two decades of the Honanki phase were warmer than normal, but without extremely warm or dry years. This finding is important not just to the archaeology of the Verde Valley but of the entire U.S. Southwest, and will force reevaluations of time honored interpretations. Through this remarkable delineation of specific periods of time with associated climate and hydrological data, Van West has added a whole new dimension to interpretations of Verde Valley prehistory. These finely tuned temporal divisions will help researchers in defining meaningful divisions of the archaeological record to correlate with social and cultural changes.

Next, in Chapter 5, Van West integrates the dendroclimatic reconstruction with other sources of paleoenvironmental information (i.e., stream-flow reconstruction, flood history, geology, faunal and botanical use, and palynological data) to narrate a history of environmental change throughout the temporal sequence of human occupation in the MVRV. This careful look into the hydrological history of the Verde Valley relative to agricultural production and changing areas of productivity is another important contribution and will be useful for developing site predictive models in the future.

Finally, In Chapter 6, Van West—using an archaeological database of more than 2,300 prehistoric and historical-period sites—presents a comprehensive overview of prehistoric settlement and land use in the MVRV. Using 18 USGS topographic maps covering the MVRV, Van West created a geographic information systems– (GIS-) compatible archaeological landscape database to discern patterns of settlement and land use through time, to compare temporal patterns of land use to the distributions of important environmental variables, and to correlate contemporary trends and extremes within the reconstructed local climate and stream flow presented in Chapters 4 and 5. A major contribution to Verde Valley archaeology, this GIS-compatible database (and its environmental data layers) will be available to researchers and can be searched, augmented, and incorporated into future research.

Native American History

The MVRV is a region of overlap between the traditional territories of the Northeastern Yavapai and the Northern Tonto Apache. Based on CNF site files and other information, the region was intensively occupied by the Yavapai well before A.D. 1500, with Sinagua sites often reused. The present project provided an opportunity to help figure out when these people first arrived and whether they interacted with Sinagua groups. We also wanted to know if and how we could distinguish between ephemeral camps of Yavapai and Archaic period hunter-gatherers (SRI 1998).

Before fieldwork began, it was thought that at least one site—Site 53/745, with its inferred wickiup circles, possible Yavapai ceramics, and simple cobble hand stones and basin metates—would be able to help address these questions. During fieldwork, seven wickiup clearings were recorded, with additional ones noted, all outside the project ROW. But testing of four possible wickiup clearings by CNF personnel and volunteers provided no conclusive evidence as to function, affiliation, or age (Pilles 2017). Moreover, the site—the entire project, in fact—yielded no projectile points associated with the Yavapai (i.e., Desert Side-notched or Cottonwood style). The small amount of material that could be associated with the protohistoric period was disappointing and precluded answering one of the main research topics. On the bright side, two Orme Ranch Plain sherds from the site surface near the wickiups were submitted for TL dating and yielded a best-fit 1σ date of A.D. 1608 ± 51, which is in accord with the protohistoric period (see Chapter 2 of this volume).

Another place with evidence of use during the protohistoric period was Locus C at Site 133/561. The locus included an *horno* (Feature 1) with associated Tizon Wiped sherds. The roasting pit—likely used to process agave—was located outside the ADOT ROW and could not be excavated. But we were able to collect a charred wood sample, which returned 2σ calibrated date ranges (A.D. 1510–1600, 1620–1670, and 1780–1800) confirming the feature's protohistoric- or historical-period age. One of the Tizon Wiped sherds was submitted for TL dating and returned a 1σ date of A.D. 1791 ± 29, which agrees with the Feature 1 radiocarbon-date ranges, particularly the youngest one.

Identifying pottery made by the Yavapai is problematic, because no vessels positively made by these people have been collected. Given the TL dates for the Tizon Wiped and Orme Ranch Plain sherds, we might be tempted to assume that this pottery was made and used by Yavapai people. The same assumption had already become entrenched in the archaeological literature, even though it was based on limited evidence. In Chapter 3 of this volume, Sagebiel and Whittlesey tackled this difficult issue by examining how these ceramic types came to be associated with the Yavapai, comparing them to ethnographically described Yavapai ceramics, identifying their distinguishing attributes and how these compare to known pottery of the Western Apache, and looking at the chronometric dates of these types. They concluded that until more research is done on Tizon Wiped and Orme Ranch Plain, these ceramics can only very tentatively be used—along with other supporting evidence—to affiliate a site with the Yavapai. No single artifact or site type is "diagnostic" by itself for Yavapai/Apache occupation. Instead, it is a combination of various artifacts with certain site types, and, when available, radiocarbon dates that suggests their presence. Exactly when the ancestors of modern Yavapai and Tonto Apache arrived in the MVRV and the nature of their relationship to the preceding pueblo peoples remain unknown. Clearly, more research is needed.

Last Thoughts

The summaries above illuminate project accomplishments as they relate to the research domains. But the project has accomplished much more. For instance, the recovery and analysis of Middle and Late Archaic period artifacts from 11 of the 13 investigated sites adds to our understanding of land use and resource-procurement strategies during that time. In particular, Sites 28/903, 31/244, and 133/561 included substantial Archaic period components. The excavated rock-lined hearth and associated ground stone at Late Archaic period Site 28/903, along with lithic assemblages from the other Archaic period site components, highlight the extensive plant-processing activities that occurred in the project area. They support our assertion that these mobile groups emphasized wild-plant resources and relied secondarily on hunting activities. The same focus on plant resources, including the procurement of raw materials for ground stone manufacturing, continued through the Formative period, though with the addition of cultivated plants.

Second, the variability in the ceramic types recovered from the Camp Verde through Tuzigoot phase occupations at Sites 53/745, 105/838, and 131/37, in the Spring Creek area, adds to our knowledge of ethnic affiliation and exchange patterns. The high percentage of Northern Sinagua ceramics at these sites indicates strong connections with the Flagstaff area, possibly as early as A.D. 700 and certainly by A.D. 1100. The common occurrence of Kayenta Anasazi ceramics throughout the project area indicates other northern ties as well—ties that remained into the historical period, when Hopi people kept returning to the Place of the Blue-Green Valley. Ceramics from Sites 53/745 and 105/838 demonstrated more variety than collections from many nearby large sites, including at least 15 types not recovered from other sites in the region (see Chapter 2, Volume 2 of this report).

The project was less successful in finding unequivocal evidence of use of the area by Yavapai groups. Tizon Wiped or Orme Ranch Plain ceramics proved insufficient as ethnic markers. Ephemeral wickiup clearings provided no clues after excavation. These people truly treaded lightly on the landscape. Well-dated contexts are needed to resolve this issue and to distinguish between Yavapai and Archaic period hunter-gatherers. More chronometric data are also needed to better address questions about Formative period land use, settlement patterns, population growth and movement, and changing interaction patterns. Let us hope that future projects will produce the chronometric data necessary to provide the temporal framework for addressing these questions.

Another challenge for future archaeologists, as well as geologists, will be to test the region's dendrohydrological record, meticulously compiled in Chapter 4 of this volume, using additional stratigraphic data. In the meantime, the project has provided much to work with—not just the new archaeological data but also the vast data set of the region's settlement, presented in Chapter 6 of this volume. Future work promises to provide many new insights into the long and layered history of the people living along the Green River below the Red Rocks.

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Additional Resource

American Southwest Virtual Museum (http://swvirtualmuseum.nau.edu/wp)

This is a digital repository of photographs, maps, information, and virtual tours of National Park Service units and museums of Arizona, Colorado, Kansas, New Mexico, Oklahoma, Texas, and Utah. Material culture information associated with Montezuma Castle, Montezuma Well, and Tuzigoot National Monuments is included on this Web site.

APPENDIX A

Middle Verde River Valley Dendroclimate Reconstruction

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
571	0.069	0.21	0.74	59.55	0.13	-0.22		wet	cool	0	7	7.93	-5.01	1
572	0.336	1.01	0.65	59.45	0.02	0.31								
573	0.049	0.15		59.34	-0.11									
574	0.557	1.68		59.27	-0.19									
575	0.488	1.47		59.3	-0.16									
576	0.186	0.56		59.05	-0.45									
577	0.034	0.10		58.76	-0.78									
578	-0.895	-2.69	-1.30	58.85	-0.68	-0.49		dry	cool	1 dry	3	-3.16	-9.00	2
579	-0.303	-0.91	1.24	59.06	-0.44	0.16								
580	-0.103	-0.31		59.12	-0.37									
581	0.126	0.38	0.42	58.93	-0.59	-0.65		wet	cool	0	3	26.52	-12.56	3
582	0.136	0.41	0.05	58.72	-0.83	0.16								
583	0.157	0.47		58.97	-0.54									
584	-0.215	-0.65	-0.23	59.45	0.02	0.17		dry	warm	1 dry	8	-1.91	5.03	4
585	0.273	0.82	0.94	59.47	0.04	0.28								
586	-0.063	-0.19		59.31	-0.15									
587	0.169	0.51		59.46	0.03									
588	-0.238	-0.71		59.83	0.46									
589	0.208	0.63		59.72	0.33									
590	-0.694	-2.09		59.44	0.01									
591	-0.042	-0.13		60.01	0.67									
592	0.049	0.15	0.43	60.71	1.48	1.46		wet	warm	1 warm	4	6.31	8.19	5
593	0.086	0.26	0.27	60.98	1.79	0.71								
594	0.244	0.73		61.24	2.09									
595	0.19	0.57		59.83	0.46									
596	-0.379	-1.14	-0.88	60.1	0.77	1.08		dry	warm	1 dry	4	-6.45	12.31	6
597	-0.148	-0.44	0.55	60.74	1.51	0.35								
598	-0.138	-0.41		60.47	1.20									
599	-0.509	-1.53		60.14	0.82									
600	0.401	1.21	0.72	60.54	1.28	0.84		wet	warm	0	3	5.05	5.24	7
601	0.135	0.41	0.43	60.21	0.90	0.48								
602	0.181	0.54		59.72	0.33									
603	-0.028	-0.08	-0.38	61.3	2.16	0.81		dry	warm	1 dry	5	-2.49	4.25	8
604	-0.314	-0.94	0.77	60.47	1.20	0.96				1 warm				
605	0.194	0.58		59.06	-0.44									
606	-0.454	-1.36		60.04	0.70									
607	-0.037	-0.11		59.82	0.45									
608	0.477	1.43	0.33	60.42	1.14	0.52		wet	warm	1 dry	5	1.28	5.72	9
609	-0.007	-0.02	1.27	60.12	0.79	0.45								
610	0.51	1.53		59.42	-0.02									
611	-0.526	-1.58		59.71	0.32									
612	0.086	0.26		59.74	0.35									
613	-0.124	-0.37	-0.42	59.74	0.35	0.14		dry	warm	0	3	-4.32	1.14	10
614	-0.052	-0.16	0.29	59.18	-0.30	0.38								
615	-0.244	-0.73		59.76	0.38									
616	0.208	0.63	0.48	59.63	0.23	0.98		wet	warm	1 wet	8	3.22	9.58	11

continued on next page

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
617	-0.235	-0.71	1.19	60.64	1.40	0.81				1 dry				
618	0.345	1.04		61.29	2.15					1 warm				
619	0.117	0.35		60.96	1.77									
620	-0.45	-1.35		60.6	1.35									
621	0.359	1.08		60.14	0.82									
622	0.851	2.56		59.49	0.06									
623	0.073	0.22		59.46	0.03									
624	-0.038	-0.11	-0.28	58.92	-0.60	-0.76		dry	cool	2 dry	8	-1.61	-5.79	12
625	-0.083	-0.25	1.42	59.66	0.26	1.05				2 cool				
626	-0.514	-1.54		57.24	-2.55									
627	-0.024	-0.07		58.55	-1.03		FR*							
628	0.447	1.34		59.96	0.61									
629	0.513	1.54		59.43	-0.01									
630	-0.938	-2.82		57.97	-1.70									
631	-0.122	-0.37		58.5	-1.08									
632	0.344	1.03	0.34	59.28	-0.18	-0.43		wet	cool	0	13	5.25	-9.92	13
633	-0.295	-0.89	0.84	60.27	0.97	0.56								
634	-0.089	-0.27		59.62	0.21									
635	0.074	0.22		59.01	-0.49									
636	0.412	1.24		58.48	-1.11									
637	0.179	0.54		58.56	-1.02									
638	0.456	1.37		58.87	-0.66									
639	0.077	0.23		58.95	-0.56									
640	-0.236	-0.71		58.93	-0.59									
641	0.52	1.56		59.28	-0.18									
642	-0.037	-0.11		59.01	-0.49									
643	0.285	0.86		59.07	-0.42									
644	-0.23	-0.69		58.53	-1.05									
645	-0.945	-2.84	-0.54	59.77	0.39	0.45		dry	warm	4 dry	10	-4.27	11.61	14
646	-0.529	-1.59	1.26	59.94	0.59	0.39								
647	0.128	0.39		59.77	0.39									
648	0.126	0.38		60.3	1.00									
649	-0.08	-0.24		59.79	0.41									
650	0.46	1.38		59.39	-0.05									
651	-0.451	-1.36		59.67	0.27									
652	-0.069	-0.21		59.42	-0.02									
653	0.076	0.23		59.76	0.38									
654	-0.502	-1.51		60.45	1.18									
655	0.23	0.69	0.81	59.56	0.14	0.48		wet	warm	0	5	10.00	4.43	15
656	0.074	0.22	0.41	60.33	1.04	0.54								
657	0.431	1.30		59.72	0.33									
658	0.262	0.79		60.34	1.05									
659	0.354	1.06		59.3	-0.16									
660	-0.835	-2.51	-1.16	60.36	1.07	0.87		dry	warm	1 dry	3	-2.62	3.90	16
661	-0.381	-1.14	1.34	60.65	1.41	0.67								
662	0.053	0.16		59.54	0.12									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
663	-0.554	-1.67	-1.75	58.84	-0.69	-0.67		dry	cool	2 dry	2	-29.89	-54.72	17
664	-0.609	-1.83	0.12	58.87	-0.66	0.02								
665	0.314	0.94	0.15	58.47	-1.12	-0.98		wet	cool	1 cool	5	0.73	-14.88	18
666	-0.33	-0.99	1.04	58.56	-1.02	0.33								
667	0.444	1.34		58.22	-1.41									
668	0.097	0.29		58.7	-0.85									
669	-0.274	-0.82		58.99	-0.52									
670	0.15	0.45	0.74	59.83	0.46	0.54		wet	warm	0	7	10.53	6.98	19
671	0.031	0.09	0.49	59.69	0.30	0.54								
672	0.29	0.87		59.78	0.40									
673	0.428	1.29		60.85	1.64									
674	0.125	0.38		59.93	0.57									
675	0.215	0.65		59.9	0.54									
676	0.478	1.44		59.32	-0.13									
677	-0.852	-2.56	-2.56	60.31	1.01	1.01		dry	warm	1 dry	1	NA	NA	20
678	0.189	0.57	0.49	62.02	3.00	0.64		wet	warm	2 warm	8	7.01	3.14	21
679	0.223	0.67	0.56	60.98	1.79	1.63								
680	-0.199	-0.60		58.39	-1.21									
681	0.362	1.09		60.45	1.18		FR							
682	0.316	0.95		61.28	2.14									
683	0.085	0.26		58.63	-0.93									
684	0.296	0.89		59.68	0.28									
685	0.026	0.08		58.46	-1.13									
686	-0.246	-0.74	0.91	56.98	-2.85	-2.58		wet	cool	1 wet	8	8.00	-39.49	22
687	0.414	1.25	0.91	57.86	-1.83	0.52	FR			8 cool				
688	0.302	0.91		57.61	-2.12									
689	0.362	1.09		57.41	-2.35									
690	-0.02	-0.06		56.42	-3.50									
691	0.716	2.15		56.9	-2.94									
692	0.387	1.16		57.12	-2.69									
693	0.492	1.48		57.36	-2.41									
694	-0.809	-2.43	-0.51	56.97	-2.86	-1.09	FR	dry	cool	5 dry	12	-5.47	-13.41	23
695	0.539	1.62	1.11	57.51	-2.23	0.98				5 cool				
696	-0.485	-1.46		57.53	-2.21									
697	0.051	0.15		58.11	-1.54									
698	-0.169	-0.51		58.01	-1.65									
699	-0.444	-1.33		58.58	-0.99									
700	-0.427	-1.28		58.86	-0.67									
701	-0.178	-0.53		59.18	-0.30									
702	0.074	0.22		59.08	-0.41									
703	0.14	0.42		59.29	-0.17									
704	-0.429	-1.29		59.49	0.06									
705	0.112	0.34		59.3	-0.16									
706	-0.633	-1.90	-0.62	60.48	1.21	0.86		dry	warm	4 dry	12	-7.52	19.65	24
707	0.207	0.62	0.99	61.02	1.84	0.52								
708	0.017	0.05		59.7	0.31									

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
709	-0.587	-1.76		60.14	0.82									
710	0.203	0.61		60.44	1.17									
711	-0.329	-0.99		60.05	0.71									
712	-0.588	-1.77		60.25	0.94									
713	-0.167	-0.50		60.75	1.52									
714	0.087	0.26		59.83	0.46									
715	0.061	0.18		59.94	0.59									
716	-0.15	-0.45		59.4	-0.04									
717	-0.602	-1.81		60.09	0.76									
718	-0.249	-0.75	-0.16	59.38	-0.06	-0.50		dry	cool	0	5	-1.07	-6.28	25
719	0.259	0.78	0.73	58.45	-1.14	0.40								
720	-0.1	-0.30		59.17	-0.31									
721	-0.303	-0.91		59.01	-0.49									
722	0.132	0.40		59	-0.50									
723	-0.35	-1.05	-0.68	59.63	0.23	0.52		dry	warm	1 dry	5	-3.60	5.87	26
724	-0.615	-1.85	0.94	59.99	0.64	0.45								
725	0.202	0.61		59.52	0.10									
726	-0.047	-0.14		59.8	0.42									
727	-0.314	-0.94		60.5	1.23									
728	0.414	1.25	1.17	59.35	-0.10	-0.74		wet	cool	2 wet	9	14.72	-16.16	27
729	0.2	0.60	0.71	58.78	-0.76	0.41				1 cool				
730	0.716	2.15		58.78	-0.76									
731	0.82	2.47		59.05	-0.45									
732	0.302	0.91		58.97	-0.54									
733	0.268	0.81		58.89	-0.63									
734	0.077	0.23		58.66	-0.90									
735	0.36	1.08		58.05	-1.61									
736	0.34	1.02		58.67	-0.89									
737	-0.005	-0.01	-0.44	59.49	0.06	0.31		dry	warm	5 dry	26	-11.22	14.98	28
738	-0.815	-2.45	1.01	59.32	-0.13	0.54								
739	-0.275	-0.83		59.79	0.41									
740	0.365	1.10		59.94	0.59									
741	-0.116	-0.35		60.2	0.89									
742	-0.607	-1.82		59.21	-0.26									
743	-0.034	-0.10		59.85	0.48		FR							
744	-0.307	-0.92		58.97	-0.54									
745	-0.014	-0.04		60.48	1.21									
746	0.117	0.35		59.57	0.16									
747	0.366	1.10		59.95	0.60									
748	-0.203	-0.61		59.78	0.40									
749	0.16	0.48		59.33	-0.12									
750	-0.657	-1.97		59.48	0.05									
751	-0.736	-2.21		59.81	0.43									
752	-0.081	-0.24		59.57	0.16									
753	-0.011	-0.03		60.07	0.74									
754	-0.093	-0.28		59.41	-0.03									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
755	-0.23	-0.69		60.3	1.00									
756	0.111	0.33		59.75	0.36									
757	-0.374	-1.12		60.41	1.13									
758	-0.018	-0.05		60.27	0.97									
759	0.372	1.12		58.98	-0.53									
760	0.103	0.31		58.66	-0.90									
761	-0.666	-2.00		59.58	0.17									
762	-0.124	-0.37		60.12	0.79									
763	0.295	0.89	0.45	60.57	1.32	0.38		wet	warm	0	14	6.99	9.87	29
764	-0.211	-0.63	0.90	60.17	0.85	0.54								
765	0.484	1.46		59.65	0.25									
766	0.425	1.28		59.38	-0.06									
767	-0.141	-0.42		59.16	-0.32									
768	0.451	1.36		59.24	-0.23									
769	0.07	0.21		59.35	-0.10									
770	-0.294	-0.88		59.75	0.36									
771	0.201	0.60		60.07	0.74									
772	0.369	1.11		59.76	0.38									
773	0.017	0.05		60.38	1.10									
774	-0.357	-1.07		59.59	0.18									
775	0.372	1.12		60.3	1.00									
776	0.397	1.19		59.3	-0.16									
777	-0.123	-0.37	-1.00	59.53	0.11	0.01		dry	warm	1 dry	3	-4.45	0.20	30
778	-0.306	-0.92	0.67	59.56	0.14	0.20								
779	-0.568	-1.71		59.25	-0.22									
780	0.092	0.28	0.35	60.1	0.77	0.28		wet	warm	0	6	2.60	5.17	31
781	0.137	0.41	0.82	59.5	0.07	0.32								
782	-0.401	-1.21		59.91	0.55									
783	0.267	0.80		59.56	0.14									
784	0.251	0.76		59.34	-0.11									
785	0.36	1.08		59.65	0.25									
786	-0.492	-1.48	-0.56	58.9	-0.62	-0.33		dry	cool	3 dry	12	-7.28	-9.10	32
787	0.239	0.72	0.93	58.73	-0.82	0.43								
788	-0.268	-0.81		59.14	-0.34									
789	-0.019	-0.06		58.49	-1.10									
790	0.126	0.38		59.01	-0.49									
791	-0.624	-1.88		59.04	-0.46									
792	-0.225	-0.68		59.03	-0.47									
793	0.299	0.90		59.82	0.45									
794	-0.219	-0.66		59.35	-0.10									
795	-0.228	-0.68		59.62	0.21									
796	-0.193	-0.58		59.41	-0.03		FR							
797	-0.646	-1.94		59.3	-0.16									
798	0.596	1.79	1.18	59.1	-0.39	-0.76		wet	cool	2 wet	10	14.68	-9.93	33
799	0.202	0.61	0.80	59.25	-0.22	0.77				2 cool				
800	0.147	0.44		58.97	-0.54									

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
801	0.51	1.53		59.12	-0.37									
802	0.147	0.44		59.09	-0.40									
803	0.75	2.26		59.08	-0.41									
804	0.541	1.63		57.3	-2.48									
805	0.755	2.27		57.92	-1.76									
806	0.214	0.64		58.6	-0.97									
807	0.053	0.16		59.35	-0.10									
808	-0.636	-1.91	-2.07	58.4	-1.20	-1.23		dry	cool	2 dry	2	-18.54	-59.99	34
809	-0.741	-2.23	0.22	58.35	-1.26	0.04								
810	0.457	1.37	0.78	59.21	-0.26	-0.62		wet	cool	0	5	10.48	-7.57	35
811	0.152	0.46	0.37	59.31	-0.15	0.41								
812	0.288	0.87		58.46	-1.13									
813	0.238	0.72		58.71	-0.84									
814	0.162	0.49		58.8	-0.74									
815	-0.078	-0.23	-0.70	58.86	-0.67	-0.70		dry	cool	1 dry	4	-6.09	-5.17	36
816	-0.179	-0.54	0.46	58.44	-1.15	0.54								
817	-0.238	-0.71		59.48	0.05									
818	-0.443	-1.33		58.56	-1.02									
819	0.092	0.28	1.05	58.85	-0.68	-0.99		wet	cool	0	4	6.58	-16.15	37
820	0.381	1.15	0.64	58.63	-0.93	0.24								
821	0.314	0.94		58.35	-1.26									
822	0.607	1.83		58.51	-1.07									
823	-0.441	-1.33	-0.62	58.42	-1.18	-0.34		dry	cool	3 dry	8	-4.68	-5.02	38
824	-0.059	-0.18	1.06	58.97	-0.54	0.54								
825	-0.666	-2.00		59.09	-0.40									
826	0.322	0.97		59.61	0.20									
827	0.137	0.41		59.89	0.53									
828	-0.235	-0.71		59.3	-0.16									
829	-0.088	-0.26		58.73	-0.82									
830	-0.628	-1.89		59.13	-0.35									
831	0.31	0.93	0.59	59.53	0.11	-0.01		wet	cool	0	8	7.53	-0.36	39
832	-0.083	-0.25	0.62	59.75	0.36	0.33								
833	0.27	0.81		59.51	0.09									
834	0.433	1.30		59.13	-0.35									
835	0.215	0.65		59.22	-0.25									
836	0.294	0.88		59.39	-0.05									
837	-0.165	-0.50		59.82	0.45									
838	0.285	0.86		59.03	-0.47									
839	-0.331	-0.99	-1.09	59.85	0.48	0.53		dry	warm	1 dry	3	-3.13	33.99	40
840	-0.729	-2.19	1.05	59.9	0.54	0.05								
841	-0.033	-0.10		59.93	0.57									
842	0.037	0.11	0.40	61.05	1.87	1.36		wet	warm	0	4	4.53	10.91	41
843	0.239	0.72	0.35	60.13	0.81	0.50								
844	0.025	0.08		60.88	1.68									
845	0.226	0.68		60.37	1.08									
846	-0.121	-0.36	-1.12	58.88	-0.64	-0.49		dry	cool	1 dry	2	-2.09	-4.63	42

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
847	-0.625	-1.88	1.07	59.14	-0.34	0.21								
848	0.188	0.57	0.33	58.78	-0.76	-0.96		wet	cool	4 cool	16	7.97	-24.41	43
849	-0.335	-1.01	0.67	58.78	-0.76	0.63	FR							
850	0.186	0.56		58.38	-1.22									
851	-0.097	-0.29		58.96	-0.55									
852	0.342	1.03		58.58	-0.99									
853	-0.096	-0.29		58.42	-1.18									
854	0.427	1.28		58.14	-1.50									
855	-0.152	-0.46		58.39	-1.21									
856	0.428	1.29		57.64	-2.08									
857	0.019	0.06		58.13	-1.51									
858	0.298	0.90		58.39	-1.21		FR							
859	0.141	0.42		58	-1.66									
860	-0.14	-0.42		59.1	-0.39									
861	0.237	0.71		59.79	0.41									
862	0.196	0.59		59.23	-0.24									
863	0.137	0.41		59.08	-0.41									
864	-0.049	-0.15	-0.43	59.05	-0.45	-0.45		dry	cool	0	3	-2.42	-5.42	44
865	-0.35	-1.05	0.54	58.83	-0.70	0.25								
866	-0.033	-0.10		59.26	-0.20									
867	-0.352	-1.06	0.24	60.33	1.04	0.60		wet	warm	2 warm	15	4.77	9.86	45
868	0.031	0.09	0.76	59.44	0.01	0.91								
869	0.426	1.28		60.08	0.75									
870	-0.16	-0.48		59.59	0.18									
871	0.021	0.06		60.07	0.74									
872	-0.153	-0.46		59.47	0.04									
873	0.417	1.25		59.11	-0.38									
874	0.022	0.07		59.78	0.40									
875	0.238	0.72		59.35	-0.10									
876	0.423	1.27		58.99	-0.52									
877	0.048	0.14		59.58	0.17									
878	-0.173	-0.52		60.05	0.71									
879	-0.152	-0.46		60.19	0.88									
880	0.308	0.93		61.41	2.29									
881	0.252	0.76		61.79	2.73									
882	-0.08	-0.24	-1.08	60.9	1.70	1.10		dry	warm	2 dry	3	-4.30	4.07	46
883	-0.432	-1.30	0.75	59.59	0.18	0.81								
884	-0.565	-1.70		60.65	1.41									
885	0.073	0.22	0.08	59.96	0.61	0.46		wet	warm	1 dry	11	0.87	7.03	47
886	-0.147	-0.44	1.03	60.91	1.71	0.72								
887	0.136	0.41		60.63	1.39									
888	0.633	1.90		59.94	0.59									
889	-0.425	-1.28		58.72	-0.83		FR							
890	0.361	1.09		59.9	0.54									
891	0.321	0.97		59.77	0.39									
892	-0.375	-1.13		59.04	-0.46									

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
893	0.231	0.70		59.93	0.57									
894	-0.245	-0.74		59.47	0.04									
895	-0.268	-0.81		59.88	0.52									
896	-0.058	-0.17	0.28	59.15	-0.33	-1.09	FRew	wet	cool	1 wet	7	1.30	-14.10	48
897	0.41	1.23	1.53	58.76	-0.78	0.54				2 cool				
898	0.415	1.25		57.76	-1.94									
899	0.897	2.70		58.44	-1.15									
900	-0.59	-1.77		58.82	-0.71									
901	-0.094	-0.28		58.45	-1.14									
902	-0.322	-0.97		58.11	-1.54									
903	-0.482	-1.45	-0.68	59.68	0.28	0.59		dry	warm	2 dry	8	-7.65	20.09	49
904	-0.46	-1.38	0.71	59.9	0.54	0.23	FR							
905	0.013	0.04		60.06	0.72									
906	-0.326	-0.98		59.93	0.57									
907	-0.422	-1.27		59.75	0.36									
908	0.065	0.20		59.8	0.42									
909	0.06	0.18		60.2	0.89		FR							
910	-0.264	-0.79		60.22	0.91									
911	0.213	0.64	0.39	59.37	-0.08	-0.18		wet	cool	0	7	3.93	-1.72	50
912	0.221	0.67	0.70	58.6	-0.97	0.73								
913	-0.001	0.00		58.48	-1.11									
914	0.034	0.10		59.7	0.31									
915	0.32	0.96		59.7	0.31									
916	-0.282	-0.85		60.18	0.86									
917	0.407	1.22		58.93	-0.59									
918	-0.062	-0.19	-0.87	59.94	0.59	0.25	FR	dry	warm	3 dry	8	-10.16	2.87	51
919	-0.073	-0.22	0.68	59.48	0.05	0.70								
920	-0.656	-1.97		60.08	0.75									
921	-0.147	-0.44		58.77	-0.77									
922	-0.485	-1.46		59.07	-0.42									
923	-0.303	-0.91		59.55	0.13									
924	-0.479	-1.44		59.61	0.20									
925	-0.105	-0.32		60.72	1.49									
926	0.278	0.84	0.84	60.13	0.81	0.56		wet	warm	0	7	9.24	6.13	52
927	0.024	0.07	0.64	59.23	-0.24	0.63								
928	0.585	1.76		60.67	1.43									
929	0.425	1.28		59.83	0.46									
930	0.041	0.12		59.19	-0.28									
931	0.427	1.28		60.03	0.69									
932	0.176	0.53		60.32	1.03									
933	-0.264	-0.79	-0.57	60.86	1.65	0.88		dry	warm	0	5	-5.12	7.29	53
934	-0.232	-0.70	0.56	59.51	0.09	0.60	FR+							
935	-0.15	-0.45		60.3	1.00									
936	0.099	0.30		59.87	0.50									
937	-0.4	-1.20		60.44	1.17									
938	0.388	1.17	0.53	59.95	0.60	0.48		wet	warm	1 dry	7	3.26	12.47	54

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
939	0.098	0.30	1.13	60.26	0.96	0.27								
940	0.252	0.76		60	0.65									
941	0.371	1.12		59.73	0.34									
942	0.476	1.43		59.7	0.31									
943	-0.635	-1.91		59.73	0.34									
944	0.278	0.84		59.58	0.17									
945	0.443	1.33	0.92	59.24	-0.23	-0.23		wet	cool	0	6	14.43	-5.35	55
946	0.261	0.79	0.38	59.02	-0.48	0.26								
947	0.178	0.54		58.91	-0.61									
948	0.426	1.28		59.43	-0.01									
949	0.369	1.11		59.48	0.05									
950	0.149	0.45		59.32	-0.13		FR							
951	-0.433	-1.30	-0.71	59.51	0.09	-0.07		dry	cool	3 dry	7	-3.89	-1.28	56
952	0.234	0.70	1.28	59.74	0.35	0.39								
953	0.062	0.19		58.85	-0.68									
954	-0.87	-2.62		58.97	-0.54									
955	-0.158	-0.47		59.42	-0.02									
956	0.162	0.49		59.52	0.10		FR							
957	-0.661	-1.99		59.61	0.20									
958	0.186	0.56	0.50	59.27	-0.19	0.10		wet	warm	0	9	6.88	1.91	57
959	0.23	0.69	0.65	59.13	-0.35	0.48								
960	0.467	1.40		59.63	0.23									
961	-0.178	-0.53		60.11	0.78									
962	0.329	0.99		59.63	0.23									
963	0.026	0.08		59.38	-0.06									
964	-0.032	-0.10		59.22	-0.25									
965	0.422	1.27		60.23	0.92									
966	0.046	0.14		59.11	-0.38									
967	-0.238	-0.71	-0.17	59.54	0.12	0.42		dry	warm	0	7	-1.31	9.38	58
968	-0.397	-1.19	0.91	59.64	0.24	0.31								
969	0.061	0.18		59.65	0.25									
970	0.023	0.07		60.15	0.83									
971	-0.09	-0.27		60.19	0.88									
972	-0.273	-0.82		59.84	0.47		FR							
973	0.517	1.56		59.58	0.17		FR							
974	-0.175	-0.53	-0.55	59.41	-0.03	-0.08		dry	cool	1 dry	6	-3.18	-2.25	59
975	-0.685	-2.06	1.03	59.16	-0.32	0.22								
976	0.089	0.27		59.41	-0.03									
977	0.271	0.82		59.65	0.25									
978	-0.17	-0.51		59.41	-0.03									
979	-0.424	-1.27		59.15	-0.33									
980	-0.693	-2.08	-0.93	59.82	0.45	0.91		dry	warm	3 dry	5	-3.84	9.48	60
981	-0.56	-1.68	1.21	60.9	1.70	0.48								
982	0.168	0.51		60.05	0.71		FR							
983	0.083	0.25		60.25	0.94									
984	-0.541	-1.63		60.06	0.72									

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
985	-0.082	-0.25	0.73	59.28	-0.18	-0.77		wet	cool	1 cool	5	5.72	-5.78	61
986	0.222	0.67	0.64	59.38	-0.06	0.66								
987	0.208	0.63		58.57	-1.00									
988	0.454	1.37		58.66	-0.90									
989	0.416	1.25		57.98	-1.69									
990	-0.394	-1.18	-0.39	58.8	-0.74	-0.40		dry	cool	2 dry	9	-4.16	-17.23	62
991	-0.483	-1.45	0.85	58.99	-0.52	0.21								
992	0.248	0.75		59.42	-0.02									
993	-0.559	-1.68		59.13	-0.35									
994	0.109	0.33		59.09	-0.40									
995	0.001	0.00		59.24	-0.23									
996	0.008	0.02		58.96	-0.55									
997	-0.115	-0.35		59.18	-0.30									
998	0.011	0.03		59.02	-0.48									
999	-0.151	-0.45	0.14	59.76	0.38	-0.07		wet	cool	0	6	1.13	-1.01	63
1000	0.162	0.49	0.74	59.05	-0.45	0.44								
1001	-0.319	-0.96		59.67	0.27									
1002	0.158	0.48		58.93	-0.59									
1003	0.058	0.17		59.71	0.32									
1004	0.368	1.11		59.11	-0.38		FR							
1005	-0.654	-1.97	-1.97	59.04	-0.46	-0.46		dry	cool	1 dry	1	NA	NA	64
1006	0.494	1.49	0.50	60.26	0.96	0.75		wet	warm	0	7	4.49	12.45	65
1007	0.261	0.79	0.78	60.31	1.01	0.42								
1008	0.017	0.05		59.68	0.28									
1009	-0.282	-0.85		60.08	0.75									
1010	0.36	1.08		59.52	0.10									
1011	0.282	0.85		60.55	1.29									
1012	0.036	0.11		60.15	0.83									
1013	-0.093	-0.28	-0.04	59.4	-0.04	-0.47		dry	cool	1 dry	20	-0.88	-17.94	66
1014	-0.509	-1.53	0.81	58.95	-0.56	0.53				1 cool				
1015	0.45	1.35		58.43	-1.17									
1016	-0.131	-0.39		59.52	0.10									
1017	0.439	1.32		59.55	0.13									
1018	-0.287	-0.86		59.12	-0.37									
1019	-0.286	-0.86		59.15	-0.33									
1020	0.366	1.10		58.46	-1.13									
1021	-0.14	-0.42		57.76	-1.94									
1022	-0.095	-0.29		59.06	-0.44									
1023	-0.419	-1.26		59.3	-0.16									
1024	0.32	0.96		58.92	-0.60									
1025	-0.205	-0.62		58.98	-0.53									
1026	0.068	0.21		58.69	-0.86									
1027	0.089	0.27		59.31	-0.15									
1028	-0.097	-0.29		59.11	-0.38									
1029	0.037	0.11		59.71	0.32									
1030	0.085	0.26		59.35	-0.10									

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1031	0.04	0.12		58.7	-0.85									
1032	0.127	0.38		59.07	-0.42									
1033	-0.045	-0.13	-0.61	59.65	0.25	0.25		dry	warm	0	7	-8.46	3.44	67
1034	-0.146	-0.44	0.51	58.8	-0.74	0.51								
1035	-0.402	-1.21		59.55	0.13									
1036	-0.294	-0.88		59.52	0.10									
1037	-0.057	-0.17		59.91	0.55									
1038	-0.055	-0.16		60.04	0.70									
1039	-0.431	-1.30		60.1	0.77									
1040	0.022	0.07	0.15	60.03	0.69	0.43		wet	warm	0	12	2.71	9.88	68
1041	-0.281	-0.84	0.65	60.65	1.41	0.52	FR							
1042	0.175	0.53		59.07	-0.42									
1043	0.08	0.24		60.02	0.68									
1044	-0.349	-1.05		59.84	0.47									
1045	0.276	0.83		60.01	0.67									
1046	-0.045	-0.13		60.19	0.88									
1047	0.324	0.97		59.75	0.36									
1048	-0.119	-0.36		59.07	-0.42									
1049	0.286	0.86		59.42	-0.02									
1050	0.065	0.20		59.77	0.39									
1051	0.15	0.45		59.86	0.49									
1052	0.416	1.25	0.46	59.17	-0.31	-0.25		wet	cool	0	15	9.77	-10.88	69
1053	-0.047	-0.14	0.70	58.82	-0.71	0.35								
1054	0.449	1.35		58.86	-0.67									
1055	-0.262	-0.79		58.88	-0.64									
1056	0.225	0.68		59.19	-0.28									
1057	0.031	0.09		59.45	0.02		FR+							
1058	0.231	0.70		59.19	-0.28									
1059	-0.033	-0.10		59.55	0.13									
1060	0.379	1.14		59.79	0.41									
1061	0.358	1.08		59.59	0.18									
1062	-0.249	-0.75		59.48	0.05									
1063	0.344	1.03		58.88	-0.64									
1064	0.052	0.16		59.22	-0.25									
1065	0.082	0.25		59.19	-0.28									
1066	0.291	0.88		59	-0.50									
1067	-0.748	-2.25	-0.39	59.98	0.63	0.59		dry	warm	1 dry	7	-2.72	6.49	70
1068	0.279	0.84	1.00	59.58	0.17	0.63								
1069	-0.258	-0.78		60.04	0.70									
1070	-0.15	-0.45		59.22	-0.25									
1071	0.141	0.42		60.86	1.65									
1072	0.026	0.08		60.32	1.03									
1073	-0.199	-0.60		59.58	0.17									
1074	0.006	0.02	0.82	60.11	0.78	0.99		wet	warm	2 wet	11	11.78	19.17	71
1075	0.014	0.04	0.77	60.26	0.96	0.57								
1076	0.202	0.61		60.88	1.68		FR+							

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1077	0.258	0.78		59.95	0.60									
1078	0.118	0.36		60.72	1.49									
1079	0.341	1.03		60.68	1.44									
1080	0.681	2.05		60.73	1.50									
1081	-0.023	-0.07		60.66	1.42									
1082	0.739	2.22		59.31	-0.15									
1083	0.334	1.00		59.88	0.52									
1084	0.332	1.00		59.98	0.63									
1085	-0.136	-0.41	-0.57	60.48	1.21	1.14		dry	warm	0	2	-4.91	21.31	72
1086	-0.246	-0.74	0.23	60.35	1.06	0.11								
1087	0.67	2.02	2.02	60.74	1.51	1.51		wet	warm	1 wet	1	NA	NA	73
1088	-0.359	-1.08	-0.40	60.77	1.55	-0.48		dry	cool	1 dry	21	-12.48	-11.94	74
1089	0.187	0.56	0.67	59.39	-0.05	0.84				1 cool				
1090	-0.544	-1.63		59.27	-0.19									
1091	-0.375	-1.13		60.44	1.17									
1092	0.12	0.36		59.39	-0.05		FR							
1093	-0.212	-0.64		59.13	-0.35									
1094	-0.254	-0.76		58.49	-1.10									
1095	-0.115	-0.35		59.67	0.27									
1096	-0.036	-0.11		60	0.65									
1097	-0.26	-0.78		58.47	-1.12									
1098	-0.188	-0.56		58.58	-0.99									
1099	-0.384	-1.15		58.81	-0.73									
1100	0.176	0.53		58.82	-0.71									
1101	-0.251	-0.75		58.49	-1.10		FR							
1102	0.134	0.40		57.98	-1.69									
1103	-0.024	-0.07		58.46	-1.13									
1104	-0.201	-0.60		59.22	-0.25									
1105	0.337	1.01		58.41	-1.19									
1106	-0.081	-0.24		58.41	-1.19									
1107	-0.228	-0.68		58.86	-0.67									
1108	-0.233	-0.70		58.43	-1.17									
1109	0.185	0.56	0.31	58.47	-1.12	-0.92	FR+	wet	cool	2 cool	11	13.54	-26.76	75
1110	0.018	0.05	0.25	58.58	-0.99	0.38								
1111	0.083	0.25		58.8	-0.74									
1112	0.127	0.38		57.98	-1.69									
1113	-0.081	-0.24		58.78	-0.76									
1114	0.103	0.31		59.02	-0.48									
1115	0.128	0.39		59	-0.50									
1116	0.149	0.45		58.56	-1.02									
1117	0.199	0.60		58.94	-0.57									
1118	0.044	0.13		58.21	-1.42									
1119	0.19	0.57		58.69	-0.86									
1120	-0.085	-0.25	-0.49	56.65	-3.23	-1.20		dry	cool	1 dry	3	-0.89	-2.06	76
1121	-0.75	-2.25	1.66	59.2	-0.27	1.76				1 cool				
1122	0.344	1.03		59.34	-0.11									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1123	-0.112	-0.34	-0.21	60.09	0.76	0.57		dry	warm	0	6	-2.32	8.69	77
1124	0.145	0.44	0.54	60.31	1.01	0.40								
1125	-0.33	-0.99		59.54	0.12									
1126	-0.202	-0.61		59.54	0.12									
1127	0.032	0.10		59.85	0.48									
1128	0.053	0.16		60.25	0.94									
1129	0.043	0.13	-0.24	58.93	-0.59	-0.29		dry	cool	1 dry	17	-6.75	-13.39	78
1130	0.05	0.15	0.61	59.11	-0.38	0.37								
1131	-0.271	-0.81		58.71	-0.84									
1132	-0.182	-0.55		58.87	-0.66									
1133	-0.508	-1.53		58.96	-0.55									
1134	-0.075	-0.22		59.37	-0.08									
1135	0	0.00		59.16	-0.32									
1136	0.063	0.19		59.61	0.20									
1137	-0.062	-0.19		59.12	-0.37									
1138	-0.218	-0.65		59.11	-0.38									
1139	0.075	0.23		58.81	-0.73									
1140	-0.404	-1.21		59.47	0.04									
1141	0.026	0.08		59.97	0.62									
1142	-0.324	-0.97		59.44	0.01									
1143	0.026	0.08		58.91	-0.61									
1144	0.182	0.55		59.22	-0.25									
1145	0.199	0.60		59.31	-0.15									
1146	-0.613	-1.84	0.17	60.03	0.69	0.86		wet	warm	2 dry	10	1.54	12.25	77
1147	0.183	0.55	1.12	59.81	0.43	0.70				1 warm				
1148	0.222	0.67		59.93	0.57									
1149	0.437	1.31		60.2	0.89									
1150	-0.623	-1.87		59.06	-0.44									
1151	0.172	0.52		61.28	2.14									
1152	0.234	0.70		60.78	1.56									
1153	0.003	0.01		60.05	0.71									
1154	0.349	1.05		60.64	1.40									
1155	0.209	0.63		60	0.65									
1156	-0.638	-1.92	-0.89	59.71	0.32	-0.27		dry	cool	2 dry	3	-1.66	-1.06	80
1157	0.321	0.97	1.61	58.48	-1.11	0.75								
1158	-0.574	-1.73		59.43	-0.01									
1159	0.289	0.87	0.65	59.6	0.19	0.44		wet	warm	0	5	3.17	7.32	81
1160	0.278	0.84	1.02	59.72	0.33	0.30								
1161	-0.376	-1.13		60.16	0.84									
1162	0.426	1.28		60.01	0.67									
1163	0.46	1.38		59.58	0.17									
1164	-0.188	-0.56	-0.35	59.47	0.04	0.49		dry	warm	1 dry	6	-1.72	6.06	82
1165	0.329	0.99	1.22	59.23	-0.24	0.48								
1166	-0.095	-0.29		59.93	0.57									
1167	0.346	1.04		60.04	0.70									
1168	-0.689	-2.07		60.26	0.96									

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1169	-0.402	-1.21		60.2	0.89									
1170	0.071	0.21	1.20	59.98	0.63	0.45		wet	warm	0	4	6.66	10.98	83
1171	0.415	1.25	0.72	59.9	0.54	0.16	FR							
1172	0.47	1.41		59.68	0.28									
1173	0.646	1.94		59.73	0.34									
1174	-0.187	-0.56	-0.89	59.7	0.31	0.77		dry	warm	1 dry	4	-6.42	6.30	84
1175	-0.517	-1.55	0.56	60.22	0.91	0.49								
1176	-0.108	-0.32		59.84	0.47									
1177	-0.377	-1.13		60.64	1.40									
1178	0.405	1.22	0.26	59.15	-0.33	0.14		wet	warm	1 dry	6	1.21	1.78	85
1179	-0.078	-0.23	1.26	59.78	0.40	0.47								
1180	0.274	0.82		59.17	-0.31									
1181	0.332	1.00		59.43	-0.01									
1182	-0.702	-2.11		60.21	0.90									
1183	0.277	0.83		59.59	0.18									
1184	0.415	1.25	0.33	59.29	-0.17	-0.38		wet	cool	0	8	3.14	-14.04	86
1185	-0.127	-0.38	0.85	59.12	-0.37	0.22								
1186	-0.281	-0.84		59.27	-0.19									
1187	0.369	1.11		59.19	-0.28									
1188	-0.051	-0.15		58.73	-0.82									
1189	-0.103	-0.31		59.15	-0.33									
1190	0.433	1.30		58.93	-0.59									
1191	0.231	0.70		59.17	-0.31									
1192	-0.169	-0.51	-0.44	59.57	0.16	0.20		dry	warm	0	3	-14.01	2.89	87
1193	-0.111	-0.33	0.09	59.8	0.42	0.21								
1194	-0.161	-0.48		59.45	0.02									
1195	0.322	0.97	-0.14	58.8	-0.74	-1.23		dry	cool	1 dry	5	-0.59	-17.33	88
1196	-0.267	-0.80	1.18	58.16	-1.48	0.36				3 cool				
1197	0.427	1.28		58.26	-1.36									
1198	-0.277	-0.83		58.58	-0.99									
1199	-0.438	-1.32		58.07	-1.58									
1200	0.295	0.89	0.75	57.42	-2.34	-2.17	FR	wet	cool	5 cool	5	8.12	-25.48	89
1201	0.013	0.04	0.46	57.75	-1.95	0.43								
1202	0.437	1.31		57.83	-1.86									
1203	0.228	0.69		56.99	-2.84									
1204	0.271	0.82		57.85	-1.84									
1205	-0.229	-0.69	-0.53	57.65	-2.07	-1.06		dry	cool	2 dry	16	-10.42	-33.06	90
1206	-0.038	-0.11	0.82	57.68	-2.04	0.51				4 cool				
1207	-0.148	-0.44		59.2	-0.27									
1208	-0.398	-1.20		58.89	-0.63									
1209	0.427	1.28		58.31	-1.31									
1210	0.084	0.25		58.78	-0.76									
1211	-0.318	-0.96		58.51	-1.07									
1212	0.088	0.27		58.38	-1.22									
1213	-0.118	-0.35		58.15	-1.49									
1214	-0.343	-1.03		58.64	-0.92									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1215	-0.129	-0.39		58.75	-0.79									
1216	-0.613	-1.84		58.43	-1.17									
1217	-0.411	-1.24		58.64	-0.92									
1218	-0.324	-0.97		58.36	-1.25									
1219	0.145	0.44		58.87	-0.66									
1220	-0.52	-1.56		59.12	-0.37									
1221	-0.291	-0.87	-0.17	60.03	0.69	0.59		dry	warm	0	3	-0.85	13.00	91
1222	0.028	0.08	0.61	59.81	0.43	0.14								
1223	0.089	0.27		59.99	0.64									
1224	-0.134	-0.40	-0.70	59.36	-0.09	-0.79		dry	cool	1 dry	4	-2.45	-5.25	92
1225	0.057	0.17	1.15	58.84	-0.69	0.61				1 cool				
1226	-0.066	-0.20		58.09	-1.56									
1227	-0.794	-2.39		58.71	-0.84									
1228	0.409	1.23	0.41	59.57	0.16	-0.68		wet	cool	1 cool	16	8.18	-21.61	93
1229	0.145	0.44	0.80	57.8	-1.90	0.50								
1230	0.029	0.09		58.67	-0.89									
1231	0.164	0.49		58.58	-0.99									
1232	0.528	1.59		58.86	-0.67									
1233	-0.242	-0.73		58.61	-0.96									
1234	-0.389	-1.17		59.48	0.05									
1235	0.401	1.21		58.62	-0.95									
1236	-0.331	-0.99		58.44	-1.15									
1237	0.07	0.21		59.03	-0.47									
1238	0.207	0.62		58.96	-0.55									
1239	0.275	0.83		59.27	-0.19									
1240	0.203	0.61		58.84	-0.69									
1241	0.36	1.08		59.3	-0.16									
1242	0.053	0.16		58.73	-0.82									
1243	0.291	0.88		58.8	-0.74									
1244	-0.141	-0.42	-0.24	59.03	-0.47	-0.20		dry	cool	1 dry	8	-2.16	-3.88	94
1245	-0.093	-0.28	0.89	58.92	-0.60	0.41								
1246	-0.377	-1.13		59.12	-0.37									
1247	-0.103	-0.31		59.51	0.09									
1248	0.486	1.46		60.02	0.68									
1249	0.094	0.28		59.1	-0.39									
1250	-0.015	-0.04		59.16	-0.32									
1251	-0.494	-1.48		59.26	-0.20									
1252	0.234	0.70	-0.08	60.52	1.26	0.51		dry	warm	1 dry	6	-0.49	6.61	95
1253	0.042	0.13	1.00	60.04	0.70	0.46								
1254	-0.668	-2.01		59.99	0.64									
1255	0.036	0.11		59.72	0.33									
1256	-0.042	-0.13		59.43	-0.01									
1257	0.234	0.70		59.54	0.12									
1258	-0.315	-0.95	0.20	58.95	-0.56	-0.51		wet	cool	0	4	0.93	-5.05	96
1259	0.379	1.14	0.87	58.73	-0.82	0.41								
1260	0.041	0.12		59.5	0.07									

