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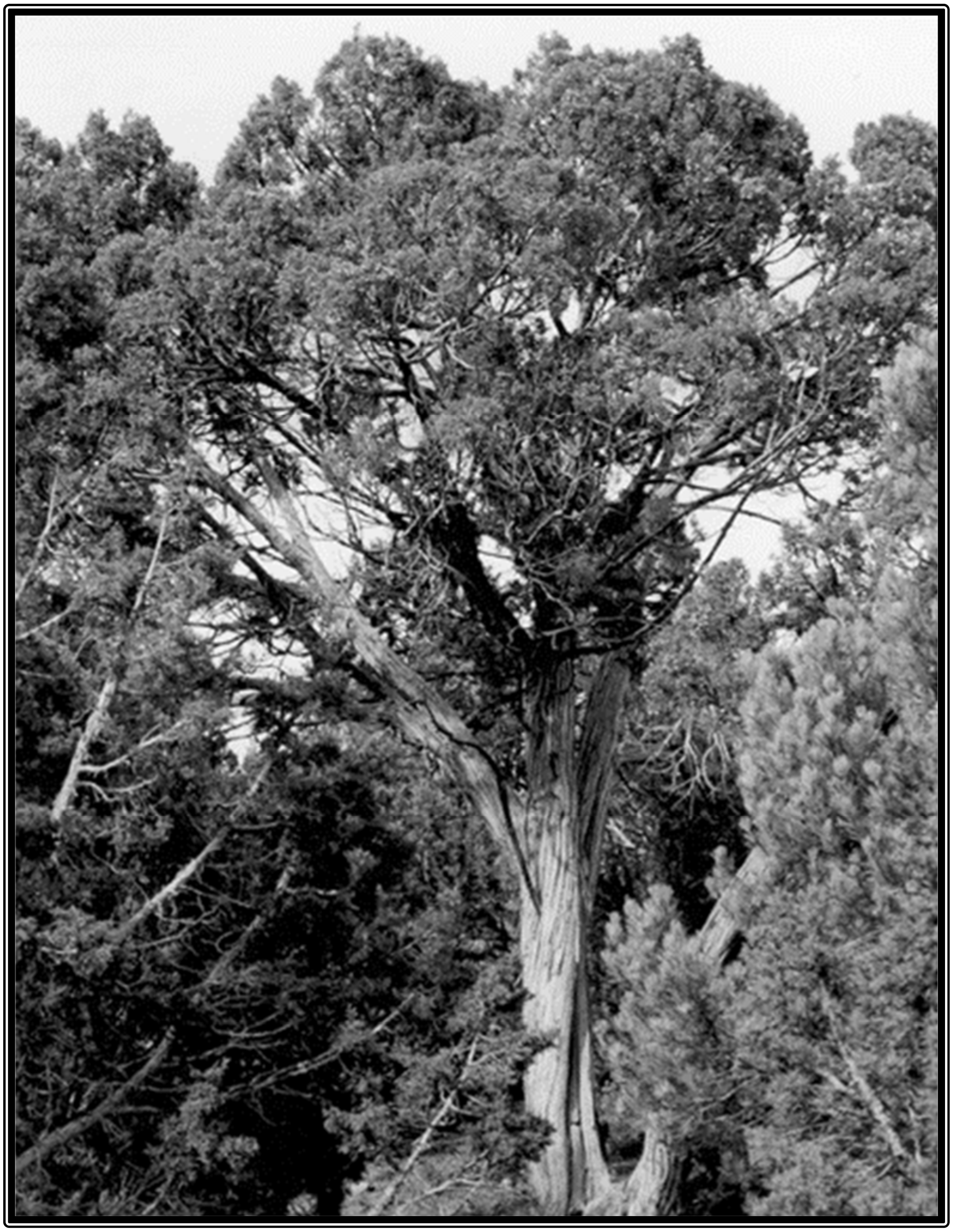

NEVADA ARCHAEOLOGICAL ASSOCIATION

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Nevada Archaeological Association

The design for the NAA logo was adapted by Robert Elston from a Garfield Flat petroglyph.

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Inquiries and general correspondence with the NAA should be directed to:

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Code of Ethics

The purpose of the NAA is to preserve Nevada's antiquities, encourage the study of archaeology, and to educate the public to the aims of archaeological research. Members and chapters of the NAA shall:

1. Uphold the purpose and intent of the NAA.
2. Adhere to all antiquities laws.
3. Seek the advice, consent, and assistance of professionals in archaeology and/or history in dealing with artifacts, sites, and other materials relating to antiquities.
4. Assist professionals and educators in accomplishing the objectives of the NAA.
5. Be a personal envoy of the NAA and responsible for conducting themselves in a manner so as to protect the integrity of artifacts, sites, or other materials.

Cover: Bow stave tree at 26WP5373. Growth arrestment notch visible near the base of the trunk.

Table of Contents

Editor's Corner

A. Craig Hauer

Welcome to the latest edition of the Nevada Archaeologist. This will be the first journal under my editorship, and my hat goes off to Geoff Smith for doing this for the last three years! This journal is a collaborative effort between the authors, reviewers, and editor. While this journal is a little late, (sorry about that and it will not happen again,) I feel it matches previous volumes in the quality and diversity of articles. In this issue, we are modifying the format of the journal. We are continuing the Peer Review Process, but also accepting non-peer reviewed contributions. Peer reviewed and non-peer reviewed contributions are presented in separate sections. Articles are peer reviewed and reports are non-peer reviewed. The reason for this change is to continue the tradition of co-mingling professional, academic, and advocationalists, a belief that is fully supported by the NAA board. This volume also contains color figures. These costs were absorbed by the authors, and it is not anticipated to be a regular occurrence.

This issue again illustrates the diversity of Nevada's archaeological record and the NAA's membership. Within this volume authors represent the private sector, academia, and avocationalists. Two articles and two reports are presented in this volume. James Bunch, Linda Scott Cummings, Peter Kováčik, and Patricia DeBunch expand on work they completed in 1999. The authors review results of initial investigations and present new chronometric and macrobotanical data on the Ash Springs Site in the Pahranagat Valley.

Continuing the theme of revisiting past research, I authored an article built on a presentation I co-authored at the NNA conference in 2003. In it, I describe a bow stave tree I located in White Pine County and present a probability model for bow stave trees in White Pine County.

Our two reports diverge from the theme of revisiting past research. Amanda