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1261	0.163	0.49		58.79	-0.75									
1262	0.2	0.60	-0.90	57.82	-1.87	-1.10		dry	cool	1 dry	3	-1.84	-4.79	97
1263	-0.778	-2.34	1.47	58.94	-0.57	0.69				1 cool				
1264	-0.322	-0.97		58.71	-0.84									
1265	0.093	0.28	0.46	58.59	-0.98	-0.74		wet	cool	1 wet	8	5.16	-19.51	98
1266	0.095	0.29	0.72	58.68	-0.88	0.30								
1267	0.262	0.79		58.59	-0.98									
1268	0.682	2.05		58.75	-0.79									
1269	-0.022	-0.07		58.8	-0.74									
1270	-0.088	-0.26		58.93	-0.59									
1271	0.048	0.14		58.65	-0.91									
1272	0.159	0.48		59.38	-0.06									
1273	-0.131	-0.39	0.20	59.62	0.21	0.72		wet	warm	1 dry	9	1.86	10.87	99
1274	0.37	1.11	0.96	60.17	0.85	0.59								
1275	0.417	1.25		60.03	0.69									
1276	-0.626	-1.88		61.09	1.92									
1277	0.21	0.63		59.82	0.45									
1278	-0.06	-0.18		60.08	0.75									
1279	0.262	0.79		59.75	0.36									
1280	0.004	0.01		59.39	-0.05									
1281	0.147	0.44		60.54	1.28									
1282	-0.229	-0.69	-0.60	59.94	0.59	0.06		dry	warm	2 dry	7	-3.36	0.62	100
1283	-0.26	-0.78	1.25	58.64	-0.92	0.62								
1284	0.35	1.05		59.28	-0.18									
1285	-0.118	-0.35		60.11	0.78									
1286	-0.769	-2.31		59.92	0.56									
1287	0.26	0.78		59.08	-0.41									
1288	-0.627	-1.88		59.41	-0.03									
1289	-0.001	0.00	0.63	59.92	0.56	0.25		wet	warm	0	3	1.93	2.42	101
1290	0.583	1.75	0.98	59.38	-0.06	0.31								
1291	0.044	0.13		59.66	0.26									
1292	-0.207	-0.62	-0.10	59.39	-0.05	0.37		dry	warm	1 dry	23	-2.86	16.82	102
1293	0.227	0.68	0.80	59.66	0.26	0.50								
1294	-0.134	-0.40		59.46	0.03									
1295	-0.347	-1.04		60.08	0.75									
1296	0.176	0.53		59.23	-0.24									
1297	-0.297	-0.89		61.15	1.99									
1298	0.362	1.09		60.06	0.72									
1299	-0.652	-1.96		59.57	0.16									
1300	0.07	0.21		59.99	0.64									
1301	-0.083	-0.25		59.3	-0.16									
1302	0.158	0.48		59.35	-0.10									
1303	0.236	0.71		59.66	0.26									
1304	-0.139	-0.42		60.11	0.78									
1305	0.164	0.49		59.68	0.28									
1306	-0.247	-0.74		60.03	0.69									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1307	-0.265	-0.80		60.15	0.83									
1308	0.067	0.20		59.82	0.45									
1309	0.076	0.23		59.27	-0.19									
1310	0.283	0.85		60.11	0.78									
1311	-0.349	-1.05		59.29	-0.17									
1312	0.321	0.97		59.68	0.28									
1313	0.107	0.32		59.75	0.36									
1314	-0.296	-0.89		59.51	0.09									
1315	-0.334	-1.00	-0.15	59.15	-0.33	-0.49		dry	cool	1 dry	6	-0.84	-6.73	103
1316	-0.613	-1.84	1.07	59.16	-0.32	0.43				1 cool				
1317	0.137	0.41		58.29	-1.33									
1318	0.045	0.14		59.13	-0.35									
1319	0.118	0.36		59.01	-0.49									
1320	0.349	1.05		59.36	-0.09									
1321	0.161	0.48	-0.40	59.55	0.13	0.52		dry	warm	0	4	-2.34	4.80	104
1322	-0.368	-1.11	0.69	59.58	0.17	0.44								
1323	-0.251	-0.75		60.28	0.98									
1324	-0.081	-0.24		60.14	0.82									
1325	0.398	1.20	0.42	59.67	0.27	0.59		wet	warm	0	5	2.25	5.28	105
1326	0.381	1.15	0.93	60.09	0.76	0.56								
1327	0.216	0.65		60.72	1.49									
1328	-0.356	-1.07		59.72	0.33									
1329	0.056	0.17		59.52	0.10		FR+							
1330	0.14	0.42	0.43	58.06	-1.60	-1.66		wet	cool	4 cool	5	8.89	-27.81	106
1331	0.039	0.12	0.24	57.8	-1.90	0.30								
1332	0.135	0.41		57.8	-1.90									
1333	0.263	0.79		57.92	-1.76									
1334	0.131	0.39		58.42	-1.18									
1335	-0.521	-1.57	-0.36	57.93	-1.75	-1.10		dry	cool	1 dry	7	-4.08	-17.22	107
1336	0.019	0.06	0.62	58.13	-1.51	0.45				2 cool				
1337	-0.007	-0.02		58.54	-1.04									
1338	-0.28	-0.84		58.7	-0.85									
1339	-0.028	-0.08		59.12	-0.37									
1340	0.033	0.10		58.55	-1.03									
1341	-0.058	-0.17		58.43	-1.17									
1342	0.048	0.14	0.20	58.9	-0.62	-0.67		wet	cool	0	4	0.99	-7.59	108
1343	0.444	1.34	0.82	59.07	-0.42	0.35								
1344	-0.021	-0.06		59.04	-0.46									
1345	-0.202	-0.61		58.41	-1.19									
1346	0.246	0.74	-0.35	58.18	-1.46	-1.35		dry	cool	2 dry	7	-2.53	-18.81	109
1347	-0.426	-1.28	0.98	58.28	-1.34	0.50				4 cool				
1348	-0.099	-0.30		57.78	-1.92									
1349	0.318	0.96		57.63	-2.09									
1350	-0.58	-1.74		58.63	-0.93									
1351	-0.172	-0.52		58.72	-0.83									
1352	-0.112	-0.34		58.65	-0.91									

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1353	0.04	0.12	0.71	58.11	-1.54	-1.60		wet	cool	6 cool	7	6.88	-42.86	110
1354	0.391	1.18	0.72	58	-1.66	0.26								
1355	-0.203	-0.61		58.53	-1.05									
1356	0.414	1.25		57.95	-1.72		FR							
1357	0.459	1.38		57.92	-1.76									
1358	0.331	1.00		57.85	-1.84		FR							
1359	0.218	0.66		58.06	-1.60									
1360	-0.561	-1.69	-0.52	58.26	-1.36	-0.75		dry	cool	1 dry	5	-2.97	-8.39	111
1361	-0.167	-0.50	0.88	58.88	-0.64	0.44				1 cool				
1362	-0.064	-0.19		59.24	-0.23									
1363	-0.312	-0.94		58.57	-1.00									
1364	0.231	0.70		59.01	-0.49									
1365	0.221	0.67	0.25	59.83	0.46	0.68		wet	warm	0	17	7.48	21.12	112
1366	0.076	0.23	0.58	59.79	0.41	0.55								
1367	0.189	0.57		60.17	0.85									
1368	-0.178	-0.53		59.14	-0.34									
1369	0.068	0.21		59.66	0.26									
1370	0.118	0.36		60.02	0.68									
1371	-0.074	-0.22		60.26	0.96									
1372	0.032	0.10		60.12	0.79									
1373	0.288	0.87		59.79	0.41									
1374	0.13	0.39		59.45	0.02									
1375	0.138	0.42		60.76	1.54									
1376	0.05	0.15		60.81	1.59									
1377	0.242	0.73		60.55	1.29									
1378	-0.084	-0.25		59.77	0.39									
1379	-0.409	-1.23		60.68	1.44									
1380	0.235	0.71		60.07	0.74									
1381	0.388	1.17		59.57	0.16									
1382	0.852	2.56	1.78	59.41	-0.03	-0.46		wet	cool	1 wet	3	6.22	-2.90	113
1383	0.286	0.86	0.86	58.6	-0.97	0.47								
1384	0.642	1.93		59.11	-0.38									
1385	-0.044	-0.13	-0.83	58.62	-0.95	-0.45		dry	cool	2 dry	5	-6.84	-4.05	114
1386	-0.091	-0.27	0.61	58.47	-1.12	0.55								
1387	-0.44	-1.32		59.52	0.10									
1388	-0.313	-0.94		59.19	-0.28									
1389	-0.491	-1.48		59.44	0.01									
1390	-0.146	-0.44	-0.09	59.99	0.64	0.60		dry	warm	0	9	-1.07	5.88	115
1391	-0.326	-0.98	0.78	60.26	0.96	0.91								
1392	0.211	0.63		59.21	-0.26									
1393	-0.361	-1.08		60.93	1.73									
1394	0.139	0.42		60.74	1.51									
1395	-0.114	-0.34		59.87	0.50									
1396	0.448	1.35		60.4	1.12									
1397	-0.1	-0.30		59.76	0.38									
1398	-0.03	-0.09		58.38	-1.22									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1399	0.463	1.39	0.38	59.97	0.62	0.55		wet	warm	0	7	3.74	12.80	116
1400	0.294	0.88	0.72	59.39	-0.05	0.30								
1401	0.034	0.10		60.07	0.74									
1402	-0.283	-0.85		59.9	0.54									
1403	0.196	0.59		60.14	0.82									
1404	0.178	0.54		59.79	0.41									
1405	0.006	0.02		60.09	0.76									
1406	-0.052	-0.16	-0.28	60.1	0.77	0.68		dry	warm	2 dry	11	-3.72	28.52	117
1407	-0.442	-1.33	0.84	60.23	0.92	0.26								
1408	0.039	0.12		60.09	0.76		FR							
1409	0.351	1.06		60.05	0.71									
1410	-0.614	-1.85		60.13	0.81									
1411	-0.064	-0.19		60.31	1.01									
1412	-0.191	-0.57		59.77	0.39									
1413	0.023	0.07		60.13	0.81									
1414	0.239	0.72		59.51	0.09									
1415	-0.043	-0.13		59.87	0.50									
1416	-0.289	-0.87		60.04	0.70									
1417	0.074	0.22	0.36	59.57	0.16	1.07	FR	wet	warm	0	4	4.84	5.54	118
1418	0.077	0.23	0.30	60.08	0.75	0.77								
1419	0.06	0.18		60.71	1.48									
1420	0.268	0.81		61.07	1.90									
1421	-0.333	-1.00	-0.22	60.12	0.79	1.56		dry	warm	2 warm	6	-1.54	12.22	119
1422	0.389	1.17	0.85	60.41	1.13	0.77	FR							
1423	-0.389	-1.17		61.33	2.20									
1424	-0.004	-0.01		60.43	1.15									
1425	0.016	0.05		61.85	2.80									
1426	-0.112	-0.34		60.56	1.30									
1427	0.242	0.73	0.53	60.72	1.49	0.80		wet	warm	0	8	6.59	10.62	120
1428	0.22	0.66	0.64	60.51	1.25	0.60								
1429	0.213	0.64		59.93	0.57									
1430	-0.076	-0.23		60.26	0.96									
1431	0.36	1.08		59.77	0.39									
1432	-0.221	-0.66		60.69	1.46									
1433	0.274	0.82		59.93	0.57									
1434	0.391	1.18		59.2	-0.27									
1435	-0.573	-1.72	-0.53	59.42	-0.02	-0.05		dry	cool	2 dry	16	-14.10	-1.48	121
1436	-0.174	-0.52	0.60	59.02	-0.48	0.53								
1437	-0.251	-0.75		58.72	-0.83									
1438	-0.285	-0.86		59.2	-0.27									
1439	-0.215	-0.65		59.74	0.35									
1440	-0.026	-0.08		59.05	-0.45									
1441	0.207	0.62		59.13	-0.35									
1442	-0.532	-1.60		59.83	0.46									
1443	-0.292	-0.88		60.38	1.10									
1444	-0.129	-0.39		59.22	-0.25									

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1445	0.084	0.25		58.75	-0.79									
1446	-0.227	-0.68		59.13	-0.35									
1447	-0.14	-0.42		59.37	-0.08									
1448	-0.086	-0.26		59.92	0.56									
1449	-0.036	-0.11		59.53	0.11									
1450	-0.124	-0.37		59.88	0.52									
1451	0.058	0.17	0.09	59.74	0.35	-0.12		wet	cool	2 dry	12	0.94	-3.50	122
1452	0.025	0.08	1.15	59.24	-0.23	0.40								
1453	0.191	0.57		59.54	0.12		FR+							
1454	0.044	0.13		58.84	-0.69									
1455	-0.755	-2.27		59.52	0.10									
1456	0.166	0.50		58.86	-0.67									
1457	0.516	1.55		58.96	-0.55									
1458	0.263	0.79		59.56	0.14									
1459	-0.425	-1.28		59.34	-0.11									
1460	-0.418	-1.26		59.72	0.33									
1461	0.182	0.55		58.98	-0.53									
1462	0.509	1.53		59.71	0.32									
1463	-0.105	-0.32	-0.22	58.8	-0.74	-0.19		dry	cool	2 dry	12	-2.63	-4.10	123
1464	-0.77	-2.31	1.01	59.35	-0.10	0.56								
1465	-0.328	-0.99		59.06	-0.44									
1466	0.501	1.51		59.01	-0.49									
1467	0.013	0.04		58.8	-0.74									
1468	-0.069	-0.21		58.97	-0.54									
1469	-0.003	-0.01		59.43	-0.01									
1470	-0.009	-0.03		58.58	-0.99									
1471	-0.462	-1.39		59.66	0.26									
1472	-0.133	-0.40		59.53	0.11		FR							
1473	0.192	0.58		59.79	0.41									
1474	0.285	0.86		60.25	0.94									
1475	-0.161	-0.48	0.51	58.68	-0.88	-0.38		wet	cool	0	7	4.94	-5.86	124
1476	0.144	0.43	0.72	58.87	-0.66	0.45								
1477	0.333	1.00		59.1	-0.39									
1478	0.411	1.24		58.88	-0.64									
1479	-0.15	-0.45		58.99	-0.52									
1480	0.387	1.16		59.84	0.47									
1481	0.222	0.67		59.39	-0.05									
1482	0.769	2.31	1.24	59.59	0.18	0.33		wet	warm	1 wet	3	2.62	2.13	125
1483	-0.122	-0.37	1.42	60.16	0.84	0.46								
1484	0.589	1.77		59.4	-0.04									
1485	-0.364	-1.09	-0.65	59.7	0.31	-0.08		dry	cool	1 dry	4	-2.92	-0.86	126
1486	0.146	0.44	0.88	59.42	-0.02	0.35								
1487	-0.526	-1.58		58.96	-0.55									
1488	-0.116	-0.35		59.4	-0.04									
1489	0.544	1.64	1.27	59.73	0.34	-0.35		wet	cool	0	3	10.85	-1.51	127
1490	0.412	1.24	0.35	59.14	-0.34	0.70	FR							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1491	0.311	0.94		58.52	-1.06									
1492	-0.397	-1.19	-0.34	59.2	-0.27	-0.26		dry	cool	3 dry	15	-5.29	-9.66	128
1493	-0.138	-0.41	0.96	59.34	-0.11	0.40								
1494	0.277	0.83		58.63	-0.93									
1495	-0.71	-2.13		59.32	-0.13									
1496	0.175	0.53		59.92	0.56									
1497	0.064	0.19		59.41	-0.03									
1498	0.06	0.18		58.97	-0.54									
1499	-0.245	-0.74		58.9	-0.62									
1500	-0.584	-1.76		59.28	-0.18									
1501	0.322	0.97		59.73	0.34									
1502	-0.049	-0.15		58.76	-0.78									
1503	-0.058	-0.17		59.1	-0.39									
1504	0.166	0.50		59.06	-0.44									
1505	-0.038	-0.11		59.04	-0.46									
1506	-0.544	-1.63		59.51	0.09									
1507	0.42	1.26	0.37	58.99	-0.52	-0.63		wet	cool	1 dry	10	3.91	-14.36	129
1508	0.416	1.25	0.93	59.26	-0.20	0.44								
1509	0.365	1.10		59.5	0.07									
1510	-0.58	-1.74		59.17	-0.31									
1511	0.409	1.23		59.17	-0.31									
1512	0.005	0.02		58.51	-1.07									
1513	0.104	0.31		58.71	-0.84									
1514	-0.011	-0.03		58.54	-1.04									
1515	0.118	0.36		58.36	-1.25									
1516	-0.034	-0.10		58.71	-0.84									
1517	-0.653	-1.96	-0.39	57.74	-1.97	-1.17		dry	cool	4 dry	12	-4.31	-18.02	130
1518	-0.197	-0.59	1.09	57.85	-1.84	0.78				5 cool				
1519	0.251	0.76		57.8	-1.90									
1520	0.062	0.19		57.27	-2.51									
1521	-0.458	-1.38		58.03	-1.63									
1522	-0.594	-1.79		58.43	-1.17									
1523	-0.093	-0.28		58.99	-0.52									
1524	-0.033	-0.10		58.86	-0.67									
1525	0.522	1.57		58.86	-0.67									
1526	0.026	0.08		59.13	-0.35									
1527	-0.515	-1.55		58.83	-0.70									
1528	0.114	0.34		59.37	-0.08									
1529	-0.257	-0.77	-0.18	60.57	1.32	0.83		dry	warm	3 dry	20	-3.43	19.53	131
1530	0.322	0.97	1.02	60.38	1.10	0.85				2 warm				
1531	-0.124	-0.37		61.89	2.85									
1532	-0.486	-1.46		61.63	2.55									
1533	-0.08	-0.24		60.39	1.11									
1534	0.012	0.04		60.52	1.26									
1535	0.013	0.04		59.24	-0.23									
1536	0.349	1.05		59.43	-0.01									

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1537	-0.093	-0.28		59.07	-0.42									
1538	-0.33	-0.99		60.48	1.21									
1539	0.19	0.57		60.26	0.96									
1540	0.319	0.96		59.9	0.54									
1541	-0.208	-0.62		59.55	0.13									
1542	-0.924	-2.78		59.57	0.16									
1543	0.281	0.85		60.15	0.83									
1544	-0.013	-0.04		60.8	1.58		FR							
1545	-0.16	-0.48		59.86	0.49									
1546	0.518	1.56		59.49	0.06									
1547	-0.445	-1.34		60.21	0.90									
1548	-0.056	-0.17		59.65	0.25									
1549	0.564	1.70	0.43	59.94	0.59	-0.42		wet	cool	0	10	6.32	-9.15	132
1550	0.448	1.35	0.67	59.09	-0.40	0.46								
1551	0.155	0.47		59.18	-0.30									
1552	0.165	0.50		59.27	-0.19									
1553	0.004	0.01		59.18	-0.30									
1554	0.008	0.02		58.74	-0.81									
1555	-0.141	-0.42		59.26	-0.20									
1556	0.135	0.41		58.63	-0.93									
1557	0.185	0.56		58.64	-0.92									
1558	-0.107	-0.32		58.77	-0.77									
1559	0.103	0.31	0.45	59.54	0.12	0.51		wet	warm	0	5	4.37	3.97	133
1560	-0.021	-0.06	0.51	59.44	0.01	0.64								
1561	0.005	0.02		59.46	0.03									
1562	0.323	0.97		60.62	1.37									
1563	0.336	1.01		60.3	1.00									
1564	0.375	1.13	0.38	59.21	-0.26	-0.67		wet	cool	0	5	1.83	-11.31	134
1565	0.136	0.41	1.03	58.71	-0.84	0.29								
1566	-0.255	-0.77		58.54	-1.04									
1567	-0.173	-0.52		58.9	-0.62									
1568	0.541	1.63		58.95	-0.56									
1569	0.108	0.33	-0.49	59.44	0.01	-0.38	FR	dry	cool	1 dry	15	-13.56	-10.22	135
1570	-0.228	-0.68	0.54	58.64	-0.92	0.55								
1571	-0.159	-0.48		59.51	0.09									
1572	-0.14	-0.42		59.01	-0.49									
1573	-0.587	-1.76		59.45	0.02									
1574	-0.192	-0.58		59.16	-0.32									
1575	-0.092	-0.28		60.01	0.67									
1576	-0.141	-0.42		58.94	-0.57									
1577	0.166	0.50		58.4	-1.20									
1578	-0.159	-0.48		58.53	-1.05									
1579	-0.35	-1.05		58.6	-0.97									
1580	-0.237	-0.71		59.69	0.30									
1581	0.001	0.00		59.49	0.06									
1582	-0.154	-0.46		59.05	-0.45									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1583	-0.28	-0.84		58.74	-0.81									
1584	-0.597	-1.79	-0.72	59.18	-0.30	0.81		dry	warm	4 dry	9	-7.80	13.26	136
1585	-0.472	-1.42	0.84	59.62	0.21	0.55								
1586	-0.064	-0.19		59.92	0.56									
1587	-0.018	-0.05		60.48	1.21									
1588	-0.006	-0.02		60.22	0.91									
1589	0.152	0.46		60.28	0.98									
1590	-0.533	-1.60		60.4	1.12									
1591	-0.477	-1.43		60.63	1.39									
1592	-0.156	-0.47		60.44	1.17									
1593	0.068	0.21	0.17	60.24	0.93	0.43		wet	warm	0	5	1.08	6.04	137
1594	0.214	0.64	0.79	59.55	0.13	0.35								
1595	0.059	0.18		59.52	0.10		FR							
1596	0.318	0.96		59.73	0.34									
1597	-0.374	-1.12		59.97	0.62									
1598	0.12	0.36	-0.44	59.13	-0.35	-0.74		dry	cool	1 dry	5	-2.01	-7.63	138
1599	0.223	0.67	1.11	58.3	-1.32	0.49				1 cool				
1600	-0.66	-1.98		58.78	-0.76									
1601	-0.387	-1.16		58.48	-1.11									
1602	-0.035	-0.10		59.29	-0.17									
1603	0.171	0.51	0.22	58.92	-0.60	-0.87		wet	cool	2 cool	10	3.34	-17.62	139
1604	0.02	0.06	0.65	58.52	-1.06	0.50								
1605	0.169	0.51		57.94	-1.73									
1606	-0.031	-0.09		58.82	-0.71									
1607	-0.064	-0.19		59.23	-0.24									
1608	0.248	0.75		58.46	-1.13									
1609	0.213	0.64		58.17	-1.47									
1610	0.44	1.32		58.54	-1.04									
1611	-0.17	-0.51		59.17	-0.31									
1612	-0.278	-0.84		59.04	-0.46									
1613	-0.509	-1.53	-1.53	60.22	0.91	0.91		dry	warm	1 dry	1	NA	NA	140
1614	0.128	0.39	0.76	59.44	0.01	-0.34		wet	cool	0	8	9.11	-5.89	141
1615	0.049	0.15	0.66	59.57	0.16	0.47	FRew							
1616	0.435	1.31		59.23	-0.24									
1617	0.21	0.63		58.74	-0.81									
1618	0.503	1.51		58.71	-0.84									
1619	-0.026	-0.08		59.65	0.25									
1620	0.146	0.44		58.65	-0.91									
1621	0.565	1.70		59.13	-0.35									
1622	-0.281	-0.84	-0.71	58.98	-0.53	-0.52		dry	cool	1 dry	4	-1.85	-5.00	142
1623	-0.811	-2.44	1.53	58.49	-1.10	0.41								
1624	-0.278	-0.84		59.27	-0.19									
1625	0.427	1.28		59.22	-0.25		FRew							
1626	-0.349	-1.05	-0.25	59.44	0.01	0.48		dry	warm	1 dry	9	-3.09	8.57	143
1627	0.068	0.21	0.74	60.2	0.89	0.50								
1628	-0.091	-0.27		60.64	1.40									

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1629	0.111	0.33		60.13	0.81									
1630	0.115	0.35		59.64	0.24									
1631	-0.027	-0.08		59.79	0.41									
1632	-0.581	-1.75		59.26	-0.20									
1633	-0.16	-0.48		59.95	0.60									
1634	0.152	0.46		59.56	0.14									
1635	0.265	0.80	0.37	59.13	-0.35	-1.53		wet	cool	5 cool	11	5.95	-18.44	144
1636	-0.014	-0.04	0.68	59	-0.50	0.91								
1637	-0.186	-0.56		58.94	-0.57									
1638	-0.067	-0.20		58.34	-1.27									
1639	0.05	0.15		58.54	-1.04									
1640	0.449	1.35		58.46	-1.13		FR+							
1641	0.273	0.82		57.97	-1.70									
1642	-0.049	-0.15		57.53	-2.21									
1643	-0.032	-0.10		56.96	-2.87									
1644	0.516	1.55		57.18	-2.62									
1645	0.141	0.42		57.24	-2.55									
1646	-0.359	-1.08	-0.90	56.43	-3.49	-2.70		dry	cool	1 dry	3	-2.43	-10.67	145
1647	0.096	0.29	1.11	57.14	-2.66	0.76				3 cool				
1648	-0.634	-1.91		57.74	-1.97									
1649	0.264	0.79	0.88	57.79	-1.91	-1.71		wet	cool	4 cool	4	7.19	-22.90	146
1650	0.489	1.47	0.49	58.31	-1.31	0.30								
1651	0.325	0.98		57.75	-1.95		FR							
1652	0.094	0.28		58.01	-1.65									
1653	-0.317	-0.95	-1.56	58.65	-0.91	-0.44		dry	cool	1 dry	2	-3.62	-1.33	147
1654	-0.723	-2.17	0.86	59.46	0.03	0.66								
1655	0.171	0.51	0.43	60.07	0.74	0.30		wet	warm	0	9	6.85	5.04	148
1656	0.249	0.75	0.57	59.82	0.45	0.54								
1657	-0.203	-0.61		60.18	0.86									
1658	-0.075	-0.22		59.92	0.56									
1659	0.112	0.34		59.63	0.23									
1660	0.157	0.47		60.08	0.75									
1661	0.453	1.36		59.01	-0.49									
1662	0.215	0.65		58.89	-0.63									
1663	0.218	0.66		59.65	0.25									
1664	-0.11	-0.33	-0.63	58.83	-0.70	-1.02		dry	cool	2 dry	8	-7.30	-20.91	149
1665	-0.152	-0.46	0.69	59.11	-0.38	0.39				2 cool				
1666	-0.45	-1.35		58.58	-0.99									
1667	-0.208	-0.62		58.76	-0.78									
1668	-0.262	-0.79		58.39	-1.21									
1669	-0.096	-0.29		58.12	-1.53									
1670	-0.574	-1.73		58.51	-1.07									
1671	0.176	0.53		58.18	-1.46									
1672	0.489	1.47	0.40	58.57	-1.00	-1.05		wet	cool	2 cool	12	5.39	-18.32	150
1673	0.169	0.51	0.88	58.52	-1.06	0.69								
1674	0.355	1.07		59.14	-0.34									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1675	-0.364	-1.09		58.94	-0.57									
1676	-0.31	-0.93		58.48	-1.11									
1677	0.352	1.06		58.84	-0.69									
1678	0.1	0.30		58.58	-0.99									
1679	-0.198	-0.59		57.93	-1.75									
1680	0.45	1.35		56.93	-2.91		FR+							
1681	0.314	0.94		58.84	-0.69									
1682	-0.018	-0.05		58.53	-1.05									
1683	0.239	0.72		59.02	-0.48									
1684	-0.759	-2.28	-0.63	59.31	-0.15	-0.23		dry	cool	1 dry	4	-1.62	-2.25	151
1685	-0.383	-1.15	1.56	59.59	0.18	0.41								
1686	-0.175	-0.53		59.3	-0.16									
1687	0.478	1.44		58.74	-0.81									
1688	0.23	0.69	0.69	59.91	0.55	1.24		wet	warm	1 warm	6	9.07	12.61	152
1689	0.465	1.40	0.45	60.67	1.43	0.59								
1690	0.053	0.16		60.19	0.88									
1691	0.335	1.01		60.47	1.20									
1692	0.174	0.52		60.39	1.11									
1693	0.113	0.34		61.4	2.28									
1694	-0.13	-0.39	-0.20	61.59	2.50	1.14		dry	warm	1 warm	5	-2.29	7.03	153
1695	0.069	0.21	0.45	60.33	1.04	0.81								
1696	-0.29	-0.87		60.24	0.93									
1697	0.056	0.17		60.24	0.93									
1698	-0.045	-0.13		59.7	0.31									
1699	0.248	0.75	0.19	59.34	-0.11	-0.48		wet	cool	0	8	2.06	-9.56	154
1700	-0.173	-0.52	0.72	59.28	-0.18	0.40								
1701	0.408	1.23		58.51	-1.07									
1702	-0.116	-0.35		58.61	-0.96		FR+							
1703	-0.155	-0.47		59.24	-0.23									
1704	-0.17	-0.51		58.88	-0.64									
1705	0.299	0.90		58.88	-0.64									
1706	0.155	0.47		59.42	-0.02									
1707	-0.294	-0.88	-0.87	59.7	0.31	0.88		dry	warm	0	3	-24.42	5.30	155
1708	-0.324	-0.97	0.11	60.48	1.21	0.50								
1709	-0.253	-0.76		60.4	1.12									
1710	0.373	1.12	0.45	59.95	0.60	1.59		wet	warm	3 warm	12	5.97	33.32	156
1711	0.256	0.77	0.90	61.01	1.83	0.57								
1712	0.179	0.54		60.49	1.22		FR							
1713	0.06	0.18		60.63	1.39									
1714	0.147	0.44		60.69	1.46									
1715	-0.385	-1.16		60.49	1.22									
1716	-0.279	-0.84		61.49	2.38									
1717	0.189	0.57		60.86	1.65									
1718	0.6	1.80		61.5	2.39									
1719	0.207	0.62		60.67	1.43									
1720	0.557	1.68		61.5	2.39									

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1721	-0.12	-0.36		60.36	1.07									
1722	-0.489	-1.47	-0.81	59.3	-0.16	-0.60		dry	cool	2 dry	3	-2.11	-4.12	157
1723	0.173	0.52	1.15	58.91	-0.61	0.44								
1724	-0.492	-1.48		58.55	-1.03									
1725	0.159	0.48	1.16	58.26	-1.36	-1.32		wet	cool	1 cool	2	2.41	-40.14	158
1726	0.613	1.84	0.97	58.34	-1.27	0.07								
1727	-0.172	-0.52	-0.56	59.74	0.35	0.57		dry	warm	4 dry	13	-7.66	17.66	159
1728	-0.496	-1.49	0.95	59.68	0.28	0.42								
1729	-0.587	-1.76		59.78	0.40									
1730	0.046	0.14		59.69	0.30									
1731	0.019	0.06		60.05	0.71									
1732	0.11	0.33		59.09	-0.40		FR+							
1733	-0.456	-1.37		60.13	0.81									
1734	0.05	0.15		59.81	0.43									
1735	-0.736	-2.21		59.86	0.49									
1736	0.079	0.24		60.23	0.92									
1737	-0.162	-0.49		60.36	1.07									
1738	0.28	0.84		60.46	1.19									
1739	-0.411	-1.24		60.18	0.86									
1740	0.005	0.02	0.51	62.16	3.16	1.45		wet	warm	1 warm	7	6.47	9.89	160
1741	0.192	0.58	0.55	61.12	1.95	1.02								
1742	-0.092	-0.28		60.64	1.40									
1743	0.358	1.08		61.02	1.84									
1744	0.066	0.20		60.54	1.28									
1745	0.259	0.78		59.69	0.30									
1746	0.397	1.19		59.6	0.19									
1747	0.071	0.21	-0.71	58.49	-1.10	-0.57		dry	cool	2 dry	6	-2.84	-8.45	161
1748	-0.898	-2.70	1.50	58.93	-0.59	0.41	FR							
1749	0.492	1.48		58.92	-0.60									
1750	-0.299	-0.90		59.57	0.16									
1751	-0.134	-0.40		58.82	-0.71									
1752	-0.65	-1.95		58.92	-0.60									
1753	-0.018	-0.05	-0.47	60.19	0.88	1.15		dry	warm	0	3	-3.77	5.61	162
1754	-0.191	-0.57	0.37	60.06	0.72	0.62								
1755	-0.258	-0.78		61.04	1.86									
1756	0.181	0.54	0.96	61.91	2.87	1.30		wet	warm	1 warm	7	15.16	10.42	163
1757	0.288	0.87	0.45	60.33	1.04	0.88								
1758	0.597	1.80		60.59	1.34									
1759	0.381	1.15		60.99	1.80									
1760	0.336	1.01		60.56	1.30									
1761	0.145	0.44		59.98	0.63		FR+							
1762	0.317	0.95		59.55	0.13									
1763	-0.265	-0.80	0.50	58.63	-0.93	-1.08		wet	cool	4 cool	9	4.57	-16.00	164
1764	0.659	1.98	0.99	59.42	-0.02	0.61								
1765	-0.096	-0.29		58.13	-1.51									
1766	0.655	1.97		58.9	-0.62									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1767	0.242	0.73		57.95	-1.72									
1768	-0.01	-0.03		58.34	-1.27									
1769	-0.036	-0.11		57.83	-1.86									
1770	0.008	0.02		58.31	-1.31									
1771	0.349	1.05		58.99	-0.52									
1772	-0.03	-0.09	-0.43	59.81	0.43	1.17		dry	warm	4 dry	19	-8.14	22.92	165
1773	-0.78	-2.34	1.01	59.91	0.55	0.97				3 warm				
1774	-0.025	-0.07		59.07	-0.42									
1775	0.199	0.60		59.5	0.07									
1776	0.043	0.13		59.7	0.31									
1777	-0.125	-0.38		60.39	1.11									
1778	-0.607	-1.82		60.25	0.94									
1779	-0.11	-0.33		60.74	1.51									
1780	-0.306	-0.92		60.38	1.10									
1781	-0.013	-0.04		59.85	0.48									
1782	-0.375	-1.13		60.49	1.22									
1783	0.236	0.71		60	0.65									
1784	0.366	1.10		60.15	0.83									
1785	-0.628	-1.89		60.51	1.25									
1786	-0.138	-0.41		60.9	1.70									
1787	0.477	1.43		62.59	3.66									
1788	-0.454	-1.36		61.6	2.51									
1789	-0.322	-0.97		61.6	2.51									
1790	-0.158	-0.47		61.04	1.86									
1791	0.292	0.88	1.44	60.75	1.52	1.33		wet	warm	1 wet	3	5.76	21.47	166
1792	0.384	1.16	0.75	60.43	1.15	0.19								
1793	0.764	2.30		60.57	1.32									
1794	-0.339	-1.02	-0.28	59.82	0.45	0.70		dry	warm	1 dry	15	-5.00	22.19	167
1795	0.199	0.60	0.85	60.21	0.90	0.47								
1796	-0.321	-0.96		59.88	0.52									
1797	-0.216	-0.65		60.61	1.36									
1798	-0.337	-1.01		60.31	1.01									
1799	0.405	1.22		59.96	0.61									
1800	-0.478	-1.44		60.08	0.75									
1801	-0.348	-1.05		60.37	1.08									
1802	0.262	0.79		59.65	0.25									
1803	-0.304	-0.91		59.29	-0.17									
1804	0.235	0.71		59.47	0.04									
1805	-0.293	-0.88		59.89	0.53									
1806	0.055	0.17		60.71	1.48									
1807	0.026	0.08		60.41	1.13									
1808	0.045	0.14		59.86	0.49									
1809	0.037	0.11	-0.44	59.15	-0.33	-1.12		dry	cool	4 dry	15	-6.19	-28.95	168
1810	-0.119	-0.36	1.06	58.02	-1.64	0.58	FR+			7 cool				
1811	0.291	0.88		58.23	-1.40									
1812	0.177	0.53		58.69	-0.86									

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1813	-0.766	-2.30		58.55	-1.03									
1814	-0.125	-0.38		58.13	-1.51									
1815	0.12	0.36		58.18	-1.46									
1816	0.241	0.73		58.37	-1.24									
1817	-0.096	-0.29		57.63	-2.09									
1818	-0.465	-1.40		58.08	-1.57									
1819	-0.078	-0.23		58.23	-1.40									
1820	-0.551	-1.66		58.4	-1.20									
1821	0.199	0.60		58.63	-0.93									
1822	-0.772	-2.32		59.41	-0.03									
1823	-0.277	-0.83		59.31	-0.15									
1824	0.215	0.65	0.59	58.99	-0.52	-0.53		wet	cool	1 dry	17	10.74	-10.17	169
1825	0.208	0.63	0.94	58.98	-0.53	0.88				1 wet				
1826	0.381	1.15		60.08	0.75					3 cool				
1827	0.082	0.25		59.66	0.26									
1828	0.809	2.43		59.19	-0.28		FR+							
1829	-0.633	-1.90		58.74	-0.81									
1830	0.055	0.17		59.42	-0.02									
1831	0.436	1.31		58.95	-0.56									
1832	0.149	0.45		59.49	0.06									
1833	0.486	1.46		59.52	0.10									
1834	0.037	0.11		59.54	0.12									
1835	0.156	0.47		58.68	-0.88									
1836	0.137	0.41		59.47	0.04									
1837	-0.108	-0.32		59.08	-0.41									
1838	0.271	0.82		58.16	-1.48									
1839	0.571	1.72		57.09	-2.72									
1840	0.093	0.28		57.61	-2.12									
1841	-0.628	-1.89	-0.92	57.7	-2.01	-1.12		dry	cool	3 dry	7	-4.72	-8.72	170
1842	-0.349	-1.05	1.36	58.51	-1.07	0.90				3 cool				
1843	-0.124	-0.37		57.75	-1.95									
1844	0.551	1.66		58	-1.66									
1845	-0.748	-2.25		58.56	-1.02									
1846	-0.158	-0.47		58.88	-0.64									
1847	-0.682	-2.05		59.91	0.55									
1848	0.65	1.95	0.51	59.49	0.06	-0.46		wet	cool	1 dry	8	4.12	-7.17	171
1849	0.429	1.29	1.00	58.52	-1.06	0.51								
1850	0.289	0.87		58.61	-0.96									
1851	-0.448	-1.35		59.31	-0.15									
1852	0.314	0.94		59.03	-0.47									
1853	0.029	0.09		59.01	-0.49									
1854	0.005	0.02		58.64	-0.92									
1855	0.093	0.28		59.72	0.33									
1856	-0.038	-0.11	-0.58	59.12	-0.37	0.05		dry	warm	3 dry	9	-4.38	1.18	172
1857	-0.891	-2.68	1.20	59.63	0.23	0.38								
1858	0.185	0.56		59.93	0.57									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1859	-0.262	-0.79		59.77	0.39									
1860	-0.073	-0.22		59.44	0.01									
1861	-0.278	-0.84		59.43	-0.01									
1862	0.492	1.48		58.94	-0.57									
1863	-0.45	-1.35		59.79	0.41									
1864	-0.433	-1.30		59.26	-0.20									
1865	0.402	1.21	1.59	60.1	0.77	0.79		wet	warm	0	2	5.95	64.07	173
1866	0.653	1.96	0.53	60.13	0.81	0.02								
1867	0.304	0.91	1.66	58.12	-1.53	-0.98		wet	cool	1 wet	2	3.14	-2.54	174
1868	0.802	2.41	1.06	59.06	-0.44	0.77				1 cool				
1869	-0.186	-0.56	-1.06	59.18	-0.30	-0.27		dry	cool	1 dry	3	-6.06	-4.19	175
1870	-0.341	-1.02	0.53	59.38	-0.06	0.19								
1871	-0.536	-1.61		59.05	-0.45									
1872	-0.268	-0.81	-0.27	59.99	0.64	0.68		dry	warm	0	6	-1.86	11.15	176
1873	-0.231	-0.69	0.87	60.51	1.25	0.36								
1874	0.444	1.34		60.21	0.90									
1875	0.046	0.14		59.83	0.46									
1876	-0.307	-0.92		59.6	0.19									
1877	-0.224	-0.67		59.97	0.62									
1878	0.222	0.67	-0.34	58.42	-1.18	-0.35		dry	cool	1 dry	6	-2.42	-2.73	177
1879	-0.538	-1.62	0.83	59.06	-0.44	0.77								
1880	0.145	0.44		59.68	0.28									
1881	-0.146	-0.44		60.08	0.75									
1882	-0.263	-0.79		59.13	-0.35		FR+							
1883	-0.091	-0.27		58.43	-1.17									
1884	0.356	1.07	0.66	58.76	-0.78	-0.49	FR*	wet	cool	0	2	2.30	-2.33	178
1885	0.085	0.26	0.58	59.27	-0.19	0.42								
1886	-0.036	-0.11	-0.72	59.24	-0.23	-0.16		dry	cool	1 dry	2	-1.66	-3.19	179
1887	-0.442	-1.33	0.86	59.36	-0.09	0.10								
1888	0.235	0.71	0.60	59.33	-0.12	-0.20		wet	cool	0	4	10.32	-2.93	180
1889	0.166	0.50	0.23	59.52	0.10	0.27								
1890	0.283	0.85		58.96	-0.55									
1891	0.108	0.33		59.25	-0.22									
1892	-0.029	-0.09	-0.75	59.74	0.35	0.52		dry	warm	5 dry	13	-9.03	13.94	181
1893	-0.206	-0.62	1.08	59.85	0.48	0.48								
1894	-0.278	-0.84		59.58	0.17									
1895	0.214	0.64		59.4	-0.04									
1896	-0.576	-1.73		60.13	0.81									
1897	0.144	0.43		60.53	1.27									
1898	-0.141	-0.42		59.35	-0.10									
1899	-0.776	-2.33		59.88	0.52									
1900	-0.451	-1.36		60.4	1.12									
1901	-0.02	-0.06		59.74	0.35									
1902	-0.681	-2.05		60.56	1.30									
1903	0.251	0.76		59.85	0.48									
1904	-0.7	-2.10		59.43	-0.01									

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								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1905	0.469	1.41	1.42	59.84	0.47	0.56		wet	warm	1 wet	6	13.10	4.66	182
1906	0.813	2.44	0.65	60.99	1.80	0.72								
1907	0.601	1.81		59.95	0.60									
1908	0.388	1.17		59.32	-0.13									
1909	0.384	1.16		59.31	-0.15									
1910	0.178	0.54		60.08	0.75									
1911	0.448	1.35	0.87	59.06	-0.44	-1.22		wet	cool	5 cool	10	9.76	-24.45	183
1912	0.21	0.63	0.90	58.92	-0.60	0.50								
1913	-0.299	-0.90		58.22	-1.41									
1914	0.349	1.05		58.73	-0.82									
1915	0.367	1.10		58	-1.66									
1916	0.441	1.33		57.83	-1.86									
1917	0.583	1.75		57.86	-1.83									
1918	-0.177	-0.53		58.52	-1.06									
1919	0.456	1.37		58.46	-1.13									
1920	0.529	1.59		58.21	-1.42									
1921	-0.249	-0.75	-0.06	59.26	-0.20	-1.05		dry	cool	4 cool	11	-0.98	-23.38	184
1922	0.388	1.17	0.64	58.42	-1.18	0.49								
1923	-0.178	-0.53		58.04	-1.62		FR							
1924	0.056	0.17		58.88	-0.64									
1925	-0.092	-0.28		58.54	-1.04									
1926	-0.102	-0.31		58.47	-1.12									
1927	-0.098	-0.29		58.28	-1.34									
1928	-0.154	-0.46		57.94	-1.73									
1929	-0.067	-0.20		58.13	-1.51									
1930	0.384	1.16		58.84	-0.69									
1931	-0.1	-0.30		59.02	-0.48									
1932	0.315	0.95	0.07	60.03	0.69	0.68		wet	warm	0	11	0.87	21.81	185
1933	0.031	0.09	0.93	60	0.65	0.34								
1934	-0.311	-0.93		59.87	0.50									
1935	-0.004	-0.01		59.69	0.30									
1936	-0.385	-1.16		60.49	1.22									
1937	0.419	1.26		60.57	1.32									
1938	0.036	0.11		59.6	0.19									
1939	-0.22	-0.66		59.96	0.61									
1940	-0.221	-0.66		60.1	0.77									
1941	0.59	1.77		59.87	0.50		FR+							
1942	0.019	0.06		60.02	0.68									
1943	-0.49	-1.47	-0.34	60.82	1.61	1.67		dry	warm	5 dry	22	-6.82	43.50	186
1944	0.332	1.00	1.09	60.08	0.75	0.84				6 warm				
1945	0.145	0.44		60.3	1.00									
1946	-0.287	-0.86		60.27	0.97									
1947	-0.433	-1.30		60.53	1.27									
1948	-0.139	-0.42		59.97	0.62									
1949	0.504	1.52		60.1	0.77									
1950	-0.251	-0.75		60.42	1.14									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								dry	warm	≥+2.00				
Year		Precipitation	Mean and	San Francisco Peaks	Temperature	Mean and		wet	cool	≤-1.28	No. of	Precipitation	Temperature	Interval
A.D.	Don-Verde	Z-Score	Standard Deviation	Bristlecone Pine	Z-Score	Standard Deviation	Frost Ring?	Precipitation	Temperature	Extremes	Years	Index	Index	No.
1951	-0.597	-1.79		60.41	1.13									
1952	0.587	1.77		60.68	1.44									
1953	-0.328	-0.99		61.86	2.81									
1954	-0.106	-0.32		61.19	2.04									
1955	-0.112	-0.34		61.03	1.85									
1956	-0.587	-1.76		62.51	3.57									
1957	0.4	1.20		61.83	2.78									
1958	0.124	0.37		62.34	3.37									
1959	-0.307	-0.92		61.48	2.37									
1960	0.187	0.56		60.43	1.15									
1961	-0.316	-0.95		61.11	1.94									
1962	0.028	0.08		60.8	1.58									
1963	-0.679	-2.04		60.36	1.07									
1964	-0.155	-0.47		60.67	1.43									
1965	0.405	1.22	0.21	60.39	1.11	1.58	FR*	wet	warm	4 dry	24	4.51	35.40	187
1966	0.132	0.40	1.11	59.5	0.07	1.07				8 warm				
1967	-0.152	-0.46		59.78	0.40									
1968	0.069	0.21		60.56	1.30									
1969	0.205	0.62		59.9	0.54									
1970	0.001	0.00		60.15	0.83									
1971	-0.696	-2.09		59.52	0.10									
1972	0.116	0.35		59.76	0.38									
1973	0.406	1.22		59.47	0.04									
1974	-0.547	-1.64		60.9	1.70									
1975	0.294	0.88		61.46	2.35									
1976	0.256	0.77		61.89	2.85									
1977	-0.648	-1.95		61.56	2.46									
1978	0.462	1.39		60.86	1.65									
1979	0.435	1.31		61.53	2.43									
1980	0.508	1.53		62.45	3.50									
1981	-0.493	-1.48		62.67	3.75									
1982	0.383	1.15		61.28	2.14									
1983	0.142	0.43		60.83	1.62									
1984	-0.376	-1.13		60.85	1.64									
1985	0.382	1.15		60.77	1.55									
1986	0.059	0.18		60.36	1.07									
1987	0.356	1.07		62.03	3.01									
1988	-0.034	-0.10		60.66	1.42									
										total years	1,418			
Mean	0.00	0.00		59.44	0.00					mean interval	7.6			
Standard deviation	0.33	1.00		0.86	1.00					minimum	1			
Minimum	-0.95	-2.84		56.42	-3.50					max	26			
Maximum	0.90	2.70		62.67	3.75					median	7			
										mode	3			

APPENDIX B

Summary of Terrestrial Ecosystem Survey (TES) Map Units within the Middle Verde River Valley

Table B.1. Coconino National Forest Terrestrial Ecosystem Survey Units in the Middle Verde River Valley

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
33	valley plains	850–1,100	0–5	linear/concave	no information	Entisol	River Wash, Aquic Ustifluents	deep, extremely cobbly, sand	not listed	alluvium, mixed sources	36–44	Pofr2, Plwr2, Alob2, Saex, Fraxi, Bocu		1,000	350	1,200	0	The unit is subject to frequent flooding, erosion of materials, and deposition of new sediment.	M	H
34	valley plains	850–1,100	0–5	linear/linear	no information	Entisol	Typic Ustipsamments, Typic Ustifluvents	deep, no rock fragments, sand	not listed	alluvium, mixed sources	36–44	Prve, Cyda, Acgr, Basa2, Cepa8, Mupu2		500	175	550	0	The unit is susceptible to wind erosion and occasional flooding. Sandy soils have very low water-holding capacity.	M	M
45	valley plains	1,200–1,500	0–5	linear/concave	no information	Inceptisol	Typic Ustifluvents, Fluventic Ustochrepts	deep, cobbly, loamy fine sand	not listed	alluvium, mixed sources	52–60	Pifa, Jude2, Quem, Bogr2		900	300	1,200	0	The unit is susceptible to wind erosion and occasional flooding. Sandy soils have very low water-holding capacity.	M	M
46	valley plains	1,100–1,400	0–5	linear/ linear-concave	no information	Entisol	Mollic Ustifluvents, Aquic Ustifluvents	deep, bouldery sand, frequently flooded	not listed	alluvium, mixed sources	48–56	Plwr2, Cuarg, Pofr2, Bogr2		1,100	350–400	1,300	0	The unit is susceptible to wind erosion and occasional flooding. Sandy soils have very low water-holding capacity.	M	M
55	valley plains/ swales	1,950–2,300	0–5	concave/concave	no information	Mollisol	Pachic Argiborolls,Vertic Argiborolls	deep, no rock fragments, loam or clay loam	basalt	alluvium, basalt/ cinders	50–60	Popr, Fear2, Mumo, Pofe, Agsm		2,000–3,000	2,000–3,000	2,000–3,000	0	The unit receives added moisture as runoff from surrounding areas and may be seasonally wet or ponded. Forage and revegetation potential is high for given components.	L	M–H
56	valley plains	1,500–1,700	0–5	linear/ linear-concave	no information	Mollisol	Mollic Ustifluvents, Aquic Haplustolls	deep, very bouldery sand, occasionally flooded	not listed	alluvium, mixed sources	60–68	Pipos, Juma, Acne2, Quar	yes	1,200–1,300	400–500	2,000–2,200	0	The unit soils have low water-holding capacity and are subject to occasional flooding.	L	M
60	valley plains	1,700–1,800	0–5	linear/ linear-concave	no information	Mollisol	Fluventic Haploborolls, Aquic Haploborolls	deep, very bouldery, fine sandy loam or loamy coarse sand	not listed	alluvium, mixed sources	64–72	Poan3, Acne2, Psmeg, Cost4		325–800	125–700	3,150–3,250	0	The unit soils have low water-holding capacity and are subject to occasional flooding.	L	M
280	valley plains/alluvial fans	900–1,150	0–5	linear-concave/ linear	south	Aridisol	Ustochreptic Camborthids	deep, no rock fragments, loam	limestone	alluvium, limestone/ sandstone	28–36	Ladi2, Prve, Himu2, Boer4, Stoco4		300	150	200	0	The unit is classified as an edaphic-zootic disclimax. Current vegetation is the result of overgrazing by livestock, as indicated by a high canopy cover of creosote bush and a low cover of black grama grass. The hot, dry climate and calcareous soil limit revegetation.	M	H
350	hills/ escarpments	900–1,300	15–80	convex/convex	all	Inceptisol	Lithic Ustochrepts, Calciorthidic Ustochrepts	shallow to moderately deep, extremely cobbly loam	limestone	residuum/colluvium, limestone	38–46	Stoco4, Caho3, Arist, Boer4		400–600	100–200	350–550	0	The unit soils are on steep slopes, are shallow, and contain significant quantities of calcium carbonate throughout the profile.	VL	VL
381	lowland plains	1,000–1,400	0–15	convex/convex	all	Inceptisol	Calciorthidic Ustochrepts, Fluventic Ustochrepts	deep, no rock fragments, fine sandy loam	not listed	alluvium, limestone	34–42	Boer4, Stco4, Prve, Arist, Himu2		450	350	400	0	The unit soils contain significant quantities of calcium carbonate throughout the profile or at a relatively shallow depth.	L	L
382	lowland plains	900–1,200	0–15	linear/linear	all	Alfisol	Arid Haplustalfs	deep, cobbly, loamy fine sand	not listed	alluvium, basalt/ cinders	40–48	Himu2, Paob, Prve		600	200	550	0	The unit has high clay content at or near the soil surface that limits revegetation potential.	L	M
383	lowland plains	900–1,200	0–15	linear/linear	no information	Alfisol	Petrocalcic Paleustalfs, Aridic Haplustalfs	deep, very cobbly loam	not listed	alluvium, basalt/ cinders	38–46	Himu2, Beha, Cegr, Prve, Paob		600	200	550	0	The unit has high clay content at or near the soil surface that limits revegetation potential.	L	M
385	elevated plains	900–1,300	0–15	linear/convex	south	Inceptisol	Calciorthidic Ustochrepts, Lithic Ustochrepts	shallow, very gravelly loam	limestone	residuum, limestone	38–46	Caho3, Stco4, Arist, Boer4		450–650	125–225	450–600	0	The unit soils contain significant quantities of calcium carbonate throughout the profile or at a relatively shallow depth and a moderate erosion potential.	L	L
401	elevated plains	900–1,300	0–15	convex/convex	all	Alfisol	Lithic Hapustalfs, Typic Haplustalfs	deep, cobbly or gravelly loam	basalt/tuff	residuum, basalt/ ash/tuff	40–50	Boer4, Juer, Bocu, Prve		500–600	100–125	650–700	1–2	The unit has moderate erosion potential. Upon removal of the overstory, catclaw mimosa and other shrubs may offer significant plant competition.	L	L

continued on next page

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/Acre/Year)	Forage[c] (Pounds/Acre/Year)	ForageM[d] (Pounds/Acre/Year)	Fuelwood Potential[e] (Cords/Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
402	elevated plains	1,050–1,400	0–15	linear/ linear-convex	east	Alfisol	Vertic Haplustalfs	deep, very cobbly, silty clay loam	basalt	residuum, cinders/ basalt	40–50	Himu2, Prve, Juos, Qutu2		600	125	700–750	1	The unit has heavy clay at or near the soil surface. Upon removal of the overstory, Turbinella oak and other shrubs may offer significant plant competition.	L	L
403	lowland plains	900–1,450	0–15	linear-convex/ linear	all	Inceptisol	Calcic Ustochrepts, Typic Hapustalfs	deep, no rock fragments, fine sandy loam	not listed	alluvium, limestone/basalt	40–50	Boer4, Bocu, Bohi2, Juos, Prve		650	150	800	1	The unit soils contain significant quantities of calcium carbonate throughout the profile or at a relatively shallow depth. Upon removal of the overstory, catclaw mimosa and other shrubs may offer significant plant competition. The unit has high revegetation potential.	M	L
404	hills	1,300–1,700	15–40	linear/convex	north	Mollisol	Typic Argiustolls	deep, very cobbly loam	basalt	colluvium, basalt/ cinders	40–50	Bogr2, Juos, Himu2		650	150	800	2	The unit has steep slopes and moderate erosion potential.	VL	VL
414	lowland plains	1,100–1,500	0–15	linear/linear	no information	Inceptisol	Vertic Ustochrepts, Calcic Ustochrepts	moderately deep to deep, no rock fragments to cobbly, silty to sandy clay loam	not listed	alluvium, basalt	40–50	Himu, Juos, Prve	yes	600–625	125–150	600–650	1	Some unit components have a high clay context at or near the surface, have vertic properties (seasonal surface cracking and high shrink-swell potential). Other units contain significant quantities of calcium carbonate through the profile or at a relative shallow depth, with a restrictive layer between 70 and 100 cm.	M	L
416	hills	1,200–1,500	15–40	convex/linear	all	Alfisol	Lithic Rhodustalfs, Typic Rhodustalfs	shallow to moderately deep, very to extremely cobbly, fine sandy loam	sandstone	residuum/colluvium, sandstone	40–50	Juos, Qutu2, Jumo		450–550	50–75	200–250	2	The unit has moderate erosion potential. Upon removal of the overstory, turbinella oak and other shrubs may offer significant plant competition.	VL	VL
417	elevated plains	1,300–1,500	0–15	linear/linear	south	Alfisol	Petrocalcic Paleustalfs, Typic Paleustalfs	moderately deep to deep, gravely, fine sandy loam	not listed	alluvium, Quaternary gravel	40–50	Juos, Prve, Bocu, Erwr		650	150	800	1	The unit has moderate erosion potential and high shrink-swell potential. Upon removal of the overstory, catclaw acacia and other shrubs may offer significant plant competition.	L	M
418	hills	1,250–1,450	15–40	linear/convex	all	Inceptisol, Alfisol	Calcic Ustochrepts, Typic Paleustalfs	moderately deep to deep, very gravelly, fine sandy loam	not listed	alluvium, mixed sources	40–50	Mibi3, Juos, Prve		600–650	125–150	700–800	1	The unit is classified as an edaphic-zootic disclimax and is a result of past overgrazing. The unit has moderate erosion potential. Some components have significant quantities of calcium carbonate throughout the profile. Upon removal of the overstory, catclaw mimosa and other shrubs may offer significant plant competition.	VL	VL
420	hills	1,100–1,500	15–40	linear/convex	all	Alfisol, Inceptisol	Lithic Haplustalfs, Lithic Ustochrepts	shallow, extremely cobbly loam	basalt/felsite	colluvium/residuum, basalt/ felsite/tuff	40–50	Juos, Qutu2, Prve, Bocu	yes	550	100–125	650–700	2	The unit has shallow soils and moderate erosion potential. Upon removal of the overstory, turbinella oak and other shrubs may offer significant plant competition.	VL	VL
430	escarpment/hills	1,250–2,000	40–120	linear/ convex-linear	all	Alfisol	Typic Hapustalfs, Lithic Haplustalfs	shallow, extremely cobbly or stony clay loam or loam	basalt	colluvium/residuum, basalt/ cinders	48–56	Pifa, Juos, Qutu2	yes	550–650	125–150	900–1,000	2	The unit has steep slopes, surface rock fragments, and rock outcrops. Given components may have a moderate to severe erosion potential. The unit provides important winter range for elk.	VL	VL
447	elevated plains	1,100–1,400	0–15	linear/linear	all	Inceptisol	Calcic Ustochrepts, Lithic Ustochrepts	shallow to moderately deep, gravelly to very cobbly, fine sandy loam	limestone	residuum, limestone	48–56	Pifa, Juos, Stco4, Atca2, Qutu2		500–600	50–75	800–900	4–6	The unit contains significant quantities of calcium carbonate throughout the profile or at relatively shallow depth. Upon removal of the overstory, Dunn oak or other shrub species may offer significant plant competition.	L	L

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
448	hills/escarpments	1,100–1,400	15–80	convex/ linear-convex	south	Inceptisol	Calcic Ustochrepts, Lithic Ustochrepts	shallow to moderately deep, very to extremely gravelly, fine sandy to sandy loam	limestone	colluvium, limestone	48–56	Pifa, Juos, Qutu2, Atca2, Stco4		500–600	50–75	800–900	4–6	The unit has severe erosion potential. The unit contains significant quantities of calcium carbonate throughout the profile or at a relatively shallow depth.	VL	VL
457	elevated plains	1,300–1,450	0–15	linear/ concave-linear	south	Alfisol	Typic Rhodustalfs, Lithic Rhodustalfs	shallow to moderately deep, gravelly to very gravelly, fine sandy loam	sandstone	residuum, sandstone	48–56	Pifa, Juos, Qutu2		800–850	50–75	300–400	3–4	Upon removal of the overstory, turbinella oak, point-leaf manzanita, and other shrub species may offer significant plant competition.	VL	M
458	hills	1,250–1,600	15–40	convex/linear	north/south	Alfisol	Typic Rhodustalfs, Lithic Rhodustalfs	shallow to moderately deep, extremely gravelly, fine sandy loam	sandstone	residuum, sandstone	48–56	Pifa, Qutu2, Juos		800–850	50–75	300–400	3–4	The unit has moderately steep to steep slopes and a moderate erosion potential. Upon removal of the overstory, turbinella oak, point-leaf manzanita, and other shrub species may offer significant plant competition.	VL	VL
462	elevated plains	1,450–1,850	0–15	linear/linear	all	Alfisol	Typic Haplustalfs	moderately deep to deep, very stony to very cobbly clay loam	basalt	residuum, basalt/ cinders	48–56	Pifa, Juos, Bogr2, Bocu	yes	700	100	1,200	7	The unit has soils with high shrink-swell potential. Upon removal of the overstory, turbinella oak and other shrubs may offer significant plant competition.	L	M
463	hills/scarp slopes of plains	1,300–1,900	15–40	linear-convex/ convex-linear	all	Alfisol	Typic Haplustalfs	shallow to moderately deep, very cobbly to very stony clay loam	basalt	residuum/colluvium, basalt/ cinders	48–56	Pifa, Juos, Qutu2, Bogr2	yes	500–700	50–100	1,000–1,200	4–6	The unit has moderate erosion potential. Upon removal of the overstory, turbinella oak and other shrubs may offer significant plant competition.	VL	VL
466	elevated plains	1,650–1,800	0–15	linear/linear	all	Alfisol	Typic Haplustalfs, Vertic Haplustalfs	deep, very cobbly clay loam	basalt	residuum, basalt/ cinders	48–56	Pied, Juos, Boer4, Bocu	yes	1,100–1,200	900–1,000	1,100–1,200	0	The unit is associated with pushed or chained woodland areas on high-clay-content soils. These areas are presently maintained in this seral stage by management activities.	L	L
470	escarpments	1,400–1,900	40–120	linear/convex	south	Mollisol	Typic Argiustolls, rock outcrop	moderately deep, extremely stony clay loam	basalt	colluvium/residuum, basalt/ cinders	48–56	Qutu2, Cemo2, Cegr, Bocu		1,400	400	1,000	0	The unit has steep slopes, surface rock fragments, and rock outcrops and is subject to severe erosion potential. The unit provides important winter range for elk and good browse for deer. Mountain mahogany is heavily utilized by wildlife.	VL	VL
471	escarpments	1,250–1,850	40–120	linear/convex	south	Inceptisol, Entisol	rock outcrop, Typic Ustochrepts, Typic Ustorthents	moderately deep, very stone to extremely bouldery, fine sandy loam to loamy fine sand	sandstone	colluvium/residuum, sandstone/ limestone	48–56	Qutu2, Arpu5, Cemo2, Gawr3		900–1,000	100–150	700–900	0	The unit has steep slopes, surface rock fragments, and rock outcrops and is subject to severe erosion potential.	VL	VL
474	elevated plains/ hills	1,300–1,500	0–40	linear-convex/ linear	all	Alfisol	Typic Rhodustalfs	moderately deep, gravelly, loamy fine sand	sandstone	residuum, sandstone	48–56	Cuarg, Arpu5, Qutu2, Pifa		850	75	400	2	The unit is classified as a fire disclimax. Fire created and continues to maintain this community. The unit has moderate erosion potential. Upon removal of the overstory, turbinella oak and other shrub species may offer significant plant competition.	VL	L
475	escarpments	1,400–1,800	40–120	linear/convex	north	Alfisol	rock outcrop, Lithic Rhodustalfs	shallow, very cobbly, fine sandy loam	sandstone	colluvium, sandstone	48–56	Cuarg, Arpu5, Qutu2, Pifa		800	50	250	2	The unit is classified as a fire disclimax. Fire created and continues to maintain this community. The unit has severe erosion potential because of the steep slopes. Upon removal of the overstory, turbinella oak, point-leaf manzanita, and other shrub species may offer significant plant competition.	VL	VL

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Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
492	elevated plains	1,700–2,100	0–15	linear-concave/ linear	south	Alfisol, Mollisol	Vertic Haplustalfs, Lithic Argiustolls	moderately deep to deep, very cobbly to very stony clay loam	basalt	residuum, basalt/ cinders	52–60	Bogr2, Agsm, Qutu2, Bocu	yes	750–1,500	50–1,400	1,500–1,600	0–10	One component of this unit is associated with pushed or chained woodland areas, clayey soil subject to vertic properties, and moderate erosion potential. Another component typically occurs along ephemeral drainages.	L	M
493	hills/scarp slopes of plains	1,800–2,100	15–40	convex/ linear-convex	all	Alfisol	Lithic Haplustalfs, Typic Haplustalfs	shallow to moderately deep, very to extremely stony loam	basalt	residuum/colluvium, basalt/ cinders	52–60	Pifa, Jude2, Qutu2, Bogr2, Juos	yes	650–750	50	1,400–1,600	8–10	The unit has shallow soils and moderate erosion potential. Upon removal of the overstory, turbinella oak and alligator juniper may offer significant plant competition.	VL	VL
495	elevated plains	1,800–2,100	0–15	linear/linear	south	Alfisol	Typic Haplustalfs	moderately deep, very cobbly loam	basalt	residuum, basalt/ cinders	52–60	Pifa, Jude2, Qutu2, Bogr2, Juos	yes	750	50	1,600	10	The unit has low revegetation potential but is well suited for fuelwood production.	L	M
520	elevated plains	1,850–2,150	0–15	linear/linear	south	Alfisol	Udic Haplustalfs, Lithic Hapustalfs	shallow to moderately deep, very cobbly to very cobbly loam	basalt	residuum, basalt/ cinders	56–64	Pipos, Jude2, Pifa, Quga, Qutu2	yes	450–800	50	1,900–2,500	3–4	The unit occurs within the transition between forest and woodlands. Reforestation and revegetation potentials are limited by the dry climate. Timber production is low. Upon removal of the overstory, alligator juniper, turbinella oak, and other shrubs may offer significant plant competition.	L	M
530	hills/scarp slopes of plains	1,750–2,150	15–40	convex/linear	all	Alfisol	Udic Haplustalfs, Lithic Hapustalfs	shallow to moderately deep, very stony loam	basalt	residuum/colluvium, basalt/ cinders	60–68	Pipos, Jude2, Qutu2, Quga	yes	400–500	25–50	1,800–2,500	3–4	The unit has moderate to severe erosion potential. The natural regeneration, revegetation, and reforestation potentials are low because of surface rock fragments and or shallow soils. Upon removal of the overstory, alligator juniper, turbinella oak, and other shrubs may offer significant plant competition.	VL	VL
546	elevated plains	2,000–2,300	0–15	linear/linear	all	Alfisol	Typic Eutroboralfs	deep, gravelly, fine sandy loam, high precipitation	limestone	residuum, cherty limestone/ sandstone	58–70	Pipos, Quga, Acmil, Fear2, Luar3		500	250	2,500	0	The unit is well suited to timber production. The natural regeneration, reforestation, and revegetation potentials are high. The potential timber productivity is higher than would be expected, because of the higher-than-normal precipitation associated with its geographic position.	L	M
549	hills/scarp slopes of plains	2,000–2,300	15–40	convex/linear	all	Alfisol	Glossic Eutroboralfs, Typic Paleboralfs	deep, very gravelly, fine sandy loam, high precipitation	limestone	colluvium, cherty limestone	58–70	Pipos, Quga, Acmil, Fear2		500	250	2,500	0	The unit has moderate erosion potential. The natural regeneration potential is high. The potential timber productivity is higher than would be expected, because of the higher-than-normal precipitation associated with its geographic position.	VL	VL
550	hills/scarp slopes of plains	1,900–2,300	15–40	convex-concave/ convex-linear	all	Alfisol	Mollic Eutroboralfs, Typic Eutroboralfs	deep, cobbly, fine sandy loam	limestone	residuum/colluvium, limestone/ sandstone	50–60	Pipos, Quga, Acmil, Fear2		500	250	2,500	0	The unit has moderate erosional potential.	VL	VL
555	escarpments	1,700–2,400	40–120	convex/convex/ linear	north/south	Inceptisol	Typic Dystrochrepts, rock outcrop	moderately deep, very stony, fine sandy loam	sandstone/ limestone	colluvium/residuum, sandstone/ limestone	64–72	Psmeg, Abco, Pipos, Quga, Acmil	yes	250–450	50–200	2,300–2,800	0	On its northern aspects, cooler, moister conditions prevail and support mixed conifer climax community. On its southern aspects, warmer and drier conditions prevail and support a ponderosa pine community. Overall, this unit has severe erosion potential because of the steep slopes, surface rock fragments, and rock outcrops.	VL	VL
565	cinder cones	2,100–2,400	15–40	linear/convex	all	Alfisol	Mollic Eutroboralfs	moderately deep, very cobbly loam	basalt	colluvium, cinders/basalt	50–60	Pipos, Quga, Acmil, Fear2, Luar3		450	200	2,300	0	The unit has severe erosion potential. The natural regeneration potential is high.	VL	VL
567	elevated plains	1,900–2,200	0–15	linear-concave/ linear	north	Alfisol	Typic Eutroboralfs, Mollic Eutroboralfs	moderately deep to deep, no rock fragments to stony, fine sandy loam	limestone	residuum, limestone/ sandstone	50–60	Pipos, Jude2, Quga, Fear2, Luar3		500	250	2,500	0	Upon removal of the overstory, alligator juniper may offer significant plant competition.	L	M

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
572	elevated plains	1,800–2,100	0–15	linear/linear	south	Alfisol	Udic Haplustalfs	moderately deep, very stony fine sandy loam	sandstone	residuum, sandstone	60–68	Pipos, Jude2, Arpu5, Mumo		500	50	2,500	0	The unit has moderate erosion potential. The natural regeneration potential is moderate. Timber production potential is low. Upon removal of the overstory, point-leaf manzanita and alligator juniper may offer severe plant competition.	L	M
575	escarpments	1,900–2,400	40–120	concave-linear/ convex -linear	all	Alfisol	Mollic Eutroboralfs	moderately deep, very cobbly loam	basalt	colluvium/residuum, basalt/ cinders	50–60	Pipos, Quga, Luar3		400–450	150–200	2,200–2,300	0	The unit has severe erosion potential. The soils are above the angle of repose. Tree roots play a major role toward stabilizing these slopes.	VL	VL
578	elevated plains	1,950–2,300	0–15	linear/linear	west	Alfisol, Mollisol	Mollic Eutroboralfs, Typic Argiborolls	deep, cobbly loam	basalt	residuum, basalt/ cinders	50–60	Pipos, Jude2, Quga, Fear2, Luar3		500	250	2,500	0	Upon removal of the overstory, alligator juniper and Gambel's oak may offer significant plant competition.	L	M
579	elevated plains	1,950–2,300	0–15	linear/linear	south	Alfisol	Lithic Eutroboralfs, Mollic Eutroboralfs	shallow to moderately deep, very to extremely stony loam to clay loam	basalt	residuum, basalt/ cinders	50–60	Pipos, Jude2, Quga, Fear2, Luar3		450–500	225–250	2,350–2,500	0	The unit has shallow soils and abundant rock fragments. Upon removal of the overstory, alligator juniper and Gambel's oak may offer significant plant competition.	L	L
582	elevated plains	2,000–2,400	0–15	linear/linear	all	Alfisol	Lithic Argiborolls, Mollic Eutroboralfs	moderately deep to deep, gravelly to cobbly loam	basalt	residuum, basalt/ cinders	50–60	Pipos, Quga, Acmil, Fear2, Luar3		500–525	250–275	2,500–2,650	0	The unit is well suited to timber production. The natural regeneration potential is high. The natural regeneration, reforestation, and revegetation potentials are high.	L	M
584	hills/scarp slopes of plains	2,000–2,400	15–40	convex/linear	all	Alfisol, Mollisol	Mollic Eutroboralfs, Typic Argiborolls	moderately deep to deep, very stony to very cobbly loam	basalt	residuum, basalt/ cinders	50–60	Pipos, Quga, Acmil, Fear2, Luar3		525	275	2,650	0	The unit has moderate to moderate to severe erosion potential. Some components are well suited to timber production.	VL	VL
585	elevated plains	2,000–2,400	0–15	linear-convex/ linear	all	Alfisol	Lithic Eutroboralfs, Mollic Eutroboralfs	shallow to moderately deep, extremely stony to very cobbly loam	basalt	residuum, basalt/ cinders	50–60	Pipos, Quga, Acmil, Fear2, Luar3		450–500	225–250	2,350–2,500	0	The unit has shallow soils and abundant surface rock fragments.	L	L
586	elevated plains	2,000–2,400	0–15	linear/linear	all	Alfisol	Mollic Eutroboralfs	moderately deep, very stony loam	basalt	residuum, basalt/ cinders	50–60	Pipos, Quga, Acmil, Fear2, Luar3		500	250	2,500	0	The natural regeneration potential is moderate.	L	L
650	elevated plains	2,150–2,400	0–15	linear/ linear-convex	north	Alfisol	Typic Glossoboralfs	deep, very gravelly, fine sandy loam, high precipitation	limestone	residuum, cherty limestone	70–80	Psmeg, Abco, Pipos, Potr5, Bere		400	150	3,500	0	The unit is well suited to timber production. The potential timber productivity is higher than would be expected, because of the higher-than-normal precipitation associated with its geographic position. The natural regeneration potential is high.	VL	VL
651	hills/scarp slopes of plains	2,100–2,400	15–40	convex/linear	north	Alfisol	Typic Paleboralfs	deep, very gravelly, fine sandy loam, high precipitation	sandstone	residuum, cherty limestone	70–80	Psmeg, Abco, Pipos, Potr5, Bere		400	150	3,500	0	The unit is well suited to timber production. The potential timber productivity is higher than would be expected, because of the higher-than-normal precipitation associated with its geographic position. The natural regeneration potential is high. The unit has severe erosion potential because of the steep slopes.	VL	VL
654	hills/mountains	2,250–2,600	15–40	convex-linear/ linear	all	Alfisol	Eutric Glossoboralfs	deep, very stony loam	basalt/andesite	colluvium, basalt/ andesite	64–72	Psmeg, Abco, Pipos, Potr5, Bere		400	150	3,500	0	The unit occurs on moderately steep to steep slopes. The surface-rock-fragment-size classes ranging from cobbly to bouldery, depending on geographic location, constrain activities. The natural regeneration potential is high.	VL	VL

[a] See the plant list for genus and species abbreviations and codes.
[b] Hb/Wd = Herbaceous/woody plant growth. This is an estimate in pounds per acre of total annual yield (air-dry/normal year) of all plants—trees, shrubs, forbs, and grasses—from the soil surface to the height of 4.5 feet. Herbaceous vegetation comprises grasses and forbs.
[c] Forage. This is an estimate in pounds per acre of annual yield of herbaceous/woody plants that may provide food for grazing animals. Generally, this represents shrubs, forbs, and grasses.
[d] ForageM = Forage maximum. This is an estimate in pounds per acre of total annual yield of native forage plants after elimination of non-forage species.
[e] Fuelwood productivity. This is the potential for fuelwood production, in cords per acre. A cord is equivalent to 128 square feet (or a 4-by-4-by-8-foot stack).
[f] Irrigation-type agriculture potential: H = high; L = low; M = medium; VL = very low.
[g] Runoff-type agricultural potential. H = high; L = low; M = medium; M–H = medium to high; VL = very low.

Table B.2. Prescott National Forest Terrestrial Ecosystem Survey Units in the Middle Verde River Valley

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
0																		Private or unevaluated land.		
30	valley plains	975–1,325	0–5	linear/linear	all	Entisol	Oxyaquic Ustifluvents	deep, cobbly, sand, occasionally flooded	not listed	alluvium, limestone/ basalt, sandstone	28–40	Pofr2, Sago, Basa4, Cyda, Muri2		800	300	1,000	0	The unit component potentially can produce a healthy riparian ecosystem supporting Pofr2 and Sago. Stream banks and wet areas should be protected to reduce erosion. Soils are subject to occasional flooding. Riverwash, an unstable miscellaneous area, is subject to frequent flooding, erosion of old materials, and deposition of new sediment.	M	M
33	valley plains	850–1,100	0–5	linear/concave	no information	Entisol	River Wash, Aquic Ustifluents	deep, extremely cobbly sand	not listed	alluvium, mixed sources	36–44	Pofr2, Plwr2, Alob2, Saex, Fraxi, Bocu		1,000	350	1,200	0	The unit is subject to frequent flooding, erosion of materials, and deposition of new sediment.	M	H
34	valley plains	1,000–1,200	0–5	linear/linear	no information	Entisol	Aridic Ustifluvents	deep, gravelly to cobbly loam sand to sandy loam, occasionally flooded	not listed	alluvium, mixed sources	28–40	Prve, Chli2, Acgr, Cyda, Mupo2		450	150	500	0	Sandy soils have a low water-holding capacity, and the revegetation potential is low because of limited soil moisture retention. Soils are subject to occasional flooding.	L–M	M
41	valley plains	1,000–1,575	0–5	linear/linear	all	Entisol	Oxyaquic Ustifluvents	deep, very cobbly to extremely stony, loamy sand to coarse sand, occasionally flooded	not listed	alluvium, mixed sources	36–48	Pofr2, Plwr2, Frve2, Sago, Cyda		1,100	350	1,200	0	The unit component potentially can produce a healthy riparian ecosystem supporting Pofr2, Frve2, Plwr2, Sala3, and Sago. Stream banks and wet areas should be protected to reduce erosion. Soils are subject to occasional flooding.	M	M
42	lowland plains	1,175–1,450	0–15	linear/linear	all	Mollisol	Typic Calciustolls	deep, gravelly to very cobbly, sandy loam to loamy sand, gullied to occasionally flooded	not listed	alluvium, dolomite/ basalt/ sandstone	34–40	Boer4, Hene5, Bocu, Juos		625	450	850	1	The unit has numerous active gullies and receives excessive run-on during peak storm events, because of its lowland position. These soils contain significant quantities of lime through the profile, which may hinder revegetation.	L	M
43	valley plains	1,220–1,500	0–15	linear-convex/ convex-linear	all	Entisol	Typic Ustifluvents	deep, cobbly, loamy coarse sand, occasionally flooded	not listed	alluvium, mixed sources	42–51	Qutu2, Miacb, Fapa, Pifa		650	100	650	0	The unit soils have low water-holding capacity, and the revegetation potential is low because of limited soil moisture retention. Soils are subject to occasional flooding. Riverwash, an unstable miscellaneous area, is subject to frequent flooding, erosion of old materials, and deposition of new sediment.	L	L
45	lowland and valley plains	1,300–1,700	0–5	linear/linear	all	Mollisol	Pachic Argiustolls	deep, gravelly loam, gullied	not listed	alluvium, mixed sources	38–44	Bogr2, Arist, Muri, Muto2		800	600	800	0	Species composition and diversity indicate departure from the edaphic climax condition as the result of recurrent and sustained disturbance. Production potential is less than under an edaphic climax. Soil condition is unsatisfactory, as indicated by soil surface structure, gullies, poorly distributed surface litter, and poor species composition and diversity.	L	M
46	valley plains	1,100–1,400	0–5	linear/linear	no information	Entisol	Mollic Ustifluvents, Aquic Ustifluvents	deep, bouldery sand, frequently flooded	not listed	alluvium, mixed sources	48–56	Plwr2, Cuarg, Pofr2, Bogr2		1,100	350–400	1,300	0	The unit is susceptible to wind erosion and occasional flooding. Sandy soils have very low water-holding capacity.	L	L
349	mountains	1,000–1,300	40–120	linear-convex/ linear-convex	all	Inceptisol	Haplocalcidic Ustochrepts	moderately deep to shallow, extremely stony sand loam	limestone	colluvium/residuum, limestone	28–40	Hene5, Atca2, Pain2, Arist		450	250	400	0	The unit is characterized by moderately deep (and shallow) soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. Erosion hazard is moderate to severe. Maintenance of the vegetation ground cover is essential, to minimize sheet and rill erosion.	VL	L

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
350	hills	900–1,200	15–80	convex/convex	all	Inceptisol	Lithic Ustochrepts	shallow to very shallow, extremely cobbly sand loam to coarse sandy loam	limestone	colluvium/residuum, limestone	28–40	Hene5, Caho3, Boer4, Arist		425	125	375	0	The unit has shallow soils, high surface rock fragments, rock outcrop, and moderately steep to very steep slopes. The erosion hazard is moderate. Maintenance of the vegetation ground cover is essential, to minimize sheet and rill erosion. Soils contain significant quantities of lime throughout the profile.	VL	VL
351	mountains	1,300–1,475	40–120	linear-convex/linear	north, northeast, northwest	Alfisol	Typic Rhoustalfs	moderately deep, extremely stony, fine sandy loam, calcareous	sandstone	colluvium/residuum, sandstone	30–35	Qutu2, Hene5, Spcr	yes	1,000	200	600	0	The unit is classified as edaphic-fire disclimax. Recurrent, episodic fire maintains this plant community. This unit is characterized by moderately deep soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and roll erosion.	VL	VL
356	hills	1,150–1,375	15–40	linear/convex-linear	south, west, southeast	Inceptisol	Haplocalcidic Ustochrepts	deep, extremely cobbly, sandy loam	not listed	alluvium, limestone	30–40	Boer4, Hene5, Arist, Bocu, Trmu		500	400	450	0	The unit is characterized by deep soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
368	alluvial fans	900–1,150	0–15	linear/linear	east	Alfisol	Vertic Haplustalfs	deep, gravelly, silty loam to very fine sandy loam, calcareous, gullied	not listed	limestone/siltstone/ sandstone	30–38	Plumu3, Prve, Elel5, Paob		375	300	375	0	The unit has severe erosion hazard. The surface texture is a silt loam, which is highly erodible. Maintenance of the ground cover is essential, to minimize sheet and rill erosion. Soils contain significant quantities of lime throughout the profile, which may hinder revegetation.	VL	L
371	hills	1,250–1,450	15–40	convex/linear	south	Alfisol	Aridic Haplustalfs	deep, very cobbly, sandy clay loam	not listed	alluvium, mixed sources	30–38	Boer4, Miacb, Acgr, Bocu, Hibe		500	350	450	0	The unit is characterized by deep soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Management of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
373	hills	1,200–1,450	15–40	convex-concave/ linear-convex	all	Mollisol	Lithic Argiustolls	shallow, extremely stony, sand clay loam	basalt	residuum, basalt	36–46	Hibe, Acgr, Bocu, Plum3		450	225	450	0	The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and moderately steep to steep slopes. The erosion hazard is moderate. Management of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
375	hills	1,275–1,375	15–60	convex-linear/linear	all	Alfisol	Aridic Haplustalfs	moderately deep to shallow, extremely cobbly to stony, sandy loam, calcareous	dolomite	residuum, dolomite	35–40	Hene5, Arist, Atca2, Boer4	yes	550	250	500	0	The unit is characterized by deep soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Management of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
382	alluvial fans	900–1,250	0–15	convex/linear	all	Alfisol	Aridic Haplustalfs	deep, very gravelly, sandy loam, calcareous	not listed	alluvium, mixed sources	28–40	Prve, Boer4, Hene5		550	275	550	0	The unit soils contain significant quantities of lime throughout the profile or at a relatively shallow depth, which may hinder revegetation.	L	L
383	hills	950–1,350	15–40	convex/ linear-convex	all	Alfisol	Aridic Haplustalfs	deep, extremely cobbly, sandy loam	limestone/ sandstone/granite	alluvium/residuum, mixed/limestone	30–38	Caho3, Hene5, Boer4, Bocu		450	175	425	0	The unit is characterized by deep soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Management of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL

continued on next page

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
402	alluvial fans	1,000–1,300	0–15	linear/convex-linear	all	Mollisol	Typic Argiustolls	deep, very gravelly sand loam, calcareous	not listed	alluvium, mixed sources	30–44	Prve, Bocu, Juos		650	200	750	1	The unit soils contain significant quantities of lime throughout the profile, which may hinder revegetation.	L	L
407	hills and mountains	1,280–1,680	15–60	convex-concave/ linear	south, southeast, southwest	Alfisol	Typic Halustalfs	deep, extremely cobbly, sandy loam	not listed	alluvium, mixed sources	40–50	Qutu2, Bocu, Boer4	yes (Agpa4)	650	175	750	0	The unit is characterized by deep soils, high surface rock fragments, and moderately steep to very steep slopes. The erosion hazard is severe. Management of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
427	lowland and elevated plains	1,200–1,500	0–15	linear/linear	all	Mollisol	Vertic Argiustolls	deep, very stony to cobbly silt clay loam to loam	basalt	alluvium/residuum, basalt	38–42	Plumu3, Erwr, Juos, Opph, Hibe		650	200	750	1	The unit erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. Physical soil properties produce seasonal surface cracking and accelerated drying of the subsoil. The low bearing strength, clayey textures, high surface rock fragments, and high shrink-swell potential of these soils may limit management activities.	L	VL
428	hills	1,300–1,600	15–40	convex/convex	all	Mollisol	Vertic Argiustolls	moderately deep, extremely stony clay loam	basalt	residuum, basalt	38–42	Erwr, Bocu, Plmu3, Juos		600	175	700	1	The unit erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The physical soil properties produce seasonal surface cracking and accelerated drying of the subsoil. The low bearing strength, clayey textures, high surface rock fragments, and high shrink-swell potential of these soils may limit management activities.	VL	VL
429	hills	915–1,280	15–40	linear-convex/ linear-convex	all	Alfisol	Typic Halustalfs	moderately deep, extremely cobbly sand loam, calcareous	basalt/tuff/ andesite	colluvium/residuum, basalt/tuff/andesite	35–46	Juer, Bocu, Caho3, Qutu2, Boer4	yes (Agpa4)	600	150	725	3	The unit is characterized by moderately deep soils, high surface rock fragments, and moderately steep to steep slope. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The soils contain significant quantities of lime throughout the profile, which many hinder revegetation.	VL	VL
430	hills, mountains, and escarpments	1,000–1,800	40–120	linear-convex/ linear-convex	all	Mollisol	Typic Argiustolls	moderately deep, extremely stony, sandy clay loam	basalt, colluvium/ residuum, basalt	colluvium/residuum, basalt	42–52	Juos, Qutu2, Pifa, Pied	yes	700	175	1,100	4	The unit is characterized by moderately deep soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the ground cover is essential, to minimize sheet and rill erosion. Narrow riparian areas occur within this ecosystem unit, supporting Plwr2, Freve2, Juma, and Salix.	VL	VL
431	elevated plains	1,220–1,520	0–15	convex/convex	all	Mollisol	Lithic Argiustolls	shallow, extremely bouldery clay loam	basalt	residuum, basalt	36–44	Hibe, Miacb, Juos, Bocu, Bohi2	yes (Agpa4)	625	125	750	1	The low bearing strength, clayey textures, high surface rock fragments, and high shrink-swell potential of these soils may limit management activities.	VL	L
432	hills	1,000–1,575	15–40	convex-concave/ linear-convex	all	Mollisol	Lithic Argiustolls	shallow, extremely stony loam	basalt/tuff, granite	colluvium/residuum, basalt/tuff/granite		Qutu2, Juos, Cegr, Bocu, Hibe		650	125	750	2	The unit is characterized by shallow soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the ground cover is essential, to minimize sheet and rill erosion. The low bearing strength, shallow depth, clayey textures, high surface rock fragments and high shrink-swell potential of these soils limit management activities.	VL	VL

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
436	mountains	1,550–2,050	40–120	convex/ convex-linear	all	Mollisol	Lithic Argiustolls	shallow, very stony loam	basalt/andesite	colluvium/residuum, basalt/andesite	46–56	Qutu2, Cemo2, Bocu	yes (Agpa4)	1,200	200	850	0	The unit is classified as edaphic-fire disclimax. Recurrent, episodic fire maintains this plant community. This unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the ground cover is essential, to minimize sheet and rill erosion. These soils are considered inherently unstable.	VL	VL
438	mountains	1,340–1,850	40–120	linear-convex/ convex	all	Alfisol	Lithic Haplustalfs	shallow, extremely cobbly, sandy loam	schist/gneiss	colluvium/residuum, schist/gneiss	40–60	Qutu2, Cemo2, Rhtr, Bocu		1,200	175	800	0	The unit is classified as a fire climax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and roll erosion.	VL	VL
440	elevated plains	1,425–1,700	0–15	linear/linear	all	Alfisol	Typic Halustalfs	moderately deep, extremely cobbly clay loam	basalt	residuum, basalt/ cinders	40–49	Juos, Pied, Qutu2, Bogr2	yes	700	100	1,200	7	The low bearing strength, clayey textures, high surface rock fragments, and high shrink-swell potential of these soils may limit management activities. The revegetation potential is low because of clayey textures and high rock-fragment content in the upper portion of the soil profile.	VL	L
441	hills	1,425–1,750	15–40	linear-convex/ linear-convex	all	Alfisol	Lithic Haplustalfs	shallow, extremely stony clay loam	basalt	colluvium/residuum, basalt/cinders	40–49	Juos, Pied, Qutu2, Bogr2	yes	500	100	1,000	5	The unit erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The physical soil properties produce seasonal surface cracking and accelerated drying of the subsoil. The low bearing strength, shallow depth, high surface rock fragments, moderately steep to steep slopes, and moderate shrink-swell potential of these soils may limit management activities.	VL	VL
445	elevated plains	1,350–1,550	0–15	linear/linear	all	Inceptisol	Calcic Ustochrepts	moderately deep, very gravelly loam	dolomitic limestone	alluvium/residuum, dolomitic limestone	38–45	Pied, Juos, Bogr2, Bocu	yes	600	125	925	6	The unit soils contain significant quantities of lime throughout the profile or at a relatively shallow depth, which may hinder revegetation.	VL	L
446	hills	1,325–1,600	15–40	linear/convex	south, west, east	Inceptisol	Lithic Ustochrepts	shallow, extremely cobbly, sandy loam	dolomitic limestone	residuum, dolomitic limestone	36–46	Pied, Juos, Bogr2, Bocu	yes	550	100	850	6	The unit is characterized by shallow soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the ground cover is essential, to minimize sheet and rill erosion. The soils contain significant quantities of lime throughout the profile, which may hinder revegetation.	VL	VL
448	hills	1,425–1,650	0–40	linear-convex/ linear-convex	all	Alfisol	Typic Haplustalfs	shallow, very cobbly, coarse, sandy loam	granite/ granodiorite	residuum, granite/ granodiorite	40–50	Qutu2, Cemo2, Arpu5, Cegr		1,100	150	500	0	The unit is classified as fire climax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and gently sloping to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL

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Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/Acre/Year)	Forage[c] (Pounds/Acre/Year)	ForageM[d] (Pounds/Acre/Year)	Fuelwood Potential[e] (Cords/Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
452	mountains	1,750–2,000	40–80	linear/linear-concave	all	Alfisol	Lithic Haplustalfs	shallow, extremely cobbly, coarse sandy loam	schist/metavolcanics	residuum, schist/metavolcanics	46–54	Pied, Qutu2,Jude2, Cemo2, Gawr3	yes	650	50	1,300	6	The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
453	hills and mountains	1,350–2,050	40–80	convex-linear/convex-linear	all	Alfisol	Lithic Haplustalfs	shallow, extremely cobbly, sandy loam	schist/granite	colluvium/residuum, schist/granite	42–52	Qutu2, Cemo2, Bogr2, Erwr, Bocu		1,200	175	700	0	The unit is classified as fire climax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and gently sloping to steep slopes. The erosion hazard is severe.	VL	VL
454	elevated plains	1,325–1,525	0–15	linear/linear	all	Alfisol	Lithic Rhodustalfs	shallow, extremely cobbly, fine sandy loam	sandstone	residuum, sandstone	40–46	Juos, Qutu2, Pied		600	100	500	2	The unit is characterized by high surface rock fragments and very shallow soils with low organic matter. The erosion hazard is moderate. Maintenance of the ground cover is essential, to minimize sheet and rill erosion. These soils contain significant quantities of lime throughout the profile, which may hinder revegetation.	VL	L
455	hills	1,350–1,550	15–40	convex-linear/convex-linear	all	Alfisol	Lithic Rhodustalfs	shallow, extremely flaggy, fine sandy loam	sandstone	residuum, sandstone	40–47	Juos, Pied, Qutu2, Bogr2		700	200	600	3	The unit is characterized by high surface rock fragments, rock outcrop, moderately steep to steep slopes, and shallow soils with low organic matter. The erosion hazard is severe. Maintenance of the ground cover is essential, to minimize sheet and rill erosion. Soil loss potentially exceeds deposition because of the steepness of slopes. The soils are considered inherently unstable. These soils contain significant quantities of lime throughout the profile, which may hinder revegetation.	VL	VL
457	hills	1,650–1,825	15–60	linear-concave/linear-concave	all	Alfisol	Typic Haplustalfs	moderately deep, very cobbly loam	dolomitic limestone	colluvium/residuum, dolomitic limestone	40–56	Qutu2, Bocu, Mesc, Bogr2	yes (Agpa4)	1,300	200	800	0	The unit is characterized by moderately deep soils, high surface rock fragments, rock outcrop, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
458	elevated and lowland plains	1,400–1,775	0–15	linear/linear	all	Alfisol	Typic Paleustalfs	moderately deep, very gravelly, fine sandy loam	sandstone	residuum, sandstone	36–46	Juos, Pied, Qutu2, Bogr2, Bocu	yes	700	100	1,200	4	No major limitations.	L	M
459	hills and side slopes of plains	1,325–1,750	15–40	linear-convex/linear-convex	all	Alfisol	Typic Paleustalfs	moderately deep, extremely cobbly, fine sandy loam	sandstone	colluvium/residuum, sandstone	36–46	Pied, Juos, Qutu2, Bogr2, Arpu5	yes	650	50	1,050	9	The unit is characterized by moderately deep soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
460	hills	1,000–1,550	15–60	linear-convex/linear-convex-concave	north	Mollisol	Typic Calciustolls	deep, extremely stony, sandy loam	not listed	alluvium, mixed sources	36–45	Pifa, Juos, Rhtr		650	150	1,000	7	The unit is characterized by deep soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
461	elevated plains	1,350–1,750	0–15	convex/convex	all	Mollisol	Typic Argiustolls	moderately deep, extremely cobbly clay loam	basalt	residuum, basalt	38–44	Juos, Pifa, Qutu2	yes	750	125	1,300	8	The low bearing strength, clayey textures, high surface rock fragments, and high shrink-swell potential of these soils may limit management activities.	VL	VL

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
462	hills	1,210–1,970	15–40	convex-linear/ convex-linear	all	Mollisol	Lithic Argiustolls	shallow, extremely stony, sandy clay loam	basalt/schist	colluvium/residuum, basalt/schist	40–52	Juos, Qutu2, Pifa, Bocu	yes	600	100	1,100	5	The unit is characterized by shallow soils, high surface rock fragments, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The low bearing strength, shallow depth, high surface rock fragments, and steep slopes of these soils may limit management activities.	VL	VL
463	elevated plains	1,310–1,690	0–15	linear/linear	all	Alfisol	Typic Haplustalfs	deep, very cobbly clay loam	basalt	residuum, basalt/ cinders/ash	40–46	Juos, Open3, Elel5, Plmu3	yes	550	100	800	8	The unit is classified as an edaphic-zootic disclimax. The species composition and diversity indicate departure from the edaphic climax condition as the result of recurrent and sustained disturbance. The low bearing strength, clayey textures, high surface rock fragments, and high shrink-swell potential of these soils may limit management activities.	VL	L
464	hills	1,270–1,765	15–40	linear/linear	all	Alfisol	Typic Argiustolls	deep, extremely stony clay loam	basalt	colluvium/residuum, basalt	40–48	Juos, Qutu2, Bocu, Bohi2	yes (Agpa4)	750	125	1,300	7	The unit is characterized by moderately deep soils, high surface rock fragments, rock outcrop, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The high surface rock fragments, steep slopes, and high shrink-swell potential of these soils may limit management activities.	VL	VL
465	mountains and escarpments	1,250–1,650	40–120	convex/ convex-linear	all	Entisol	rock outcrop, Lithic Ustorthents	very shallow, extremely flaggy, fine sandy loam	sandstone	residuum, sandstone	38–48	Juos, Pied, Qutu2		500	50	400	2	The unit is characterized by very shallow soils, high surface rock fragments, rock outcrop, and very steep slope. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. Soil loss potentially exceeds deposition because of the steepness of slopes. These soils are considered inherently unstable.	VL	VL
466	hills, mountains, and escarpments	1,050–1,975	40–120	convex/convex	all	Inceptisol	rock outcrop, Lithic Ustochrepts	shallow, extremely stony loam, calcareous	limestone	colluvium/residuum, limestone	38–48	Pied, Cemo2, Juos, Pofe		500	100	850	5	The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. Soil loss potentially exceeds deposition because of the steepness of slopes.	VL	VL
468	mountains and escarpments	1,500–1,700	40–120	linear/convex-linear	south, west, east	Entisol	Lithic Ustorthents	shallow, extremely flaggy, loamy fine sand	sandstone	residuum, sandstone	44–49	Qutu2, Arpu5, Cemo2, Gawr3, Nomi	yes (Agpa4)	900	100	500	0	The unit is classified as an edaphic-fire disclimax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetation ground cover is essential, to minimize sheet and rill erosion.	VL	VL
469	alluvial fans	1,050–1,350	0–15	concave/linear	all	Alfisol	Typic Paleustalfs	deep, very stony, coarse sandy loam	not listed	alluvium, mixed sources	36–45	Qutu2, Arpu5, Rhtr, Cegr		1200	150	600	0	The unit is classified as an edaphic-fire disclimax. Recurrent, episodic fire maintains this plant community. The low bearing strength, clayey textures, and high surface rock fragments of these soils may limit management activities.	L	L–M

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Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
473	elevated plains	1,350–1,750	0–15	linear/linear	all	Alfisol	Petrocalcic Paleustalfs	moderately deep, very gravelly, fine sandy loam	not listed	alluvium, mixed sources	38–50	Juos, Pied, Maha4, Qutu2, Rhtr, Bocu, Bogr2		650	150	950	3	The unit soils contain significant quantities of lime throughout the profile or at a relatively shallow depth, which many hinder revegetation.	L	L
474	hills	1,300–1,800	15–40	linear/linear-convex	all	Mollisol	Lithic Argiustolls	shallow, extremely cobbly loam, calcareous	limestone	alluvium/colluvium, residuum, mixed sources, limestone	41–51	Juos, Pied, Pust, Bogr2	yes	500	100	1,100	4	The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential minimize sheet and rill erosion. These soils contain significant quantities of lime throughout the profile or at a relative shallow depth, which many hinder revegetation.	VL	VL
475	mountains and hills	1,425–1,950	40–120	linear-convex/ convex-concave	all	Alfisol	Lithic Haplustalfs	shallow, very stony, coarse sandy loam	granite/ granodiorite	colluvium/residuum, granite/granodiorite	40–52	Qutu2, Arpu5, Cemo2, Arpu		1,100	150	700	0	The unit is classified as an edaphic-fire disclimax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
476	hills	1,500–1,950	0–40	convex/convex	all	Alfisol	Typic Haplustalfs	shallow, very cobbly, coarse sandy loam	granite/granitic gneiss	residuum, granite/ granitic gneiss	40–50	Quem, Qutu2, Arpu5, Cemo2		1,200	125	750	0	The unit is classified as a topo-edaphic-fire disclimax, as indicated by the significant canopy cover of Quem. Cool-air drainage, additional moisture as run-on, and recurrent episodic fire maintain this plant community. The unit is characterized by shallow soils, high surface rock fragments, and nearly level to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
478	mountains and hills	1,750–2,050	15–80	convex/convex	south	Alfisol	Lithic Haplustalfs	shallow, extremely cobbly, sandy loam	limestone	colluvium/residuum, limestone	40–50	Arpu, Cemo2, Gawr3, Qutu2	yes	1,200	175	800	0	The unit is classified as a fire climax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, and moderately steep to very steep slopes. The erosion hazard is severe.	VL	VL
479	mountains	1,250–1,850	40–120	convex-linear/ convex-concave	all	Mollisol	Typic Argiustolls	shallow, very cobbly, coarse sandy loam	granite	colluvium/residuum, granite	44–56	Qutu2, Pifa, Juos, Cemo2		750	175	1,100	4	The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
480	mountains	1,750–2,150	40–120	convex/ linear-convex	south, east	Alfisol	Lithic Haplustalfs	shallow, extremely cobbly loam	dolomitic limestone	residuum, dolomitic limestone	44–56	Pied, Qutu2, Jude2	yes	650	125	1,200	6	The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
482	hills	1,400–1,600	15–40	convex-linear/linear	south, west	Entisol	Lithic Ustorthents	very shallow, extremely flaggy, loamy fine sand	sandstone	residuum, sandstone	42–48	Arpu5, Juos, Pied, Qutu2	yes	500	75	300	2	The unit is characterized by very shallow soils, high surface rock fragments, rock outcrop, and moderately steep to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL

Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
485	elevated plains and hills	1,500–1,900	0–40	linear-convex/ linear-convex	all	Mollisol	Typic Argiustolls	moderately deep, extremely stony, sandy loam	basalt, andesite	colluvium/residuum, basalt/andesite	44–52	Qutu2, Jude2, Bocu, Bogr2	yes (Agpa4)	750	125	1,300	8	The unit is characterized by moderately deep soils, high surface rock fragments, and nearly level to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	L
490	elevated plains	1,700–1,980	0–15	linear/linear	all	Mollisol	Vertic Paleustolls	deep, very stony silt loam	basalt	residuum, basalt	48–58	Jude2, Bogr2, Bocu	yes (Agpa4)	650	550	1,400	13	The erosion hazard is moderate. The surface texture is silt loam, which is highly erodible. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The physical soil properties produce seasonal surface cracking and accelerated drying of the subsoil. The soils are subject to piping, and pipes may collapse and develop into gullies.	VL	L
491	hills	1,700–1,950	15–40	linear/linear-convex	all	Mollisol	Typic Argiustolls	moderately deep, extremely stony loam	basalt	colluvium/residuum, basalt	50–60	Jude2, Quar, Bogr2,Pifa, Cemo2	yes (Agpa4)	750	100	1,700	8	The unit is characterized by moderately deep soils, high surface rock fragments, and moderately steep to steep slopes The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion.	VL	VL
535	hills	1,700–1,800	0–40	convex-concave/ convex-concave	all	Alfisol	Lithic Haplustalfs	shallow, very channery, sandy loam	schist/sandstone	residuum, schist/ sandstone	56–60	Pipos, Quar, Quem, Qutu2		500	50	1,550	0	The unit is characterized by shallow soils, high surface rock fragments, and undulating to steep slopes. The erosion hazard is moderate. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The reforestation and natural regeneration potentials are low because of the steep slopes and shallow soils. If the overstory of Pipos is removed, Qutu2 may become well established and offer significant plant competition.	VL	L
550	mountains and escarpments	1,900–2,380	40–120	linear/convex	north, northeast, northwest	Mollisol	Pachic Argiborolls	moderately deep, very bouldery loam	basalt	colluvium/residuum, basalt	55–65	Pipos, Quga, Pofe		625	300	2,250	0	The unit is characterized by moderately deep soils, high surface rock fragments, rock outcrop, and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The reforestation and natural revegetation potentials are low because of the steep slopes and high rock content.	VL	VL
551	mountains and escarpments	1,600–2,325	40–120	convex-linear/linear	south, southeast, southwest	Mollisol	Lithic Argiustolls	shallow, extremely stony loam	basalt	colluvium/residuum, basalt	44–60	Qutu2, Cemo2, Quar	yes	1,300	250	800	0	The units is classified as an edaphic-fire disclimax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, rock outcrop, and very steep slopes. The erosion hazard is severe.	VL	VL
554	hills and mountains	1,770–2,090	15–50	linear-convex/ linear-convex	west, south, east	Alfisol	Lithic Haplustalfs	shallow, very cobbly, sandy loam	schist	colluvium/residuum, schist	48–60	Pipos, Quar, Arpu, Jude2		450	100	2,050	0	The unit is characterized by shallow soils, high surface rock fragments, and undulating to steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The reforestation and natural regeneration potentials are low because of the steep slopes and shallow soils.	VL	VL

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Map Unit Symbol	Landform	Elevation Range (m)	Slope (%)	Landform Shape (Section/Plan [Vertical/ Horizontal])	Aspect(s)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Bedrock	Parent Material	Precipitation (cm)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	U.S. Forest Service Management Comments (Actual or Potential Limitations/Uses)	Agricultural Potential	
																			Irrigation[f]	Runoff[g]
555	hills and mountains	1,850–220	15–80	convex/convex	all	Alfisol	Lithic Haplustalfs	shallow, very cobbly, sandy loam	schist/ granodiorite	colluvium/residuum, schist/grondiorite	48–64	Arpu, Quar, Quem	yes (Agpa4)	1800	375	1,200	0	The unit is classified as an edaphic-fire disclimax. Recurrent, episodic fire maintains this plant community. The unit is characterized by shallow soils, high surface rock fragments, and moderately steep to very steep slopes. The erosion hazard is severe.	VL	VL
560	hills and mountains	2,000–2,350	15–60	convex/ linear-concave	north, east	Mollisol	Lithic Argiborolls	shallow, very stony loam	basalt/tuff/ limestone	colluvium/resid-uum, basalt/cinders/ limestone	50–56	Pipos, Jude2, Quga	yes	475	225	2,350	0	The unit is characterized by shallow soils, high surface rock fragments, and moderately steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. Soil loss potentially exceeds deposition because of the steepness of slopes. These soils are considered inherently unstable.	VL	VL
570	elevated plains	2,150–2,300	0–15	linear/linear	all	Alfisol	Mollic Eutroboralfs	moderately deep, very stony loam	basalt	residuum, basalt/ cinders	55–64	Pipos, Jude2, Quga	yes	500	250	2,500	0	The low bearing strength, clayey textures, and high surface rock fragments of these soils may limit management activities. The reforestation potential is low because of surface rock fragments. The natural regeneration potential is high.	VL	VL
580	elevated plains	2,300–2,400	0–15	linear/linear	all	Alfisol	Mollic Eutroboralfs	moderately deep, very stony loam	basalt	residuum, basalt/ cinders	60–64	Pipos, Quga, Pofe		500	250	2,500	0	The low bearing strength, clayey textures, and high surface rock fragments of these soils may limit management activities. The reforestation potential is low because of surface rock fragments. The natural regeneration potential is high.	VL	VL
581	hills	2,150–2,375	15–40	linear/linear	north, east	Alfisol	Mollic Eutroboralfs	moderately deep, very stony loam	basalt	residuum, basalt/ cinders	60–64	Pipos, Quga, Pofe		500	250	2,500	0	The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The low bearing strength, clayey textures, and high surface rock fragments of these soils may limit management activities.	VL	VL
610	mountains	1,950–2,300	40–120	linear-convex/ linear-convex	north, northwest, northeast	Alfisol	Eutric Glossoboralfs	very bouldery loam	schist/granite	colluvium/residuum, schist/granite	68–76	Abco, Psmeg, Pipos, Quga, Syor2		300	50	3,000	0	The unit is characterized by high surface rock fragments and steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The reforestation potential is low because of the steep slopes. The natural regeneration potential is high.	VL	VL
650	hills and mountains	2,170–2,345	15–60	linear-convex/linear	west, northwest, northeast	Alfisol	Eutric Glossoboralfs	moderately deep, very cobbly loam	basalt/schist	colluvium/residuum, basalt/schist	68–76	Psmeg, Abco, Quga, Pipos, Syor2		350	125	3,400	0	The unit is characterized by moderately deep soils, high surface rock fragments, and moderately steep to very steep slopes. The erosion hazard is severe. Maintenance of the vegetative ground cover is essential, to minimize sheet and rill erosion. The reforestation potential is low because of the steep slopes. The natural regeneration potential is high.	VL	VL

[a] See the plant list for genus and species abbreviations and codes.
[b] Hb/Wd = Herbaceous/woody plant growth. This is an estimate in pounds per acre of total annual yield (air-dry/normal year) of all plants—trees, shrubs, forbs, and grasses—from the soil surface to the height of 4.5 feet. Herbaceous vegetation comprises grasses and forbs.
[c] Forage. This is an estimate in pounds per acre of annual yield of herbaceous/woody plants that may provide food for grazing animals. Generally, this represents shrubs, forbs, and grasses.
[d] ForageM = Forage maximum. This is an estimate in pounds per acre of total annual yield of native forage plants after elimination of non-forage species.
[e] Fuelwood productivity. This is the potential for fuelwood production, in cords per acre. A cord is equivalent to 128 square feet (or a 4-by-4-by-8-foot stack).
[f] Irrigation-type agriculture potential: H = high; L = low; L–M = low to medium; M = medium; VL = very low.
[g] Runoff-type agricultural potential. H = high; L = low; L–M = low to medium; M = medium; VL = very low.

Table B.3. Natural Resources Conservation Service Terrestrial Ecosystem Survey Units in the Middle Verde River Valley

Map Unit Symbol	Soil Name	Landform	Elevation Range (m)	Slope (%)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Parent Material	Precipitation (Inches)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present or Likely?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	Land Capability (Class)		Natural Resources Conservation Service Management Comments Regarding Use and Management	Agricultural Potential	
																Nonirrigated	Irrigated		Irrigation[f]	Runoff[g]
400	Bodecker extremely gravelly sandy loam	floodplain	3,000–4,000	1–3	Entisol	Ustic Torriorthent	very deep; extremely gravelly sandy loam; excessively drained; very low AWC	mixed alluvium	12–14	grasses, shrubs, riparian tree species						7s	2s?	Urban land and wildlife habitat (and irrigated cropland); these soils support the greatest diversity of flora and fauna in survey area, including neotropical migratory birds. Corn, cotton, barley, and other small grains grown with irrigation.	M	H
401	Bodecker (40), water (30), Horner complex (15)	floodplain	3,000–3,500	0–3	Entisol	Ustic Torriorthent, Ustic Torrifluvent	very deep, gravelly fine sandy loam to loamy sand; excessively to somewhat drained; very low to moderate AWC	mixed alluvium	12–14							7w	2w?	Urban land and wildlife habitat (and irrigated cropland for Bodecker soils); these soils support the greatest diversity of flora and fauna in survey area, including neotropical migratory birds. Corn, cotton, barley, and other small grains grown with irrigation on Bodecker soils.	M	M
402	Horner soils and urban land	floodplain	3,000–3,500	0–3	Entisol	Ustic Torrifluvent	very deep; loamy sand and sandy loam, somewhat excessively drained, low AWC	mixed alluvium	12–14	riparian tree species, grasses, forbs						7w		Urban land, wildlife habitat, and pasture.	M	M
403	Riverroad loam	floodplain	3,800–4,000	0–2	Entisol	Ustic Torrifluvent	very deep; loam to silt loam, and silty clay loam; well drained; very high AWC	mixed alluvium	12–14	mesquite, acacia, desert willow, grasses						6c	2c	Urban land, pasture, and wildlife (and irrigated cropland); these soils support the greatest diversity of flora and fauna in the study area, including neotropical migratory birds. Cotton, sorghum, wheat, alfalfa, sugar beets, lettuce, and small grains grown with irrigation.	VH	M
404	rock outcrop (55), Wheels (30) complex	ridges and buttes	5,000–6,500	15–90	Entisol	Lithic Ustorthent	very shallow to shallow; extremely channery loamy sand; excessively drained; very low AWC	colluvium and residuum from sandstone	16–20	grasses, shrubs, agave, sotol, yucca	yes					6e		Urban land and wildlife habitat.	VL	VL
405	Turist soils, rock outcrop and urban land	hills and buttes	4,500–5,000	15–90	Inceptisol	Lithic Ustochrept	shallow; extremely channery sandy loam and loam; well drained; very low AWC	residuum from sandstone	16–20	grasses, oak, pinyon, juniper, shrubs	yes					6e–7e		Urban land and wildlife habitat.	VL	VL
406	Sedona soils, Turist soils, and urban land	hills	4,000–4,500	3–15	Inceptisol	Typic Rhoustalf, Lithic Ustochrept	shallow; extremely channery loam to silty clay loam to silt loam and channery sandy loam; well drained; very low AWC	colluvium and residuum from shale and mudstone	16–20	grasses, shrubs, oak, pinyon, juniper, cacti	yes					6s		Urban land, livestock grazing, and wildlife habitat.	VL	L
408	Vortex soils and urban land	fan terraces	4,000–4,500	0–3	Inceptisol	Aridic Ustochrept	very deep; loamy fine sand to fine sandy loam; somewhat excessively drained; low AWC	alluvium from sandstone	16–20	grasses, cacti, juniper, oak, manzanita						6c		Urban land and wildlife habitat.	L	M
409	Vortex fine sand	stream terraces	4,000–4,500	0–2	Inceptisol	Aridic Ustochrept	very deep; somewhat excessively drained; fine sand to loamy fine sand, and gravelly fine sand; low AWC	alluvium from sandstone	16–20	grasses, cacti, juniper, oak, manzanita						6c		Urban land and wildlife habitat.	M	L
411	Cockscomb soils and urban land	hills	4,300–4,700	3–40	Alfisol	Aridic Haplustalf	very deep; gravelly loam to gravelly clay loam to gravelly clay to gravelly sandy loam; well drained; low AWC	basaltic alluvium over older mixed alluvium	16–20	grasses, juniper, mimosa, pinyon, canotia, cacti, yucca						6s		Urban land, livestock grazing, and wildlife habitat.	VL	L
414	White House gravelly sandy land	fan terraces	3,000–3,500	7–15	Aridisol	Ustic Haplargid	very deep; sandy clay loam to clay to sandy clay and coarse sandy loam; well drained; moderate AWC	granitic alluvium	12–14	grasses, mimosa, juniper, pinyon, canotia, cacti, yucca						6s		Urban land, livestock grazing, and wildlife habitat.	VL	L
415	Altar soils, Bodecker soils, and urban land	fan terraces	3,000–4,000	3–7	Aridisol, Entisol	Ustic Haplocambid, Ustic Torriorthent	very deep; sandy loam to gravelly loamy coarse sand; well to excessively drained; low to very low AWC	granitic alluvium	12–14	grasses, shrubs, forbs						6s–7s		Urban land, livestock grazing, and wildlife habitat.	L	M

continued on next page

Map Unit Symbol	Soil Name	Landform	Elevation Range (m)	Slope (%)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Parent Material	Precipitation (Inches)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present or Likely?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	Land Capability (Class)		Natural Resources Conservation Service Management Comments Regarding Use and Management	Agricultural Potential	
																Nonirrigated	Irrigated		Irrigation[f]	Runoff[g]
416	Perilla sandy loam	stream terraces	2,900–3,000	2–7	Aridisol	Ustic Haplocambid	very deep; sandy loam to calcareous sandy loam; somewhat excessively drained; moderate to high AWC	mixed alluvium	12–14	grasses, shrubs, forbs						6c		Wildlife habitat.	M	VH
417	Biplane soils and urban land	mesa	4,500–4,800	0–3	Alfisol	Vertic Haplustalf	deep to a petrocalcic horizon; silty clay to clay to calcareous clay to cobbly clay loam to indurated petrocalcic horizon; well drained; moderate to high AWC	alluvium from volcanic and sedimentary rocks	16–20	grasses, juniper, cacti, shrubs						6s		Wildlife habitat, livestock grazing, and urban land.	VL	M
418	La Lande family soils and urban land	alluvial fans	3,000–4,000	1–3	Aridisol	Ustic Haplocambid	very deep; loam to calcareous loam; well drained, high AWC	granitic alluvium	12–14	mesquite, acacia, well, hackberry, grasses						6c	2c?	Urban and wildlife habitat (and irrigated cropland)	L–M	VL
419	Altar soils, Bodecker soils, and urban land	fan terraces	3,000–4,000	1–3	Aridisol, Entisol	Ustic Haplocambid, Ustic Torriorthent	very deep; gravelly loam to sandy clay loam (Altar) and gravelly loamy sand to gravelly sandy loam and sandy clay loam (Bodecker); well drained; moderate to low AWC	granitic alluvium (Altar) to mixed alluvium (Bodecker)	12–14	grasses, mesquite, acacia, oak, juniper (Altar) and grasses, mimosa, shrubs (Bodecker)						6s		Urban land, livestock grazing, and wildlife habitat.	L–M	H
420	Mingus soils, Tapco Soils, and urban land	fan terraces	3,400–3,800	3–12	Aridisol	Abruptic Argidurids, Duric Petroargid	moderately deep to hardpan (Mingus) and very shallow to hardpan (Tapco); gravelly clay loam to gravelly clay (Mingus) and gravelly sandy loam to gravelly clay (Tapco); well drained; moderate (Mingus) to very low (Tapco) AWC	mixed alluvium	12–14	grasses, shrubs, mesquite, acacia, mimosa, ceanothus						6s		Urban land, livestock grazing, and wildlife habitat.	L	M
421	Shamizo, water (Oak Creek), mollic fluvaquents complex	floodplain	3,800–4,200	0–1	Entisol	Aridic Ustorthent	very deep; stony sand to stony coarse sand (Shamizo) and stony sandy loam to very stony sand (Mollic Fluvaquents); excessively to poorly drained; very low AWC	mixed alluvium	16–20	riparian tree species (e.g., cottonwood, walnut, sycamore), grasses, forbs						7w		Wildlife habitat and riparian areas.	M	L
422	Bewearze soils and urban land	fan terraces	3,000–4,000	2–8	Aridisol	Ustic Haplocambid	very deep; silt loam to sandy and silt loam; well drained; high AWC	alluvium from lacustrine sediments of the Verde Formation	12–14							6s		Urban land and wildlife habitat.	L	VL
423	Hatranch, Ryallen complex	fan terraces	3,000–4,000	3–60	Entisol, Aridisol	Ustic Torriorthent, Ustic Calciargid	very deep; silty clay loam to silty clay (Hatranch) and gravelly loam to gravelly clay (Ryallen); well drained; high to moderate AWC	residuum from gypsiferous lacustrine sediment of the Verde Formation (Hatranch) to fan alluvium from igneous rocks overlaying Verde Formation	12–14	grasses, cacti, juniper, shrubs (Hatranch) to grasses, shrubs, mimosa, acacia, mesquite (Ryallen)	yes					6s (Ryallen) to 7e (Hatranch)		Urban land, livestock grazing, and wildlife habitat.	L	M
424	Eloma soils and urban land	fan terraces	3,500–4,000	1–8	Aridisol	Ustic Haplargid	very deep; gravelly loam to silty clay loam; well drained; moderate AWC	granitic alluvium	12–14	grasses, shrubs, mimosa, acacia, mesquite	yes					6s		Wildlife habitat and livestock grazing.	L	M
425	Swisshelm soils and urban land	stream terraces	3,000–3,500	0–3	Aridisol	Ustifluventic Haplocambid	very deep; sandy loam to fine sandy loam; well drained, moderate to high AWC	mixed alluvium	12–14	mesquite, acacia, willow, hackberry, grasses, shrubs						6e	2s	Wildlife habitat and irrigated cropland. Cotton, corn, chilies, small grains, and alfalfa grown with irrigation.	VH	H
426	Guest soils and urban land	alluvial fans	3,500–4,000	1–5	Entisol	Ustertic Torrifluvent	very deep; silt loam to silty clay loam; well drained; high AWC	mixed alluvium	12–14	grasses, mesquite, mimosa, cacti						6s	2s?	Wildlife habitat, livestock grazing, and irrigated cropland. Alfalfa, small grains, and pasture with irrigation.	VH	VH
427	Monterosa family soils and urban land	fan terraces	3,500–4,000	2–15	Aridisol	Ustic Petrocalcid	very shallow and shallow to a hardpan; gravelly loam to gravelly sandy loam; well drained, very low AWC	mixed alluvium	12–14	grasses, canotia, mesquite, cacti, juniper, shrubs						6s		Wildlife habitat and livestock grazing.	L	M

Map Unit Symbol	Soil Name	Landform	Elevation Range (m)	Slope (%)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Parent Material	Precipitation (Inches)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present or Likely?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	Land Capability (Class)		Natural Resources Conservation Service Management Comments Regarding Use and Management	Agricultural Potential	
																Nonirrigated	Irrigated		Irrigation[f]	Runoff[g]
428	Pagesprings soils, Blancoverde soils, and urban land	hills	3,500–4,500	3–60		Ustic Haplocalcid, Ustic Torriorthent	very shallow and shallow on summits and ledges (Pagesprings) and deep on side slopes (Blancoverde); gravelly loam to silt loam (Pagesprings) and stony loam to calcareous clay loam (Blancoverde); well drained; very low to low AWC	residuum from limestone (Pagesprings) and colluvium and residuum from lacustrine sediments of the Verde Formation	12–14	grasses, yucca, shrubs (Pagesprings) and grasses, canotia, mesquite, cacti, mimosa, juniper, shrubs (Blancoverde)						7s (Pagesprings), 7e (Blancoverde)		Range land, urban land, and wildlife habitat.	VL	L
429	Pagesprings soils and urban land	mesas	4,000–4,500	2–6	Aridisol	Ustic Haplocalcid	very shallow and shallow; gravelly loam to cobbly sandy loam; well drained; very low AWC	residuum from limestone	12–14	grasses, yucca, shrubs						7s		Urban land, rangeland (livestock grazing), and wildlife habitat.	VL	L
430	Perilla family fine sandy loam	broad drainageways	3,000–4,000	3–15	Aridisol	Ustic Haplocambid	very deep; loamy fine sand to fine sandy loam; somewhat excessively drained; moderately to high AWC	mixed alluvium	12–14	grasses, mesquite, mimosa, acacia, yucca, shrubs and forbs						6c		Wildlife habitat and livestock grazing.	L	H
431	Billgray, Fetch complex	pediments	3,000–4,000	3–8	Aridisol, Entisol	Ustic Haplocalcid, Ustic Torriorthent	very deep (Billgray) and shallow (Fetch); fine sandy loam to loamy fine sand (Billgray) and loamy fine sand (Fetch); well drained (Billgray) to somewhat excessively drained (Fetch); high (Billgray) to low (Fetch) AWC	residuum and alluvium from sandstone	12–14	grasses, winterfat, ceanothus, juniper, oak, jojoba, shrubs (Billgray) and grasses, jojoba, shrubs (Fetch)						6s (Billgray), 7s (Fetch)		Rangeland (livestock grazing) and wildlife habitat.	L	M
432	Gyberg, Billgray complex	pediments	4,000–4,500	3–8	Aridisol	Ustic Calciargid	very deep; loamy fine sand to sandy loam (Gyberg) and loamy fine sand to sandy loam (Billgray); well drained; moderate AWC	residuum and alluvium from sandstone	12–14	grasses, mesquite, acacia, oak, juniper, shrubs (Gyberg) and grasses, winterfat, ceanothus, juniper, oak, jojoba, creosote (Billgray)						7s		Rangeland (livestock grazing) and wildlife habitat.	L	M
433	Tuzigoot soils, Altar family soils, and urban land	fan terraces	3,000–4,000	1–15	Aridisol	Ustic Haplocalcid, Ustic Haplocambid	very deep; silt loam to silty clay loam (Tuzigoot) and gravelly loam (Altar); well drained, high to very high (Tuzigoot) to moderate AWC	lacustrine sediments (Tuzigoot) and alluvium from limestone and sandstone (Altar)	12–14	grasses, winterfat, ceanothus, juniper, oak, jojoba, creosote (Tuzigoot) and grasses, mesquite, acacia, oak, and juniper (Altar)						7s		Urban land and wildlife habitat.	M	M
434	Graham very stony loam	hills	4,000–4,500	3–15	Aridisol	Ustic Haplargid	very shallow to shallow; stony clay loam to cobbly clay; well drained, very low AWC	basalt alluvium	14–16	grasses, juniper, oak, acacia, canotia						6s to 6e		Wildlife habitat and livestock grazing.	VL	L
437	Altar family soils, Penthouse soils, and urban land	fan terraces	3,000–4,000	3–8	Aridisol	Ustic Haplocambid, Ustic Calciargid	very deep; gravelly fine sandy loam to gravelly sandy clay loam (Altar) and gravelly clay loam to calcareous gravelly sandy loam (Penthouse); well drained; low AWC	mixed alluvium	12–14	grasses, mesquite, acacia, oak, juniper (Altar) and grasses, mimosa, acacia, mesquite, ceanothus (Penthouse)						6s		Urban land, livestock grazing, and wildlife habitat.	L	M
438	Tombstone soils, Stronghold soils, and urban land	fan terraces	3,300–3,600	2–10	Aridisol	Ustic Haplocalcid, Ustic Haplocalcid	very deep; gravelly sandy loam to gravelly loamy sand (Tombstone) and gravelly fine sandy loam to loam (Stronghold); somewhat excessively drained (Tombstone) to well drained (Stronghold); very low (Tombstone) to moderate to very high AWC (Stronghold)	mixed alluvium	12–14	grasses, canotia, mesquite, cacti, mimosa, juniper, shrubs						6s		Urban land, livestock grazing, and wildlife habitat.	L	VH
439	Blancoverde soils, Monterosa family soils, and urban land	hills	3,400–4,000	2–30	Aridisol	Ustic Torriorthent, Ustic Petrocalcid	deep (Blancoverde) to very shallow and shallow to a hardpan (Monterosa); gravelly fine sandy loam to sandy clay loam (Blancoverde) and gravelly sandy loam (Monterosa)	mixed alluvium and residuum from lacustrine sediments of the Verde Formation (Blancoverde) and mixed alluvium (Moterosa)	12–14	grasses, canotia, mesquite, cacti, mimosa, juniper, shrubs						7s (Blancoverde) and 6s (Monterosa)		Urban land and wildlife habitat.	VL	L

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Map Unit Symbol	Soil Name	Landform	Elevation Range (m)	Slope (%)	Soil Order	Soil Subgroup (Major Components Only)	Phase: Soil Depth, Rock-Fragment Class, Texture Class, Other (If Listed)	Parent Material	Precipitation (Inches)	Dominant Vegetation[a] (Canopy Cover: Highest 3%–5% or >5%)	Agave Species Present or Likely?	Hb/Wd[b] (Pounds/ Acre/Year)	Forage[c] (Pounds/ Acre/Year)	ForageM[d] (Pounds/ Acre/Year)	Fuelwood Potential[e] (Cords/ Acre)	Land Capability (Class)		Natural Resources Conservation Service Management Comments Regarding Use and Management	Agricultural Potential	
																Nonirrigated	Irrigated		Irrigation[f]	Runoff[g]
440	Mule family soils and urban land	fan terraces	3,300–4,500	25–50	Aridisol	Ustic Haplocalcid	very deep; gravelly sandy loam to very gravelly loam; well drained; moderate AWC	mixed alluvium	12–14	grasses, canotia, mesquite, cacti, mimosa, juniper, shrubs						7e		Wildlife habitat and livestock grazing.	VL	VL
441	Penthouse (60%), Tombstone (30%) complex	stream terraces	3,400–3,600	2–30	Aridisol	Ustic Calciargid, Ustic Haplocalcid	very deep; sandy loam to sandy clay (Penthouse) and gravelly sand y loam (Tombstone); well drained (Penthouse) to some excessively drained (Tombstone); moderate to high (Penthouse) to low (Tombstone) AWC	mixed alluvium	12–14	grasses, mesquite, mimosa, acacia, ceanothus, shrubs (Penthouse) and grasses, canotia, mesquite, cacti, mimosa, juniper, shrubs (Tombstone)						6s (Penthouse) and 6s to 7e (Tombstone)		Urban land, rangeland, and wildlife habitat.	L	M
443	Feps fine sandy loam	floodplains	3,300–3,400	0–1	Aridisol	Typic Hydraquent	very deep; sandy loam to loam; very poorly drained; high AWC	mixed alluvium	12–14	grasses, mesquite, sedges, rushes, cattail						7w		Wildlife habitat.	VL	VL
445	rock outcrop, Lampshire complex	mountains	5,000–5,500	3–90	Aridisol	Abruptic Argidurids	very shallow and shallow; flaggy loam to flaggy silty clay loam; well drained, very low AWC	colluvium and residuum from igneous rocks	14–16	grasses, oak, ceanothus, juniper, mountain mahogany, shrubs	yes					7s to 7e		Wildlife habitat and livestock grazing.	VL	L
446	Mine dumps	mine dumps and tailings	4,000–5,000	0–75		NA	very deep deposits; fragments; excessively drained, very low AWC	mined and processed materials	12–14	NA						NA		NA	NA	NA
447	Mine tailings	tailing ponds	4,000–5,000	0–3		NA	very deep; slickens consisting of ground and processed ore from Jerome, high in pyrite and oxidation of iron sulfides; excessively drained; very low AWC	mined and processed materials	12–14	NA						NA		NA	NA	NA

Key: AWC = available water capacity; NA = not applicable.

[a] See the plant list for genus and species abbreviations and codes.

[b] Hb/Wd = Herbaceous/woody plant growth. This is an estimate in pounds per acre of total annual yield (air-dry/normal year) of all plants—trees, shrubs, forbs, and grasses—from the soil surface to the height of 4.5 feet. Herbaceous vegetation comprises grasses and forbs.

[c] Forage. This is an estimate in pounds per acre of annual yield of herbaceous/woody plants that may provide food for grazing animals. Generally, this represents shrubs, forbs, and grasses.

[d] ForageM = Forage maximum. This is an estimate in pounds per acre of total annual yield of native forage plants after elimination of non-forage species.

[e] Fuelwood productivity. This is the potential for fuelwood production, in cords per acre. A cord is equivalent to 128 square feet (or a 4-by-4-by-8-foot stack).

[f] Irrigation-type agriculture potential: H = high; L = low; L–M = low to medium; M = medium; VH = very high; VL = very low.

[g] Runoff-type agricultural potential. H = high; L = low; M = medium; VH = very high; VL = very low.

Table B.4. Plant Key for the Terrestrial Ecosystem Survey Descriptions from Coconino and Prescott National Forests

Code, by Plant Type	Scientific Name	Common Name
Forb		
Acmil	*Achillea millefolium lanulosa*	western yarrow
Erige	*Erigeron* spp.	fleabane
Erwr	*Eriogonum wrightii*	shrubby buckwheat
Laar6	*Lathyrus arizonicus*	Arizona peavine
Luar3	*Lupinus argenteus*	silvery lupine
Mesc	*Menodora scabra*	yellow or rough menodora
Poan5	*Potentilla anserina*	common silverweed
Poten	*Potentilla* spp.	cinquefoil
Grass		
Agcr	*Agropyron cristatum*	crested wheatgrass
Agsm	*Agropyron smithii*	western wheatgrass
Arist	*Aristida* spp.	threeawn
Arlo3	*Aristida longiseta*	red threeawn
Bltr	*Blepharoneuron tricholepis*	pine dropseed
Bocu	*Bouteloua curtipendula*	sideoats grama
Boer4	*Bouteloua eriopoda*	black grama
Bogr2	*Bouteloua gracilis*	blue grama
Bohi2	*Bouteloua hirsuta*	hairy grama
Carex	*Carex* spp.	sedge
Cyda	*Cynodon dactylon*	Bermuda grass
Eleoc	*Eleocharis* spp.	spikerush
Fear2	*Festuca arizonica*	Arizona fescue
Feov	*Festuca ovina*	sheep fescue
Hene5	*Hesperostipa neomexicana*	New Mexico porcupinegrass
Hibe	*Hilaria belangeri*	curly mesquite
Hija	*Hilaria jamesii*	galleta
Himu2	*Hiaria mutica*	tobosa
Juncu	*Juncus* spp.	rush
Mumo	*Muhlenbergia montana*	mountain muhly
Mupo2	*Muhlenbergia porteri*	bush muhly
Mupu2	*Muhlenbergia pungens*	sandhill muhly
Muri	*Muhlenbergia richardsonia*	mat muhly
Muri2	*Muhlenbergia rigens*	deer grass
Muto2	*Muhlenbergia torreyi*	ring muhly
Nomi	*Nolina microcarpa*	beargrass
Paob	*Panicum obtusum*	vine mesquite
Plmu3	*Pleuraphis mutica*	tobosa or tobosagrass
Pofe	*Poa fendleriana*	mutton grass
Popr	*Poa pratensis*	Kentucky bluegrass
Sihy	*Sitanion hystrix*	bottlebrush squirreltail
Spcr	*Sporobolus cryptandrus*	sand dropseed
Stco4	*Stipa comata*	needle-and-thread grass
Trmu	*Tridens muticus*	slim tridens
Shrub		
Acgr	*Acacia greggii*	catclaw acacia

continued on next page

Code, by Plant Type	Scientific Name	Common Name
Agave	*Agave* spp.	agave, century plant
Agpa	*Agave palmeri*	Palmer agave (century plant)
Arpa	*Arctostaphylos pringlei*	Pringle manzanita
Arpu5	*Arctostaphylos pungens*	point-leaf manzanita
Atca2	*Atriplex canescens*	fourwing saltbush
Basa2	*Baccharis sarothroides*	desertbroom, resinbush
Beha	*Berberis haematocarpa*	red barberry
Bere	*Berberis repens*	Oregon grape
Caho3	*Canotia holacantha*	crucifixion thorn
Cegr	*Ceanothus greggii*	desert ceanothus
Cemo2	*Cercocarpus montanus*	mountain mahogany
Cepa8	*Celtis pallida*	desert hackberry
Chili2	*Chilopsis linearis*	desert willow
Chna2	*Chrysothamnus nauseosus*	rubber rabbitbrush
Comes	*Cowania mexicana stansburiana*	cliffrose
Cost4	*Cornus stolonifera*	red-osier dogwood
Drwr	*Eriogonum wrightii*	shrubby buckwheat
Elel5	*Elymus elynoides*	bottlebrush squirreltail
Eula5	*Eurotia lanata*	winter fat
Fapa	*Fallugia paradoxa*	Apache plume
Gawr3	*Garrya wrightii*	Wright silktassel
Juco6	*Juniperus communis*	common juniper
Ladi2	*Larrea divaricata*	creosote bush
Maha4	*Mahonia haematocarpa*	red barberry
Miacb	*Mimosa aculeaticarpa biuncifera*	catclaw acacia
Mibi3	*Mimosa biuncifera*	catclaw mimosa
Open3	*Pountia englemannii*	Engelmann's prickly pear
Opph	*Opuntia phaeacantha*	prickly pear
Pain2	*Parthenium incanum*	mariola
Prve	*Prosopis velutina*	velvet mesquite
Pust	*Purshia stansburiana*	Stansbury cliffrose
Quga	*Quercus gambelii*	Gambel's oak
Qutu2	*Quercus turbinella*	turbinella oak
Rhtr	*Rhus trilobata*	squawberry, squawbush
Rimo2	*Ribes montigenum*	gooseberry currant
Saex	*Salix exigua*	coyote willow
Syor2	*Symphoicarpus oreophilus*	mountain or whortleleaf snowberry
Tree		
Abco	*Abies concolor*	white fir
Ablaa	*Abies lasiocarpa arizonica*	corkbark fir
Acne2	*Acer negro*	boxelder
Alob2	*Alnus oblongifolia*	Arizona/New Mexico alder
Cuarg	*Cupressus arizonica glabra*	Arizona cypress
Fraxi	*Fraxinus* spp.	ash
Frve2	*Fraxinus velutina*	velvet ash
Jude2	*Juniperus deppeana*	alligator juniper
Juer	*Juniperus erythrocarpa*	redberry juniper
Juma	*Juglans major*	Arizona walnut
Jumo	*Juniperus monosperma*	one-seed juniper
Juos	*Juniperus osteosperma*	Utah juniper

Code, by Plant Type	Scientific Name	Common Name
Piar	*Pinus aristata*	bristlecone pine
Pied	*Pinus edulis*	pinyon pine
Pien	*Picea engelmannii*	Engelmann spruce
Pifa	*Pinus fallax*	Arizona pinyon pine
Pipos	*Pinus ponderosa scopulorum*	ponderosa pine
Pist3	*Pinus strobiformis*	southwestern white pine
Plwr2	*Platanus wrightii*	Arizona sycamore
Poan3	*Populus angustifolia*	narrow-leaf cottonwood
Pofr2	*Populus fremontii*	Fremont cottonwood
Potr5	*Populus tremuloides*	Quaking aspen
Psmeg	*Pseudotsuga menziesii glauca*	Douglas-fir
Quar	*Quercus arizonica*	Arizona white oak
Quem	*Quercus emoryi*	Emory oak
Quga	*Quercus gambelii*	Gambel's oak
Sago	*Salix gooddingii*	Goodding's willow

APPENDIX C

Contents

APPENDIX C

Summary of Excavated Sites in the Middle Verde River Valley as of 2005[1]

Carla R. Van West

The following descriptions of excavated sites in the middle Verde River valley (MVRV) are presented in chronological order. This list does not include better-known sites, such as Tuzigoot Pueblo and Montezuma Castle, which are described in widely distributed reports. Within each temporal phase, beginning with the Archaic period and ending with the protohistoric period, site or project descriptions are generally ordered by the dates of published reports.[1]

Tested Sites Attributed to the Archaic Period (6500 B.C.–A.D. 1)

Dry Creek (NA5005)

Richard Shutler, Jr., and William Y. Adams were the first to assign a site to the Archaic period: the Dry Creek site—a flaked and ground stone scatter on a low terrace adjacent to a seasonally flowing stream, Dry Creek. Today, the site is only a few hundred meters west of Arizona State Route (SR) 89A, near Lower Red Rock Loop Road. The Dry Creek site became the type site for a preceramic time period that the authors suggested may have dated to as early as 5000 B.C. but that more likely dates between 2000 and 1500 B.C. (Shutler and Adams ca. 1949:42), based on geomorphic evidence supplied by geologist Ernst Antevs. The authors collected a variety of stone tools and lithic-manufacture debris from surface collections, eight 2-by-2-m test units, and two test pits placed in the central portion of the site and excavated to depths ranging from about 135 to 175 cm below the modern ground surface (MGS). In addition, they located two hearths and a number of pieces of fire-cracked rock (FCR) surrounding the hearths. The focus of their unpublished manuscript (Shutler and Adams ca. 1949, ca. 1950) and their short article published in the journal *Plateau* (Shutler 1951) was to provide data for recognizing Archaic period campsites in the region. First, they described the stone tools from this site and characterized the assemblage. Second, they assigned sites like the Dry Creek site to an early position within the cultural sequence of the MVRV—and, presumably, the cultural sequence of northern Arizona.

Shutler and Adams (ca. 1949:10) noted that the majority of the flaked stone recovered from the site was local Kaibab chert and that most of the ground stone was Supai sandstone. A few flaked stone items were manufactured from obsidian presumed to have derived from a source south of Williams, Arizona, and a few manos were made from locally available basalt cobbles. Formal flaked stone tools took the form of percussion-flaked scrapers, choppers, gravers, knives, hammerstones, projectile points, and drills. Ground stone tools took the form of shallow, basin-type metates; grinding slabs; and unifacially and bifacially worked, one-handed manos. Because only three or four projectile points and a small amount of animal bone (identified as deer, jackrabbit, porcupine, and possibly antelope) were recovered from their test units, they inferred that the site was a short-term encampment used primarily to procure and process plant remains and to manufacture stone tools.

Although nearly 60 years have passed since Shutler and Adams undertook their study of the Dry Creek site materials, archaeologists have added surprisingly little detail to this original characterization. The recovery of flotation and pollen remains, advances in absolute-dating techniques and stone sourcing, technological analyses of stone tools, recovery of human remains dated to portions of this long

[1] These are sites for which some sort of publication or limited-distribution report was available in 2005.

time period, and recognition of rock-art styles assigned to Archaic period peoples have expanded our understanding of cultural practices before the farming way of life took hold in the MVRV. Nevertheless, our understanding of Archaic period architecture, settlement systems, material culture, ideology, social identities, intergroup interactions, and related topics is quite meager.

Verde View (AZ O:5:12 [ASM])

As part of the data recovery efforts associated with highway work along U.S. Interstate Highway 17 (I-17), McGuire (1977) excavated portions of the Verde View site. From Locus 2 and other isolated proveniences, he recovered eight projectile points and several unifacially worked tools that contrasted markedly with the later, Cloverleaf phase materials at that site. Seven of the points were basalt and resembled Pinto Basin points (Amsden 1935; Rogers 1939). McGuire (1977:41) assigned these to the Middle Archaic period based on their similarity to points associated with the Pinto Basin complex—an Archaic period assemblage that Harrington (1957:72) dated as having occurred from 2000 to 1000 B.C. in southern California. The eighth point, a nondiagnostic projectile made of chert, was also assigned to the Middle Archaic period based on its large size and morphology and on evidence of patination.

Smoke Trail (NA13669)

In 1975, G. Meeks Etchieson (1977, 1980) conducted data recovery at a locale slated for the development of the Smoke Trail Resort along Red Rock Loop Road. The site was located on a bench north of and immediately overlooking Oak Creek. It was an aceramic site that contained flaked and ground stone recovered from both subsurface deposits and the MGS. A single feature was recorded: an ovoid, surface rock alignment (5.25 by 4 m) inferred to have been the base of a temporary brush shelter. Numerous chert nodules and chert and basalt artifacts were found within the rock feature, including two end scrapers, three side scrapers, one scraper plane, five flake scrapers, cores, debitage, and a rectangular, one-handed mano. Although no diagnostic projectile points were recovered (a midsection of a dart point was found), a number of basalt one-handed manos, rectangular mano fragments, and sandstone basin metates were recovered. Etchieson (1980:14) noted that many chert items recovered at the Smoke Trail site were manufactured from a silicified fossil sponge of Permian age (*Actinocoelia* sp.). Other items were manufactured from chert and chalcedony that had weathered out from the Kaibab limestone. Etchieson compared the materials recovered from this site to those recovered from the Dry Creek site. Similarities and differences were observed in the range and the raw materials of the artifact types recovered, the presence or absence of structural features and work areas, and the inferred functions as campsites associated with plant gathering and processing. Etchieson (1980:39) was unwilling to assign the site to the Dry Creek phase, but he acknowledged its overall similarity to the Dry Creek type site. Among Etchieson's conclusions was one particularly important one: he noted that the Smoke Trail site possessed attributes that might be indicative of a much later Apache or Yavapai origin or even of a short-term, aceramic campsite of Formative period peoples. Many archaeologists have adopted Etchieson's cautious position regarding assignment of cultural origins or temporal phases to sites with similarly nondiagnostic assemblages.

Verde Valley School Road (NA14450/AR-03-04-06-40 [CNF])

Based on the overall similarity of materials recovered at a site along Verde Valley School Road and Little Park Wash (a tributary to Oak Creek) to those described by Shutler and Adams (ca. 1949), Margaret Powers (1978) assigned the site to the Archaic period Dry Creek phase. She identified four "features" at NA14450: an unlined, conical roasting pit (1.1 m in diameter and 40 cm in depth); a dense artifact concentration along the wash that included a nondiagnostic, triangular-shaped, basalt projectile point with a short stem; a subsurface deposit of charcoal and artifacts exposed in a test trench; and a dispersed, surface lithic scatter. The artifacts recovered included 27 manos (24 basalt, 2 sandstone, and 1 limestone), 23 metates (17 sandstone, 5 basalt, and 1 granite), and 17 items of miscellaneous ground stone. The 291 flaked stone items included 252 items manufactured from chert or quartzite, 10 manufactured from obsidian, and 10 manufactured from basalt. A small amount of animal bone also was recovered, but it was not described or identified. No samples were taken for botanical or chronometric analyses. Powers inferred that the activities represented at the site included manufacture and repair of stone tools and procurement and processing of plant and animal remains. Like Etchieson, she acknowledged that the aceramic site could have been created by Formative period, protohistoric period, or early-historical-period groups, such as the Yavapai or Apache, but she concluded that the site most likely dated to the Archaic period.

Marsland (NA15729/ AR-03-04-06-327 [CNF])

Steven Dosh and Donald Weaver (1979) conducted data recovery at the Marsland site as part of a private-federal land-exchange project. The surface lithic scatter was located on a tributary of Dry Creek about 2 miles north of Sedona. Although excavators conducted subsurface testing at the site, no subsurface features or materials were found. They did, however, recover 417 flaked stone artifacts from a 10 percent, random sample of 104 collection units (each 3 by 3 m) and 16 artifacts from nonrandom locations outside the random units. Among the non-randomly collected items were 2 basin metates; 6 one-handed, oval manos; 4 projectile point fragments; 1 bifacial tool; 1 unifacial tool; 1 quartzite flake; and 1 obsidian flake.

The authors conducted morphological, technological, and statistical analyses of the materials and their distributions. They were able to estimate the likely total artifact population from their sample and concluded that their collection was reasonably representative. All of the raw materials identified, with the exception of obsidian, were inferred to be local: Kaibab chert, quartzite, and fossil sponge; Supai sandstone; and vesicular basalt. The collection consisted of a large number of debitage flakes, a smaller number of cores and utilized flakes, and a few formal flaked stone tools distributed in three concentrations. Because all four points were fragmentary (two tips and two bases), the authors did not assign any to a morphological class. However, they inferred that basal grinding on one point fragment was a technological trait associated with Archaic period sites in north-central Arizona (McNutt and Euler 1966; Windmiller and Huckell 1973). They also noted that all four "fragments appear to be from either contracting stem forms with triangular blades or expanding stem forms with short triangular blades" (Dosh and Weaver 1979:40–41). They favorably compared these projectile point forms to similar forms recovered by Haury (1950) and Huckell (1973:191), who inferred such forms to be Archaic period (5000–1000 B.C.) in age.

Dosh and Weaver (1979:43) suggested that the Marsland site was a limited-activity site with at least two activities represented: the fabrication of flaked stone tools and the procurement and processing of wild-plant foods. They tentatively assigned it to the Dry Creek phase based on its similarities with sites assigned to that time period (Etchieson 1977, 1980; Powers 1978; Shutler 1950; Shutler and Adams ca. 1949) but acknowledged that it might be an aceramic Formative period site or a Yavapai or Apache site. The absence of pottery and other artifacts associated with agricultural people, the absence of habitation and storage features, and the presence of suspected Archaic period projectile points and technologies composed their evidence for assigning the site to the Archaic period. Dosh and Weaver (1979:43) suggested that this occupation took place sometime between 5000 B.C. and A.D. 1.

Jack's Canyon Lithic Sites: AR-03-04-06-297 (CNF) and AR-03-04-06-306 (CNF)

In 1981, Eric Bergland undertook archaeological investigations at two surface lithic scatters in Jack's Canyon as part of his Master's thesis (Bergland 1982). Both sites were located in an area scheduled for land exchange, astride an ephemeral wash. He mapped, surface collected, and placed test excavations in the two sites. Virtually all artifacts were recovered from the MGS. He recovered more than 2,000 items, to which an earlier collection at those sites was added. Bergland was among the first to conduct a formal technological analysis of lithic collections in the MVRV. He used Sullivan's (1980) taxonomic system to classify the flaked stone collection and to make inferences about site function. He also was the first in the MVRV to suggest that a thermal feature was used to heat-treat chert for stone-tool production.

AR-03-04-06-297 (CNF) was an extensive lithic-procurement locale with a single rock-pile feature (0.55 m in height by 1 m in width) inferred to be a roasting pit for thermally altering chert. Analysis of the flaked stone revealed that tool manufacture and modification also took place at the site. Bergland suggested that portions of site were used by Archaic period hunters for making and using stone tools, especially hunting implements but also for plant processing. He recovered one complete and two partial projectile points that represented two different point styles. The two point fragments, which represented one style, had serrated margins and were deeply corner-notched projectile points that Bergland (1982:62) suggested were similar to those recovered at the Dry Creek site. The complete specimen, representing a different style, was pressured flaked and manufactured from heat-treated chert. It exhibited a contracting stem, like a Gypsum Cave point, and had an impact fracture on its tip. AR-03-04-06-306 (CNF) was a lithic scatter that was inferred to have been an Archaic period task location where raw-material reduction, tool production, and food processing took place and that was used for a short time.

Bergland (1982:65–67) compared his data with data from Shutler's Dry Creek site and Etchieson's Smoke Trail site. All three sites contained pebble and flaked stone tools and similar projectile point types "variously attributed to complexes known as Chiricahua-Cochise (Sayles and Antevs 1941), Chiricahua-Amargosa II (Haury 1950), and most recently, Pinto-Amargosan (Bowen 1981)" (Bergland 1982:65). He also noted that all three sites contained one-handed manos and basin metates, but whereas the Jack's

Canyon sites produced tools predominantly made of chert, the other two sites used a greater variety of raw materials. This was paralleled by a greater use of basalt for ground stone tools at Jack's Canyon than at the other two sites, where sandstone was the favored material for manos and metates. Bergland concluded that the two Jack's Canyon sites were most like the Dry Creek site and accepted Antev's suggested date for the Dry Creek site: ca. 2000–1500 B.C.

Bergland's most important contribution was his observation that Archaic period groups in the MVRV heat-treated Kaibab chert to enhance its flaking properties. He suggested that "Archaic people of the Upper Verde Valley . . . roughed out crude bifaces or cores from untreated chert and then heat-treated them before further reduction" (Bergland 1982:70).

Rancho del Coronado Land-Exchange Sites: AZ O-5-19 (NAU) and AZ O-5-22 (NAU)

In 1984, archaeologists from the Archaeology Laboratory of Northern Arizona University (NAU), with assistance from Verde Valley Archaeology Society (VVAS) volunteers, undertook data recovery at four sites near the intersection of SR 89A and Cornville Road prior to a proposed federal-private land exchange (Graff 1990). Two of the four sites were inferred to be Archaic period in age. AZ O-5-19 (NAU) is also designated AR-03-04-06-383 (CNF). AZ O-5-22 (NAU) is also designated AR-03-04-06-390 (CNF). Archaeologists mapped and collected all surface artifacts, excavated a series of 50-by-50-cm test units until sterile sediments were reached, collected pollen samples, and analyzed the recovered lithic collection using methods proposed by Sullivan and Rozen (1985). No features or subsurface deposits were encountered in any of the test excavations, and both sites were considered surface scatters.

At AZ O-5-22 (NAU)—the smaller of the two lithic scatters—the following categories of material were recovered: flaked stone (debitage, cores, core tools, scrapers, two Pinto Basin–style points, bifaces, and unifaces), ground stone (a slightly ground, oval, sandstone cobble that may have been a one-handed mano), and FCR. The raw materials for the flaked stone artifacts included a preponderance of miscellaneous chert, followed by basalt and less obsidian and other stone types (yellowish chert, reddish chert, chalcedony, and mudstone/siltstone). From the range of tool types and the amount of debitage recovered, Graff inferred that the site was a lithic-reduction and food-procurement/processing site.

At AZ O-5-19 (NAU), a similar suite of materials was recovered: flaked stone (flakes, shatter, cores, core tools, scrapers, unifaces, bifaces, and projectile points, especially Pinto Basin–style points), ground stone (a 5-pound sandstone lap stone with evidence of shallow pitting), and FCR. At this site, basalt was the predominant tool stone, followed by obsidian and other stone (red chert, mudstone/siltstone, yellow chert, chalcedony, Presley Wash obsidian, and other igneous stone). From the range, quantity, and distribution of stone artifacts observed, Graff interpreted this larger scatter as a location where hunting, hide working, food processing, and lithic reduction occurred.

Graff (1990:117–118) noted that similar activities were carried out at both of the sites. In both cases, hunting (flaked stone tools, especially projectile points), food processing (FCR, scrapers, and utilized flakes), and stone-tool manufacture and maintenance (cores, flakes, and debitage) were emphasized to the exclusion of plant processing. She cited the dearth of ground stone (especially manos and metates) as evidence for this inference and suggested that the sites were occupied seasonally by hunters as temporary camps. The larger site was likely used repeatedly over many seasons, whereas the smaller site may have been used only once. She suggested that sites like these represent but one type of short-term settlement in a hunting-gathering settlement system that ranged far and wide throughout a given territory. Evidence for widespread movement or shared contacts took the form of high frequencies of nonlocal raw material derived from locations outside the MVRV (e.g., obsidian, Presley Wash obsidian, certain cherts, and other igneous stone).

As for assigning these sites to the Archaic period, Graff (1990:119–121) addressed the question of what dates should be associated with the presence of Pinto Basin–style projectile points. She noted that different lithic analysts assigned Pinto Basin points to different portions of the long Archaic period. Whereas Huckell (1984:194) concluded that Pinto Basin points are diagnostic of the Middle Archaic period in southern Arizona (6500–1000 B.C.), Sullivan and Rozen (1985:774) suggested that bifacial tools produced with hard-hammer manufacturing techniques rather than soft-hammer techniques—such as Pinto Basin points—are characteristic of the Early Archaic period. Perhaps as a compromise, she assigned an Early to Middle Archaic period date to these two lithic scatters.

Offield Land-Exchange Sites: AR-03-04-06-673 (CNF) and AR-03-04-06-674 (CNF)

In 1995, archaeologists from Southwestern Environmental Consultants, Inc. (SEC), conducted data recovery at two sites affected by a land-exchange project (Horton and Logan 1996). Both sites were multicomponent sites with Late Archaic period, Southern Sinagua, and historical-period Euroamerican occupations. Both sites contained well-defined prehistoric artifacts consisting of flaked and ground stone artifacts, a small number of Formative period potsherds, and historical-period check dams and trash scatters. Archaeologists mapped and plotted all surface artifacts and explored the subsurface for buried features and deposits. Within each site, archaeologists excavated six 1-by-1-m test units, cut trenches with a backhoe, and placed a series of auger holes in areas that appeared to have depth. No subsurface cultural remains were identified at either site, despite a concerted effort to locate them. Thus, all analyses were confined to artifacts collected from the surface within 4-by-4-m collection units. Material-culture studies suggested that both sites were short-term limited-activity sites associated with resource exploitation (stone, plants, and animals), expedient stone-tool manufacture, and resource processing.

Flaked stone items were classified using the system described by Sullivan and Rozen (1985), and microscopic edge-wear analysis was performed on both flaked and ground stone. Archaeologists recovered 285 flaked stone and 8 ground stone items from AR-03-04-06-673 (CNF). Most of the flaked stone was debitage and shatter, but several formal tools were identified: 3 end scrapers, 1 flanged drill, 1 chopper, 1 biface, and 8 cores. Of the 8 ground stone items, 3 were complete one-handed manos, 2 were fragmentary one-handed manos, and several were grinding-slab fragments. Most of the flaked stone artifacts were manufactured with Kaibab chert or quartzite. One end scraper was made with Perkinsville chert, and the biface was made with Presley Wash obsidian. Edge-wear analysis indicated a degree of rounding and polishing on scrapers, which suggested that scrapers might have been used for working hides or wood. Similarly, microflaking and crushing scars were identified on the single chopper—damage that could result from working tough plant parts, like agave and yucca. All but 1 of the ground stone items were fashioned from Supai sandstone cobbles or slabs. A single one-handed, basin-type mano was manufactured from a basalt cobble. Microscopic inspection of use wear on the ground stone tools was conducted to infer grinding-tool sets and whether grinding implements were used in a reciprocal or rotary motion. Most items exhibited wear on a single surface, but 2 basin-type manos showed wear on two (opposite) surfaces.

Archaeologists recovered 311 flaked stone and 9 ground stone items from AR-03-04-06-674 (CNF). As is typical, most of the flaked stone was debitage and shatter, but several formal tools were identified: a single (Late Archaic period) San Pedro–style projectile point, 3 bifaces, 1 scraper, and 2 cores. Only the base of the San Pedro–style point was recovered. It was manufactured from Kaibab chert and was broken by impact. All 7 tools were either Kaibab chert or quartzite. Of the 9 ground stone items, 2 were grinding slabs, and 7 were one-handed, basin-type manos. All but 1 of these 9 items were manufactured from Supai sandstone: a single mano made from basalt. As with AR-03-04-06-674 (CNF), microscopic analysis revealed that 6 of the 9 ground stone objects were worn on one side only; the remaining 3 (2 manos and 1 grinding slab) showed wear on two (opposite) sides. Most of these tools were used in a reciprocal motion, and most were expediently fashioned.

Horton and Logan compared their results with tools, material types, and technologies discussed in previous reports. They suggested that the lithic collections from these two sites were technologically and statistically very similar to other sites that they had recently excavated and that produced radiocarbon dates in the first few centuries A.D. (Horton and Logan 1996:44; also see the discussion below on the Squaw Peak phase). AR-03-04-06-722 (CNF), a lithic scatter with a human burial at Cross Creek Ranch (Logan and Horton 2000), apparently yielded a radiocarbon age of 1510 ± 80 B.P. on loose human bone (Beta-52277) (reported as A.D. 440 ± 80) (see Logan and Horton 2000:Appendix B). We calibrated this radiocarbon age with Calib 5.0.1 and derived a 2σ probability range of A.D. 392–662. AR-03-04-06-294 (CNF), a habitation site at Jack's Canyon with a firepit and a shallow pit structure with preserved datable charcoal from structural posts, yielded four radiocarbon dates (Beta-75536, 1680 ± 50 B.P.; Beta-75537, 1650 ± 50 B.P.; Beta-75538, 1600 ± 50 B.P.; and Beta-75539, 1510 ± 10 B.P.). As reported by Logan and Horton (1996:49, Appendix B), these four dates span a 2σ calibrated radiocarbon interval with dates as early as A.D. 245 and as late as A.D. 655. The youngest of these four samples (1510 ± 10 B.P.) yielded a 2σ date range of A.D. 425–655.

Horton and Logan (1996) also noted that the ground stone collections from AR-03-04-06-673 (CNF) and AR-03-04-06-674 (CNF) seemed to be very similar to those reported by Shutler and Adams (ca. 1949) for the Dry Creek site, by Etchieson (1980) for the Smoke Trail site, and by Dosh and Weaver (1979) for the Marsland site. All these sites "contain expediently used hand sized cobbles that show little to no shaping" (Horton and Logan 1996:41). They suggested that differences in the selection of raw materials (e.g., basalt over sandstone or vice versa) may be related to the type of substance processed with the grinding equipment, which, in turn, may reflect the season of site use (Horton and Logan 1996:41). Thus, on the bases of recovering a San Pedro–style projectile point and overall similarities with assemblages recovered from dated sites, Horton and Logan assigned both sites to the Late Archaic period, which they associated with the 1500 B.C.–A.D. 1 time period. Both AR-03-04-06-673 (CNF) and AR-03-04-06-674 (CNF) were limited-activity sites where resources were gathered and processed at an unknown date within this lengthy time interval.

Dusty Cave (AR-03-04-06-481 [CNF])

In 1985, archaeologists with Plateau Mountain Desert Research (PMDR) conducted National Register of Historic Places– (NRHP-) eligibility testing at a rockshelter site in Oak Creek Canyon prior to slope-stabilization efforts (Weaver and Lefthand 1996). The site consisted of two shelter openings, a narrow shelf connecting the shelters, and a talus slope at the base of a vertical cliff face formed in Supai Formation sandstone. They located, mapped, surface collected, and excavated a number of hand-dug shovel tests, four 1-by-1-m test units, and a single trench at this site, which was named Dusty Cave. The tested deposits were deep and stratified; the deepest cultural stratum ranged from 125–130 to 160–175 cm below the MGS. From this lowest unit, archaeologists recovered flaked stone and ground stone artifacts but no ceramics. Formative period (A.D. 1100–1400) ceramics were present in the upper strata. Although samples for pollen, flotation, and radiocarbon dating were collected from these excavations, none were submitted for analysis. Nonetheless, the authors (Weaver and Lefthand 1996:23) inferred that the lowest strata represented an Archaic period deposit based on the stratigraphic position; the absence of ceramics; the inclusion of flakes, one-handed manos, and basin metates; and the similarity to other sites considered Archaic period in age (e.g., Dry Creek, Marsland, and Verde View). They suggested that the site represented a Late Archaic period occupation dating sometime between 500 B.C. and A.D. 500. On the basis of recovered artifacts, they posited that activities associated with the site included hunting, tool manufacture and maintenance, and food preparation (Weaver and Lefthand 1996:24, 28). Because of the depth and integrity of the deposits within Dusty Cave, as well as its potential to yield information significant to prehistory, the authors recommended that the site was indeed eligible for listing in the NRHP.

Red Rock State Park Sites: Full Moon (AZ O:1:42 [ASM]), Lost Kitchen (AZ O:1:33 [ASM]), and Cross Creek Bridge (AZ O:1:39 [ASM])

In 1988 and 1989, archaeologists from PMDR and the VVAS tested 19 sites in Red Rock State Park and its access road and along Red Rock Loop Road (Weaver 2000). Among these 19 were 3 sites with features inferred to be Archaic period in age. Two of the 3 sites yielded organic materials that were dated via radiocarbon methods. Archaeologists mapped, surface collected, and investigated each site with auger holes, hand-dug test pits, and backhoe trenches. Pollen, flotation, and radiocarbon samples were taken from buried proveniences. In addition, a sample of obsidian artifacts was submitted for obsidian-hydration analysis from 2 of the 3 sites. This is one of the few projects in the MVRV that employed this technique, a dating method that is considered by some to be unreliable.

From the Full Moon site, archaeologists recorded a shallow, basin-shaped, partially slab-lined roasting pit found eroding out of an arroyo. The existing portion of the feature measured 1.4 by 0.85 m and was approximately 30 cm in depth. The lower 19 cm of the pit was lined with sandstone slabs. The pit bottom contained powdery charcoal and burned sandstone residue. No artifacts were recovered, and none of the samples taken from the feature (pollen, flotation, and radiocarbon samples) yielded results. The near absence of surface artifacts, the depth of the feature, the proximity to other sites inferred to be preceramic in age, the geomorphology, and the general feature characteristics suggested to Weaver (2000:43–44) that the feature was either Archaic period (2000 B.C.–A.D. 700) or Yavapai (A.D. 1400–1860).

Archaeologists located four features at the Lost Kitchen site, each associated with artifacts. Among the features were a heavily distributed and poorly preserved human burial; a basin-shaped pit with ash, charcoal, and FCR; a mano cache; and a cultural surface with three irregularly shaped depressions on which a cluster of artifacts was located. It was from this deeply buried cultural surface (1.14 m below the MGS) that two basin metates, a faceted hand stone, flaked stone, unidentifiable bone, FCR, charcoal, and ash were recovered. Charcoal submitted for radiocarbon analysis returned a 2σ calibrated Accelerator Mass Spectrometry (AMS) date range of 759–400 B.C. (Weaver 2000:211)[2]. Flotation analysis identified wood charcoal from this deposit as *Cupressus/Juniperus* type and *Pinus* type (Kwiatkowski 2000:192). Pollen analysis indicated elevated frequencies of cheno-am pollen, including cheno-am aggregates (Scott Cummings 2000:185). Weaver (2000:129) assigned these four features to the Late Archaic period (1500 B.C.–A.D. 300) on the basis of the complete absence of ceramics, the highly deteriorated human burial, the deeply buried deposits, and the radiocarbon date derived from the wood charcoal. An obsidian-hydration date on a flake of Partridge Creek obsidian of A.D. 842—if accurate—suggested that later occupation took place at the site, as well (Weaver 2000:129, 211).

At the Cross Creek Bridge site, archaeologists identified a series of buried features and deposits inferred to date to the Late Archaic period (1500 B.C.–A.D. 500). Among

[2] We calibrated the published ^{14}C age of 2430 ± 60 B.P. with Calib 5.0.1 (Weaver 2000:211); no laboratory report sheets were included in this final report.

these early features were four basin-shaped pits interpreted as roasting pits (Features 1, 4, 5, and 6), each with ash, charcoal, and FCR; several clusters of artifacts that may have been caches; two small firepits; and ancient use surfaces ranging from 35 to 70 cm below the MGS. Weaver (2000:147) suggested that these deposits were roughly contemporaneous and represented base camps occupied by hunter-gatherer groups, either repeatedly or for a relatively long duration. Artifacts recovered included a wide range of flaked and ground stone artifacts, a broken bone awl (likely deer), and a *Haliotis*-shell bead. Among the 953 flaked stone artifacts were 7 cores, 6 core tools, 8 hammerstones, 1 projectile point, 2 bifaces, 1 scraper, 2 scraper planes, 8 choppers, 7 gravers, 2 tabular tools, 417 utilized flakes, and 492 pieces of debitage. No ceramics were recovered. The projectile point was not typed but was described as a complete, leaf-shaped, corner-notched projectile (dart) point of Kaibab chert with a slightly concave base (Weaver 2000:164). Among the 73 ground stone artifacts were 21 whole or fragmentary hand stones, 38 whole or fragmentary (one-handed?) manos, 2 grinding stones, 3 whole or fragmentary basin metates, 1 grinding slick, and 8 unidentified fragments.

Pollen analysis of samples from three of the four roasting pits (Features 4, 5, and 6) revealed high frequencies of cheno-ams accompanied by aggregates. Cattail and Liguliflorae (a composite in the aster family) pollen were also recovered from these roasting features (Scott Cummings 2000:186). Flotation analysis from these same thermal features resulted in the identification of charred purslane seeds, cheno-am seeds, and hedgehog cactus seeds. Wood-charcoal types included *Cupressus/Juniperus* type, *Pinus* type, and possibly a member of the Rosaceae family (Kwiatkowski 2000:192).

Two charcoal samples from this site were submitted for radiocarbon dating. One sample was taken from a buried roasting-pit feature (Feature 5) and returned AMS 2σ calibrated date ranges of 813–735, 690–662, and 649–546 B.C. (Beta-81689) (Weaver 2000:211)[3]. The second sample was from an unknown provenience (Specimen 39) and returned conventional radiocarbon 2σ calibrated date ranges of A.D. 1400–1698, 1723–1816, and 1834–1878 (Beta-35501) (Weaver 2000:211)[4]. In addition, nine obsidian artifacts were submitted for obsidian-hydration dating. Materials apparently were visually sourced to Government Mountain, R S Hill, Presley Wash, Burro Creek, and a quarry near Sitgreaves Mountain or Kendrick Peak. The earliest date was 959 B.C.; the latest was A.D. 1362; three dated to the A.D. 300s and 400s, one dated to the A.D. 800s, two dated to the A.D. 1100s, and one sample could not be dated (Weaver 2000:211).

Although Weaver was unwilling to assign the Full Moon site to either an Archaic period or a Yavapai/Apache affiliation, he was willing to assign both the Lost Kitchen site and the Cross Creek Bridge site to the Late Archaic period, which he dated to the 2000 B.C.–A.D. 700 interval. Both were aceramic sites with deeply buried cultural deposits and/or subsurface features (roasting pits, hearths, use surfaces, and artifact clusters), possessed similar artifact types, and yielded radiocarbon dates that appeared to confirm preceramic period occupations. The obsidian-hydration dates, if credible, however, suggested that each site also experienced later occupations dating to the Formative and protohistoric periods.

Tested Sites Attributed to the Late Archaic/ Early Formative Period Squaw Peak Phase (ca. A.D. 1–650/700)

Montezuma Well Unit (NA4616C) and Calkins Ranch (NA2385)

In 1958 and 1959, archaeologists from the Museum of Northern Arizona (MNA) and the U.S. Department of the Interior National Park Service (NPS) excavated several sites in the MVRV in order to delineate a cultural sequence for this area (Breternitz 1958, 1960a). One of the four pit structures excavated by NPS archaeologist Albert Schroeder at the Montezuma Well site (NA4616C), House 4, was assigned to the Squaw Peak phase. Similarly, one pit structure at the Calkins Ranch site along West Clear Creek excavated by MNA's David Breternitz (House 1C) was assigned to the Squaw Peak phase (note: for an alternate phase assignment for this feature, see the next section on the Hackberry phase). On the basis of these two excavations, Breternitz (1960a:19–21) prepared a preliminary description of the Squaw Peak phase, a time period he equated with the San Pedro–stage Cochise (Archaic period) culture documented in southern Arizona.

Excavation revealed two house forms; one was nearly circular (NA4616C, House 4), and the other was rectangular with rounded ends (NA2385, House 1C); each was constructed as a shallow pit structure with a jacal superstructure, and both structures contained floor features. Circular House 4 had a single center post with peripheral

3 We calibrated the reported ^{14}C age of 2570 ± 40 B.P. with Calib 5.0.1. Laboratory reports were not included in the final report (Weaver 2000:211).

4 We calibrated the reported ^{14}C age of 340 ± 110 B.P. with Calib 5.0.1. Laboratory reports were not included in the final report (Weaver 2000:211).

wall posts; a short, stepped ramp entry facing southeast; a hearth between the center post and the entryway; two subfloor, bell-shaped storage pits along the north wall; and a number of ground stone artifacts on the floor (manos, metates, grinding slabs, rubbing stones, and anvils). Rectangular House 1C was the earliest and lowest of three superimposed structures. Its long side was oriented northwest-southwest, and its entryway was missing; presumably it was destroyed by later construction. House 1C also had a single central roof-support post with wall-support posts peripheral to the floor area; a hearth near the western wall; three subfloor, bell-shaped storage pits (two to the north and one to the south); and a number of ground stone artifacts on the floor (six manos and one stone ring).

Breternitz reported that neither site produced fired-clay pottery, although one site produced an unfired-clay ball of Verde Brown pottery paste[5] (Breternitz 1960a:13, 21) (the site number and provenience were not provided). Both sites produced ground and flaked stone. Breternitz (1960a:14–17, 21) listed the following artifacts as characteristic of the Squaw Peak phase: one-sided and two-sided, round to oval manos; one-handed hand stones; grinding slabs and grinding stones (no formal metates); rubbing stones (including polishing pebbles); flaked "knife-scrapers"; and bone-antler flaking tools. Although provenience was not provided, archaeologists recovered antelope, deer, jackrabbit, and cottontail bone from Squaw Peak contexts. Neither site produced shell or human remains that could be assigned to the Squaw Peak phase.

Long Bow Ranch Sites: NA16942 and NA16943

In 1982, volunteers with the VVAS worked with archaeologists from the MNA to investigate two sites that were to be impacted by road modifications (Weaver et al. 1982). Both sites were identified by surface scatters of lithic artifacts partially within the right-of-way (ROW) of U.S. Forest Service (USFS) Road 216A. Both sites were mapped, surface collected, and auger tested. Field archaeologists determined that the smaller scatter, NA16942 (AR-03-04-06-236 [CNF]), was a surface scatter without buried features but with a variety of flaked and ground stone artifacts that led researchers to assign the site to either the Dry Creek or the Squaw Peak phase. Among these 247 artifacts were 8 cores, 7 utilized flakes, 1 fragmentary side-notched point, 4 one-handed manos, and 1 hammerstone; the remainder were lithic debitage. In contrast, archaeologists located a small but buried, stone-lined roasting pit in one portion of the larger surface scatter, NA16943 (AR-03-04-06-335 [CNF]).

The roasting pit (not illustrated in their report) measured 50 cm in diameter by 25 cm in depth. Flotation and ^{14}C samples were collected from its fill. No botanical remains were identified in the flotation sample, but two ^{14}C samples (material not reported; presumably wood charcoal) were submitted and returned uncalibrated conventional radiocarbon ages of 1390 ± 120 B.P. (UGa-4496) and 1545 ± 140 B.P. (UGa-4497). Although no radiocarbon report was included as an appendix to their report, Weaver et al. (1982:14) assumed that these two dates were equivalent, respectively, to A.D. 560 and A.D. 405. We calibrated these two radiocarbon ages with Calib 5.01 (Stuiver and Reimer 1993) and derived 2σ probability ranges—ca. A.D. 410–895 and 926–936 and A.D. 139–155, 167–195, 209–723, and 739–770, respectively. One inference that can be drawn from these radiocarbon samples is that the material dated (presumably wood charcoal) was a mixture of older and newer wood, and the younger sample is a better indicator of the site age. If so, the feature was used sometime in the first millennium A.D., mostly likely prior to A.D. 936 and most likely after A.D. 410. Alternatively, the feature was reused by later groups, and the second date indicates a different roasting episode. We concluded that the site could date to the Squaw Peak phase, but it could also postdate that period (e.g., to the Hackberry or Cloverleaf phase).

Jack's Canyon Site: AR-03-04-06-294 (CNF)

In the summer of 1994, 11 sites in Jack's Canyon were investigated as part of a federal land-exchange project during which 19.75 acres of USFS land was transferred to private ownership (Logan and Horton 1996). Data recovery at one of these sites, AR-03-04-06-294 (CNF), revealed two buried features: Feature 1, an isolated extramural hearth, and Feature 2, a prehistoric cultural surface (2.75 m north-south by 2 m east-west) 42–55 cm below the MGS that the excavators interpreted as a shallow pit house.

Feature 1 was a small, unplastered, shallow, oval-shaped hearth (25 by 50 cm and 15 cm in depth) outlined with FCR. It was located 8 m southeast of Feature 2. From Feature 1, archaeologists recovered juniper or cypress fuelwood, a juniper seed, three cheno-am seeds, and a single maize cupule (Logan and Horton 1996:41).

[5] As part of their 1979 excavation and analysis of archaeological sites along U.S. Department of Agriculture Forest Service Road 9 (now renumbered Arizona State Route 260), Stebbins et al. (1981:104, Table 30) re-examined ceramics recovered from Breternitz's 1958 excavations at the Calkins Ranch site (NA 2385). Their reanalysis resulted in a revised dating scheme for several features at the Calkins Ranch site, including House 1C. In contrast to what Breternitz reported (1960a:21), pottery sherds (e.g., Verde Brown) were indeed recovered from the fill and floor of House 1C, and the structure was reassigned to the A.D. 700–800 Hackberry phase (Stebbins et al. 1981:104).

Feature 2 consisted of hard-packed earth that was oxidized in some areas and uneven, patchy, and nonexistent in other areas. On this surface, archaeologists located two postholes, a firepit (Feature 2.1), and a sizable flaked and ground stone assemblage. Analysis of the pollen and flotation samples taken from the firepit indicated that juniper or cypress was used as fuelwood, and the firepit contained a heavily charred maize kernel and an uncharred hackberry seed. They also noted that the fill of this feature contained large amounts of charcoal, ash, and burned soil. They recovered burned wood from the surface and close to the MGS and interpreted it as the remains of structural posts. Four samples of this charred wood found in contact with the cultural surface were submitted for radiocarbon analysis. They returned four conventional radiocarbon ages of 1680 ± 50 B.P. (Beta-75536), 1650 ± 50 B.P. (Beta-75537), 1600 ± 50 B.P. (Beta-75538), and 1510 ± 60 B.P. (Beta-45539). They reported the 2σ calibrated probability ranges for these four samples as A.D. 245–515, 265–540, 380–590, and 425–655, respectively. We recalibrated these four conventional radiocarbon ages with Calib 5.0.1 and obtained very similar dates (A.D. 240–441, 453–460, 484–532; 258–299, 319–537; 343–571; and 427–644, respectively). We also pooled the four dates and obtained a pooled mean of 1618 ± 26 B.P., which resulted in a 2σ calibrated date range of ca. A.D. 392–535. Therefore, it is likely that this feature was constructed and used sometime during the Squaw Peak phase, as described by Logan and Horton (1996:49). These radiocarbon dates also are reasonable proxies for the date of the earliest evidence for maize agriculture in the MVRV, although they are not dates derived directly from the maize remains.

Excavations at the site as a whole resulted in the recovery of 552 items of flaked stone, 18 ground stone artifacts, and 8 pottery sherds. All sherds were Verde Brown (A.D. 1000–1400) and were recovered from the MGS or from shallow test units (not in Features 1 or 2). Among the flaked stone were two Kaibab chert diagnostic projectile points—corner-notched points stylistically similar to San Pedro Corner-notched points—and one point fragment that appeared to be a reworked Gypsum Cave point. In addition, a large edge-abrader tool of rhyolite interpreted as both a side and end scraper was recovered. The remaining flaked stone was debitage and was 99.8 percent local Kaibab chert, and the balance was manufactured from quartzite, rhyolite, and obsidian. The ground stone assemblage from the site consisted of 10 basalt and vesicular basalt basin manos, 1 vesicular basalt trough mano, 3 sandstone grinding slabs, 1 sandstone basin metate, 2 basalt polishing stones, and 1 indeterminate sandstone object. Two of the 3 grinding slabs were associated with Feature 1, the extramural hearth. Seven of the 10 basin manos, the basin metate, and the 2 polishing stones were associated with Feature 2, the Squaw Peak phase pit house.

Logan and Horton (1996:49) interpreted this site as a seasonally occupied habitation (i.e., warm season) that served as a resource-procurement and -processing locale, which included the grinding of maize in a trough metate. Despite the presence of maize and maize-grinding equipment, the remaining stone tools were typical of sites attributed to the Dry Creek phase (Late Archaic period).

Crescent Moon Ranch (AZ O:1:88 [ASM])

In 1996 and 1997, archaeologists from Dames & Moore undertook limited data recovery and monitoring at two sites that had been subjected to disturbance during the construction of the natural-gas Sedona Pipeline (Shepard et al. 1998). The two sites were located on the Crescent Moon Ranch property (presently owned by USFS), on a terrace adjacent to Oak Creek. One of these sites, AZ O:1:88 (ASM) (also designated AR-03-04-06-412 [CNF]), was tested with a number of backhoe trenches and hand-dug excavation units, and three formal human burials, each capped with an overturned metate, were discovered. Associated grave goods, including time-diagnostic projectile points, led archaeologists to infer that the burials dated to the Late Archaic/Early Formative period.

Features 1, 2, and 3 were human burials representing two adults and one child. All were disturbed by bioturbation. Feature 2 was the most complete and was located at a depth of 80–95 cm below the MGS. Feature 1 was a tightly flexed young adult (16–20 years of age) placed on its back. It was capped with an inverted, 36-pound, basalt basin-metate fragment above a flat/concave basalt mano and two fragments of a flat/concave vesicular basalt metate, as well as three unmodified boulders (5 pounds, 6 pounds, and 42 pounds). One *Glycymeris*-shell bead was recovered in a trench near this burial. Feature 2 was a tightly flexed adult (35–50 years of age) also placed on its back, with the head to the north, facing south. It was capped with a large, 97-pound, sandstone basin metate. Three beads were recovered near the burial: one *Glycymeris* bead and two *Conus* or *Olivella* beads; all were considered funerary objects. Feature 3 was a poorly preserved child burial capped with a 28-pound, flat/concave basalt metate. No grave goods were recovered.

Elsewhere on the tested portion of the site, a variety of flaked, ground, and ceramic artifacts were recovered, as were subsistence remains in the forms of faunal bone and plant remains identified in pollen and flotation samples. Although an isolated Clovis point was found, several San Pedro–style (n = 4) and Basketmaker (n = 6) dart points were retrieved from various excavation units. Energy dispersive X-ray fluorescence analysis of a sample of flaked stone items revealed that the Clovis point was manufactured from Hardscrabble Mesa dacite; that four San Pedro points were made from Hardscrabble Mesa dacite (n = 1) and Government Mountain obsidian (n = 3); that three

Basketmaker points were fashioned from Government Mountain obsidian; and that the majority of large, tertiary flakes submitted for analysis were manufactured from Government Mountain obsidian. A single specimen was made from Black Tank obsidian. In addition, two arrow points, a number of bifaces, scrapers, and an eccentric with heavy edge grinding were recovered. Most flaked stone artifacts, however, were chert, which was presumed to be locally available.

The 53 ground stone tools or tool fragments included 12 metates and 41 manos. Most of the metates were flat/concave and were manufactured from basalt. Two basin metates were recovered: 1 sandstone and 1 basalt. The manos had flat/concave (n = 9), basin (n = 18), trough (n = 4), or indeterminate (n = 10) grinding surfaces. Most were manufactured from basalt, although a few were sandstone, vesicular basalt, andesite, granite, or quartzite. Twenty-three of the 41 manos had two use surfaces each rather than one use surface each, and 1 basalt basin-type mano exhibited three use surfaces.

The ceramic artifacts included 52 sherds ranging in type from as early as Lino Gray and Deadmans Gray or Black-on-red to as late as Tuzigoot Plain and Clear Creek Brown (Shepard et al. 1998:58). The authors considered the sherds evidence of later land use and unassociated with the deep burials.

Maize pollen was recovered from the overturned basin metate above burial Feature 1. Elsewhere on the site, remains of rabbits, hares, deer, beaver, and turtle (a carapace) were recovered. Pollen analysis revealed the presence of cheno-am, mint, and lily. Flotation analysis revealed fuelwood sources that included juniper, pine, piñon, and either willow or cottonwood. Shepard et al. (1998:64, 73) suggested that the portion of AZ O:1:88 (ASM) that they investigated was a habitation site that included a cemetery and that was occupied sometime between 800 B.C. and A.D. 800 by precursors of later Sinagua farmers. We suggest here that these burials more likely date to the prepottery but maize-producing Squaw Peak phase. These early farmers grew and processed maize, used Late Archaic period lithic technology, and interred their dead as their Late Archaic period ancestors did but seemingly did not use ceramic containers to store or cook foodstuffs.

AR-03-04-06-722 (CNF)

In 1993, archaeologists from SEC undertook data recovery at two sites on USFS land south of Sedona that was slated for private land exchange (Logan and Horton 2000). Investigations at one of these sites, AR-03-04-06-722 (CNF), a surface lithic scatter with a Late Archaic period occupation, included a single adult burial in a deep, straight-sided pit, with two cobbles above the pit. The burial (Feature 1) was discovered at 1.3 m below the MGS. The burial was a mature male (60–70 years of age), tightly flexed, lying on its right side, with the head to the northwest. No grave goods accompanied the individual. No evidence of cranial deformation or signs of trauma or disease were observed, but the individual had poor dental health. A sample of loose bone was submitted for radiocarbon assay (Beta-52277) and returned a conventional radiocarbon age of 1510 ± 80 B.P. (see the footnote in Logan and Horton [2000:Appendix B]). The authors did not calibrate this age estimate but reported it as equivalent to A.D. 440 ± 60. We calibrated this conventional radiocarbon age with Calib 5.0.1 as having a 2σ probability range of A.D. 392–662, which clearly dates the burial to the Squaw Peak phase.

Archaeologists recovered a total of 1,143 flaked stone artifacts from the site surface (11 projectile points, 8 bifaces, 4 scrapers, 7 hammerstones, and debitage); 28 ground stone artifacts (17 basin manos, 5 basin metates, 2 grinding slabs, and 4 abraders/polishers), and 7 sherds (including Tsegi Polychrome, Tusayan White Ware, and Verde Brown). Ninety-four percent of the total lithic raw material was Kaibab chert; the remainder was manufactured from rhyolite, basalt, obsidian, and quartzite. The dominant ground stone material was vesicular basalt, followed by sandstone. Of the 11 projectile points, 6 were sufficiently complete and distinct to be typed as Pinto Shoulderless, Gypsum, San Pedro Side-notched, Western Basketmaker, Desert Side-notched, and Cohonina, representing traditions ranging in age from the Middle Archaic period to the Formative period.

Logan and Horton (2000:101,106–107) suggested that AR-03-04-06-722 (CNF) was a seasonal or temporary resource-processing location used repeatedly over a long time, possibly as early as the Middle Archaic period and certainly by the Late Archaic period/Squaw Peak phase, as indicated by the adult-male burial.

Cross Creek Ranch Talon Site (AZ O:1:141 [ASM])

During 2002 and 2003, archaeologists from SWCA Environmental Consultants (SWCA) conducted data recovery at 24 cultural components of the 220-acre Cross Creek Ranch site (AZ O:1:141 [ASM]) west of Red Rock State Park. A portion of this extensive site, Area 101, contained a firepit (Feature 2) that was assigned to the Squaw Peak phase (Edwards et al. 2004). Feature 2 was located in Backhoe Trench 3 and appeared as a subsurface charcoal lens associated with artifacts. Wood charcoal from this feature was submitted for radiocarbon assay, although no descriptions of the laboratory, no sample number, and no conventional radiocarbon age were reported. Edwards et al. (2004:213) reported that the calibrated date for this sample was A.D. 430–660 ± 60. Although the reporting of this date is certainly incorrect, we do not have sufficient information to recalibrate it and confirm the inference that this feature dates to the Squaw Peak phase.

Elsewhere in the report, analysts reported that 50 flaked stone artifacts (1 hammerstone, 17 flakes, 1 core, and debitage) and 8 ground stone artifacts (4 manos, 1 metate, 1 hand stone, 1 nether stone, and 1 unidentified fragment) were recovered from Area 101. No ceramics were recovered. Pollen analysis from firepit fill revealed the presence of arboreal pollen and certain species of economic plants, including high-spine Compositae/Asteraceae (e.g., sunflower, aster, snakeweed, and seepwillow), yucca, grasses, and spiderling. No maize was recovered from the firepit fill.

Tested Sites Attributed to the Hackberry Phase (A.D. 650/700–800)

Hackberry Phase Type Site (NA3607)

With hopes of elucidating the culture history of the MVRV, archaeologists from the MNA embarked on an archaeological testing program in the valley in 1949. The first site tested was NA3607 (also designated AR-03-04-01-101 [CNF] and NA4625B), located in the eastern portion of the MVRV, in Hackberry Basin. Although the investigation was never published, the data resulting from 1 week's worth of testing "the partial remains of a slab-lined pit house associated with trade pottery of the known Basketmaker III culture of the San Juan Region" (Shutler 1951:1–2) were used by Breternitz (1960a:21) to represent the first pottery-bearing phase in the MVRV. The alluded-to trade pottery was Lino Gray and Lino Black-on-gray. The presence of these two types together suggested that the structure was used in the A.D. 700–800 interval. Breternitz (1960a:21) also reported that a thick, lanceolate projectile point was recovered from NA3607.

Verde Ball Court (NA3528), Trash Mound

Excavations conducted in 1957 and 1958 by the MNA were continuations of the MNA's attempt to outline the prehistory of the MVRV. Three sites were investigated: Calkins Ranch (NA2385), Verde Ball Court (NA3528), and a portion of NA4616, a multicomponent site now on the NPS–Montezuma Well property (Breternitz 1960a). Although most of the components investigated dated to the Squaw Peak, Cloverleaf, Camp Verde, and Honanki phases, a small number of artifacts assigned to the Hackberry phase were recovered from the lowest levels of a trash mound at the Verde Ball Court site. Breternitz (1960a:11) reported "evidence that trash deposition began during the Hackberry phase between A.D. 600 and 800." Among these artifacts were potsherds identified as Verde Brown, Snaketown Red-on-gray, and Gila Butte Red-on-buff (Breternitz 1960a:21).

Calkins Ranch (NA2385), House 1C

As part of their 1979 excavation and analysis of archaeological sites along USFS Road 9 (now renumbered SR 260), Stebbins et al. (1981:104, Table 30) re-examined ceramics recovered from Breternitz's 1958 excavations at the Calkins Ranch site (NA2385). Their reanalysis resulted in a revised dating scheme for several features at that site, including House 1C. In contrast to what Breternitz reported (1960a:21), pottery sherds (e.g., Verde Brown) were indeed recovered from the fill and floor of House 1C, and the structure was reassigned to the A.D. 700–800 Hackberry phase (Stebbins et al. 1981:104).

Tested Sites Attributed to the Cloverleaf Phase (A.D. 800–900)

Calkins Ranch (NA2385), Houses 2, 3, 4, and 7

As discussed in regard to the Squaw Peak and Hackberry phases, archaeologists from the MNA excavated several sites in the MVRV in 1958 and 1959 to help define a cultural sequence for this area (Breternitz 1958, 1960a:6–7, Figures 13–15). Among these sites was the multicomponent Calkins Ranch site on the north bank of West Clear Creek. Archaeologists assigned four houses to the Cloverleaf phase on the basis of architectural styles and associated pottery. Two structures (Houses 4 and 7) were shallow, rectangular pit houses (or houses-in-pits) with ramped side entryways and raised interior floors, as evidenced by notched-stone floor supports. The other two structures (Houses 2 and 3) were irregular-shaped or oval surface structures with jacal walls. Although each house was damaged by the property owner's ditching machine, sufficient evidence remained to suggest that each had a hearth and a variety of other floor features, including storage pits, postholes, and floor-support stones. Archaeologists recovered artifacts from the floors of the two surface structures as well as from their fill. Breternitz's (1960a:Figure 18) list of pottery types recovered from these four houses implied that the two pit houses were earlier than the two surface structures, but functional differences or occupational duration could account for the differences between those two groups.

Pit-structure House 7 was illustrated in Breternitz (1960a:Figure 15). As depicted, it measured approximately 6.7 m in length by 5.6 m in width, was oriented east-west, and had a west-facing entryway that was about 0.78 m in length and 1 m in width and flanked by side floor grooves. Although the structure was only partially excavated, archaeologists identified two in situ notched-stone floor supports and a number of regularly spaced pits that once held floor or roof supports. Figure 15 did not indicate that floor artifacts were found, but elsewhere in Breternitz's report (1960a:Figures 18, 22, 23), he indicated that ceramics were recovered from the house floor and floor features.

Pit-structure House 4 was illustrated in Breternitz (1960a:Figure 16). As depicted, it measured 8.6 m in length by 5.6 m in width, was oriented slightly east of north-south, and had an east-facing entryway that was about 2.25 m in length and 1.1 m in width. The only plain ware recovered from either of the two pit structures was Verde Brown. Archaeologists also recovered a small number of decorated sherds that included Kana'a Black-on-gray, Deadmans Black-on-red, Santa Cruz Red-on-buff, and trace amounts of Floyd Black-on-gray, Black Mesa Black-on-white, Snaketown Red-on-gray, Gila Butte Red-on-buff, and Sacaton Red-on-buff. Archaeologists also recovered a decorated slate palette, a bone awl, several items of ground stone from the floor, and an extended inhumation burial in a rectangular pit accompanied by two Verde Brown vessels and an abalone-shell pendant.

As depicted in Breternitz (1960a:Figures 13 and 14), surface-structure House 2 measured approximately 6.1 m in length by 3.6 m in width, was oriented east-west, and had a 0.6-m-long-by-0.6-m-wide entryway on the south side. Floor artifacts included a basalt cylinder, three manos, two rubbing stones, one hand stone/hammerstone, and one hammerstone/abrader.

Irregularly shaped surface-structure House 3 measured about 6.6 m in length by 3 m in width, was oriented east-west, and had a 0.6-m-long-by-0.6-m-wide entryway on the north side. Floor artifacts included two manos, one mano/pestle, one rubbing stone, one shaped rock/pounder, one grinding stone, and one hammerstone. A concentration of large cobbles was encountered in the center of the floor. The only plain ware that archaeologists recovered from the surface structures was Verde Brown. They also recovered a small number of decorated sherds that included Kana'a Black-on-gray, Black Mesa Black-on-white, and Santa Cruz Red-on-buff—pottery types that, if contemporaneous, would suggest an occupation dating to the early 900s.

NA9009

Archaeologists from the MNA conducted salvage excavations on a site near the confluence of Sycamore Creek and the Verde River when road improvements on a USFS road threatened to destroy portions of the site (Skinner 1965). The location of the site (NA9009, also designated AR-03-04-06-08 [CNF]) is outside the study area defined for our project, but it is within the Verde River watershed and close to our study area. Skinner's notes in the MNA sites files suggested that the site was likely a small pit-house farmstead located on the first terrace above Sycamore Creek. Archaeologists excavated a single unlined pit house (approximately 4.5 by 3.6 m) that was oriented north-south and had an entryway (approximately 1 m in length by 0.5 m in width) on the west side. They identified two floor features. The first was a 20-cm-diameter firepit near the entryway that was surrounded by a clay collar some 50 cm in diameter. The second was a 40-cm-deep, bell-shaped storage pit that was 50 cm in diameter at the floor surface. They also recovered two human burials in the upper fill inferred to be Tuzigoot phase burials associated with a nearby Tuzigoot phase village, the Packard Ranch Ruin (NA3501)[6]. Archaeologists recovered a single tree-ring specimen from the excavations that proved undatable but was identified as cottonwood. They also recovered cottontail phalanges and a jackrabbit ulna in the pit-house fill. Skinner assigned the pit structure to the Cloverleaf phase on the basis of recovered ceramics from the fill (19 Verde Brown sherds) and surface (10 Verde Brown and 2 Kana'a Black-on-white sherds) and the architectural style.

Lazy Bear (NA11076)

In 1971, archaeologists from the MNA conducted emergency salvage excavations on private land after archaeological deposits were noted by a contractor installing a sewer lagoon in Sedona (James and Black ca. 1974). At a depth of approximately 1 m below the MGS, they identified the remains of a pit structure and a series of associated features that they later named the Lazy Bear site (NA11076, also designated AR-03-04-06-155 [CNF]) after the housing development on which the features were found. The site is one of the few single-component sites attributed to either the late Cloverleaf phase or the early Camp Verde phase. The shallow pit structure (an illustration was not included in the draft report) was subrectangular (3.58 m in length by 2.95 m in width by 0.18 m in depth) and had a short ramp entryway near the center of the south wall. James and Black (ca. 1974:3) inferred that the superstructure

[6] Turner (2004) reported that one of the burials—a 15–20-year-old female buried with turquoise earrings—had a molar tooth that was apparently drilled for therapeutic or palliative purposes (see the Tuzigoot phase section).

of the pit house was supported by four corner posts, with secondary posts along the wall margins of wattle and daub construction. They also found a series of postholes curving outward from the north wall that may have represented a surface structure. The pit house contained an unlined hearth circled by a shallow basin, a bell-shaped pit capped by an overturned metate, and an upright, notched slab next to one of the major postholes (suggestive of a raised floor). Floor-contact and floor-fill artifacts included a metate, a chert scraper, lithic debitage, and 35 potsherds.

The archaeologists also found extramural features south and east of the pit house. They included two large postholes indicating a ramada; a bell-shaped pit; a small, vertical-sided pit capped by an overturned metate; a small, unlined hearth; and an area interpreted as a lithic-working area. They were also able to identify a hard-packed occupation surface on which artifacts were deposited.

Flaked and ground stone, pottery, and animal bone were recovered during the salvage operations (James and Black ca. 1974:4–7). Flaked stone items included the elongated tip of an obsidian projectile point that may have been reworked as a drill, four chert scrapers, and considerable debitage composed of chert, basalt, and obsidian. Ground stone items included 1 two-handed mano, 3 one-handed manos, 2 incipient trough metates, 1 open-ended metate, 1 basin metate, the poll of a three-quarter-groove axe, 1 hammerstone, 3 pestle pounders, 1 piece of ground hematite, and numerous ground stone fragments. Bone items included a single bone awl manufactured from the proximal portion of a deer or mountain-sheep metatarsal, as well as unmodified bone identified as cottontail, jackrabbit, antelope, deer, and unknown rodent. The ceramic assemblage of 383 sherds included both plain and decorated wares. Rio de Flag Brown was the predominant plain ware (89 percent), followed by Verde Brown, a type similar to Angle Brown, Rio de Flag Smudged, Deadmans Gray, and Wingfield Plain. Kana-a Black-on-white was the predominant decorated ware (although most of the sherds were part of a single bowl), followed by Black Mesa Black-on-white and Deadmans Black-on-red.

James and Black (ca. 1974:7–11) assigned the pit house and associated use surface and extramural features to the A.D. 875–925 period based on time-diagnostic, cross-dated ceramics, placing the site in the late Cloverleaf or early Camp Verde phase. They suggested that the architectural forms—especially the pit house with the entry ramp and the raised floor—provided evidence of cultural influences from the south or the Mogollon highlands. In contrast, the ceramic assemblage was suggestive of persistent connections with northerly production sources. They favorably compared this site to the Stoneman Lake site (Metcalf 1973) on the Coconino Plateau, east of the MVRV, and suggested that the Mogollon Rim was not a cultural barrier and that people and materials moved freely from both regions. Their findings also challenged the then-current belief that Sinagua groups did not enter the MVRV until the A.D. 1100s (Breternitz 1960a:27; Colton 1946:302–305, 1968:10).

Stoneman Lake (NA11254)

In 1973, archaeologists from the MNA, with assistance from the VVAS, excavated portions of a pit-house site within the ROW of a realignment of Stoneman Lake Road (Metcalf 1973). The site was situated on a flat between Rattlesnake and Rarick Canyons, along an ancient trail that connected the Verde River valley with locations far to the east (i.e., the Stoneman Lake Trail) (Colton 1964).

Archaeologists conducted excavation within the 100-foot-wide ROW and identified the remains of three pit houses, a trash mound, a rubble heap, and a large concentration of lithic artifacts. The trash mound and rubble heap were trenched, and the pit houses were completely excavated. Metcalf (1973:6) described each of the pit houses and noted their similarities. Each was a circular to oval pit structure with a central post support, smaller auxiliary posts near the margins, and a ramp entry to the southeast. Pit House 1, the largest and most irregular in shape, measured 6–6.73 m in diameter and 1.1–1.23 m in depth. It was unlined, unburned, and not well preserved. A single mano was on the floor. Pit House 2 was 5.8 m in diameter and 59–69 cm in depth. It, too, was unlined and unburned. Its ramped and stepped entry was 1.66 m in length and 0.71–1.08 m in width and had a 20-cm step. Archaeologists identified a number of postholes, a floor pit, and several floor artifacts (including four manos) and ground areas on exposed bedrock in the floor. Pit House 3 was 5.8–5.93 m in diameter and 78 cm in depth. It was the best preserved of the three houses. Its ramp entry was 2.38 m in length and 0.76–1.16 m in width and had a 34-cm rise from floor to exit. Archaeologists identified three postholes, five manos, fragments of a single metate, and a grinding slab on the floor.

Metcalf's (1973) incomplete draft report did not report the proveniences of the 14,530 sherds from this site. Nor is it clear where most of 15,000 items of flaked stone (include 109 projectile points) were recovered. A few projectile points, a few ground stone items (manos, metates, and a grinding slab), and a number of miscellaneous artifacts (a ground-basalt pipe, a fragmentary clay pipe, 3 fragments of clay figurines, and 3 sherd discs) were outlined and labeled as to general context. However, it is clear that the artifacts were recovered from both surface and excavated contexts and that the site and its locality were visited over hundreds of years (Lino Black-on-gray through Jeddito Black-on-yellow). The vast majority (69 percent) were classified as Rio de Flag types from the Alameda Brown Ware series, followed by Verde Brown (28 percent) and considerable numbers of types from the Tusayan White Ware (0.7 percent) and Tusayan Gray Ware (1 percent) series. Remaining types recovered included Deadmans Gray (0.6 percent), Verde Gray (0.1 percent), Gila Butte Red-on-buff (a trace percentage), and Jeddito Black-on-yellow (a trace percentage). Metcalf dated the pit-house site to the period between A.D. 775 and 875 based on the co-occurrence of well-dated Tusayan White Wares (Lino black-on-gray, Kana'a Black-on-white, and Black Mesa Black-on-white) and assigned it to the Sunset phase (ca. A.D. 700–900) of the Northern Sinagua sequence based on the preponderance of northern Alameda Brown Ware.

Verde View (AZ O:5:12 [ASM])

Prior to the construction of I-17, archaeologists from the Arizona State Museum (ASM) Highway Salvage Program conducted data recovery on three sites near Camp Verde, Arizona (McGuire 1977). One of these three, the Verde View site, proved to be a multiple-component site with Middle Archaic period and Cloverleaf phase occupations. The Archaic period materials were recovered in Locus 2 and were discussed above. The Cloverleaf phase remains were discovered in Locus 1.

Archaeologists mapped and systematically collected surface artifacts from Locus 2 before excavating hand-dug units to prospect for subsurface features. By these methods, they identified two pit houses (Feature/House 1 and Feature/House 2) and three extramural features (Feature 3, an artifact cache that included a Deadmans Black-on-red bowl and a Santa Cruz Red-on-buff jar; Feature 4, a disturbed hearth with FCR and ash; and Feature 5, a trash deposit). Both structures were rectangular houses with side entries, floor grooves, postholes that defined perimeter walls, and hearths aligned with the entryways. Both also contained artifacts on the floor and within the pit-house fill, and both had burned. The houses were approximately 10 m apart, and their entryways faced each other.

House 1 (6.7 m in length by 6.1 m in width and 45–52 cm below the prehistoric occupation surface) was oriented more or less north-south and had an entryway on the east wall (approximately 1.5 m in length by 1.5 m in width). Archaeologists identified a number of floor features: two hearths near the entryway, a discontinuous floor groove around the house perimeter, and multiple postholes. From the floor, archaeologists recovered ceramics (25 Verde Brown sherds from different vessels, 1 Floyd Black on-gray sherd, and 1 Santa Cruz Red-on-buff sherd), flaked stone (1 tabular-knife fragment, 1 hammerstone, 1 core, and 9 flakes), ground stone (1 mano) (McGuire 1977:18, Table 2), and a *Glycymeris*-shell-bracelet fragment (McGuire 1977:39).

House 2 (6.9 m in length by 6.6 m in width and 36–52 cm below the prehistoric ground surface [PGS]) was oriented northwest-southeast and had an entryway on the west wall (approximately 1.7 m in length by 1.4 m in width). As with House 1, archaeologists identified a number of floor features: a single hearth near the entryway, a discontinuous floor groove around the house perimeter, and multiple postholes. From the floor, they recovered ceramics (2 partially reconstructible Verde Brown vessels), flaked stone (4 hammerstones, 1 tabular knife, 1 lap stone with red pigment, 4 cores, and 5 flakes), and ground stone (a slab-type metate in the entryway, a mano, 5 unworked pieces of sandstone, 1 piece of sandstone with a ground edge, and a faceted stone ball). Reed (*Phragmites australis [formerly P. communis]*) was recovered from the floor groove and presumably was used for wall construction (McGuire 1977:18, 40). Piñon pine and wood tentatively identified as ash, inferred to be roofing or wall materials, were also recovered.

Of the 3,930 sherds recovered at the Verde View site, more than 89 percent were classified as Verde Brown. The remaining plain ware included Wingfield Plain and unidentified Alameda Brown Ware. Decorated wares were few in number (57 sherds, or 1.5 percent) but included, in order of abundance, Floyd Black-on-gray, Santa Cruz Red-on-buff, unidentified red-on-buff, Deadmans Black-on-red, and Kana'a Black-on-white (McGuire 1977:Table 2). Among the ground stone objects were 18 manos, at least 7 of which had been used with trough-type metates (McGuire 1977:38, Table 4). Several marine-shell artifacts—*Glycymeris*-bracelet fragments and an *Aequipecten circularis* ring—were recovered at this site (McGuire 1977:39).

Kish (AZ N:4:18 [ASM])

In 1975, Arizona State Parks archaeologist Glenn Miller conducted salvage excavations at a site within Dead Horse Ranch State Park (DHRSP) that was threatened by road construction. The site had been identified the year before as three surface artifact concentrations (S-9, S-10, and S-11) (Schreiber 1974) but was later combined into a single site. The site was given the name "Kish" (the name of the daughter of one of the excavators) (Max Castillo, personal communication 2008) and was only later assigned two official site numbers: AZ N:4:18 (ASM) and NA16600. A small fraction of this large, multicomponent site on the first terrace above the Verde River was investigated. In 1975, Miller and his crew placed test units in the ROW of the park road that crossed the site. The materials collected from this mitigation project were analyzed by various members of the research faculty at NAU and by Arizona State Parks staff. Kriegh (1977) analyzed the faunal remains, Hevley analyzed the pollen and flotation remains (no report), and Smithwick (1978) analyzed the human remains. The unpublished manuscript describing this work was drafted by Robert Munson, an archaeologist assigned to nearby Fort Verde State Park (Munson 1977). The manuscript has remained a very rough draft for 30+ years. Excavators identified several subsurface features at Kish, including one pit house. The other features included two pits, two rock piles, two burned areas, and an adult-human burial.

Miller and his crew surface collected a portion of the site from three artifact concentrations located in a set of 2-by-2-m grid squares and excavated a series of backhoe trenches. All excavated material was screened through 1/4-inch hardware cloth, and flotation and pollen samples were collected. A single, poorly preserved pit structure (Feature 10/Pit House 1) was identified during the excavations in the area defined by grid-unit Rows 31–33, Columns H–K. Munson (1977) described it as 4 m in length, 3.14 m in width, and at least 0.25 m in depth. It was oriented along a north-northeast–south-southwest axis and had a lateral entryway approximately 55 cm in length and 30 cm in width in the middle of the northwest wall. Four pits, three of which were interconnected, were identified in the pit-house floor. Only one chalcedony flake was recovered from the floor of the structure. The remaining material was recovered from the floor pits or from the pit-house fill, which was inferred to have washed in from later occupations. The archaeological material recovered in the floor pits included ceramics, flaked and ground stone, shell, and animal bone. The ceramic collection from the pits (n = 1,258) included 1,230 Verde Brown (94.4 percent of the total, including 17 jar rims and 6 bowl rims); 15 Wingfield Plain, silver schist variety; 2 Wingfield Plain, purple schist variety; 4 Gila Butte Red-on-buff; and 3 Tuzigoot (?) Plain sherds as well as 1 unidentified Tusayan White Ware bowl rim and sherds of unknown types. Ground stone recovered from the pits in the pit house included 6 trough and shallow-trough metates of vesicular basalt and 1 grinding slab of basalt; a number of one-handed manos (unifacial and bifacial) or mano fragments manufactured from sandstone, vesicular basalt, and basalt; hammerstones; and a river-cobble pestle. Flaked stone recovered from the pits in the pit house included whole and fragmentary projectile points of obsidian and fine-grained basalt (1 stemmed obsidian point and 1 basalt point with side and bottom notches) and a number of basalt, chert, chalcedony, and rhyolite cores and flakes. A fragment of a *Glycymeris*-shell bracelet was recovered from Pit 1. Faunal material from the pits included bones of jackrabbit, unidentifiable cottontail, and unidentified fish. Unworked copper ore was also recovered from one of the pits, as were a number of unworked cobble- and boulder-sized rocks of different materials.

Munson (1977) was cautious about inferring a period of occupation for the pit house on the basis of architectural style, ceramic-production dates, or shell-bracelet styles. Although he saw stylistic evidence that the pit house was similar to some Hohokam houses described for the late Pioneer or early Colonial period, the presence of non-Hohokam-like intramural pits and of later ceramics called that assignment into questions. Tentatively, then, he assigned the pit house to the early ninth century A.D. (the early 800s), which correlates to the Cloverleaf phase. Munson did, however, infer that the pit house was a lightly built, seasonal structure with storage pits containing reusable tools and stockpiled raw materials intended for subsequent use.

In 1990, when new undertakings were proposed for DHRSP, archaeologists from Northland Research, Inc. (Dosh 1990), and SWCA revisited the Kish site (Zyniecki and Motsinger 1991). Northland Research, Inc., archaeologists conducted testing within portions of the Kish site in response to proposed development associated with the Arizona Boys Ranch Camp (Dosh 1990:1–2). Trenching in the southern portion of the site, where impacts were anticipated, revealed the presence of subsurface pit houses and three rock- and ash-filled pits. Analysis of cultural materials recovered from these features suggested that they represented occupation dating to the late 1000s or early 1100s, equivalent to the late Camp Verde or early Honanki phase (Dosh 1990:26, 27). Northland Research, Inc., archaeologists also established a 5-by-5-m grid system for the surface of the entire site and systematically collected surface artifacts from the proposed development area. In addition, they collected a judgmental sample of grid units to the west of the proposed development area, in and around the rubble mounds inferred to be surface masonry structures, for the purpose of analytic comparison. Ceramic analysis confirmed the presence of a late occupation dating to the late Honanki and Tuzigoot phases (Dosh 1990:18, 26, 27).

SWCA archaeologists conducted a survey of a 418-acre portion of DHRSP (Zyniecki and Motsinger 1991). In addition to evaluating 2 previously recorded sites (AZ N:4:18 [ASM] [the Kish site] and AZ N:4:31 [ASM]), they recorded 21 sites and 36 isolated occurrences. The Kish site, among other sites in the park, was described and recommended eligible for listing in the NRHP.

SWCA archaeologists returned to the park in 1993 and undertook data recovery at five NRHP-eligible sites, including Kish (Zyniecki and Anduze 1996). Data recovery took the form of mapping, surface collection (using both stratified-random-sample and judgmental approaches), and backhoe trenching in areas slated for ground disturbance. Seven trenches of various lengths were excavated. Ceramics, flaked stone, and ground stone collected from these units were analyzed by specialists.

The archaeologists recovered 2,463 artifacts from the surface-collection units (1,577 sherds, 859 flaked stone items, and 27 ground stone items) and 1 unworked malachite mineral specimen. Of the 1,577 sherds, 616 were large enough to assign to named classes (Zyniecki and Anduze 1996:Table 3.2). By far, the best-represented pottery type was Verde Brown of the Alameda Brown Ware series (n = 422), followed distantly by other plain and decorated wares. In order of abundance, plain ware types belonged to the Alameda Brown Ware, other brown ware (e.g., Wingfield Plain), Prescott Gray Ware, San Francisco Mountain Gray Ware, and Tizon Brown Ware series. In order of abundance, decorated wares were assigned to Tusayan White Ware (n = 18), Hohokam Buff Ware (n = 7), Cibola White Ware (n = 2), and San Juan Red Ware (n = 1). Virtually all decorated sherds were assigned to pottery types dated to the A.D. 700–1285 interval, but the best date range for the occupation at the Kish site was A.D. 850–1130 (Walsh-Anduze 1996:58).

Archaeologists recovered only one artifact from the trenches—a one-handed, bifacially modified mano—and did not observe any subsurface features (Zyniecki and Anduze 1996:39). Twenty-five features, however, were mapped from surface evidence. These included 13 rock concentrations, 4 FCR concentrations, 1 rock ring, 1 rock circle, 1 mounded trash area, 3 deflated trash mounds, and 2 artifact concentrations (Zyniecki and Anduze 1996:Table 3.3).

Drawing on previous investigations at the site, Zyniecki and Anduze (1996:108) concluded that the Kish site was a recurrently used habitation site dating to the A.D. 800–1125 interval (equivalent to Phases 2 and 3 of the sequence described by Fish and Fish [1977] and the Cloverleaf and Camp Verde phases of the Breternitz [1960a] sequence). A wide variety of activities were undertaken at this location during its occupation. Spatial analysis of temporally sensitive artifacts did not reveal any patterning.

SWCA's Verde Terrace (AZ N:4:23 [ASM]), Features 3 and 4

Archaeologists recorded this site during an inventory of cultural resources on and adjacent to Tuzigoot National Monument (Tagg 1986). In 1988, archaeologists from SWCA conducted data recovery on this site and four others in advance of clearing the land for a housing development between Clarkdale and Cottonwood, Arizona (Greenwald 1989). Surface manifestations of the site included an artifact scatter, the remains of a single masonry room, and a rock cluster inferred to be a single-room structure or ramada. The site was mapped, surface collected, and explored with 16 backhoe trenches and numerous hand-dug excavation units. Four of the nearly two-dozen features defined at this site were excavated. Data recovery revealed that the site located on the first terrace north of the Verde River was complex and multicomponent (Hovezak et al. 1989:27). Structures and features dated to times within the Hackberry or Cloverleaf phase, the Honanki or Tuzigoot phase, and the historical period.

Feature 3 was a rectangular pit house (5.65 m east-west by 4.15 m north-south) with a centrally located, circular fire hearth; two ash pits; a number of postholes; and a bell-shaped storage pit. The posthole pattern suggested that the house had a gabled roof and two short interior walls that partitioned the house into distinct areas. The house was oriented east-west and had a well-defined entryway (1.4 m in length and 1–1.3 m in width) with a possible threshold on the south side of structure. Greenwald (1989:139) reported that the morphology and material remains associated with this pit house and the Feature 4 pit house exhibited a strong Hohokam influence. Archaeologists recovered numerous floor artifacts, including ceramics, ground stone, and flaked stone. They also collected samples from various proveniences for macrobotanical, pollen, and radiocarbon analysis. Floor-contact ceramics and two radiocarbon dates on charred maize kernels and stalk fragments (F.S. 931) and wood charcoal (F.S. 841) recovered from the fill immediately above the floor provided dates for the structure. Among the better-dated ceramic sherds (dates provided by Breternitz [1966]) were Deadmans Fugitive Red (A.D. 687–1207), Floyd Black-on-gray (A.D. 775–937), and Rio de Flag Brown (A.D. 800–1061).

Macrobotanical analysis identified the charred remains of corn kernels and cupules, dropseed grass, buckwheat, sunflower, and cheno-ams in the floor fill. Charred building material included common reed stems, cottonwood, and mesquite (Brandt 1989). Analysis of a pollen sample collected beneath a mano on the pit-house floor yielded corn, cattail, mesquite, and cheno-am remains.

Archaeologists recovered 99 sherds in the floor of pit-house Feature 3. These sherds included 61 Verde Brown, 11 Wingfield Plain, 10 Kirkland Gray, 7 unidentified plain ware, 3 Floyd Black-on-gray, 2 Rio de Flag Brown, 1 Deadmans Fugitive Red, 1 Verde Gray, 1 Clear Creek Brown, 1 Snaketown or Gila Butte Red-on-buff, and 1 unidentified gray ware (Hovezak et al. 1989:41) and had an extended production range of A.D. 687–1256 and a more likely range of between A.D. 775 and 1061. The ^{14}C samples were dated by Beta Analytic, Inc., but the authors did not include sample numbers, sample reports, or calibration information in their report (Hovezak et al. 1989:67)[7]. The authors reported these dates, respectively, as A.D. 850 ± 70 for the corn remains (F.S. 841) and A.D. 770 ± 60 for the wood (F.S. 931), which they interpreted as construction material. They suggested that these dates, taken together with the ceramics, placed the occupation of Feature 3 sometime between A.D. 710 and 920 and most likely after A.D. 800.

Feature 4 also was a rectangular pit house (5 m northwest-southeast by 4 m northeast-southwest) with a centrally located hearth and an unlined, bell-shaped storage pit. The house entry was on the center of the northeast

7 Unfortunately, no radiocarbon-analysis sheets; Beta Analytic, Inc., sample numbers; or conventional radiocarbon ages were presented in the report. As a result, we do not know whether the report dates were calibrated or simply subtracted from A.D. 1950. As a result, we were unable to calibrate these dates with a modern calibration program, like Calib 5.0.1, or to provide comparable radiocarbon-date ranges from other sites described in our report.

wall. The structure was damaged by the backhoe when it was trenched, and the hearth and other features were removed. A large stone slab was found blocking the doorway. Four ceramic bowls (2 Verde Brown bowls, 1 Black Mesa Black-on-white bowl with a kill hole used for a human cremation, and 1 Wingfield plain bowl), along with a mano and metate, were found inside the doorway. Other artifacts on the floor included 4 sherds (2 Verde Brown and 2 Kirkland Gray), a *Glycymeris*-shell-bracelet fragment, ground stone, and flaked stone, among the 392 sherds recovered from the fill (Hovezak et al. 1989:Table 4.3), which appeared to be a mixture of in situ deposits and later trash. The structure had not burned but appeared to have been abandoned and sealed after the cremation was placed inside. Samples were recovered for macrobotanical and pollen analyses, but no suitable materials were recovered for radiocarbon assay. The presence of the Black Mesa Black-on-white bowl suggested that this structure was used for interment of a cremation in the subsequent Camp Verde phase.

Hovezak et al. (1989:68) concluded that the early occupation of the Verde Terrace site dated to sometime in the A.D. 750–950 period. The locale was used as a habitation for a small agricultural group who grew and processed maize and other foodstuffs, stored food and other goods, and lived in shallow pit houses along the Verde River.

Crescent Moon Ranch Pit House (AZ O:1:111 [ASM])

As described above in the discussion of the Squaw Peak phase, archaeologists from Dames & Moore conducted data recovery at two sites on the Crescent Moon Ranch: AZ O:1:88 (ASM) and AZ O:1:111 (ASM) (Shepard et al. 1998).

Coconino National Forest (CNF) archaeologist Peter J. Pilles, Jr. (1991), tested AZ O:1:111 (ASM) (also designated AR-03-04-06-250 [CNF]) in 1991. Nine backhoe trenches and five 1-by-1-m hand-dug excavation units were used to explore the subsurface. Pilles encountered several features, including two pit houses, three storage pits, one roasting pit, one cache of stone tools, and one human burial. He also recovered 9 whole and fragmentary basin metates, 27 manos, several marine-shell fragments, flaked stone debitage, and ceramic artifacts. Among the pottery were jar sherds identified as Sacaton Red-on-buff. Pilles also sampled the archaeological deposits for radiocarbon dating and tree-ring and pollen analyses. Apparently, these samples have not yet been submitted for analysis, as they have not been reported. Despite the limited analysis of the material remains, however, Pilles was able to suggest that the buried archaeological remains likely represented a small pit-house hamlet composed of 2–3 pit structures dating to the A.D. 850–925 interval. In 1996, when Dames & Moore archaeologists were investigating this site, Pilles considered these remains to be associated with the Hackberry phase—an interval he then dated to the A.D. 650–900 interval (see Shepard et al. 1998:Figure 5). In this report, we consider the A.D. 850–925 interval to be associated with the Cloverleaf phase rather than the Hackberry phase. Nevertheless, the presence of a tradeware vessel from the Gila-Salt Basin—Sacaton Red-on-buff—suggests that the occupation of this site (if this vessel was in a secure, undisturbed context clearly associated with the pit-house occupation) might have been even later, possibly as late as A.D. 1150 but certainly in the 900s or 1000s (Camp Verde phase).

Additional work at this site by Dames & Moore archaeologists in 1996 and 1997 was performed in a different area from the area investigated by Pilles in 1991. Dames & Moore archaeologists surface collected the area of potential effects within and near the pipeline ROW and placed five backhoe trenches along the ROW. A single amorphous pit feature (80 cm in diameter and 60 cm in depth) was discovered in the wall of a backhoe trench. From it was recovered a single basalt mano about 40 cm below the MGS. They also recovered a total of 182 artifacts during the data recovery, most of which were collected from the MGS. These artifacts included flaked stone (3 formal tools—a Kaibab chert arrow point, a Kaibab chert biface, and 1 obsidian flake; cores; and flakes), ground stone (a basalt basin-metate fragment, 3 basin manos, 1 flat/concave basalt basin mano from the pit feature, and a basalt mano fragment), ceramics (63 plain ware sherds, including Verde Brown, Deadmans Gray, Wingfield Plain, and an unclassified Alameda Brown Ware), faunal bone (unidentified medium-sized to large mammal), and a fuel-wood botanical sample for flotation analysis (juniper/cypress and willow/cottonwood).

Shepard et al. (1998:72) remarked that their data recovery efforts did not produce data to support or refute Pilles' (1991) interpretation of the function or age of AZ O:1:111 (ASM). Consequently, a secure assignment of this site to either the Cloverleaf (A.D. 800–900) or Camp Verde (A.D. 900–1150) phase cannot be made at this time.

Jessica (AZ O:1:47 [ASM])

In 1988 and 1989, archaeologists from PMDR and the VVAS tested 19 sites in Red Rock State Park and along its access road and Red Rock Loop Road (Weaver 2000). One of these sites was AR-03-04-06-126 (CNF) (AZ O:1:47 [ASM]), the Jessica site, an unassuming artifact scatter south of Red Rock Loop Road and north of Oak Creek.

The first archaeologists to report this site described it as a small artifact scatter with two features visible on the site surface: a rock alignment and a stone-lined hearth. During data recovery, PMDR archaeologists mapped the site and excavated the hearth (Weaver 2000:14–19). The hearth was 1.1 m in diameter and 27 cm in depth and had been constructed within a conical pit that measured 97 cm at the top and 56 cm at the bottom. The sides were lined with 13 sandstone slabs and 1 small basalt cobble. The hearth was not plastered. Archaeologists recovered 21 fire-altered Verde Brown sherds at the base of the hearth and in situ deposits of wood charcoal. They also took samples of charcoal and sediment for flotation, pollen, and radiocarbon analysis. Kwiatkowski (2000:Table 38) identified the plant remains recovered from the flotation samples, and Scott Cummings (2000:186) identified the pollen. Both analysts identified cheno-ams in their samples. Kwiatkowski, however, also recovered charred *Portulaca* (purslane) seeds and *Zea mays* (maize) kernels and glume fragments. In addition, he identified the wood charcoal as predominantly pine, with less cypress or juniper. Given the location of this site in a piñon-juniper woodland, the *Pinus* type was probably piñon pine and less juniper. The wood-charcoal sample submitted for radiocarbon dating (Beta-35498) returned a conventional radiocarbon age of 1050 ± 70 B.P. Although Weaver reported this date as A.D. 900 ± 70 (Weaver 2000:Table 42), the 2σ calibrated date range for this sample was A.D. 782–1157,[8] with the highest likelihood that the true date is after A.D. 857.

Archaeologists also recovered ground and flaked stone from the site surface (Weaver 2000:19, Table 33). Ground stone included 3 manos, 1 mano fragment, and 1 basin-shaped-metate fragment. Flaked stone included 1 core, 10 scrapers, 2 scraper planes, 1 chopper, and 40 flakes. None of these items was described in any detail, and it is impossible to know from the report whether these artifacts had characteristics that suggested early (Cloverleaf or early Camp Verde phase) rather than late (late Camp Verde phase) use.

The conclusion that can be drawn from this investigation is that the hearth was used for food processing and preparation sometime during the Cloverleaf (ca. A.D. 800–900) or Camp Verde (ca. A.D. 900–1150) phase.

Tested Sites Attributed to the Camp Verde Phase (A.D. 900–1150)

Caywood and Spicer Pit Houses (NA3544)

In the winter of 1934, Louis Caywood and Edward Spicer supervised the excavation of a small site on the east bank of the Verde River, about 3 miles north of Clarkdale (Caywood and Spicer 1935). Laborers paid by the Civilian Works Administration excavated two pit structures at NA3544 and a portion of another site (site number unknown) along the Verde River, on the north bank of Sycamore Creek. The two shallow pit houses at NA3544 were rectangular and had rounded corners, east-facing vestibule-type entries, firepits centered in front of the entries, plastered floors, and three rows each of postholes that once supported pole, brush, and mud roofs. Floor artifacts included fragments of trough metates and one-sided (two-handed?) manos. One of the houses was illustrated (Caywood and Spicer 1935:Figure 1), and it measured approximately 5.2 m in length by 3 m in width and about 35 cm in depth. Decorated sherds found in the vicinity of the pit structures—Kana'a Black-on-white, Deadmans Black-on-white, Deadmans Black-on-red, and Tusayan Black-on-red—led Caywood and Spicer to suggest that the pit structures dated to the same period as did the earliest occupation at Tuzigoot Pueblo, ca. 1050.

> "The houses were oval in form with a vestibule entry on the east side. They had been constructed by making an excavation about 18 inches deep, lining the bottom and sides of the pit thus made with plaster . . . and roofing it over with a framework of piles on which were laid other poles and brush to form perhaps a flat roof with a slightly leaning side wall (see hand-drawn sketch, Figure 1). On the floors of the houses were single surface manos and fragments of trough metates of scoriaceous (vesicular) basalt. The fill of one of the rooms yielded a double handful of charred beans and a few charred kernels of corn. Several very well made obsidian arrow points of both stemmed and unstemmed varieties were found near one of the dwellings. The pottery found in connection with the pit houses gives a basis for fixing the period during which the pit houses were occupied. Sherds found on the surface in the immediate vicinity of the dwellings are identical with types that have been found and dated in the region of the San Francisco Peaks, Arizona. These have been described under the names of Kana-a and Deadmans Black-on-white and Deadmans and Tusayan Black-on-red. With the exception of the Tusayan Black-on-red, they have been assigned a time period earlier than 1050 A.D. by the Museum of Northern Arizona . . . . The pit house site just described is situated on rolling terrace land bordering a stretch of excellent farmland beside the Verde River. A similar pit house village, of which a portion of only one floor of one dwelling was uncovered, lies about five miles to the north on the west bank of Sycamore Canyon near the point at which the latter empties into the Verde River. Pot sherds found on the surface of this site are of the same early decorated black-on-white types and early decorated

[8] We calibrated the published ^{14}C age of 1050 ± 70 B.P. with the calibration program Calib 5.0.1 (Weaver 2000:Table 42); no laboratory report sheets were included in this final report.

black-on-red types as those found at the other pit house village. As yet we know almost nothing of the life that the inhabitants of these pit houses led. We have little knowledge of the time at which they existed. We know only that they are earlier than the final great period of Tuzigoot's existence. The pottery types found in connection with them are of the very earliest types found at Tuzigoot. The story that they have to tell will end where the story of Tuzigoot begins" [Caywood and Spicer 1935:5–7].

Winneman Ranch Pit House (NA3945A)

In 1954, Lloyd Pierson, Zorro Bradley, and their wives conducted salvage archaeology on a private ranch in the Verde River valley at the request of the ranch manager (Pierson 1959). Two pit houses were exposed during a construction project on the ranch, which is north of Wet Beaver Creek and about 1.5 miles downstream from Montezuma Well. One structure, NA3945B, was mostly destroyed by bulldozing activities and was not excavated, but the second structure, NA3945A, was largely intact. The salvage team excavated slightly more than half of this pit house, which they believed greatly resembled Sacaton phase pit houses described elsewhere (e.g., Haury 1932:14; Gladwin et al. 1937). Pierson (1959:Figure 1) depicted and described the house as a rectangular pit structure approximately 25 feet in length by 14 feet in width and about 2 feet in depth (7.6 by 4.3 by 0.6 m) that appeared to have been remodeled during its use life. Evidence for this remodeling included two entryways, along with two clay-lined hearths (one filled with earth; the other, with ash) and two subfloor storage pits (one bell-shaped and filled with trash, and the other, cylindrical and seemingly in use at abandonment). The wall perimeter was defined by a groove approximately 3 inches in width and 6 inches in depth (7.6 by 15.2 cm) and a regular series of outside posts. Artifacts recovered during the salvage work included two-handed manos used with trough metates and oval and round hand stones, as well as fragments of ground stone, a hammerstone, concretions, a fragment of a *Glycymeris*-shell bracelet, and pottery. The excavators recovered ceramics from the storage pits, floor, and fill (Pierson 1959:Table 1). Plain ware types were dominated by Verde Brown, followed distantly by Wingfield Plain, Kirkland Gray, Tuzigoot Brown, and Tuzigoot Red. Decorated types included Sacaton Red-on-buff, Kana'a Black-on-white, Santa Cruz Red-on-buff, Black Mesa Black-on-white, Sosi Black-on-white, and Deadmans Black-on-red. Storage-pit and floor-contact artifacts were confined to a number of Verde Brown, Wingfield Plain, and Kirkland Gray sherds and a single Sacaton Red-on-brown sherd. On the basis of available tree-ring dates associated with these ceramic types, Pierson suggested that House A was occupied during the A.D. 900–1100 interval, equivalent to the Sacaton phase. Not long after Pierson published this information, Breternitz (1960a) suggested that this site likely dated to the early portion of the Camp Verde phase (A.D. 900–1050).

Camp Verde Phase Structures at the Montezuma Well Unit (NA4616C), Calkins Ranch (NA2385), and Verde Ball Court (NA3528)

As discussed earlier, archaeologists from the MNA and the NPS excavated several sites in the MVRV in order to delineate the cultural sequence for this area (Breternitz 1958, 1960a). NPS archaeologist Albert Schroeder and MNA archaeologist David Breternitz excavated three pit structures (Houses 1, 2, and 3) and a surface structure (Structure 1) at the Montezuma Well Unit (NA4616C) that they assigned to the Camp Verde phase. Breternitz also excavated two pit structures (Houses 1A and 1B) at the Calkins Ranch site (NA2385) along West Clear Creek and assigned them to the Camp Verde phase. Lastly, Breternitz excavated House 2 at the Verde Ball Court site (NA3528) and assigned it to the Camp Verde phase. On the basis of these excavations, Breternitz (1960a:23–25) augmented Colton's (1939a:50–51) definition and description of the Camp Verde phase—a time period more or less equivalent to the Sedentary period (i.e., the Sacaton period) of the Hohokam sequence. Breternitz also distinguished early (A.D. 900–1050) and late (A.D. 1050–1100/1125) subphases based on the presence of Ancestral Pueblo trade wares.

Examples of an early Camp Verde phase presence in the Verde River valley include House 2 at the Verde Ball Court site, Houses 1A and 1B at the Calkins Ranch site, and House 1 at the Montezuma Well Unit. Verde Ball Court site House 2 was a shallow, rectangular pit house (approximately 6.7 m in length by 4 m in width) that was oriented more or less north-south and had a bulbous-shaped entryway on the west side outlined with posts and grooves (approximately 2 m in length by 2 m in width at its maximum). Breternitz (1960a:6) noted that this structure was unusual in that its walls were formed of upright adobe slabs. Floor features included a hearth near the entryway, two main roof supports, a number of smaller postholes closer to the house margin, and a number of floor-contact artifacts. The plan drawing for this house (Breternitz 1960a:Figure 11) listed floor-contact artifacts as a Verde Brown jar, a Tuzigoot Red Smudged bowl embedded in the clay basin of the hearth, a cluster of *comal* (?) fragments, two manos, a hammerstone, and a polishing pebble.

At the Calkins Ranch site, archaeologists identified two poorly preserved, shallow pit houses—Houses 1A and 1B—above the well-preserved remains of Squaw Peak phase House 1C. Breternitz (1960a:Figure 10) illustrated the remains and noted that Camp Verde phase ceramics were recovered from both structures. Each contained a number of postholes, a hearth/firepit, and subfloor pits. Archaeologists identified a side entryway on the southwest side of better-preserved House 1B (approximately 4.8 by 4.5 m), but insufficient evidence was present to suggest the former shape of either house or their roof-support systems.

As with the two early Camp Verde phase houses at Calkins Ranch, the single early Camp Verde phase house at the Montezuma Well Unit (House 1) was not well preserved. Breternitz (1960a:5) described it as an oval structure (approximately 5.2 m in length by 4.2 m in width) oriented northwest-southeast. Although archaeologists identified a number of postholes, no clear pattern emerged to suggest its roof-support system. Archaeologists recovered three manos or hand stones from the floor. Superimposed on part of this shallow pit house was a partially preserved surface structure (Structure 1) that Breternitz (1960a:Figure 9) assigned to the late Camp Verde phase because it was clearly later than House 1. Archaeologists did not recover any ceramics from this structure. Breternitz noted that the structure was defined by two slab walls, one on the west and the other on the south, and two fire areas on the east. He suggested (Breternitz 1960a:5) that the slab walls were the bases for brush or jacal walls and that the structure may have been a semicircular ramada with a back wall rather than an enclosed house.

The two clear examples of the late Camp Verde phase were Houses 2 and 3 at the Montezuma Well Unit. House 3 has been preserved in place by the NPS and is the structure along Montezuma Well Road that is currently interpreted for the public. As depicted (Breternitz 1960a:Figure 6), House 3 was a rectangular pit house (or house-in-pit, approximately 7.6 m in length by 4.7 m in width) that was oriented north-south and had a bulbous entryway (1.5 m in length by 2.3 m in width) on the east side. The walls were defined by a continuous floor groove and regularly spaced posts. Two centrally aligned postholes appeared to have been roof supports for a gabled roof. Archaeologists discovered a centrally located trench with postholes that Breternitz (1960a:3) inferred was a screen deflector, a basin-shaped firepit near the entryway, and a plastered floor (Breternitz 1960a:23). They also recovered the following floor artifacts: a pottery anvil, a Verde Brown bowl, two projectile points, two manos, an anvil/rubbing stone, two cobble grinding stones, two hammerstones, a rubbing stone, and a chopper. On the basis of its relatively large floor area, Breternitz considered House 3 to be a communal structure.

Smaller House 2 at the Montezuma Well Unit was also a rectangular pit house (approximately 4.6 m in length by 2.2 m in width). It was oriented more or less east-west and had an entryway (approximately 0.6 m in length by 0.6 m in width) on the south side (Breternitz 1960a:Figure 5). It contained a central firepit opposite the entryway and two roof-support postholes aligned along the center but no floor artifacts. Sherds in the structural fill confirmed that it was contemporary with nearby House 3.

Archaeologists did not recover samples for flotation, pollen, radiocarbon, or tree-ring analysis from any of the sites tested by the MNA in the MVRV in 1957–1958. Material culture, however, was analyzed, and diagnostic sherds, projectile points, ground stone artifacts, shell artifacts, and architectural forms were used to assign temporal phases to given structures. Summaries of these items per material category and per phase are found in Breternitz (1960a).

Verde Brown was the predominant local plain ware during the Camp Verde phase, as it was in the earlier phases. As presented by Breternitz (1960a:Figure 18, 23–24), what distinguishes early from late Camp Verde phase ceramic collections are the presence and relative proportions of a number of additional plain and decorated ceramic types. Breternitz observed that the number and proportion of Tuzigoot plain ware ceramic types (e.g., Tuzigoot Brown, Tuzigoot Brown Smudged, Tuzigoot Red, and Tuzigoot Red Smudged) increased through time and that the type was ever present in the late Camp Verde phase. The number of Tusayan Corrugated sherds also increased through time. In contrast, Wingfield Plain and Deadmans Gray decreased through time. Similarly, Breternitz observed that the number and proportion of the decorated types Black Mesa Black-on-white and Tusayan Black-on-red regularly increased through time, whereas Kana'a Black-on-white, Deadmans Black-on-red, Snaketown Red-on-gray, Gila Butte Red-on-buff, and Santa Cruz Red-on-buff decreased through time. Present in small amounts throughout the phase was Sacaton Red-on-buff.

ASM's Verde Terrace (AZ O:5:6 [ASM])

Archaeologists from the ASM Highway Salvage Program investigated portions of a site northwest of Camp Verde when plans to widen and improve the valley's major north-south highway were initiated. The first investigation of AZ O:5:6 (ASM) took place in 1956 under the direction of William Wasley (1957). The second investigation took place in 1976 under the direction of Randall McGuire (1977). McGuire assigned the name "Verde Terrace" to the site in 1976.

In 1956, when ASM archaeologists first encountered the site, they observed a surface scatter of artifacts on the first terrace above the Verde River; no architectural features were visible. Only after test units were excavated did they encounter a buried pit structure. They found that the roughly rectangular pit house (House 1) was prehistorically excavated into both sterile soil and the underlying Verde Formation limestone bedrock, which later served as its floor. As depicted in his site report (Wasley 1957:Figure 1), the structure was about 2.62 m in length by 2 m in width by 0.75 m in depth (below the MGS). Neither the walls nor the floor of the pit house was plastered. The arrangement of the postholes suggested that the roof of the structure was supported by four larger corner posts, with smaller auxiliary posts recessed into the east and west walls. Wasley favorably compared this construction technique with an early Pueblo II rectangular pit house that he had excavated at the Cerro Colorado site near Quemado, New Mexico (later described in Bullard [1962]). The pit house did not contain a formal hearth but did have an ashy area near the center of the structure that likely served as a firepit. The archaeologists did not find evidence of an entryway, but Wasley surmised that the irregularity of the walls and the limestone hid what was probably a lateral entry. They also encountered burned roof material about 10 cm above the pit-house floor that may have been deposited as trash rather than as an in situ layer. The only floor-contact artifacts were a fragment of a *Glycymeris*-shell bracelet and about a dozen Verde Brown plain ware sherds. The upper fill contained two floor polishers, four hand stones or rubbing stones, one rectangular two-handed mano, fragments of other rectangular manos, and metate fragments. A Hohokam Red-on-buff sherd resembling Santa Cruz Red-on-buff was recovered from the upper fill. Sherds from the site's surface included plain and decorated wares. Among the decorated sherds were Black Mesa Black-on-white (about 50 percent), Tusayan Black-on-red, Kana'a Black-on-white, Holbrook Black-on-white, and Sosi Black-on-white. The plain ware assemblage was dominated by Verde Brown and included minor amounts of Tuzigoot Red, Wingfield Plain, Aquarius Brown, and a few sherds of Tusayan Corrugated. Based on the production dates associated with the decorated sherds, Wasley assigned House 1 to an occupation beginning before A.D. 1000 and lasting until no later than A.D. 1050.

When ASM archaeologists returned to the MVRV to mitigate the adverse impacts of proposed construction on I-17, they once again encountered AZ O:5:6 (ASM). McGuire (1977:53) reported that he and his crew used a backhoe to excavate six regularly spaced trenches across the site and located a variety of features in the trench walls. Among these were 11 probable pit structures, 1 bell-shaped pit, 3 hearths, 1 trash mound, and 3 human cremations. Archaeologists excavated a sample of these features (8 pit structures, 1 bell-shaped pit, and a crematorium with 7 adjacent cremated deposits) and further investigated the trash mound. Houses 1, 2, and 3 were partially superimposed, as were Houses 6 and 7. The crematorium area was located above and within abandoned House 5. As with the Verde View site (AZ O:5:12 [ASM]), archaeologists took pollen and flotation samples; they also took six archaeomagnetic samples from hearths or floors in the pit houses. Two of the six archaeomagnetic samples were processed when the report was written and provided the first absolute dates assigned to Camp Verde phase architecture in the MVRV.

McGuire's table (1977:Table 5) provided a succinct description of each of the excavated pit structures; some of these data are included in Table 35, Chapter 6 of this volume. McGuire (1977:53) noted that the pit structures excavated at the Verde Terrace site exhibited a wide range of floor plans, internal features (i.e., posthole patterns, hearths, and pits), and depths below the PGS. Most of the structures were between 10 and 60 cm in depth and contained hearths that were plastered and centered in front of the entries; the entries were located at the same levels as the floors (i.e., not ramped downward) and exhibited no standardized posthole patterns. One of the structures, House 3, was quite unlike the others. It had a ventilator, a roof entry, a bench, a depth greater than 1 m, and no floor features—characteristics that McGuire likened to Colton's (1946:267–270) Rio de Flag Focus pit structures. In contrast to the houses assigned to the Camp Verde phase by Breternitz (Montezuma Well site NA4616C, House 3, and Verde Ball Court site, House 2), none of the structures at the Verde Terrace site exhibited architectural traits that clearly showed Hohokam cultural influence. After considering the architectural record for both the Cloverleaf and Camp Verde phases, McGuire (1977:55) concluded that the earlier Cloverleaf phase did exhibit stylized architecture in the tradition of the Gila-Salt Basin Hohokam but that the later Camp Verde phase did not. Rather, the greater variety of forms in the post-900 period suggested to him that additional and perhaps different cultural traditions were influencing the architectural patterns of the Camp Verde phase.

Archaeologists recovered many artifacts from the trenches, pit-structure excavations, trash mound, and cremations. A total of 6,535 sherds and 12 whole or partial ceramic vessels were recovered. Over 91 percent of all sherds were plain wares (primarily Verde Brown and Wingfield Plain, with less unidentified Gila Plain, Tuzigoot Plain, Young Brown, and unidentified Alameda Brown). Red wares (primarily Tuzigoot Red, with less Verde Red and Wingfield Red) composed less than 3 percent of all sherds. Finally, the decorated wares composed about 6 percent of the total but represented more than a dozen types from as far north as the San Juan River area and as far south as the Gila-Salt Basin. The most numerous types included Black Mesa Black-on-white, Deadmans Black-on-red, Tusayan Black-on-red, Sosi Black-on-white, Tusayan Corrugated, Holbrook Black-on-white (Style A), and Holbrook Black-on-white (Style B). A small number of Sacaton Red-on-buff and Gila Butte Red-on-buff sherds were also recovered. The 12 whole or partial vessels included 6 Black Mesa Black-on-white bowls, 3 Wingfield Plain bowls, 1 Verde Brown bowl, 1 Verde Brown jar, and 1 Sacaton Red-on-buff bowl. Most of these reconstructible vessels were associated with one of the seven cremation deposits near the crematorium (primarily adults and at least one young child). These cremated remains were deposited sometime after the A.D. 917 ± 23 archaeomagnetic date for the floor of House 5 and before the production end date for Black-Mesa Black-on-white pottery (A.D. 1178). Flaked stone artifacts included numerous scrapers, tabular knives, and cores. Ground stone included numerous metate fragments and manos (primarily trough metates and rectangular and loaf-shaped manos), lap stones, and pestles. Basalt was the overwhelming choice for metates and manos, with only a few specimens fashioned from Supai sandstone or granite. A small number of freshwater- and marine-shell items were recovered (beads, pendants, and bracelets), and a few unusual artifacts (a clay-figurine fragment with coffee-bean eyes, a vesicular basalt plumb bob, a fragment of hematite, and a *Glycymeris*-shell needle) were also recovered.

The analyses of flotation and pollen samples revealed that at least two domesticates—maize and common beans—were grown at the Verde Terrace site. Other recovered plants, likely used for food, medicine, and crafts, were *Chenopodium*, amaranth, wild buckwheat, beeweed, cactus, plantain, and globemallow. The analysis of nonhuman faunal remains resulted in the identification of 15 species. Among these were species undoubtedly used for food and other functions. In order of abundance, the economic taxa were cottontail and jackrabbit, with small numbers of wood rat, deer, pronghorn, mountain sheep, mountain lion, unidentified bird, mud turtle, bony fish, and *Anodonta* (a freshwater clam). Also present were toads, frogs, pocket gopher, and kangaroo rat.

McGuire (1977:87) suggested that, given the time span bracketed by the two archaeomagnetic dates (A.D. 917 ± 23 from the floor of House 5 and A.D. 1167 ± 27 from the hearth in House 4), the Verde Terrace site was either inhabited continuously by no more than two or three households at any time or was a location inhabited by two or more noncontemporaneous populations. Without the remaining archaeomagnetic dates, he was unable to suggest which scenario was more likely. Nevertheless, McGuire was able to support the dates assigned generally to the Camp Verde phase by Breternitz (1960a), and he suggested that there was considerable continuity in architecture and material culture between the Cloverleaf and Camp Verde phases. The Verde Terrace site was a small but relatively predictable, year-round residential site with the full complement of domestic functions, including storage and interment of human remains.

Camp Verde Phase Features near the Confluence of the Verde River and West Clear Creek (NA15761 and NA2385, Calkins Ranch)

In 1979, archeologists from the MNA conducted data recovery at six sites along USFS Road 9 (now renumbered SR 260) in the MVRV between the modern town of Camp Verde and West Clear Creek (Stebbins et al. 1981). All sites were mapped, surface collected in part or as a whole, and tested for buried archaeological deposits. Tested sites with intact buried deposits were further explored with backhoe trenches and hand-dug excavation units. Two sites, NA15761 and NA2385, contained architectural remains dating to the Camp Verde phase. Of the two, the more complex and potentially more significant site was the Calkins Ranch site (NA2385), first investigated by MNA archaeologists in 1957 (Breternitz 1960a). The 1979 MNA crew re-excavated Breternitz's Houses 5 and 6 and excavated five pit houses located in the trenches (Pit Houses A, B1, B2, C, and F). Houses A, B1/B2, and C were assigned to the Camp Verde phase. Houses F, 5, and 6 were likely constructed and used in the Honanki and Tuzigoot phases. In addition, the MNA archaeologists recovered several cremations in trenches and tested a trash mound formerly explored by Breternitz that apparently dated primarily to the Camp Verde phase. They also collected pollen, flotation, radiocarbon, and archaeomagnetic samples. Analysis of the pollen and flotation samples contributed useful information, but neither the radiocarbon data nor the archaeomagnetic data were reported in sufficient detail for complete confidence in their reported dates.[9]

[9] Stebbins et al. (1981) did not report what materials were submitted for radiocarbon analysis (wood charcoal, annual seeds, or other plant parts); neither did they report the analytic laboratory, sample number, or conventional radiocarbon age. They also did not calibrate the results. It appears that they subtracted the laboratory's conventional age from A.D. 1950and reported the standard error associated with that assay. The archaeomagnetic dates were assessed with the curve reported by DuBois (1975) but not in a way such that these could be independently evaluated. We have made some assumptions concerning the dates reported in Stebbins et al. (1981:Table 29) and have calibrated what we believe was the reported radiocarbon age received from their laboratory. Four samples (wood charcoal?) from Camp Verde phase Pit House A were submitted for radiocarbon assay, and the laboratory returned the following radiocarbon ages: two were from subfloor contexts (1580 ± 75 B.P. and 960 ± 80 B.P.), one was from floor fill (1050 ± 60 B.P.), and one was from the floor (1010 ± 115 B.P.). The oldest of these dates (1580 ± 75 B.P.) seems to have been discarded. The other three were used to assign Pit House A to the Camp Verde phase (Stebbins et al. 1981:Figure 17). The report noted that these three samples suggested that Pit House A was occupied in the tenth century. We used Calib 5.0.1 to calibrate these three dates. With the 2σ probability, the younger radiocarbon age from the subfloor (960 ± 80 B.P.) returned calibrated date ranges of A.D. 898–920, 945–1227, 1233–124, and 1248–1251. The floor-fill sample (1050 ± 60 B.P.) returned 2σ date ranges of A.D. 832–836 and 869–1155. The floor-context sample (1010 ± 115 B.P) returned a 2σ date range of A.D. 778–1252. Based on these three sets of dates alone, without considering other dating techniques, this structure could date to either the Camp Verde phase or the Honanki phase.

As at ASM's Verde Terrace site (McGuire 1977), Stebbins et al. (1981) found considerable variability in pit-structure architecture. Pit structures ranged in shape and style from D-shaped pit houses with perimeter posts, wall troughs, and two central roof supports (House A) to a rectangular pit structure that may have had raised floors supported by upright stone slabs (House F). Two structures were superimposed (Structures B1 and B2). Some structures had lower walls formed by the native caliche-filled subsoil and upper walls likely of jacal construction and/or small cobbles (House C), and others had upright limestone and sandstone slabs that formed the lower portions of the walls (House 6). Archaeologists located the floors of these structures at depths ranging from 35 to 200 cm below the MGS and 25–60 cm below the PGS at the time of their construction. All seem to have been excavated into a caliche-filled "subsoil," and at least one of the structures had burned (Structure A).

Archaeologists recovered many artifacts from the trenches, pit-structure excavations, trash mound, and cremations. Several thousand ceramic items, several hundred flaked stone items, and several dozen ground stone items were recovered. Plain wares dominated the collection: in order of abundance, Verde Brown, Tuzigoot Plain, Wingfield Plain, and Alameda Brown Ware, with less Verde Gray, Verde Red, Clear Creek Brown, Grapevine Brown, Wingfield Red, Gila Plain, Tonto Red, and Moenkopi Corrugated. Decorated wares were dominated by types from the Tusayan series (especially Black Mesa Black-on-white and Kana-a Black on-white), with fewer from the Gila-Salt Basin (Santa Cruz Red-on-buff and Gila Butte Red-on-buff) and other regions in the U.S. Southwest (e.g., Deadmans Black-on-red, Holbrook Black-on-white [Style B], and Tsegi Orange Ware). Flaked stone items recovered from floor and floor-fill contexts included lithic debris in all stages of reduction as well as the two projectile points and the knife reported by Breternitz (1960a). Ground stone recovered from floor and floor-fill contexts were a slate palette and an abrader fragment (Pit House A), hammerstones (Pit House B), and manos and a hoe fragment (Pit House C). Interestingly, few items of bone or shell were recovered (Stebbins et al. 1981:87).

Analyses of the flotation (Gasser 1981) and pollen (Gish 1981) samples revealed the ubiquity of maize and cheno-am-family plants in each structure that was inferred to date to the Camp Verde phase. Gasser also identified the regular appearance of grass seeds, *Opuntia* (cholla or pricklypear) seeds, and juniper berries. Flotation analysis revealed that juniper, grass, reeds, and willow/cotttonwood were likely used for walls and roofs. Gish noted the regular inclusion of cholla pollen in the pit-structure samples and the occasional presence of cattail, *Boerhavia*-type pollen, and possible four o'clock.

Stebbins et al. (1981:22–32) also excavated a single structure at NA15761, which was inferred to be a seasonally used farmhouse or field house, given the range of recovered artifacts and the absence of an interior hearth. Although it had been partially removed by erosion, archaeologists were able to determine that the rectangular structure was partially subterranean, had been excavated into a slope, and had cobble "masonry" walls set in clay mortar. Although the archaeologists could find no trace of a hearth, they did find two internal postholes and two shallow depressions. Artifacts recovered from the floor fill included some 73 plain ware sherds (with a similar suite of types as at the Calkins Ranch site) but no decorated sherds. Decorated sherds were, however, recovered from the upper fill and included Black Mesa Black-on-white, Verde White-on-red, and Chevron Black-on-white. Archaeologists also recovered a few flakes from the floor fill of the structure but no ground stone. They did recover three hoe fragments, one axe-head fragment, one metate fragment, three manos, and one grinding slab from the upper fill.

The investigations by Stebbins et al. (1981:96) augmented Breternitz's description of the Calkins Ranch site by increasing the number of excavated features, offering the first analyses of botanical remains and radiocarbon and archaeomagnetic dates (although not well reported), and increasing the sample of artifacts retrieved from the site. They were able to confirm that the Calkins Ranch site was a long-lived habitation site with a definite occupation during the Camp Verde phase.

NA17305

In 1982, archaeologists from the MNA conducted NRHP-eligibility testing on a portion of a large, unnamed artifact scatter near Cornville (NA17305, also designated AR-03-04-06-378 [CNF]) prior to realignment of a county road (Dosh 1983). Only the portion of the site that was on USFS land was investigated; the remainder was on private land. Archaeologists mapped, surface collected, and excavated test units in search of subsurface remains. The tested portion of the site proved to be an extensive surface scatter without buried features (although structures were suspected to exist in the untested portions of the site).

The majority of the 1,259 artifacts recovered were classified as lithic debitage; few formal lithic tools or potsherds were present. The presence of Black Mesa Black-on-white sherds suggested that the site dated primarily to the Camp Verde phase. Analyses of artifacts recovered from the site surface revealed that the site was primarily a chert (fossilized sponge, *Actinocoelia meandrina*) source where primary reduction took place. Technological analyses of these lithics remains, however, suggested that Formative period stone reduction was distinctive from preceramic period stone-tool reduction and that technological characteristics may be useful for distinguishing the two time intervals. Dosh not only analyzed the lithic collection for NA17305 but also compared this collection to extant collections presumed to be Late Archaic and Formative period in age. The technological attributes that best distinguished these time periods was a clear preference for faceted striking platforms in the aceramic Archaic period–like sites vs. a preference for flat striking platforms in the ceramic-bearing Formative period sites.

The Wood Site (AZ O:1:29 [ASM])

Members of the VVAS and other volunteers, under the supervision of archaeologists from CNF, conducted data recovery at the multicomponent Wood site (assigned three site numbers: NA13384, AZ O:1:29 [ASM], and AR-03-04-06-134 [CNF]) between October 1975 and March 1981. The land on which the site was located was slated for a land exchange between the federal government and private land owners. Hallock (1984) summarized investigations at the site. Over the course of 5½ years, supervised volunteers investigated 7 pit houses, 4 small structures inferred to be Yavapai wickiups, 20 stone-lined roasting pits, and 3 stone-lined, exterior storage pits inferred to be associated with Structure 1. Based on the mean ceramic dating of recovered pottery (38 named types representing plain and decorated varieties of Alameda Brown Ware, Prescott Gray Ware, San Juan Red Ware, Tusayan Gray Ware and White Ware, and Little Colorado Gray Ware and White Ware—no Salt-Gila Basin buff wares), a single tree-ring date (1097 + vv in Pit House 3), two archaeomagnetic dates (A.D. 1040–1090 from the hearth in Pit House 1 and A.D. 1100–1150 from Pit House 3), and stratigraphic relationships, all of the pit houses were assigned to the late Camp Verde phase.[10] Two pit houses, however, were stratigraphically earlier than the remaining 5 houses and were partially superimposed by later structures. The later of these 2 late Camp Verde structures dated to sometime after A.D. 1100. The earlier late Camp Verde structures dated to the late 1000s, given the presence of several post-1075 sherds on the floor and in the subfloor features of Pit Houses 2 and 4.

As with the inferred Camp Verde phase structures investigated by McGuire (1977) and Stebbins et al. (1981), Hallock's map of the site and of individual pit structures (Hallock 1984:Figures 3–10) showed the considerable variability in architectural forms, sizes, depths, roofing systems, and floor features (see Table 35 and Figure 32, Chapter 6 of this volume). Five of the seven houses were round or oval (Pit Houses 2, 4, 5, 6, 7); one of these had a ramp entryway (Pit House 5). One house (Pit House 3) was larger than all the others and was irregular in shape. Only one pit house (Pit House 1) was rectangular and had a side entry. Two pit houses (Pit Houses 1 and 3) had notched-stone floors or platform support stones similar to the notched floor-support stones described by Haury (1932:16–19) for Roosevelt 9:6 in the Tonto Basin and a structure at the Calkins Ranch site by Stebbins et al. (1981) (House F). The depths of pit houses ranged from 30 to 120 cm below the PGS, and most of these had one or more floor features (hearths, ash pits, storage pits, postholes, and floor-support stones).

Archaeologists recovered many artifacts from the Wood site. Ceramics (10,315 sherds), flaked stone (6,411 items), and ground stone (15+ grinding stones/metates and 93+ hand stones/manos) were the primary artifact categories, but a small number of jewelry items (beads and bracelet fragments), "exotic" items likely used in religious ceremonies (1 argillite tube; 2 small, stone cylinders; and 1 stone marble), and a few other clay, stone, and antler artifacts were recovered (pulley-type spindle whorls, ceramic disks, worked argillite, and an antler flaking tool). Archaeologists also recovered faunal remains in the seven pit structures, although these were not quantified or described in detail. Hallock (1984) reported that deer, bighorn sheep, cottontail, pocket gopher, wood rat, snake, and freshwater clam (*Anodonta*) were recovered. Hallock did not mention the recovery or analysis of pollen or flotation samples. Artifacts recovered from the four Yavapai structures, the roasting pits, other extramural features, and the site surface were not reported in Hallock (1984).

The Volunteer Site (NA17244)

Volunteers from the VVAS assisted archaeologists from the MNA with the excavation and analysis of a prehistoric agricultural site composed of a series of 30+ rock alignments on a gentle slope and a single masonry room/pit structure inferred to be a seasonal field house (Halbirt 1984). The work was undertaken as part of a federal land exchange between CNF and a private land owner. Research at the Volunteer site (NA17244/AR-03-04-06-402 [CNF]) was directed specifically toward the recovery of subsistence remains and the determination of site function. Archaeologists mapped the site, made surface collections, and tested with trenches and hand-excavated test units. They excavated portions of several rock alignments and completely excavated the masonry room that surrounded a pit structure. An archaeomagnetic sample taken from the hearth of the pit structure (best fit date: A.D. 1050–1100) and production dates for recovered ceramics (especially Holbrook Black-on-white [Style A], Tusayan Black-on-red, and Tusayan Corrugated) suggested a use date between A.D. 1050 and 1150 (Halbirt 1984:30). Both chronological estimates assigned the occupation of the pit structure to the late Camp Verde phase (A.D. 1050–1150).

[10] The mean ceramic dating technique used here was an unreliable way to date this site, especially because some types seem not to have been correctly dated and because large vessels contributed disproportionately to the total).

Feature 1, the masonry room/pit structure, was described as a single structure rather than as an earlier pit structure over which a masonry structure was constructed. Archaeologists noted that the masonry structure was well defined on three sides by large, unshaped basalt boulders and upright basalt and sandstone slabs; it measured 6.5 by 4.5 m. They also defined an opening or entry in the east wall. Archaeologists estimated that the masonry was about 1 m in height. Within the masonry walls was a rectangular pit house with a slab-lined, east-facing entry. The structure measured 4.3 by 3.1 m and was found 50 cm below the MGS. The house contained a circular, clay-lined and lipped hearth opposite the entryway; two corner postholes; and a rectangular pit. Artifacts recovered from the floor included a metate, two hammerstones, and several brown ware sherds. Archaeologists recovered samples for pollen, flotation, archaeomagnetic, and radiocarbon analyses.

Most of the 672 artifacts recovered from this site were found within and adjacent to the pit structure; only a few artifacts were recovered from the linear alignments/field area. Of these 672, 542 were ceramic, 119 were flaked stone, and 7 were ground stone. Plain wares were dominated by Tuzigoot Brown, followed by Verde Brown; a small number of Verde Red, Alameda Brown, and Wingfield Plain sherds also were recovered. Decorated wares included a small number of Holbrook Black-on-white (Style A), Tusayan Black-on-white, and Tusayan Corrugated sherds. The room contained a greater number of bowl sherds, whereas the extramural surfaces were dominated by jar sherds. Flaked stone was recovered primarily from extramural proveniences and represented stone-tool manufacture in all stages of reduction. Sixteen flaked stone items were classified as tools: 1 midsection of an obsidian projectile point, 4 scrapers, and 11 utilized flakes. Chert was the overwhelming choice for flaked stone material, followed distantly by chalcedony, quartzite, obsidian, basalt, and andesite. Ground stone recovered included 4 metates (3 trough and 1 slab), 3 manos (rectangular and plano-convex; the single complete specimen was a two-handed form), and 4 hammerstones. Two of the trough metates were used to construct the west wall of the pit structure; the single slab-type metate was on the pit-house floor. Metates and manos were manufactured either of sandstone or vesicular basalt. All 4 hammerstones were made from basalt cobbles and were well used.

Pollen and flotation samples from the floor and intramural features collectively contained two domesticates—corn and squash—as well as wild foods, including purslane, pricklypear, cheno-am seeds, juniper seeds, manzanita nutlets, beeweed, and wild grape. In addition, a charred yucca-leaf fragment was recovered from the pit-house floor. No faunal remains were recovered.

Halbirt (1984:33) ended his report with a discussion of site function. Work at the Volunteer site confirmed that the site was likely a warm-season base camp with associated agricultural terraces, but few activities other than plant procurement and processing were documented. No evidence for animal procurement or use was recovered, either in the form of animal bone or as stone technology. The pit house, however, seemed to have been used for temporary food storage and preparation. Analysis of the flaked stone collection suggested that expediently manufactured flakes were used as scrapers for processing plant material (as evidenced in the use-ground margins and stepped-fractured edge damage) but probably were not curated by their manufacturers. Acreage calculated for the usable area behind the 30+ terraces and grids amounted to only 0.62 acres—an estimate that would have contributed only a quarter of what Hack (1942) conjectured was required annually to support a Hopi farmer (2.5 acre per person per year). Despite this conclusion, Halbirt (1984:35) emphasized that the small sites, like the Volunteer site, were repositories of important information regarding Sinagua land-use patterns.

Ireye (AZ N:4:31 [ASM])

Dosh (1990) tested a site in DHRSP prior to construction of camp facilities in the eastern portion of the park; mapped, gridded, and surface collected the site; and placed 10 backhoe trenches in a location chosen as a leach field, where underground utilities were to be established. Although none of the inferred architectural features (earlier, buried pit structures and later surface structures) was excavated, analysis of stratigraphic profiles and artifacts recovered from both surface and subsurface contexts indicated that this site had two major occupations. The earlier component dated to the late Camp Verde/early Honanki phase (ca. A.D. 1050–1150) and was deeply buried (1–2 m below the MGS). At least two pit houses and several pits were bisected by trenches. Verde Brown was the predominant pottery type in both occupations. Diagnostic pottery types associated with the early occupation were Black Mesa Black-on-white and Sosi Black-on-white. The later component dated to the late Honanki and/or Tuzigoot phase (A.D. 1250–1425) and included small, single-room, masonry surface structures inferred to be field houses. Diagnostic pottery types associated with the later occupation were Tusayan Corrugated, Moenkopi Corrugated, Awatovi Plain, and Awatovi Black-on-yellow. Both occupations contained a small number of Tusayan Black-on-red and Tusayan Polychrome sherds. Dosh (1990:26) inferred that the pit houses of the earlier period were once elements of a year-round pit-house settlement system, whereas the later masonry surface rooms were seasonally used field houses for occupants of either the Tuzigoot Pueblo or the Bridgeport Ruin community.

Alldredge (NA20981)

As part of a land sale between the CNF and a private owner, archaeologists from SEC conducted data recovery on a portion of a large artifact scatter near Table Top Mountain and Sedona. The site was designated NA20981 and AR-03-04-06-648 (CNF). The archaeologists mapped, surface collected, and explored the subsurface of the small parcel. Hand-dug test units and backhoe stripping revealed a pit structure that dated to the late Camp Verde phase, ca. A.D. 1060–1100 (Logan et al. 1992:20). Although the authors did not specify the depth below the MGS, we estimated that the threshold stone that marked the PGS was 30–40 cm below the MGS when the site was excavated. Prehistorically, the structure was excavated some 15–20 cm below the PGS. The structure was rectangular with rounded corners and had an east-facing entry with a threshold stone and a step stone. The floor features included two postholes along the north-south axis of the house, exterior peripheral posts, and a hearth near the entryway. At least 9 artifacts were recovered on the floor, including 5 partial jars, 1 bowl, 2 manos, and 1 tabular-stone abrading tool. The structure had burned, and archaeologists collected the remains of the two central roof supports for radiocarbon samples. Logan et al. (1992) did not report the proveniences for all the ceramic artifacts recovered from the excavations, but their analysis of the 83 sherds recovered from this investigation suggested that the pit house was occupied sometime between A.D. 1000 and 1200. Although the authors (Logan et al. 1992:20) did not report the conventional radiocarbon ages or the laboratory that processed the two samples, they did report two dates as A.D. 1050 ± 50 for Sample 1 and A.D. 1110 ± 50 for Sample 2. We do not know whether these are calibrated dates or simply the difference between A.D. 1950 and the conventional age B.P. Based on the standard deviations associated with these two midpoints, they interpreted the likely age of the structure as ranging from A.D. 1060 to 1100. Because we have insufficient information to assign an absolute date, we must accept the authors' temporal assignment, but we could argue that the more likely date falls in the early 1100s rather than the late 1000s.

Camp Verde Phase Components at DHRSP Sites: Kish (AZ N:4:18 [ASM]), Ireye (AZ N:4:31 [ASM]), AZ N:4:33 (ASM), and AZ N:4:34 (ASM)

DHRSP data were drawn from survey data reported by Zyniecki and Motsinger (1991), excavations at five sites reported by Zyniecki and Anduze (1996), limited testing of the Ireye site reported by Dosh (1990), and partial excavation of the Kish site reported by Munson (1977). The Munson (1977) and the Zyniecki and Anduze (1996) excavations were described briefly in the discussion of the Cloverleaf phase. However, Zyniecki and Motsinger (1991) and Zyniecki and Anduze (1996) also assigned occupation at the Kish site to the Camp Verde phase. Zyniecki and Motsinger (1991) assigned a number of DHRSP sites to Phases 2 and 3 (Phase 2 is equivalent to the Cloverleaf and early Camp Verde phases, ca. A.D. 800–1000; Phase 3 is equivalent to the late Camp Verde phase, ca. A.D. 1000–1125), including ASM sites AZ N:4:18 (Kish), AZ N:4:31 (Ireye), AZ N:4:32–34, and AZ N:4:51. They assigned other sites to Phases 3–5 (Phase 4 is equivalent to the Honanki phase, ca. A.D. 1125–1300; Phase 5 is equivalent to the Tuzigoot phase, ca. A.D. 1300–1425). All of these latter sites were recorded as surface scatters with various features. Zyniecki and Motsinger (1991) inferred that AZ N:4:35 (ASM), AZ N:4:36 (ASM), AZ N:4:40 (ASM), and AZ N:4:41 (ASM) were field houses. Kish, Ireye, and AZ N:4:32 (ASM) also had components dating to Phases 4 and 5.

SWCA archaeologists returned to DHRSP and further investigated five sites: Kish, Ireye (no additional information was gained through trenching), AZ N:4:33 (ASM) (first inferred to be a habitation but reinterpreted as a lithic artifact scatter associated with resource procurement ca. 900–1100), AZ N:4:34 (ASM) (a likely habitation with one possible room block), and AZ N:4:38 (ASM) (inferred to be an agricultural-field locale dating primarily to Phases 3 and 4).

SWCA's contribution to the later testing work was to (1) confirm that Kish was a long-lived habitation site dating to A.D. 850–1130, (2) identify a considerable pre–Tuzigoot phase occupation (Cloverleaf through Honanki phases) at the DHRSP locale, and (3) question why so little Hohokam material culture was present at sites presumably occupied during the period of greatest Hohokam influence in the MVRV (Zyniecki and Anduze 1996:114).

SR 179 Data Recovery Site (AR-03-04-06-238 [CNF])

In 1998, archaeologists from PDMR tested five sites along the ROW of SR 179 prior to the widening and improvement of that highway, which connects I-17 to Sedona (Weaver and Spaulding 1999). All sites (AR-03-04-06-238 [CNF], AR-03-04-06-516 [CNF], AR-03-04-06-611 [CNF], AR-03-04-06-758 [CNF], and AR-03-04-06-759 [CNF]) were mapped, surface collected, and tested with subsurface auger holes, hand-dug units, or backhoe trenches. No surface or subsurface features were identified. Each site was a surface artifact scatter that contained a variety of flaked and ground stone artifacts and a small number of sherds, and all were interpreted as temporary campsites. At least one (AR-03-04-06-238 [CNF], also designated AZ O:1:62 [ASM] and NA19793) and possibly another (AR-03-04-06-516 [CNF]) contained surface sherds that suggested that they were used during the late Camp Verde or early Honanki phase.

From AR-03-04-06-238 (CNF), archaeologists recovered 42 sherds (Verde Brown, Tuzigoot Plain, Tuzigoot Red, Lino Gray, and unidentified Tusayan white ware), 22 ground stone items (hand stones, one- and two-handed manos, basin- and slab-metate fragments, hammerstones, and polishing stones), and 232 items of flaked stone in all stages of reduction. Lithic materials included Kaibab chert, fine-grained basalt, rhyolite, quartzite, and obsidian from Government Mountain, RS Hill, and Kendrick Peak, as well as a type identified as "Kanab-type, Utah" obsidian (Weaver and Spaulding 1999:10).

After comparing the sites investigated along SR 179 to other nearby studied sites, Weaver and Spaulding (1999:54–58) concluded that their sites were "typical" of the settlement pattern of the Camp Verde to Honanki phases in the Village of Oak Creek–Sedona region. This pattern (ca. A.D. 1000–1300) "consisted of small, widely scattered masonry room structures, scattered small clusters of pit houses or single pit houses, with special use, probably seasonally occupied, temporary camps scattered throughout the surrounding region" (Weaver and Spaulding 1999:54). They also suggested that households likely used more than one structure in any single year (e.g., winter use of a pit structure inferred by Logan et al. [1992] for the Alldredge site and summer use of a pit structure inferred by Halbirt [1984] for the Volunteer site). Finally, they noted that that no evidence of Hohokam influence or trade connections was recovered at any of the SR 179 sites or at other sites in the Village of Oak Creek–Sedona area. On this basis, they suggested that "heavy Hohokam influence reportedly typical of the Camp Verde phase in the Verde Valley itself (Fish et al. 1980:168–169; Pilles 1981b:12) did not extend into the Village of Oak Creek–Sedona region" (Weaver and Spaulding 1999:58).

Red Rock State Park Sites: High Lonesome (AZ O:1:12 [ASM]), Waterworks (AZ O:1:27 [ASM]), and Gone Orchard 1–3 (AZ O:1:15 [ASM], AZ O:1:37 [ASM], and AZ O:1:38 [ASM])

In 1988 and 1989, archaeologists from PMDR and the VVAS investigated 19 sites in Red Rock State Park and along its access road and Red Rock Loop Road (Weaver 2000). At least two sites, High Lonesome and Waterworks, and most likely the three Gone Orchard sites, were assigned to the early Camp Verde phase, ca. A.D. 900–1050, on the basis of ceramic cross-dating. All were close together on a single terrace overlooking Oak Creek, and they contained similar suites of artifacts. In describing the largest of the sites, High Lonesome, Weaver (2000:84) inferred that the terrace supported a variety of domestic activities, including the processing and consumption of wild and domesticated foods and stone-tool manufacture.

The High Lonesome site (AZ O:1:12 [ASM]) was collected but not excavated. Located on a terrace overlooking Oak Creek, the site included a one-room basalt-cobble structure (3 by 3 m), a petroglyph panel, historical-period rock piles containing prehistoric artifacts, and a surface artifact scatter. Archaeologists recovered 144 flaked stone items fashioned from Kaibab chert and quartzite (21 tools, 2 cores, 102 flakes, and 19 pieces of debitage), 15 ground stone items manufactured from basalt or vesicular basalt (9 oval cobble manos, 3 rectangular manos, 1 complete basin metate, 1 complete trough metate, and 1 metate fragment), and 15 pottery sherds (5 Verde Brown, 2 Wingfield Plain, 1 Rio de Flag Brown, 3 Tusayan White Ware, 2 Black Mesa Black-on-white, 1 Santa Cruz Red-on-buff, and 1 unidentifiable brown ware). Weaver (2000:84) assigned the site to the early Camp Verde phase.

The Waterworks site (AZ O:1:27 [ASM]) also was collected but not excavated. Given its artifact content and proximity to the High Lonesome site, Weaver (2000:111) inferred that Waterworks was likely a single site. Although no features were observed on the site surface, the range of artifacts was similar to that of High Lonesome. Archaeologists recovered 54 flaked stone items, of which all but 2 were fashioned from Kaibab chert (10 tools, 3 cores, 28 flakes, and 13 pieces of debitage); 22 ground stone items manufactured primarily from basalt or vesicular basalt (5 oval hand stones, 6 oval manos, 2 rectangular manos, 1 possible mano, 1 grinding slab, 5 basin metates, 1 sandstone trough metate, and 1 round pumice ball); and 29 ceramic sherds (12 Verde Brown, 4 Tuzigoot Plain, 3 Rio de Flag Brown, 1 Rio de Flag Tooled, 2 Deadmans Gray, 3 Tusayan White Ware, and 4 Black Mesa Black-on-white).

The Gone Orchard sites (AZ O:1:15 [ASM], AZ O:1:37 [ASM], and AZ O:1:38 [ASM]) were surface collected and tested with backhoe trenches. No evidence of intact surface or subsurface features or cultural deposits was found. Archaeologists recovered 146 flaked stone items manufactured from Kaibab chert, basalt, and quartzite (4 cores, 17 tools, 73 flakes, and 52 pieces of debitage); 10 ground stone artifacts of basalt, vesicular basalt, and quartzite (1 hand stone, 5 oval manos, 1 rectangular mano, and 3 unidentifiable fragments); and 46 ceramic items (34 Verde Brown, 1 Tuzigoot Plain, 6 Rio de Flag Brown, 2 Wingfield Plain, and 3 Tusayan White Ware). Weaver

(2000:94) assumed that these sites were contemporaneous with the nearby High Lonesome and Waterworks sites and may have been part of a single occupation of the high, level terrace overlooking Oak Creek.

Verde Ranger Station (AR-03-04-01-1004 [CNF])

USFS archaeologists Martine and Pilles (2005), with assistance from the VVAS, excavated a portion of what was once a larger site underneath the Verde Ranger Station prior to a land sale. The Verde Ranger Station site (AR-03-04-01-1004 [CNF]/AZ O:5:133 [ASM]/NA26435) was recorded by Hoffman and Adams (1998), and the northern portion of the site was tested by Hall (2001). Martine and Pilles investigated the southern portion of the site with eight backhoe trenches and five hand-excavation units. These subsurface explorations revealed the presence of a pit house and a ramada area.

Although the pit house dated to the Honanki phase, a large, bell-shaped storage pit dating to the Camp Verde phase was located partially beneath the pit house. Martine and Pilles (2005:14) assigned the storage pit to sometime within the Camp Verde phase because of its stratigraphic position, contrasting fill, and diagnostic pit-fill artifacts, which included a Holbrook Black-on-white (Style A) sherd and an Elko Side-notched projectile point. Other artifacts recovered were two basalt picks, a mano, a chert core, a hammerstone, and a hoe fragment. Archaeologists estimated the pit's dimensions as 1 m in width at the top, 1.3 m at the base, and 1.4 m in depth below the PGS. Martine and Pilles (2005:14) speculated that other Camp Verde phase occupational features were once present at the site but have been destroyed by construction activities at the Verde Ranger Station and along SR 260.

Tested Sites and Site Components Attributed to the Honanki Phase (A.D. 1150–1300)

Panorama Ruin (NA5111)

As part of MNA's Verde Valley Expedition research project, archaeology graduate students Richard Shutler and William Adams excavated two small ruins dating to the Pueblo III time period (Shutler 1951; Shutler and Adams ca. 1949). The earlier of the two was Panorama Ruin, located in Big Park, some 5 miles south of Sedona, near SR 179. The ruin was a three-room, southeast-facing, masonry pueblo situated on a ledge 500 feet above the base of Court House Rock. It is but 1 of about 10 ruins in the same location dating to the same early Pueblo III time period. The Panorama Ruin is 1 of 4 sites on the upper ledge of Court House Rock.

Two of the three rooms (Rooms 1 and 2) were contiguous and fronted with a stone retaining wall or "wing wall." The third room (Room F) was about 7.6 m east of the other rooms. Occupational trash was concentrated in front of the wing wall and the area between it and Room F. All three were constructed with irregular blocks of Supai sandstone set in abundant mortar. The walls were double walls with rubble fill ranging from 30 to 90 cm in width. In the cases of Rooms 1 and 2, the lower portions were formed of large sandstone slabs. Shutler and Adams (ca. 1949:48) reported that Room 1 was approximately 2.65 by 4 m and had an entry in the east wall. It contained a rectangular, slab-lined hearth; two circular storage cists (one slab-lined); and a number of floor artifacts (one projectile point; six scrapers; one full-grooved, double-bitted axe; one two-handed-mano fragment; one piece of polished hematite; and one antelope-long-bone awl). Room 2 was approximately 2.5 by 3.7 m and had no wall entry, but it contained a square, slab-lined firepit resting on bedrock and an accumulation of burned bone and sherds south of the firepit. On the floor of Room 2 were one projectile point, one scraper, one hammerstone, and one antelope-long-bone awl. Room F was approximately 2.7 by 2.45 m and had an opening in the east wall and a rectangular, slab hearth. Floor artifacts included three scrapers; one chopper; one vesicular basalt trough metate; three whole, two-handed, vesicular basalt manos; two two-handed, vesicular basalt mano fragments; one sandstone hoe fragment; one polishing pebble; two restorable jars; and one restorable bowl (unpainted pottery; the types were not specified). Scrapers, choppers, and hammerstones were manufactured from either Kaibab chert or quartzite, and projectile points were manufactured from either obsidian or jasper. Food remains took the form of animal bones only; no plant remains were recovered. Faunal remains, in order of abundance, included pronghorn, mountain sheep, mule deer, jackrabbit, and raven.

The authors dated the occupation of the site to the period between A.D. 1125 and 1160 based on the ceramic collection and the presence of coursed masonry architecture, which was believed to date to no earlier than A.D. 1125. The majority of the pottery (1,748 of 2,055 sherds, not including the restorable vessels) was unpainted plain ware, most of which was Alameda Brown Ware, followed by Tusayan Gray Ware, Hohokam Plain Ware, and trace amounts of San Francisco Mountain Gray Ware and Prescott Gray Ware. The remaining 307 pottery sherds were Tusayan White Ware, Little Colorado White Ware, Tsegi Orange Ware, and a single sherd of Jeddito Yellow Ware.

Kittredge Ruin (NA4490)

The Kittredge Ruin was the later of the two Pueblo III sites excavated by Shutler and Adams for the MNA in the Red Rock area, 10 miles southwest of Sedona (Shutler 1951; Shutler and Adams ca. 1949). The ruin was an 18-room cliff dwelling located at the base of a large sandstone cliff at the mouth of Hartley Canyon. It was recorded by Fewkes (1912:197) as the ruin at the mouth of Black (Hartley) Canyon. Thirteen rooms (Rooms 1–10 and Rooms 16–18), located in three sections, were at ground level; 5 rooms (Rooms 11–15) were second-story rooms. Three of the ground-floor rooms (Rooms 7, 8, and 9) in the central section were located between large fallen boulders and the cliff wall and yielded a number of perishable items but were considerably damaged by the collapse of the upper-story rooms. The ground-floor rooms in the north (Rooms 1–5) and south (Rooms 16–18) sections were poorly preserved. Shutler and Adams excavated only 3 rooms (Rooms 3, 4, and 5), the fallen debris between the boulder and the cliff wall (largely from Rooms 6–9), and the trash midden adjacent to and downslope from Rooms 3, 4, and 5.[11]

The ground-floor rooms were built against the cliff under an overhang and used the cliff as the rear wall. The north, south, and east walls generally were coursed masonry set in mortar, sometimes chinked with small spalls. Rooms 2 and 3 used fallen boulders as room dividers. The second-story rooms were also constructed with coursed masonry in abundant mortar and showed traces of plaster on both interior and exterior walls. Roofs were not intact at the time of excavation, but evidence for juniper beams, perpendicular cane thatch, and a mud or adobe seal were present. Room sizes and forms varied, but they tended to be rectangular.

Room 3 was the largest, at 3.5 by 5 m; Rooms 4 and 5 were approximately 3 by 4.5 m. Room 3 had an entryway and contained an ashy area on the floor but no formal firepit; the remains of a large storage jar were found in the center of the room. Floor artifacts included one triangular, reworked projectile point blade; both halves of a vesicular basalt trough metate; two whole and one fragmentary vesicular basalt mano; one well-used three-quarter-groove axe; several chert scrapers, and three bone implements.

Room 4 contained a doorway; a smooth, hard-packed adobe floor; and a series of well-preserved adobe ridges (20 cm in width and 5 cm in height) that were added after the original floor was created. As with Room 3, there was not a firepit, but a large storage jar was found in the center of the room. Floor artifacts included 3 vesicular basalt trough metates; 13 whole or fragmentary, unifacial and bifacial manos of vesicular or smooth basalt or sandstone; 1 sandstone hoe; 1 axe fragment; several projectile points; several bone implements (2 awls and 2 needles); 1 cane arrow shaft; a number of chert scrapers, choppers, and knives; and 1 small, crushed jar.

Room 5 also contained a smooth, hard-packed adobe floor; a slight ridge defining a slightly higher northern portion from a lower southern portion; and a well-made, circular, clay-lined firepit in the northeastern portion. Room 5 also contained a slab-walled storage bin built against the cliff along the northern wall. Floor artifacts included one large, broken storage jar; one antler spatula; one bone knife; one drilled, red, clay-stone (argillite?) pendant; one small piece of polished turquoise; one small piece of cotton fabric; yucca-fiber cordage; and two arrow-shaft fragments.

Room fill and trash middens produced a number of perishable items, including numerous agave leaves, pieces of agave cordage, a piece of what might have been an agave spring apron, agave-cord netting, and wooden artifacts interpreted to be fragments of a batten and shuttle used in weaving. In addition, plant-food remains were recovered and included maize cobs, stalks, and tassels; agave quids; beans; and animal bone (mule deer, pronghorn antelope, mountain sheep, cottontail, jackrabbit, prairie dog, and coyote, with cottontail and pronghorn the most numerous). A small amount of shell was also recovered at the site (*Cardium*, *Olivella*, and *Anodonta*). Pictographs were recorded from the cliff face above Rooms 4 and 5, adjacent to the second-story rooms; within Room 3; and in the middle-section crevice rooms. Shutler and Adams described these as figures of turtle, feathered serpent, and mountain sheep; calendar marks; and ladders.

As with Panorama Ruin, the authors dated the occupation of the site based on the ceramic collection and the presence of coursed masonry architecture. Shutler (1951:8) suggested that the site was occupied sometime between A.D. 1210 and 1240 (although Pilles suggested that the site was occupied sometime between A.D. 1150 and 1200).[12] The vast majority of pottery (1,452 of 1,475 sherds) was unpainted plain ware; only 23 sherds were decorated types. The most abundant was Alameda Brown Ware, followed distantly by Hohokam Plain Ware and trace amounts of Prescott Gray Ware and San Francisco Mountain Gray Ware. Interestingly, no Tusayan or Little Colorado Gray Wares were present. The 23 decorated sherds, however, all were northern types from the Colorado Plateau (Tusayan White Ware, Walnut Black-on white, Flagstaff Black-on-white, Tusayan Black on-on-red, Wupatki Black-on-white, Citadel Polychrome, and Kiet Siel Polychrome).

[11] Although the plan for this site was not published in Shutler's 1951 *Plateau* article, a portion of the field map was contained in the unpublished manuscript; it was photocopied onto several sheets and contained the site-plan layout.

[12] Pilles annotated a CNF copy of the Shutler and Adams (ca. 1949) manuscript and suggested an occupation date of A.D. 1150–1200 for the Kittredge Ruin based on the ceramic collection.

Hidden House (NA3500)

In 1933, Clarence R. King, Research Engineer for the United Verde Copper Company in Clarkdale, Arizona, began excavating a spectacularly preserved human burial in a four-room cliff dwelling that we now know as Hidden House. In 1934, King—with help from archaeologists Edward Spicer and Louis Caywood, who were then excavating Tuzigoot Pueblo—completed the excavation of the cliff dwelling. Although notes were taken during the excavations, the site was not written up until Keith Dixon took on the project for his Master's degree in Anthropology at the University of Arizona. The well-illustrated report was published by the MNA in 1956 (Dixon 1956).

Hidden House is located in a shallow rockshelter within a Supai sandstone formation along the east wall of Sycamore Canyon, some 0.7 miles upstream from the junction of the Verde River and Sycamore Creek, about 7 miles north of Clarkdale. The four rooms are contiguous, with masonry walls set in abundant mortar. Dixon described Rooms 2, 3, and 4 as roughly rectangular and each measuring some 2.5 by 3 m; Room 1 was nearly circular and measured about 3 m in diameter. The structure was accessed through a T-shaped doorway in Room 1 that was defined by rounded or bowed walls. In addition, Room 1 contained a 15-cm^2 loophole. The back wall of the rockshelter formed the back wall of the rooms. In some places, the bedrock floor was plastered and smoothed. Based on notes taken in 1934 during the excavations, Dixon suggested that the rooms were roofed with poles, thatch, and mud. Room 2 contained two subfloor storage cists (both approximately 90 cm in depth and 90 cm in diameter) that were abandoned and partially filled with wind-blown sand and debris before the dead man was laid out in his finery with funerary offerings. Analysis revealed that the individual was approximately 40 years old, 5 feet 6 inches tall, and exhibited vertical-occipital head deformation. His hair was pulled back in a single braid tied with cotton cordage, and he wore a breech cloth, a pair of sandals, and a cotton "turban." His face was painted with yellow pigment, and his body was wrapped from chin to ankles with a large, ornately painted blanket secured with yucca cords. Along his right side were the following artifacts:

> a bow with part of the bowstring, a cloth quiver containing 12 arrows, an unfinished bow, a leather quiver containing 10 unfinished arrows, a bundle of 4 arrow foreshafts, a mass of yucca fiber ready for spinning, and beside the head a decorated cotton bag containing a bundle of animal sinew and a bundle of feathers tied with cotton cord. On his chest were a feathered stick and box made from the hollowed-out base of an agave stalk. Close to the left hip and partially over the trunk were a decorated basket, a gourd container, and a bowl and effigy jar of Walnut Black-on-white pottery. The effigy jar was in the bowl, and it contained a deer-bone awl. A large plain basket was on the left side near the feet. On the left side, close to the shoulder, were a pair of looped bags or leggings made of human hair folded and tied with many wrappings of cotton yarn, and a plain white cotton bag containing a hank of human hair [Dixon 1956:9–10].

Calkins Ranch Ruin (NA2385), House 5

During the 1958 and 1959 excavations by the MNA at the Calkins Ranch site (NA2385), a single structure, House 5 (Breternitz 1960a:3), was assigned to the early portion of the Honanki phase (A.D. 1100–1150). Today, we might reassign this house to the late Camp Verde phase, but the structure seemed to be "transitional" in terms of architectural elements, combining slab and masonry wall-building techniques.

House 5 was partially excavated into a caliche-filled substrate and resembled a rectangular pit house connected to a D-shaped entrance room with a slab-walled entryway. The main room measured 6.1 m north-south by 4.27 m east-west, and the entrance room measured 3.96 m north-south by 2.44 m east-west. The connecting passageway was about 0.9 by 0.9 m. The northern, eastern, and western foundation walls of the main room were excavated into a sloping hillside and were constructed of horizontally laid stone masonry. In contrast, the east wall foundation on the downhill side of the house was constructed of upright stone slabs, as was the connecting passage to the entrance room. Breternitz's Figure 2 suggested that the walls of the entrance room were also defined by masonry rather than slabs.

The main room of House 5 contained a hearth along the centerline, facing the entryway, and had two center roof supports and a storage pit in the northeast corner. Floor artifacts included two projectile points, one knife, one grooved abrader, one hoe, one sandstone disk, and five restorable ceramic vessels. Among these were two Verde Brown jars, one Tuzigoot Brown bowl or jar, one Tuzigoot Brown bowl, and one Sosi Black-on-white jar.

The entrance room had no floor features, but it did have floor artifacts that suggested to Breternitz that it was the grinding or mealing room for the house. Among these floor items were two manos and a restorable Verde Brown jar.

Calkins Ranch Ruin (NA2385), House F

In 1979, when MNA archeologists conducted data recovery along SR 260, they excavated a structure that they assigned to the late Camp Verde phase based on an uncalibrated radiocarbon date taken from a sample in the northern quadrant of the house (Stebbins et al. 1981). Throughout their report, Stebbins and her colleagues did not cite the laboratory, the sample number, or the material from which the radiocarbon age was derived (Stebbins et al. 1981:Table 29). Neither did they tell whether the sample was the uncalibrated radiocarbon age or the calibrated date and range. We have reason to believe that the authors simply subtracted the laboratory-provided radiocarbon age and standard deviation from the year A.D. 1950 to produce an age estimate. Therefore, we assume that the date they reported for Structure F, A.D. 1120 ± 55 (Stebbins et al. 1981:66, Table 29), was given to them as an uncalibrated radiocarbon age of 830 ± 55 B.P. We calibrated this date using Calib 5.0.1 and produced 2σ ranges of A.D. 1044–1098, 1119–1142, and 1147–1279, with a high likelihood that the true date falls after A.D. 1147. Thus, House F was more likely a structure constructed and used in the Honanki phase rather than the preceding Camp Verde phase.

House F was a rectangular, west-facing house with a collared hearth located near what was suspected to be the side entryway; it contained four buried, vertical stone slabs inferred to be floor risers. One of the two central postholes was identified; the other was presumed to have been destroyed by the backhoe during trenching. The authors inferred that the radiocarbon sample was part of the burned superstructure or roof. Floor artifacts included 1 grinding slab with red pigment, 3 manos, 1 "plummet" stone, 1 reconstructible Verde Brown jar, and 39 sherds (24 Verde Brown, 9 Tuzigoot Plain, 2 Alameda Brown Ware, 2 Holbrook Black-on-white [Style B], 1 Gila Plain, and 1 Grapevine Brown).

Swallet Cave (NA4630A)

In 1960, a small "cave" or rockshelter site associated with Montezuma Well was excavated by NPS archaeologist Ed Ladd (1964). The site had been partly excavated by William Back, the private land owner of the well unit prior to land acquisition by the NPS in 1947. In the intervening years, the site was probed illegally by vandals. Consequently, the NPS determined to salvage information about the site and its contents before this information was irretrievably lost and to stabilize the existing architecture.

Swallet Cave was a seven-room habitation site located above the pool line of Montezuma Well, in the southwestern portion of the well's depression. The rockshelter was backed by the limestone cliff of the well's interior and was situated immediately east of the inside outlet of the well. Some 80 feet above the site, along the rim of Montezuma Well, was a Tuzigoot phase pueblo (NA1273A). Ladd suggested that some of the later pottery sherds that were recovered from Swallet Cave were actually from this later-period site and that inhabitants from one of the several Tuzigoot phase habitations around the well may have removed and recycled useful timber and building stone from Swallet Cave.

Ladd's 1964 report contained photos, but the plan map was missing from the manuscript we inspected. The seven rooms were contiguous and followed the curve of the cliff and overhang. The walls were constructed of limestone blocks and slabs set in abundant mortar. Most walls were just a single course thick, averaging 46–61 cm in width and ranging from less than 30 cm to 1.2 m tall. The smallest room was approximately 0.9 by 1.5 m, the largest room was approximately 3.4 by 2.7 m, and the average size was approximately 2.4 by 1.8 m. The only floor features encountered during the excavations were in Room 6, the largest room. It contained two prepared floors, the lower floor associated with a clay-lined firepit and the upper floor associated with a stone-lined hearth. Ceramic sherds were recovered from every floor, in varying numbers. A single obsidian projectile point was recovered on the floor of Room 1. Two poorly preserved human burials were encountered—one a young child accompanied by a Tuzigoot Red (smudged) bowl under the floor of Room 6 and the other an adult laid on the floor under a ledge in the rear of Room 4. No funerary offerings accompanied the adult.

Given the history of disturbance associated with this site and the likelihood that trash from the pueblo along the well's rim was incorporated into the room fill, the list of artifacts and subsistence remains recovered by Ladd and his crew cannot be securely associated with the Honanki phase occupation of Swallet Cave. The fact that a dwelling dating to the Honanki phase was constructed along the pool of Montezuma Well and next to the "swallet" (defined as the opening through which a stream descends underground, or, in this case, where the Montezuma Well water exits the well) is useful information. General information on construction techniques, room size, and room number adds detail to the picture of dwelling types during the Honanki phase.

Oak Creek Valley Pueblo (AR-03-04-06-341 [CNF])

The Oak Creek Valley Pueblo (also designated AZ O-5-7 [NAU]) is the remaining portion of a small precontact pueblo on the Oak Creek Valley Estates. It was excavated by graduate student Paul Williams and volunteers from NAU and the Prescott Center, under an agreement between the private developer of Oak Creek Valley Estates and NAU archaeologists. The fieldwork took place in 1978 and 1979. Williams excavated, analyzed, and wrote up the site for his NAU Master's degree (Williams 1985). Colleen Jeffers analyzed the pollen remains for her NAU Master's degree (Jeffers 1983). Steve Emslie and Bruce Van Devender assisted Williams with the analysis of 2,007 faunal bones (including 814 mammal, 50 bird, 158 fish, and 275 reptile and amphibian bones) from this site. Their study represented one of the larger faunal collections from the Verde River valley at that time. Mark Taylor analyzed the human remains recovered from this site and published an article on his findings (Taylor 1985).

Oak Creek Valley Pueblo was a 15–20-room masonry pueblo located on a low ridge east of Spring Creek, not far from the confluence of Spring Creek and Oak Creek. Six well-preserved rooms in a small room block on the summit of the ridge were excavated; the remaining rooms, on the southern slope of the ridge, were damaged when part of the hillside was removed to build the subdivision clubhouse. The pattern of wall bonding and abutting suggested that Rooms 1–4 were built as a unit and that Rooms 5 and 6 were added sometime later. Williams speculated that a second story could have been constructed above Rooms 2 and 3 based on the amount of wall rubble and the contrasting floor levels of Rooms 1 and 4. The walls were constructed with river cobbles, limestone, and other rock set in abundant mortar—similar in style and technique to that used at Tuzigoot Pueblo. The wall foundations were constructed with larger rocks than were the upper walls. Walls appeared to have been double walls with rubble fill and were about 50 cm thick. Floor areas ranged from about 15 to 23 m^2, with an average of about 19 m^2. Considerable remodeling took place within these six rooms, as evidenced by multiple floors and duplicated thermal and storage features in Rooms 1, 2, 4, and 6.

All rooms apparently served a variety of domestic functions, including the interment of human infants and young children; a total of seven human burials (and two additional burial pits) were recovered. All of the in-house interments (Rooms 2 and 4) were infants or young children; the sole adult was found in a test pit northeast of Room 1. Some of the infants were laid to rest near room margins or under the walls, behind upright slabs, often accompanied by small ceramic vessels. One or more elaborate graves contained two small skeletons placed in prepared pits covered with horizontal stone slabs or wooden elements. A miniature Tuzigoot Plain bowl and two turquoise pendants accompanied the two children. Another child was placed in a prepared grave with an inner pit that created side “shelves” covered with a series of short wooden sticks; no durable grave goods were found. The only adult burial was located outside the room block: a 65-year-old female placed on her back with her head to the northwest and with a large bowl at her feet. Taylor (1985:116) noted that all seven individuals, whether young or old, were in poor health and were malnourished. The old woman had osteoarthritis and vertebral osteophytosis, porotic hyperostosis of the cranial bones, multiple dental carries, enamel hypoplasia, and an infection in the mastoid process. The seven children ranged in age from 9 months to 3 years; all showed the effects of anemia (i.e., porotic hyperostosis). Taylor (1985:116–118) compared burial data from this site with burial data from Tuzigoot Pueblo and found great similarities in burial locations, customs, mortality rates, and the widespread occurrence of porotic hyperostosis associated with maize-rich and iron-poor diets.

Archaeologists recovered about 15,000 pottery sherds, hundreds of whole and fragmentary stone tools and ornaments, dozens of ground stone artifacts, and thousands of pieces of lithic debitage. Almost 90 percent of all recovered ceramics were Alameda Brown Ware (primarily Verde Brown and Tuzigoot Plain), with small proportions of Prescott Gray Ware (Verde Gray), Tusayan White Ware, Tusayan Gray Ware, Tsegi Orange Ware, San Francisco Mountain Gray Ware, and Winslow Orange Ware. On the basis of the ceramic collection, Williams assigned the occupation of Oak Creek Valley Pueblo to sometime within the A.D. 1150–1325 time period (i.e., the Honanki phase into the early Tuzigoot phase).

Red Rock State Park Christmas Tree Site (AZ O:1:34 [ASM]) and Centruroides House (AZ O:1:5 [ASM])

In 1988 and 1989, when archaeologists from PMDR and the VVAS tested 19 sites in Red Rock State Park, they investigated a Honanki phase structure at the Christmas Tree site (Weaver 2000). Another masonry room at the Centruroides House site dated either to the late Camp Verde or Honanki phase.

The Christmas Tree site (also designated AR-03-04-06-535 [CNF]) was a one-room, masonry, residential structure with an extramural slab-lined hearth located on a steep, south-facing slope 30 m north of Oak Creek. The masonry room was excavated into the hillside and measured 4 m east-west by 3.5 m north-south. Prehistoric builders excavated 1.25 m on the upper slope and 0.5 m on the lower slope to create the foundation for the room. The belowground foundations were larger boulders (presumably basalt and limestone) and rock slabs (presumably sandstone). The aboveground walls were double coursed. The floor was plastered with a 1-cm-thick layer of clay and crushed sandstone that covered the entire floor surface, presumably including a raised section of floor or bench on the east side of the room. Floor features on the west side of the room included a central posthole (with remains of a burned post on the floor) and a vertical-sided firepit plastered with the crushed-sandstone-clay mixture. Although Weaver did not describe the presence of an entryway into this room, a photograph of this structure (Weaver 2000:Plate 11) suggested that an entry may have existed in the north wall. Because the room burned, impressions of burned beams and thatch, mud daub, and abundant charcoal and ash were found on the well-preserved floor. Kwiatkowski (2000:Table 4.1) identified wood charcoal from the floor and hearth as sycamore, cypress or juniper, and a type of pine. Samples for pollen, flotation, and radiocarbon dating were collected.

Scott Cummings (2000) identified cheno-ams, cattail, and maize pollen on the eastern section of the floor, and Kwiatkowski (2000) noted the presence of charred agave fibers, grass seeds (cf. *Hordeum* and *Bromus*), juniper seeds, and cheno-am seeds on both sides of the floor and in the hearth. A radiocarbon sample on charred wood from the floor of the room (Beta-35500) returned a radiocarbon age of 780 ± 70 years B.P. Weaver (2000:73, Table 42) reported this uncalibrated date as A.D. 1170 ± 70 (A.D. 1100–1240). We calibrated this radiocarbon age with Calib 5.0.1 and derived 2σ probabilities of A.D. 1045–1096, 1119–1142, 1147–1310, and 1360–1387, with the greatest likelihood that the true date range is 1147–1310, which supports Weaver's Honanki phase inference.

Weaver (2000:73) did not identify which of the 33 flaked stone tools, 9 ground stone items, or 93 sherds were recovered from the Christmas Tree site's masonry-room floor. Presumably, archaeologists recovered the flaked stone items (16 scrapers, 3 choppers, 3 hammerstones, 2 scraper planes, 1 hand pick, 1 graver, 1 tabular basalt tool, 1 biface, 3 cores, and 2 core tools), the ground stone items (4 whole cobble manos, 1 mano fragment, 1 grinding slab/metate, 1 whole hand stone, 1 notched axe fragment, and 1 shaft straightener), and the sherds (41 Tuzigoot Red; 32 Tuzigoot Plain; 14 Tuzigoot Plain, Red Rock variety; 6 Verde Brown) from excavated contexts. A single Black Mesa Black-on-white sherd was recovered from the site's surface. On the basis of the radiocarbon age and the presence and predominance of Tuzigoot Red (A.D. 1150–1400+), Weaver inferred that this masonry room was occupied during the Honanki phase.

The Centruroides House site (also designated AR-03-04-06-128 [CNF]) was a single-room masonry structure situated on a hillside overlooking the channel of Oak Creek. As with the Christmas Tree site structure, the Centruroides House was excavated into the hillslope and included the same locally available building materials—basalt river cobbles, limestone terrace rock, and sandstone slabs. Unlike the Christmas Tree structure, this structure had no floor features, a poorly preserved floor, and no extramural features, save a boulder grinding slick. Although the range and types of artifacts recovered were similar, there were differences that potentially signal differences in site use, duration, and time period. The masonry room at the Christmas Tree site was more substantial and was occupied for a longer period of time, possibly later in time. The masonry room at Centruroides House seemed to have been a field house that involved much less investment in labor and that, possibly, was occupied earlier in time.

Archaeologists recovered 91 flaked stone items (2 cores, 53 flakes and utilized flakes, 35 pieces of debitage, and most of a projectile point), 12 items of ground stone (6 whole cobble manos, 4 mano fragments, and 2 hand stones), and 26 ceramic sherds (25 Tuzigoot Plain, Red Rock variety, and 1 Verde Brown). They also collected samples for pollen, flotation, and radiocarbon analysis. Scott Cummings (2000) identified aggregates of cheno-ams, globemallow, and mesquite pollen. Kwiatkowski (2000) did not identify charred plant parts in the flotation samples, but he noted that cheno-am seeds, globemallow seeds, juniper-branch fragments, hedgehog cactus seeds, hackberry seeds, mallow seeds, and clammyweed (cf. *Polansia*) seeds were among the uncharred taxa. The radiocarbon sample (Beta-35499) derived from the fill of the masonry structure returned a radiocarbon age of 870 ± 60 B.P. As with the Christmas Tree site, Weaver reported the uncalibrated age and range as A.D. 1080 ± 60 (A.D. 1020–1140). We calibrated this radiocarbon sample with Calib 5.0.1 and derived a 2σ range of A.D. 1036–1260. The presence of Tuzigoot Plain ceramics suggests that the occupation postdates A.D. 1100, and the calibrated dates suggest that it was abandoned before A.D. 1260.

Cross Creek Ranch Pueblo (NA26505)

In 1993, archaeologists from SEC undertook data recovery at two sites on USFS land south of Sedona that was slated for private land exchange (Logan and Horton 2000). The larger and later of the two sites, Cross Creek Ranch Pueblo (NA26505, also designated AR-03-04-06-703 [CNF]), was a primarily a Honanki phase masonry pueblo with a Honanki phase child burial, four extramural hearths, and a possible pit structure. A second temporal component dating after A.D. 1300 was represented by four roasting pits, two of which contained ceramic types associated with Yavapai culture.

Cross Creek Ranch Pueblo was located on a level colluvial bench near the confluence of Oak Creek and an unnamed eastern tributary. It was an L-shaped room block with three distinct masonry rooms. Wall abutments and bonds suggested that Room 2 was built first, followed by Room 3 and, finally, Room 1. All rooms were constructed by first digging a foundation trench and laying either upright sandstone slabs or basalt cobbles in the trench, over which horizontal sandstone slabs and/or basalt-river-cobble walls were erected. The aboveground walls were double-course walls set in mortar, often with small stone spalls inserted into the mortar. Wall height ranged from five to seven courses of stone. Floors were prepared and often incorporated charcoal and ash. Roofs were manufactured from wood beams, thatch, and clay, as evidenced by large quantities of charcoal flecking and sections of burned clay 15–20 cm above the floor in Room 1.

Room 1 measured 6.5 by 5.25 m and contained a central thermal feature interpreted as a hearth or fire area, a single doorway through the southeastern wall, and a partition that divided the floor space into a western section and an eastern section. Floor artifacts included four manos, one abrader, one Archaic period projectile point, three pieces of flaked stone, and three sherds. Samples for pollen, flotation, and radiocarbon analysis were taken. Two charcoal samples on the floor, inferred to be roofing material, were submitted. The larger charcoal sample (Beta-71145) returned a radiocarbon age of 660 ± 50 B.P. (Logan and Horton 2000:Appendix B). Using Calib 5.0.1, we derived a calibrated 2σ range of A.D. 1271–1401. The smaller and presumably less-reliable charcoal sample (Beta-71146) yielded a radiocarbon age of 300 ± 110 B.P. Again using Calib 5.0.1, we derived calibrated 2σ ranges of A.D. 1427–1706, 1719–1825, and 1832–1884.

Room 2 measured 7.5 by 5 m and contained three earlier, clay-lined hearths; a formal, slab-sided hearth; and a doorway in the southwestern wall that connected to Room 3. Floor artifacts included two flake knives, two abraders, one hammerstone, one bone awl, one hoe, and a shattered Diablo Brown vessel. Samples for pollen, flotation, and radiocarbon analysis were collected. Burned roof fall directly above the floor (Beta-71148) returned a radiocarbon age of 880 ± 70 B.P. Using Calib 5.0.1, we calibrated this age estimate and derived a 2σ range of A.D. 1026–1262.

Room 3 measured 7.5 by 5 m and contained two entryways, one connecting to Room 2 and the other in the southeastern wall. Room 3 also contained two circular hearths, one of which was clay lined. Floor artifacts included four manos, two abraders, one hammerstone, one metate, one scraper, and one crushed Tuzigoot Brown vessel. Samples were collected for pollen, flotation, and radiocarbon analysis. Charcoal from fill of one of the two hearths (Beta-71149) returned a radiocarbon age of 900 ± 70. Using Calib 5.0.1, we calibrated this age estimate and derived a 2σ range of A.D. 1020–1258.

From these three rooms, Scott Cummings and Puseman's (2000) analyses of plant remains from this site revealed that the occupants used a variety of domesticated, encouraged, and wild plants, including maize, squash/gourds, cheno-am plants, beeweed, sedge, ephedra, pricklypear, squawberry, cattail, and grasses. Analysis of hearth material confirmed that juniper, piñon, saltbush, and mountain mahogany were used for fuel. Other wood, including alder, ash, and sycamore, were collected, as well. Goodman et al.'s (2000) analysis of the faunal collection confirmed that the usual range of animals found in the MVRV were also found at the Cross Creek Ranch Pueblo: cottontail, jackrabbit, pocket gopher, and deer, followed by woodrat, bobcat, dog/coyote, squirrels, turtle, birds (including Gambel's quail, turkey, and woodpecker), and fish.

Archaeologists recovered a considerable number of artifacts and environmental samples from the site, including 3,547 ceramic sherds, 2,632 flaked stone items, 211 ground stone objects, 12 worked-bone artifacts, 88 shell items, and 532 nonhuman animal bones. The vast majority of all ceramics recovered were Alameda Brown Ware (both Southern Sinagua and Northern Sinagua types), followed by fewer Tusayan White Ware, Tusayan Gray Ware, Prescott Gray Ware, San Francisco Mountain Gray Ware, Little Colorado White Ware, San Juan Red Ware, Tsegi Orange Ware, Cibola White Ware, and Tizon Brown Ware sherds. Among the stone items were 50 complete or partial projectile points (including Desert Side-notched, Cottonwood Triangular, and Elko Eared, among others) and a variety of grinding-stone sets (trough, basin, and slab metates and manos). Items of special interest included two notched-stone slabs recovered from the fill of Rooms 1 and 2 (floor or platform supports?), marine shell, argillite, a stone censor, two tabular tools/hoes, and a three-quarter-groove axe.

The single human burial (Feature 9) was inferred to be a 5-year-old girl buried in a prepared pit (110 by 70 cm and 30 cm in depth) marked by upright slabs at the head and feet. Three nested ceramic bowls (all Alameda Plain Ware: Tuzigoot Smudged bowl, Tuzigoot Brown sherds, and Diablo Brown sherds) were buried with the child, whose body was extended, head to the northeast, and placed above three river cobbles. Analysis of the pollen remains from one of the inner bowls indicated that cheno-am, squawberry, and yucca were among its contents.

Logan and Horton (2000:84) suggested that the three-room pueblo, the burial, and the extramural hearths dated sometime within the period between A.D. 1100 and 1300 based on radiocarbon dates, ceramic cross-dates, architectural styles, and material-culture analyses. Using Calib 5.0.1, we calculated a pooled mean and standard error of 780 ± 30 years B.P. for the four samples (Beta-71145, Beta-71148, Beta-71149, and Beta-71150), resulting in a 2σ date range of A.D. 1213–1280. It is likely that the occupation suggested by Logan and Horton can be narrowed to having occurred during a single century between A.D. 1200 and 1300.

Cross Creek Ranch Talon Site (AZ O:1:141 [ASM])

During 2002 and 2003, when archaeologists from SWCA conducted data recovery within the 220-acre Cross Creek Ranch site, they identified four prehistoric structures and three historical-period features in an area referred to as Area 23/24/25/26. The cultural remains were located along a terrace above Oak Creek, in the southwestern portion of Cross Creek Ranch (Edwards et al. 2004:188). Feature 1 was a subrectangular, semisubterranean, masonry-lined room. Features 2.1 and 2.2 were adjacent subrectangular, semisubterranean rooms. Feature 8 was a badly preserved rectangular, semisubterranean, masonry structure with a subfeature of unknown function (two parallel, 1.45-m-long rows of upright slabs capped by horizontal slabs).

The three rooms—Features 1, 2.1, and 2.2—contained a variety of floor features, floor artifacts, and subsistence remains. In each case, prehistoric builders excavated a pit into the hillside, used earth as the lower portions of the walls, and constructed a wall on the PGS. As with the nearby Cross Creek Ranch Pueblo, the lower sections of the masonry walls were robust and were created with two courses of cobbles and boulders. The upper sections of walls were one to three courses wide and were created with smooth basalt or vesicular basalt cobbles and, occasionally, sandstone cobbles laid in abundant clay mortar. Archaeologists noted that the wall mortar was often chinked with pebbles and cobble fragments; one sherd was used as chinking, as well. No roofing material was preserved, but archaeologists presumed that rooms were enclosed with poles, thatch, and mud. Features 1 and 8 were adjacent, as were Features 2.1 (Room 1) and 2.2 (Room 2).

Feature 1 was a subrectangular, semisubterranean, masonry-lined room measuring 4.7 by 4.5 m and 1.5 m in depth. Archaeologists excavated only a portion of the structure; no floor features were observed in this area. They did note, however, that the floor was an unplastered, use-compacted surface containing soot and ash. Floor artifacts included 1 sandstone slab, 1 tabular stone tool, 4 animal bones (cottontail), and 72 Alameda Brown Ware sherds (all Tuzigoot Plain, Red Rock variety). Archaeologists collected pollen and flotation samples from this structure. Pollen grains of economic species included cheno-ams, globemallow, a *Boerhavia*-like plant, and evening primrose. Flotation analysis resulted in the recovery of one charred item similar to squash rind and one cheno-am seed.

Feature 2 was a subrectangular, semisubterranean room block containing two rooms excavated into the hillslope. Unlike Feature 1, it was excavated completely. Feature 2.1 (Room 1) was upslope. The room measured 4.3 by 3.75 m and 2.3 m in depth. Archaeologists identified only three small postholes in the northwest corner (not pictured on their map). As with Feature 1, the floor was a use-compacted surface. Floor artifacts included one flaked stone item and one Alameda Brown Ware sherd (Tuzigoot Plain, Red Rock variety). Edwards et al. (2004) suggested that this was the storage area for the residence. Although both pollen and flotation samples were collected, only pollen analysis identified economically useful plant remains, largely restricted to cheno-am pollen. A sample from the fill of this room was submitted for radiocarbon assay. Edwards et al. (2004:201) neither described what was dated nor cited the laboratory, sample number, and conventional radiocarbon-age estimates. What they did report is difficult to interpret: A.D. 1180–1280 ± 40. We cannot calibrate this date without a radiocarbon age or judge what this range and standard deviation mean.

Feature 2.2 (Room 2) measured 4.42 by 4.15 m, and its floor was 0.59 m lower than the floor in Room 1 and was unplastered and compacted by use. Nine floor features were identified: a hearth, a pit/pot rest, a possible pit, a central posthole and four peripheral postholes, and an elevated mound of clay. Floor artifacts included 468 sherds (467 Alameda Brown Ware and 1 Prescott Gray Ware), 27 flaked stone items, 1 mano, 1 tabular tool, and 15 animal bones (deer, cottontail, and jackrabbit). Archaeologists collected flotation, macrobotanical, pollen, and radiocarbon samples from Room 2. Floor-contact flotation samples contained six charred maize cupules, one charred maize kernel, and one charred cheno-am seed. Beargrass fiber was recovered from the floor fill. Pollen grains of economic species included maize, pricklypear, cholla, *Boerhavia* type, evening primrose, and cheno-ams. Subfloor features were also sampled for plant remains. Additional evidence for maize, cheno-ams, squash, pricklypear, evening primrose, and a *Boerhavia* type was recovered from the hearth, the pits, and the pollen-washed mano. In addition, buckwheat pollen was identified in the hearth. As with Room 1, Edwards et al. (2004:207) reported that a radiocarbon age was obtained from materials contained in the floor fill: A.D. 1180–1290 ± 50. Again, they did not describe what was dated, and they did not cite the laboratory, sample number, or conventional radiocarbon-age estimates. As before, we can neither evaluate what this range and standard deviation are nor calibrate this date without a radiocarbon age.

SWCA archaeologists recovered a considerable number of artifacts and environmental samples from the Honanki phase component of the Talon site. Overall, they collected 2,475 ceramic sherds, 955 flaked stone items, 19 ground stone tools, 32 mineral samples, 13 pieces of shell, and 152 animal bones. No human burials were encountered. The vast majority of ceramics were Alameda Brown Ware (2,419 sherds, predominantly classified as Southern Sinagua types, Tuzigoot Brown, Red Rock variety; Tuzigoot Brown; and Verde Brown, with lesser amounts of other Southern Sinagua and Northern Sinagua types), followed distantly by Tusayan White Ware (n = 36, including 1 sherd each of Tusayan Black-on-white and Kayenta Black-on-white), Prescott Gray Ware (n = 8), Cibola White Ware (4 Klagetoh Black-on-white), Hohokam Plain Ware (n = 2, 1 Wingfield Plain and 1 Wingfield Red), and Tusayan Gray Ware (1 Tusayan Corrugated). Among the flaked stone items were 12 projectile points (11 Government Mountain and Presley Wash obsidian and 1 dacite, including types classified as Desert Side-notched, Cottonwood Triangular, and Pinto). Among the 19 ground stone artifacts were 9 manos (mostly trough type), 3 metates (trough and flat/concave), 1 nether stone, 1 grinding slab, 1 flat abrader, 1 pottery-polishing stone, 2 tabular tools, and 1 unidentified object. Mineral items included pieces of Coconino sandstone (temper material), kaolinite chunks, and a turquoise fragment. Shell species included *Anodonta* and an indeterminate fragment of either *Glycymeris* or *Laevicardium*. In order of abundance, animal remains included deer, cottontail, jackrabbit, prairie dog, and bird (including a hawk talon, for which the site was named).

Edwards and O'Hara (2004:284) concluded that the Talon site was a year-round habitation site or farmstead that sheltered a single family, but if it was a locus of the nearby and contemporary Cross Creek Ranch Pueblo, the locality might be a small hamlet. Domestic activities included butchering and consuming animals, consuming domesticated- and wild-plant foods, processing animal hides, manufacturing and using bone and stone tools, and fabricating ceramics. Edwards and O'Hara (2004:284) suggested that all four prehistoric rooms at the Talon site dated to the thirteenth century, placing it firmly within the Honanki phase. Combining radiocarbon dates and ceramic-production dates, they believed that the Feature 1 room was occupied sometime between A.D. 1225 and 1300, that Room 1 was occupied between A.D. 1250 and 1300, that Room 2 was occupied between A.D. 1260 and 1300, and that Feature 8 was occupied between A.D. 1260 and 1300.

Verde Ranger Station (AR-03-04-01-1004 [CNF]) Pit House

Late in 2003 and early in 2004, USFS archaeologist Kristen Martine and volunteers from the VVAS excavated a pit structure (Feature 1) and a ramada area (Feature 2) at the Verde Ranger Station (also designated AZ O:5:133 [ASM] and NA26435) that were inferred to date to the Honanki phase (Martine and Pilles 2005). The work was necessitated by the sale of a federal land parcel near SR 260 on which the Verde District Ranger Station was located. The site was on a low rise, less than 1/2 mile east of the Verde River.

Feature 1 was a subrectangular structure measuring 6.1 m north-south by 3.82 m east-west. The prehistoric builders excavated a pit into sterile sand, river cobble, and calcic-rich sediments about 1.1 m below the PGS. The pit structure had a use-compacted floor; a formal, slab-lined hearth constructed within a large but shallow, oblong pit; a west-wall ventilator tunnel; a storage pit; a firepit; two ash-filled pits; and a charcoal-filled posthole. Three of the walls were lined with river cobbles set in abundant clay mortar, with a few upright sandstone slabs at the basal course. Many artifacts were recovered on and within a thick, burned layer above the floor. Martine and Pilles (2005:10–11) suggested that there were two floors in this structure, separated by 3–8 cm of clay loam that contained charcoal, sherds, and other artifacts. They opined, however, that an alternative explanation was that the upper floor may have been part of the collapsed roof fall and that the lower Floor 2 was the actual floor.

Many artifacts were recovered from the floor and within features of the pit house, including a number of restorable vessels and isolated sherds from around the slab-lined hearth, a ground stone cache of six manos and a metate, a trough metate inverted over a mano, grinding slabs, projectile points, a shaft straightener, a polishing pebble, a hoe, and a spindle whorl. Archaeologists also collected radiocarbon, pollen, ash, charcoal, and soil samples, but none of the samples had been sent out for analysis at the time the report was prepared. On the basis of temporally diagnostic ceramics (especially Flagstaff Black-on-white, Walnut Black-on-white, and Kayenta Black-on-white sherds in features and fill, as well as diagnostic projectile point styles and stratigraphic relationships), Martine and Pilles (2005:14) inferred that the pit structure and the nearby ramada area were constructed and used sometime between A.D. 1225 and 1300.

Tested Sites and Site Components Attributed to the Tuzigoot Phase (A.D. 1300–1400/1425)

Middle Verde Ruin/Talbot Ranch Ruin (AZ O:5:11 [ASM])

In 1965, self-trained archaeologist Franklin Barnett and his wife Joan Barnett assisted Merlyn Talbot with the write-up of amateur excavations in the smaller of the two room blocks on the Talbots' private land (Barnett 1965). This ruin is currently known as Talbot Ranch Ruin. Apparently unknown to Barnett, the larger of the two massed room blocks had already been explored by physician and naturalist Edgar Mearns (1890:13–18, Figure 12) sometime during the 1884–1888 period, when he served as medical doctor and surgeon to soldiers stationed at U.S. Army garrison Fort Verde. Mearns referred to both room blocks and a number of cavate dwellings across the canyon to the south as the Middle Verde Ruin/Talbot Ranch Ruin. As depicted on Mearns' (1890:Figure 12) map, the larger, western room block contained some 90 rooms, whereas the smaller, eastern room block contained 23 rooms. By the time that the Barnetts helped Talbot with his excavations, the southern portions of both room blocks were on lands assigned to the Yavapai-Apache Nation as the largest parcel of their dispersed-parcel reservation in the MVRV. Thus, the amateur archaeologists only investigated those relatively undisturbed rooms in the eastern room block that were on Talbot's private land (Barnett 1965:Figure 5). These two major room blocks and associated cavates have also been designated NA3535, NA8959, AR-03-04-06-26 (CNF), AR-03-04-06-27 (CNF), and AR-03-04-06-28 (CNF).

An annotated photocopy of Barnett's unpublished manuscript is housed in the CNF supervisor's office in Flagstaff. It describes the excavation of and the material remains recovered from seven rooms in the northern room block. Accompanying the manuscript is a photocopy of a letter that Barnett wrote to Talbot, along with vague sketch maps and photographs pertaining to three additional rooms excavated by Talbot after he had completed his manuscript. Barnett clearly disapproved of Talbot's lack of rigor and was disappointed that Talbot had continued. Despite this, Barnett submitted a copy of his manuscript to the MNA, and the profession is better informed about these late prehistoric remains because of his dedication to the goals of professional archaeology. Barnett was forthright about his task; he merely wanted to prepare a descriptive report of work accomplished and did not attempt to interpret or synthesize his findings.

A comparison of Barnett's (1965:Figure 5) map of the investigated rooms with the sketch map published by Mearns (1890:Figure 12) revealed the positions of these seven rooms and underscored the relative accuracy of Mearns' late-nineteenth-century observations. With the information at hand, we can only guess where the additional three rooms were located on the private lands within the smaller room block. Mearns depicted the rooms of the smaller, eastern room block as being larger, on average, than the rooms in the larger, western room block. Whether this signified a difference in the time and style of construction or was because he did not investigate the smaller room block is unknown.

Most of the seven adequately described rooms were on the margins of the room block and were roughly rectangular rooms of semicoursed, shaped, limestone-block masonry laid in a clay mortar chinked with limestone spalls. Only one wall of one room (Room 4) had a basal course of river cobbles used as footings. The excavators looked for evidence of wall and floor plastering but found none; each floor, however, was thoroughly use-compacted. Neither did the excavators find evidence for wall entryways. Barnett inferred that each room was entered from a roof entry. The excavators discovered that most of the rooms had burned and that evidence for burned roof fall was quite notable in Rooms 1 and 3. Of the seven rooms, five had central, slab-lined or otherwise-defined firepits, two had floor "rolls" of clay berms that partitioned space, and five had human burials placed in shallow pits near the room margins, covered with stone slabs. Of the five burials, four were infants or young children in the form of cranial burials or an extended skeleton. A small number of offerings accompanied these children. The remaining burial was an adult placed in an extended position within a pit or crypt, with a mano placed between its knees.

Interestingly, the excavators found no artifacts in the fill but did find a number of artifacts on the floor. None of the ceramics in any of the seven rooms were decorated types, and no whole pots were found. Several vessels were crushed and restorable—all were either Verde Brown (plain and corrugated) or Tuzigoot Red, and most were storage jars. In addition, Barnett reported that a lump of unfired clay for producing a Tuzigoot Red vessel was recovered from Room 5. Barnett's (1965:Table 2) list of floor artifacts recovered from each room included numerous flaked and ground stone tools: "malpais" (vesicular basalt) and sandstone metates, manos, grinding stones, anvils, hammerstones, three-quarter-groove axes, pestles, a mortar, abrading stones, a wedge, a palette knife, a malpais planting implement, a slate planting implement, two paint dishes, two sandstone pottery-smoothing implements, two heat-deflector slabs, shaft smoothers, scrapers, and an obsidian arrow point. He also listed two bone awls and a bivalve shell.

The three rooms (Rooms 8, 9, and 10) that Talbot explored without the help of Barnett were also rectangular masonry rooms. Each had a child burial in the southwest corner of the room, and two of the three had firepits. All had floor artifacts (manos, metates, scrapers, hammerstones, and one slate "pencil" fashioned from a soft stone [3 3/4 inches in length and 3/16 inches in diameter]).

Perkins Pueblo (AZ N:4:2 [ASU])

Although Perkins Pueblo (also NA2440 and NA9469) is not in the MVRV (it is in the upper Verde River valley, in the town of Perkinsville), it is contemporary with large, late pueblos in the MVRV, such as Tuzigoot Pueblo. Arizona State University (ASU) archaeologists excavated 5 of the 43+ rooms of the plaza-oriented pueblo in 1964 and 1965. Norman T. Alger (1968) wrote a Master's thesis in Anthropology at ASU comparing Perkins Pueblo with Tuzigoot Pueblo, some 20 miles to the south. The site is located on a high, narrow terrace overlooking the Verde River, above the Ben Perkins Ranch, and 3/4 mile southeast of a railroad station.

Exhausted Cave (NA10769)

Exhausted Cave (NA10769) is a component of the Clear Creek Ruins (NA2806). Bruce Hudgens (1975) conducted excavations and analyses of the recovered materials for a Master's thesis from NAU. It is a human-altered natural feature within the Verde Formation. As measured from a plan-view site map, the cavate was about 6 m in length and had two walled entryways on a natural ledge and a fairly level work area in front of the cave, extended a maximum of 3.85 m in depth from front to back, and had a maximum of 1–1.5 m of interior space from floor to ceiling. Floor features within the cavate included two cists, several firepits, and a slab-lined hearth. At the rear of the cavate was a natural ledge that was modified to a form a level, walled-in bench area. Two storage cists were high in the walls, near the ceiling. The primary entrance on the east faced slightly to the southeast; the secondary entrance faced more to the southwest.

The cavate showed at least two occupations. Between A.D. 1130 and 1275/1300, it was used for temporary shelter and storage for an individual or small group engaged in mining of gypsum, salt, and calcite. Between

A.D. 1275/1300 and about 1320, the cave was occupied by a flint knapper who may also have been the owner of an extraordinary ceremonial medicine bundle (Cache 1) that contained numerous and rarely recovered perishable and nonperishable items. The Tuzigoot phase use of this cave was marked by the presence of Jeddito Yellow Ware sherds. The preservation of perishable items and the contents of the two caches were exceptional.

As described by Hudgens (1975), the chronology of the deposits in the cavate, which was based on decorated ceramics, was as follows: lower Strata I and II, 1120 or 1130 to about 1250; Stratum III, from 1250 to 1275/1300; Stratum IV, from 1275/1300 to 1320.

Perishables: Perishable artifacts included bone artifacts (four items: worked bone, a turtle-shell carapace, and antelope hooves); shell artifacts (marine and freshwater mollusks: shell beads, rings, bracelets, and pendants of *Olivella, Glycymeris, Laevicardium, Conus, Nassarius, Tagelus, Ostrea, Pecten, Haliotis*, and Pelecypoda); leather artifacts (from extraordinary Cache 1: a desiccated skin bag, two wrapped bundles, two pouches, and leather fringe); feathers (two wild-turkey-feather bundles); leaf artifacts (a yucca sandal, matting, braided yucca, a grass pot rest, wrapped grass, miscellaneous objects); wood artifacts (a self-bow, arrow shafts, a taper stick, a shed-separating tool for weaving, a batten, a spindle whorl, a comb, a needle, a stripped devil's claw, and other worked items); and bast (flax or *Apocynum*) and cotton artifacts (batting, thread, cords, and textiles, found mostly in Cache 2).

Caches: Cache 1 (resting on top of post-1300 Stratum IVb), interpreted as a medicine bundle, consisted of a mended leather and textile bag made of prairie-dog skin and plain-weave bast fabric. Within it or associated with it were lithic artifacts, pouches, bundles, fringe, and twine, and near it were the turtle shell, the antelope hooves, the clay-mineral block, and possibly the feather bundle. Within bundles were various materials, including soil, plant leaves, pollen, meal, cotton thread, minerals, and feathers. Cache 2 (a well-hidden and formerly blocked ceiling chamber), interpreted as a seed cache within textile bags, contained corn, pumpkin, cotton, and either graythorn or buckthorn, as well as raw clay.

Tuzigoot Phase Features near the Confluence of the Verde River and West Clear Creek at NA15769 and the Calkins Ranch Site (NA2385), House 6

As discussed earlier, archeologists from the MNA conducted data recovery in 1979 at six sites along USFS Road 9 (now renumbered SR 260) (Stebbins et al. 1981). Two of six sites revealed archaeological features with either archaeomagnetic or radiocarbon dates associated with the Tuzigoot phase. After excavation and analysis, Stebbins et al. (1981:40, 96) suggested that the single structure at NA15769 was a Tuzigoot phase field house contemporaneous with nearby Clear Creek Pueblo. Similarly, they interpreted House 6 at the Calkins Ranch site (NA2385) as a seasonally used residence dating to the end of the Tuzigoot phase. Although radiocarbon and archaeomagnetic data were reported by Stebbins et al. (1981), the authors provided insufficient detail for complete confidence in their reported dates.[13] As we have noted elsewhere in this appendix, we made some assumptions concerning their reported dates and recalibrated the assumed radiocarbon age (Stebbins et al. 1981:95).

NA15769 was a single masonry room and associated surface artifact scatter located on a small bench below the mesa on which the large Clear Creek Ruin is located. The structure was located above the first terrace and floodplain of West Clear Creek. In 1979, the south wall of the masonry room was visible in the slope of the ridge. Archaeologists excavated this feature and determined that the walls were constructed from slabs and irregular chunks of limestone set in a clay mortar and were about 35 cm thick. Interior room dimensions were 4.8 by 1.5 m; exterior dimensions were 5.8 by 2.1 m. The structure had a 52-cm-wide entryway in the longer south wall, and the overall orientation of the house was to the southeast. The maximum remaining wall height was 82 cm. The structure contained a clay-collared, circular hearth (with interior measurements of 25 cm in diameter and 8 cm in depth); the overall diameter was 54 cm. The complete inventory of floor artifacts was unclear, but at least two items—two complete basalt manos—were recovered. In addition, 103 sherds were recovered from the structure. These included, in order of abundance, Verde Brown, Clear Creek Brown, Tuzigoot Plain, Tonto Red, Tuzigoot Red, Alameda Brown Ware, and single examples of Verde Red, Gila Plain, and Wingfield Plain.

Archaeologists recovered samples for flotation and pollen analysis from this structure. Gasser's (1981:126) flotation analysis identified a maize cupule and Juniper-like wood from the floor fill and seeds from a cheno-am and Cruciferae/Brassicaceae–type plants in the hearth. Gish's

[13] Stebbins et al. (1981) did not report what materials were submitted for radiocarbon analysis (wood charcoal, annual seeds, or other plant parts); neither did they report the analytic laboratory, sample number, or conventional radiocarbon age. They also did not calibrate the results. It appears that they subtracted the laboratory's convention age from A.D. 1950 and reported the standard error associated with that assay. The archaeomagnetic dates were assessed with the curve reported by DuBois (1975) but were not reported in a way such that these may be independently evaluated.

(1981:Figure 20) pollen analysis also resulted in the identification of maize, cheno-am, and juniper pollen but also revealed pollen aggregates of piñon, low-spine Compositae/Asteraceae, and grasses. Archaeologists took archaeomagnetic samples from the hearth that produced an estimated date range of A.D. 1365–1425; they also collected a radiocarbon sample from this structure (material, provenience, laboratory number, and specimen number not reported) that they interpreted as A.D. 1515 ± 110 (uncalibrated). We assume that the laboratory reported this radiocarbon age as 435 ± 110 B.P. and calibrated this age estimate with Calib 5.0.1 to derive 2σ ranges of A.D. 1294–1666 and 1784–1795, with a high probability that the true age falls in the earlier time interval. Thus, it would appear that the structure was built and used at the end of the Tuzigoot phase and, as Stebbins et al. (1981:40, Table 30, Figure 19) suggested, may have been an agricultural or seasonally used structure associated with the Clear Creek Ruin.

House 6 at the Calkins Ranch site (NA2385) was tested during the MNA's investigations at that site in 1958 and 1959 but was not described in Breternitz's (1960a) publication. When the MNA returned in 1979 to conduction mitigation studies along USFS Road 9/SR 260, they more fully investigated this structure. By 1979, a significant portion of the house had been lost to road construction and erosion. Nevertheless, enough remained to determine that the house was approximately 4 m in length and 5.2 m in width, had walls with a basal course of upright limestone and sandstone slabs topped by horizontally laid blocks of stone in mortar, and had a caliche-plastered floor; also, the house had burned. No floor features were noted in the remaining portion of the house, and only a few floor-fill artifacts were recovered. These included 77 sherds (dominated by Verde Brown and Tuzigoot Plain, with fewer Tonto Red, Clear Creek Brown, Wingfield Plain, Alameda Brown Ware, and Wingfield Red sherd and an unknown black-on-red type), 1 interior flake, and 1 object interpreted as either a miniature *tchamahia* or a chisel-grinding tool (Stebbins et al. 1981:Table 20).

Archaeologists took flotation and pollen samples, but only Gish (1981:Figure 21) was able to identify the presence of cheno-ams, low-spine Compositae/Asteraceae, piñon, and juniper in these relatively uninformative samples. Archaeologists also recovered a sample for radiocarbon assay (material, provenience, laboratory number, and specimen number not reported) that they claimed dated sometime within the A.D. 1330–1460 range (A.D. 1395 ± 65, uncalibrated). We assumed that the laboratory reported this radiocarbon age as 555 ± 65 B.P., and we calibrated this date with Calib 5.0.1 to derive a 2σ range of A.D. 1292–1444. Although Stebbins et al. (1981:76) suggested that House 6 resembled House 5 (see the section discussing Honanki phase investigations) and both Tuzigoot phase structures that were occupied year round, we are unconvinced that they are contemporary.

Verde Valley Ranch Project Sites: The Verde Terrace (AZ N:4:23 [ASM]) Field House and the AZ N:4:28 (ASM), Locus B, *Horno*

As discussed in the Cloverleaf phase section, archaeologists from the MNA undertook excavations at five sites on private property between Clarkdale and Cottonwood in 1988 (Greenwald 1989). Features at two sites were assigned primarily to the Tuzigoot phase. Feature 1 at the Verde Terrace site (AZ N:4:23 [ASM]) was interpreted as a field house dating to the Honanki and Tuzigoot phases. Feature 1 in Locus B of AZ N:4:28 (ASM) was a roasting pit or *horno* dating to the Tuzigoot phase or the protohistoric period. The proximity of the Verde Valley Ranch development to Hatalacva and Tuzigoot Pueblos suggested to Greenwald and his colleagues that the prehistoric occupants of Hatalacva Pueblo may have been responsible for the construction and use of these features.

According to Hovezak et al. (1989:27), the Verde Terrace site was a complex, multiple-component site with later components that obscured earlier, buried components. Numerous features were discovered in 16 backhoe trenches and multiple hand-excavation units. Ultimately, SWCA archaeologists selected 3 structures and 4 extramural features for complete excavation. Two features, Feature 1 and Feature 8, were inferred to date to the Honanki or Tuzigoot phase. Of these 2 features, only Feature 1 was investigated in detail. Feature 1 (Hovezak et al. 1989:34–37) at the Verde Terrace site was a subrectangular pit structure excavated prehistorically some 50–60 cm below the PGS. The interior space measured 2.48 by 1.67 m. The lower walls were unplastered earthen walls. The upper walls on the north, east, and south sides were inferred to have been constructed of stacked and dry-laid cobble and boulders reinforcing roof-support posts. The west wall may have been jacal, because a linear series of postholes without benefit of rock reinforcement was encountered. Entry to the structure was likely through this less-substantial west wall. The floor was use-compacted and contained 18 subfeatures, including 4 warming pits, 1 ash pit, 6+ postholes, and 2 pits of unknown function; none of these was a formal hearth. One warming pit contained primary refuse of charcoal and ash. Scott Cummings (1989) identified pollen in a sample from this warming-pit feature; it contained pollen from corn, cotton, squash, and plantain inferred to have been grown by occupants of the field house in fields near the structure. Archaeologists recovered few artifacts from this structure, which appeared to have filled with wall rock fall and natural deposits only. A few ceramic artifacts were recovered from floor and floor-fill contexts; most of these were Tuzigoot Plain jar sherds. Neither subsistence remains nor datable samples were recovered from floor features, the floor, or structural fill. The feature was dated by associated ceramics.

AZ N:4:28 (ASM) consisted of three spatially distinct loci on the edge of the river terrace above the Verde River and within 1 km of Hatalacva Pueblo. Locus A was interpreted as a Yavapai encampment, Locus B was the site of a substantial roasting pit and associated debris, and Locus C was a dispersed artifact scatter with evidence of use by both Archaic and Ceramic period people. Locus B (Greenwald 1989:89–91, 97–100, 103) contained a well-defined *horno* from which radiocarbon-assay and archaeomagnetic dates were derived. The locus also contained a light artifact scatter. Feature 1 was a 2.75-m-diameter earth oven approximately 1.37 m in depth that had been lined primarily with tabular limestone rocks and heavily altered by heat. The feature was surrounded by a 25-m-diameter area of clean-out debris close to the edge of the terrace. The bottom layer was filled with ash and carbonized wood, the layer immediately above it was carbonized wood with ash, and the uppermost layer was ashy silt containing many pieces of FCR. Although samples for pollen, flotation, and radiocarbon assay were recovered, few samples produced interpretable results. Charred cheno-am seeds thought to have been part of the moist roasting-pit liner were recovered from the lowest layer, and cheno-am pollen was identified from the upper two *horno* levels. A piece of wood charcoal submitted to Beta Analytic, Inc., returned a radiocarbon date. Greenwald (1989:103) reported this date as A.D. 1380 ± 50, but we cannot evaluate its accuracy or precision.[14] Samples for archaeomagnetic dating were taken from the *horno* and returned two date intervals: A.D. 925–1010 and A.D. 1375–1650. The earlier portion of the second interval, A.D. 1375–1650, is likely the more accurate date, and it is consistent with the radiocarbon and ceramic evidence for the locus (which included items classified as "Yavapai Plain Ware" [Orme Ranch and Yavapai Plain]). Greenwald suggested that the earth oven was used in the late 1300s or 1400s and was late prehistoric or early protohistoric period in age.

Rancho del Coronado Sites: AZ O-5-20 (NAU) and AZ O-5-21 (NAU)

As discussed in the section concerning investigated Archaic period sites, archaeologists from NAU and the VVAS tested and excavated four sites on the privately owned Rancho del Coronado property (Graff 1990). Two of these four sites were assigned to the Tuzigoot phase. Both sites contained a single architectural feature interpreted as a domestic structure with an interior hearth and evidence of at least seasonal occupation. Archaeologists mapped and collected all surface artifacts, excavated a series of 50-by-50-cm test units until sterile sediments were reached, excavated features, collected pollen and flotation samples, and analyzed the recovered materials. No samples for archaeomagnetic dating or radiocarbon assay were collected.

AZ O-5-20 (NAU) (also designated NA18307 and AR-03-04-06-384 [CNF]) consisted of a single pit structure (Feature 2), 11 rock piles, and a thin scatter of surface artifacts on the west-facing slope of a low limestone hill. The pit structure was discovered about 40 cm below the MGS, during testing. Graff (1990:92–100, Figure 22) reported that excavation revealed that the structure was rectangular (3 by 1.9 m) and had a steeply ramped or stepped entry (ca. 1.1 by 0.5 m) on its short, northwest wall and a recess or bench on its short, southeast wall. The pit walls of the structure were not faced with stone but were clay plastered. The aboveground portion of the walls apparently was rock masonry that had fully collapsed. The floor was encountered at 88 cm below the PGS. Floor features consisted of a single slab-bottomed hearth in the northwest corner of the room and at least 4 postholes. Archaeologists recovered a single plain ware sherd, a piece of daub thought to have been from the timber roof, and a long sandstone cobble believed to be a lap stone. In addition, a few plain ware sherds were recovered from the hearth. Archaeologists took a pollen sample from beneath the floor-contact lap stone and a flotation sample from the hearth; the results of the pollen analysis were not reported. Van Ness (1990:Table 3) analyzed the flotation samples. She identified some 500 fragments of charred maize kernels and cobs as well as charred goosefoot and unidentifiable fuel-wood charcoal from the hearth of the structure.

AZ O-5-21 (NAU) (also designated NA18308 and AR-03-04-06-389 [CNF]) consisted of a nearly square, surface masonry room (Feature 1); four extramural postholes interpreted as a windbreak (Feature 2); and a thin scatter of surface artifacts on a southeast-facing hillslope with outcrops of limestone (Graff 1990:68–80). The structure was oriented northwest-southeast, measured 2 by 2 m on its interior, and had an entryway (50 cm in width and at least 70 cm in length) on its southeastern wall. The foundation of the structure was excavated into decomposing limestone bedrock and sterile soil. The aboveground walls were composed of limestone rocks laid as a double wall, approximately 35–40 cm in width. On the basis of associated rock fall, Graff estimated that the aboveground walls were 2–4 m above the PGS. The floor was encountered 50 cm below the MGS. Floor and wall features included a hearth, a small ash pit or warming pit, a wall niche, and an entryway. The hearth (approximately 30 cm in diameter) was a circular basin excavated into the use-hardened

[14] Greenwald (1989), unfortunately, did not report the sample number, the conventional radiocarbon age, and whether this date was calibrated.

floor in the southwest corner of the structure. Five thermally altered sandstone cobbles were positioned around the rim of the hearth. Adjacent to the hearth was a small, subrectangular depression excavated into the sterile sediments below the floor. A small concavity identified as a 32-cm-deep wall niche or storage feature was located in the northwest corner of the structure, at floor level, below the masonry wall. Archaeologists observed the entryway to the structure on the MGS. At the time of excavation, it measured 70 cm in length, 50 cm in width, and 50 cm in depth, and it was lined with two upright sandstone slabs. Graff (1990:80) noted, however, that its dimensions were altered by a large crucifixion-thorn shrub that penetrated the entryway.

Archaeologists recovered several artifacts on the floor or within features, including an artiodactyl-bone awl, a core, and 23 sherds (15 Tuzigoot Plain from a single vessel, 3 additional Tuzigoot Plain, 2 Tuzigoot Red, and 3 Verde Brown). Archaeologists also took two samples from the hearth for flotation analysis and a single composite floor sample for pollen analysis. The results of the pollen analysis were not reported, but in the flotation analysis, Van Ness (1990:Table 3) identified approximately 50 charred fragments of corn cob or kernels, charred goosefoot, and unidentified members of the sunflower and grass families as well as unidentified pieces of wood charcoal and 4 small pottery sherds.

Graff (1990:121–125) concluded that the two sites were occupied during the Tuzigoot phase based on the ceramics contained within the structures. Nevertheless, there were differences in the architecture and the surface ceramics (e.g., Bidahochi Polychrome, Tuzigoot Red, and Verde Corrugated were recovered in the surface collections of NA18308 but not NA18307) that may be meaningful. She offered alternative interpretations. The presence of late ceramics on the site surface of NA18308 might mean that it was occupied later in the Tuzigoot sequence. The presence of a pit structure at NA18307 might mean that it was a year-round residence occupied by a small group, rather than a seasonal field house. Alternatively, the differences in architecture may signal that different social groups inhabited the area. Despite these unknowns, Graff (1990:124) suggested that the proximity of these two sites to the Bridgeport Ruin and to other Tuzigoot phase pueblos along the Verde River indicated the likelihood that they were components of a larger, nearby Tuzigoot phase community.

Mindeleff Cavate Site or “Cavate Lodge Group” (NA1511)

This site, which was recorded by Cosmos Mindeleff (1896) during his Verde River Survey, was investigated by Susan Hall (1992) as part of her NAU Master’s degree program. She noted that “cavates” are artificial cave-like rooms carved out of soft rock (not natural caves or unmodified rockshelters). A cavate can be a complete room, but it may also be part of a room recessed into a cliff face, with masonry construction completing the room. Mindeleff (1896:217) used the term “cavate lodges” to describe rooms “hollowed out of cliffs and hills by human agency.” Cavates are typically secondary to more-extensive, mesa-top pueblos in the Verde River valley, but this is not true for the Mindeleff Cave site, where cavates dominate (with small pueblos on the mesa bench above).

Mindeleff’s Cavate Lodge Group is south of Camp Verde and the Clear Creek drainage, on the east side of the Verde River. It contains some 350 rooms in 100 clusters. The cavate dwelling units range in size from 1 to 10 rooms; most units contain 2–5 rooms. Single cavate rooms likely are not habitations; rather, they probably functioned as field houses, lookouts, or storage or special-activity locations (see the description of Exhausted Cave in Hudgens [1975]). Other cavate units likely were dwellings, complete with hearths, storage features, niches, and so forth. A mesa-top pueblo nearby was inferred to be a Tuzigoot phase construction. Hall reasoned that if the nearby cavates were contemporaneous with this mesa-top pueblo, then Mindeleff’s Cavate Lodge Group also was occupied primarily in the Tuzigoot phase.

Groseta Ranch Road (AZ N:8:40 [ASM]) Field Houses, Features 2 and 19

In 1997, archaeologists from ARS investigated four sites within or adjacent to the ROW of SR 279 prior to an Arizona Department of Transportation road-widening project (Kwiatkowski 1999). The four sites—AZ N:8:40 (ASM), AZ N:8:41 (ASM), AZ N:8:42 (ASM), and AZ N:8:43 (ASM)—were mapped, but only those portions of AZ N:8:40, the Groseta Ranch Road (GRR) site, were excavated. The GRR site and its two immediate neighbors, AZ N:8:42 and AZ N:8:43, were Tuzigoot phase field houses inferred to have been seasonal shelters for a small group of farmers from Tuzigoot Pueblo, which was located less than a mile to the east. AZ N:8:41 was inferred to have been an Archaic period lithic scatter.

Features 2 and 19 at the GRR site were conjoined field houses. Immediately to their east was a surface artifact concentration. Elsewhere on the site were rock piles. The earlier of the two structures was Feature 19. Excavation revealed that Feature 19 was an unburned structure (3.5 by 2 m in its interior dimensions) built within a shallow house pit 15 cm in depth. Its wall were unshaped, dry-laid cobbles and boulders of basalt and other rock ranging from 49 to 67 cm in height and 50–73 cm in width that were, in some places, two course wide. Archaeologists did not identify any floor features within the use-compacted floor surface and inferred that the roof was supported directly on the walls rather than by posts. They recovered ceramics from floor and floor-fill proveniences, including 23 Tuzigoot Plain, 10 Tuzigoot Red, 19 Verde Brown, 11 Verde Red, and 4 other unidentified sherds.[15] Archaeologists also recovered a few lithic cores, flakes, and shatter from this structure. A single radiocarbon sample from wood charcoal was submitted to the University of California, Riverside, for AMS dating, but it returned a modern radiocarbon age. Project archaeobotanists examined floor-fill samples from Feature 19 and identified maize and squash/gourd pollen and phytoliths suggestive of maize, among other plants.

Sometime after Feature 19 was no longer used, Feature 2 was appended to its northern wall and the presumed entryway. Feature 2 was also an unburned field house (3.65 by 3.6 m) that showed evidence of remodeling. Unlike Feature 19, it was constructed on the PGS, not in a shallow pit. As with the earlier structure, the walls of Feature 2 were unshaped, dry-laid cobbles and boulders with occasional rock chinking. Most of the rock was vesicular basalt, but fine-grained basalt, quartzite, rhyolite, and metamorphic rock were also used. Existing walls ranged from 34 to 52 cm in height and 20–64 cm in width and were a number of courses wide. As with Feature 19, no floor features were encountered on the use-compacted surface, but two small patches of red, oxidized soil suggested deliberate use of heat. The entryway was located along the center of the north wall. Archaeologists submitted a wood-charcoal sample believed to have been sycamore construction timber to the University of California, Riverside, for AMS dating. Sample UCR-3591 returned a radiocarbon age of A.D. 650 ± 60 that was calibrated with the intercept method at a 1σ range of A.D. 1290–1398 and a probability range of A.D. 1278–1413. These date ranges were supported by the ceramic data from the floor and floor-fill proveniences. The ceramic sherds included 88 Tuzigoot Plain sherds, 37 Tuzigoot Red sherds, 51 Verde Brown sherds, 19 Verde Red sherds, 1 Prescott Gray sherd, and 1 other unidentified sherd. Although proveniences for other artifacts recovered from this feature were not reported, both flaked and ground stone were recovered. Among these were 2 projectile points (1 a small, complete, side-notched point of Government Mountain obsidian similar to specimens recovered at Tuzigoot Pueblo), cores, flakes, a flat mano, and a trough-mano fragment. As with Feature 19, project archaeobotanists examined floor-fill samples from Feature 2 and identified pollen from maize, among other wild and weedy species, as well as phytoliths suggestive of maize.

[15] Ceramic analyst Andrew Christenson (1999) identified sherd temper within the Tuzigoot phase–type ceramics from this site and within a sample drawn from Tuzigoot Pueblo. Apparently, his was the first documentation of the use of sherds as deliberate inclusions in late prehistoric ceramics of the region.

Kwiatkowski (1999:154) concluded that the GRR and neighboring AZ N:8:42 (ASM) and AZ N:8:43 (ASM) were Southern Sinagua field houses situated on the remains of a Pleistocene and Holocene alluvial fan dissected by ephemeral drainages, on a landform about a mile west of the Verde River. This landform was likely covered with an open mesquite-saltbush plant community during the Tuzigoot phase. Each site consisted of a single field house and a surface artifact concentration within a larger, more dispersed surface artifact scatter and nearby rock features. Evidence for the nearby cultivation or use of maize and squash was contained in both field houses, one rock pile, and an excavation trench. Kwiatkowski (1999:155) suggested that rock features, such as rock piles and check dams, possibly were used by the field houses' inhabitants to direct runoff onto agricultural fields presumed to have been present nearby.

Spring Creek Pueblo (NA26019)

The Spring Creek Pueblo (NA26019) was a 41-room Tuzigoot phase pueblo on private land along Spring Creek, a tributary of Oak Creek. This site was close to the SR 89A ROW and to AZ O:1:104/AR-03-04-06-902 (ASM/CNF) and AZ O:1:105/AR-03-04-06-838 (ASM/CNF), which were investigated by SRI in 1998; the sites are 0.3 and 0.7 km, respectively, from the pueblo. SRI archaeologists were aware that a sizable masonry pueblo was located on the privately owned Seven Springs Ranch property, but they were not invited to visit it. In 2008, when new owners welcomed documentation of the site before the property was developed for home sites, Jerry Erhardt and several other members of the VVAS were allowed to inspect the heavily pot-hunted structure and prepare a site map. The developer told Erhardt that he planned to preserve this site as a "cultural sanctuary" within the development. The VVAS volunteers also made a quick inventory of surface artifacts (Jerry Erhardt, personal communication 2008). Nearly 250 sherds were tallied; virtually all decorated ceramics were post-1300 types from the Hopi and Winslow areas (e.g., Jeddito Black-on-yellow, Tuwiuca Black-on-orange, Awatobi Black-on-yellow, and Homolovi Polychrome), which suggested that the site was a Tuzigoot phase construction.

Using a classification advanced by Pilles (1996a), Spring Creek Pueblo can be categorized as a "massed room block"–type pueblo that was constructed in stages around a core of rooms. Overall dimensions of the room block were 35 m in length by 35 m in width; it was built into the slope of a low hill, facing north-northeast. Interestingly, the walls of several core rooms (rooms that were somewhat larger than the average peripheral room) were constructed with white limestone blocks. There also were at least two rooms that were constructed of red sandstone. Most of the walls, however, were constructed with tabular gray/black basalt stone, generally 70 cm thick. Most of the original core rooms were larger than the peripheral rooms.

Tested Sites and Site Components Attributed to the Protohistoric and Early Historical Periods (A.D. 300–1848)

The Wood Site (NA13384)

As described in the Camp Verde phase discussions, members of the VVAS and other volunteers supervised by USFS archaeologists conducted data recovery at the multiple-component Wood site (also designated AZ O:1:29 [ASM] and AR-03-04-06-134 [CNF]) between October 1975 and March 1981 (Hallock 1984). The land on which the site was located was slated for a land exchange between the federal government and private land owners. Hallock (1984) summarized investigations at the site. Over the course of 5 1/2 years, supervised volunteers investigated 7 Camp Verde phase pit houses, 4 small structures inferred to be Yavapai wickiups, 20 stone-lined roasting pits, and 3 stone-lined, exterior storage pits inferred to be associated with Structure 1. The focus of the report was on the Sinagua period pit structures and related artifacts, although the 4 structures were briefly described. Artifacts recovered from the 4 Yavapai structures, the roasting pits, other extramural features, and the site surface were not described in Hallock's brief report.

Structure 1 (reported as 5.75 by 4.5 m but mapped as smaller than this) was built into the MGS and had a use-compacted surface or "floor" 25–30 cm below the MGS. Associated with this structure were an intramural storage pit, an extramural storage pit, a stone-lined hearth, an ash pit to the south, a storage pit to the north, and two extramural postholes. Structure 2 (4 m in diameter) had a use-compacted "floor" 30–35 cm below the MGS. Associated with this structure were an intramural, bell-shaped storage pit and a shallow hearth in the center. Structure 3 (3 by 2.75 m) had a short ramp entry and a depth of 75 cm below the MGS. It contained a central pit (75 by 50 cm and 20 cm in depth) filled with thermally altered basalt cobbles. Structure 4 (3 m diameter) had a use-compacted surface 35–40 cm below the MGS. Associated with it were an intramural, shallow hearth and a bell-shaped storage pit (50 by 35 cm and 50 cm in depth). Sometime after this structure fell into disuse, Roasting Pit 10 was constructed along the former southeastern margin of this brush house.

The roasting pits were scattered across the site and fell into two size classes. The larger pits were ca. 1 m in diameter by 50 cm in depth, and the smaller pits were 50 cm in diameter and 20–30 cm in depth. Some pits were lined with sandstone slabs and had sandstone-slab bottoms (generally the larger pits); the others were lined with basalt cobbles. A charred agave heart was recovered from one of the larger sandstone-lined pits. Evidence for the reuse (in later events) of rocks from earlier roasting events was noted.

Hallock (1984:24–26) interpreted three of the four structures as brush wickiups and interpreted the fourth structure with the ramped entry as a sweat lodge. He interpreted the 20 roasting pits and the 3 pits immediately south of Structure 1 as evidence of Yavapai occupation based on the stratigraphic position of the pits and structures above the Camp Verde phase pit structures and based on their relationship to the MGS.

Red Rock Loop Road Sites: NA18191 and NA18192

Archaeologists from the MNA undertook archaeological investigations along Red Rock Loop Road in September 1984 as part of a federal land-exchange project between the CNF and private developers (Dosh 1985). Three were investigated: NA18191 (also designated AR-03-04-6-457 [CNF]), NA18192 (also designated AR-03-04-06-458 [CNF]), and NA192A (also designated AR-03-04-06-475 [CNF]). Dosh (1985:32) interpreted NA18191—the largest of the three—as a seasonal base camp where plant foods were cooked and perhaps processed. Several features were investigated, and one feature produced a radiocarbon date from a thermal feature that suggested that it could have dated to anytime between the late Camp Verde phase and the Tuzigoot phase.

Feature 4 was a slab- and cobble-lined pit filled with FCR and sediment. No artifacts were recovered from this pit. Although archaeologists collected flotation, pollen, and radiocarbon samples from this feature, which was interpreted as an earth oven or roasting pit, no botanical remains were identified. The two samples submitted for radiocarbon assay (material not reported, presumably wood charcoal), however, did result in uncalibrated radiocarbon ages. The sample (UGa-5325) produced a conventional radiocarbon age of 755 ± 80 B.P., which was reported as A.D. 1195. Another sample (UGa-5326) produced a conventional radiocarbon age of 1025 ± 120 B.P., which was reported as A.D. 925. Although Dosh (1985:23) knew that calibration of these dates would result in a large range, he did not anticipate an end date much later than A.D. 1300. We calibrated both of these dates. UGa-5325 resulted in a 2σ range of approximately A.D. 1047–1398. The older sample, presumably derived from old fuelwood (UGa-5326), resulted in a 2σ range of A.D. 725–1255. Without knowing more about the contexts of these samples and the nature of the material assayed, we suggest that the younger sample, UGa-5325, which produced the A.D. 1047–1398 range, was the better of the two samples for estimating the age of the feature. The date range associated with UGa-5325 suggested that the slab-lined pit could have been used during the late Camp Verde, Honanki, or Tuzigoot phase or even by early Yavapai groups.

Dosh (1985:32) interpreted NA18192 as a small farming locale based on its location and the presence of old check dams, basin- and slab-metate fragments, and a partially reconstructible pottery jar similar to Orme Ranch Plain. Dosh (1985:33) interpreted NA18192A as a locus of NA18192 at which stone-tool production took place. All three sites yielded numerous examples of chopper or pulping planes and ground stone.

Dosh (1985) concluded that three sites were either late Southern Sinagua or early Yavapai sites dating to the 1300–1400 time interval based on the radiocarbon dates from NA18191 (Feature 4), the presence of the Yavapai-like pottery jar, the similarity of NA18191 to a nearby site (AR-03-04-06-460 [CNF]) that produced Jeddito Corrugated pottery (post–A.D. 1300), and the ethnographically documented association of roasting features with Yavapai subsistence practices.

Verde Valley Ranch Project (AZ N:4:28 [ASM]), Locus A

Locus A of this site was a surface artifact concentration with a larger, more diffuse artifact scatter (Greenwald 1989:82). Locus B, which contained a roasting pit dated with radiocarbon and archaeomagnetic methods to the post–A.D. 1300 interval (see the Tuzigoot phase discussion), may be associated with the inferred Yavapai use of Locus A.

From Locus A, archaeologists recovered flaked stone (n = 191), ground stone (n = 1), ceramics (n = 127), and shell (n = 8). Among the flaked stone items were 4 Yavapai points, presumably Desert Side-notched projectile points. Among the 127 sherds were 42 classified as Apache Plain Ware (39 Fingernail Indented, 2 Rimrock Plain, and 1 unknown) and 2 classified as “Yavapai Plain Ware” (Yavapai Plain), as well as 4 “proto-Hopi” Orange Ware sherds and 1 Hopi Yellow Ware (Jeddito Black-on-Yellow) sherd.

Clarkdale Pipeline Project Archaeological Project (AZ N:4:72 [ASM]/AR-03-09-05-279 [PNF])

Motsinger and Mitchell (1994a) inferred that AZ N:4:72 (ASM) was an encampment of Northeastern Yavapai with the remains of at least one wickiup (Structure 1), probably two additional wickiup rings (Structures 2 and 3), and four rock piles. The authors were unsure as to whether the rock piles were associated with the structures. Structure 1 was a 2-m-diameter cleared area with 18 stones scattered around the clearing. Excavation of a 1-by-2-m test unit in the northern portion of the structure revealed small, discontinuous lenses of ashy soil just below the MGS that were interpreted as an unprepared living surface or floor. Structures 2 and 3 were located about 40 m to the west of Structure 1. Structure 2 was a cleared area with a slight depression surrounded by a scatter of flaked and ground stone tools. Structure 3 was a 2-m-diameter leveled area with two right-angle walls that formed a corner.

Jack’s Canyon Data Recovery Sites: AR-03-04-06-265 (CNF), AR-03-04-06-293 (CNF), AR-03-04-06-296 (CNF), AR-03-04-06-304 (CNF), and AR-03-04-06-306 (CNF), Locus B

As described previously in the discussion of the Squaw Peak phase, SEC archaeologists Logan and Horton (1996) conducted data recovery at 11 sites in Jack’s Canyon as part of a federal land-exchange project. Data recovery at 5 sites produced evidence of protohistoric period or early-historical-period aboriginal land use by Yavapai or Apache cultural groups. Yavapai-associated artifacts were recovered from sites AR-03-04-06-265 (CNF), AR-03-04-06-293 (CNF), AR-03-04-06-296 (CNF), and AR-03-04-06-306 (CNF), Locus B. Artifacts and a radiocarbon-dated roasting pit with charred agave remains were recovered from AR-03-04-06-304 (CNF).

AR-03-04-06-265 (CNF) was a diffuse artifact scatter that included flaked stone (n = 560), ground stone (n = 16; 9 basin manos, 4 basin metates, 1 grinding slab, 1 hammerstone, and 1 flat abrader), and ceramics (n = 96) as well as a single feature, a shallow roasting pit. Of the 96 sherds recovered from the surface and the first 10 cm below the MGS, 2 were classified as Tizon Wiped, and 12 were classified as “Yavapai Plain Ware”. Most of these were recovered near a shallow roasting pit (1.25 by 1.1 m and 30 cm in depth) filled with FCR and dark, ashy soil (no radiocarbon sample was taken) that produced charred hedgehog, hackberry, and grass seeds as well as piñon and juniper/cypress fuel-wood charcoal.

AR-03-04-06-293 (CNF) was a diffuse lithic scatter without features. Archaeologists recovered 136 pieces of flaked stone, including a single complete Desert Side-notched projectile point, and 1 sherd typed as Cerbat Brown (a Tizon Brown Ware). Desert Side-notched points are often referred to as "Pai" points (Euler 1958; Pilles 1981a) and are typically associated with Havasupai, Walapai, Yavapai, and Southern Paiute groups.

AR-03-04-06-296 (CNF) was a flaked and ground stone scatter with two features, both surface historical-period rock alignments. Archaeologists recovered 941 flaked stone and 5 ground stone artifacts (4 sandstone grinding slabs and 1 vesicular basalt basin-metate fragment). One of the grinding slabs was recovered from a subsurface test unit, lying flat on a compacted surface. Pollen and flotation samples collected from under the grinding slab revealed the presence of charred remains of buckwheat, grass, spiderling, and filaree plants. Given that filaree (*Erodium*) was introduced to the region during the historical period, Logan and Horton suggested that its presence in both pollen and macrobotanical samples in a sealed context suggested use of the site by post-1583 populations in the MVRV.

AR-03-04-06-306 (CNF), which was previously recorded by Bergland (1982), encompassed two artifact scatters. Locus A was a flaked and ground stone scatter with 2 sherds and a small thermal feature. Locus B was a sherd (n = 275) and lithic scatter with flaked (n = 183) and ground (n = 22) stone. Of the 275 sherds recovered in Locus B by Bergland and SEC, 13 were classified as Cerbat Brown, and 32 were classified as "Yavapai Plain Ware". The 22 ground stone items consisted of 9 basin manos, 6 basin metates, 4 slab metates, 1 trough mano, 1 indeterminate nether stone, and 1 flat abrader. Logan and Horton suggested that Locus B was the location of wild-plant procurement and processing and also the locus of primary lithic-core reduction. The predominance of basin manos and metates and slab metates and the protohistoric period ceramics collectively point to its use as a short-term-activity Yavapai site.

AR-03-04-06-304 (CNF) was a large artifact scatter with three features. Archaeologists recovered flaked stone (n = 607), ground stone (n = 25), and ceramics (n = 45). Features 1 and 2 were roasting pits, and Feature 3 was a small rockshelter. Surface Feature 1 (a 2-by-1.25-m, unlined roasting feature filled with basalt and sandstone cobbles) was poorly preserved, but Feature 2 (1.8 by 1.5 m, 76 cm in depth, and unlined) was well preserved and was found through subsurface testing. It contained fire-cracked basalt and sandstone cobbles, ash, 3 manos, a few flaked stone items, and sufficient charcoal to submit for a standard radiocarbon assay. Pollen and flotation samples were taken and revealed charred juniper/cypress and barberry fuelwood and the charred remains of agave fiber, catclaw pods, and a beeweed seed.

Two radiocarbon samples submitted to Beta Analytic, Inc., from Feature 2 charcoal returned radiocarbon ages of 30 ± 50 B.P. (Beta-75540) and 220 ± 80 B.P. (Beta-75541). Logan and Horton reported these, respectively, as A.D. 1690–1730/1820–1920 and A.D. 1485–1950 based on the report from Beta Analytic, Inc. We recalibrated these dates and derived 2σ probability ranges of A.D. 1684–1734 and 1806–1929 for the younger charcoal and A.D. 1492–1602 and 1614–1893 for the older charcoal. In both samples, the greater likelihood was that the true dates of the samples were with the second or most-recent time interval (i.e., post–A.D. 1806 and post–A.D. 1614, respectively). Of the 45 sherds, 44 were "Yavapai Plain Ware" found in a concentration near Feature 3, the rockshelter. Of the 25 ground stone items, 17 were basin manos, 3 were basin metates, 1 was a grinding slab, 1 was a mano "blank" (manuport), 2 were abraders, and 1 was an indeterminate basalt fragment.

Logan and Horton (1996) concluded that AR-03-04-06-304 (CNF) was produced during the historical period by Yavapai. The 44 "Yavapai Plain Ware" sherds near the sooted rockshelter, the roasting pit with charred agave fiber, the predominance of expedient stone-tool production in local raw materials (chert and quartzite only), the presence of three reworked Archaic period–type projectile points, the preponderance of basin manos and metates, and the presence of a grinding slab suggested that this was the local site of wild-plant exploitation and processing sometime after A.D. 1684.

Data Recovery along SR 179 (AZ O:1:106 [ASM])

AZ O:1:106 (ASM) (also designated AR-03-04-06-759 [CNF]) was an artifact scatter with evidence of at least two occupations inferred to have been a short-term encampment. Weaver and Spaulding (1999) inferred an earlier use during the Honanki phase and a later use by Yavapai or Apache groups. They based the later use during the protohistoric and early historical periods (ca. 1300–1850) on the presence of 18 Rimrock Plain and 2 or 3 Orme Ranch Plain sherds in conjunction with a variety of nondiagnostic ground stone items.

Cross Creek Ranch Land-Exchange Site (AR-03-04-06-703 [CNF]), Roasting-Pit Features 8, 10, 16, and 18

As described in the Honanki phase discussion, AR-03-04-06-703 (CNF) (also designated NA26505) was a multicomponent site with a three-room masonry pueblo (Cross Creek Pueblo), a possible pit structure, a midden, four extramural hearths, a child burial in an extramural pit, and four rock-lined roasting pits (Logan and Horton 2000). The pueblo, midden, hearths, and burial appeared to have been associated with the thirteenth-century pueblo, whereas the four roasting pits were inferred to have been protohistoric period in age, dating to sometime after A.D. 1300. Of the four, Features 8 and 10 were the best preserved, and Feature 8 contained sufficient charcoal to submit a conventional radiocarbon sample for analysis. Only Feature 10 contained identifiable plant remains.

Feature 8 was a sandstone-slab- and basalt-cobble-lined roasting pit (2 by 1.8 m and 63 cm in depth). The pit was filled with dark, ashy concentrations; fire-reddened concentrations; and small amounts of gravel, small cobbles, and FCR. Flotation analysis revealed that juniper, saltbush, and sycamore wood were used as fuel, and fragments of charred and uncharred animal bone may have represented roasted meat. A submitted charcoal sample (Beta-71147) returned a radiocarbon age of 590 ± 60 B.P., which Logan and Horton reported as A.D. 1300 ± 60, representing a range of A.D. 1300–1420. We recalibrated this radiocarbon age with Calib 5.0.1 and derived a very similar 2σ probability range of A.D. 1287–1428. Archaeologists recovered 23 ceramic sherds and several pieces of flaked stone. Ceramics recovered from Feature 8 included 19 Alameda Brown Ware sherds (6 Tuzigoot Brown, 2 Verde Brown, 3 Kinnikinnick Brown, 2 Rio de Flag Brown, 2 Youngs Brown, and 4 Angell Brown), 1 Tizon Wiped sherd, 2 "Yavapai Plain Ware" sherds, and 1 Wingfield Plain sherd.

Feature 10 was a sandstone-slab- and basalt-cobble-lined roasting pit (2 by 1 m and 40 cm in depth) with a slab- and cobble-lined base and nearly vertical walls. The pit was filled with FCR and ash but contained little charcoal. Flotation analysis revealed the presence of juniper and ash used as fuelwood and charred goosefoot seeds. Artifacts recovered from this feature included 14 sherds (6 Tuzigoot Brown, 4 Verde Brown, 1 Tizon Wiped, 2 Cerbat Brown, and 1 "Yavapai Plain Ware"), 1 basin mano, 1 grinding slab, and flaked stone debitage.

Feature 16 was a sandstone-slab- and basalt-cobble-lined roasting pit (1.2 m in diameter and 35 cm in depth) that was constructed in the fill of a possible pit structure (Feature 3) and was located only 40 cm west of another roasting pit, Feature 18. Portions of the feature were missing as a result of tree-root damage. Archaeologists recovered 15 ceramic sherds, 1 grooved abrader, 1 trough mano, and a few pieces of flaked stone debitage. All but 1 of the sherds was Alameda Brown Ware: 11 Tuzigoot Brown, 2 Verde Brown, and 1 Kinnikinnick Brown; the other sherd was unidentified buff ware. The other sherd was an unidentifiable buff ware.

Feature 18 was a partially lined roasting pit (70 by 80 cm and 46 cm in depth) with noncontiguous, upright sandstone slabs and basalt cobbles. The feature was considerably damaged when it was bisected by exploratory backhoe trenches. As with nearby roasting-pit Feature 16, Feature 18 was constructed above and into the possible pit feature (Feature 3). The roasting pit was trash filled, however, and contained charcoal, ash, and artifacts. Among the artifacts were a trough metate, an abrader, a mortar, numerous debitage flakes, and 30 Alameda Brown Ware sherds: 20 Tuzigoot Brown, 2 Verde Brown, 1 Beaver Creek Brown, 2 Diablo Brown, 3 Angell Brown, and 2 indeterminate Alameda Brown Ware.

Logan and Horton (2000:84) inferred that at least two of the roasting-pit features, Features 8 and 10, were used post–A.D. 1300 by a protohistoric period group who deposited the late-occurring ceramic types, such as Tizon Wiped, Cerbat Brown, and "Yavapai Plain Ware." Elsewhere on the site, Phagan (2000:65) identified nine Desert Side-notched projectile points fashioned from Government Mountain obsidian—a type considered diagnostic for Yavapai occupation. Thus, the radiocarbon dates, the ceramic types, and the projectile point forms associated with Pai technology, as well as the characteristically nondiagnostic ground stone collection, represent evidence for a protohistoric period occupation by Yavapai groups at this site.

Red Rock State Park Scorpion Pit (AZ O:1:20 [ASM]) and Cross Creek Bridge (AZ O:1:39 [ASM])

Weaver (2000:100) described the Scorpion Pit site (AZ O:1:20 [ASM]) as a dense flaked and ground stone scatter with a small, round, shallow, basin-shaped roasting pit (1.3 m in diameter and a maximum depth of 35 cm) containing FCR. Although the thermal feature could not be dated and no sherds were recovered, the presence of a single Desert Side-notched "Pai" projectile point, three small late Sinagua-style points, and a considerable number of stone tools suggested to Weaver that the site was a campsite occupied by Yavapai during the protohistoric or early historical period.

Weaver (2000:147) described the Cross Creek Bridge site (AZ O:1:39 [ASM]) as a repeatedly used campsite occupied from at least the Late Archaic period. Subsurface testing revealed the presence of four roasting pits, a hearth, two firepits, two artifact clusters, and at least four occupation surfaces. Weaver reported that a radiocarbon date on charcoal from one of the features (Beta-35501) (unspecified provenience) (Weaver 2000:Table 42 [Site 39]) returned an assay of 340 ± 110 B.P. He reported it as equivalent to A.D. 1610 ± 110 or a range of 1500–1720 and suggested that Yavapai reoccupied the campsite during the protohistoric or early historical period. We recalibrated this radiocarbon age with Calib 5.0.1 and derived 2σ ranges of A.D. 1400–1698, 1723–1816, and 1834–1878, with the greatest likelihood that the true age of the sample was the 1400–1698 interval. Because the provenience of this sample was not documented, this date is unreliable.

Dry Creek Sites: AR-03-04-06-72 (CNF) and AR-03-04-06-194 (CNF)

Archaeologists from Kinlani Archaeology tested two sites on CNF land scheduled for road improvements (Dosh 2003). The purpose of the work was to assess potential impacts to the sites and to evaluate NRHP eligibility. The two previously recorded sites were adjacent to each other on the first terrace above Dry Creek, north of Sedona. Both demonstrated a pattern of long-term land use. AR-03-04-06-72 (CNF) was a large, dispersed artifact scatter with features that included two possible pit structures, a possible trash midden, three roasting pits, and several agricultural terraces and rock clusters. AR-03-04-06-194 (CNF) was an artifact scatter with a roasting pit, an agricultural terrace or check dam, rock clusters, and an artifact concentration.

Kinlani archaeologists mapped, surface collected, and explored the subsurface of each site with backhoe trenches and hand-excavation units. Twenty-nine possible features were identified at the larger, northern AR-03-04-06-72 (CNF), and 5 were identified at the smaller, southern AR-03-04-06-194 (CNF). The majority of these features were tested, and several produced samples for radiocarbon assay. Of particular interest here are the radiocarbon-dated features, which included 4 late-dating roasting pits. Archaeologists collected radiometric, thermoluminescence, flotation, and pollen samples from each feature, but only the radiometric and flotation samples were processed.

Three roasting pits were excavated at AR-03-04-06-72 (CNF). Feature 1A was a shallow roasting pit on the edge of a large, mounded roasting-pit complex (containing at least five pits and piles of pit discards) in which Feature 1B was located. Flotation analysis revealed that juniper/cypress and piñon were used as fuelwood in both features and that charred seeds of a cheno-am-family plant were present. Analysis of charcoal collected from Feature 1A (Beta-171335) resulted in a conventional radiocarbon age of 910 ± 60 B.P., calibrated to a 2σ probability range of A.D. 1005–1255. Analysis of charcoal from Feature 1B (Beta-171338) resulted in a conventional radiocarbon age of 510 ± 60 B.P., calibrated to a 2σ probability range of A.D. 1310–1470. Feature 6 was a small, slab-lined roasting pit (ca. 0.7 m in diameter and 45 cm in depth) discovered in a test trench and partially destroyed by the trench. It contained dark soil, fire-cracked sandstone and basalt, and artifactual material. Archaeologists submitted samples for radiocarbon and flotation analyses. Although the flotation analysis did not reveal charred seeds, a standard radiocarbon assay on charcoal from Feature 6 (Beta-171337) returned a radiocarbon age of 740 ± 80 B.P., calibrated with a 2σ probability range of A.D. 1160–1400.

A single roasting-pit feature was excavated at AR-03-04-06-194 (CNF). Feature 4 appeared on the surface as a cluster of FCR. Excavation revealed a small pit containing charcoal, ceramics, and flaked stone. The ceramic types included Tuzigoot Plain, Tuzigoot Smudged, Verde Red, and Verde Brown. The radiocarbon sample submitted for Feature 4 (Beta-171339) returned a radiocarbon age of 260 ± 60 B.P., calibrated to 2σ probability ranges of A.D. 1480–1685 and 1735–1810.

Dosh (2003:131) recommended that the sites had sufficient integrity and information potential to be eligible for listing in the NRHP. Two of the most important findings that emerged from this testing program were that roasting pits were used during the Honanki and Tuzigoot phases and that some features were created or reused by protohistoric period Yavapai.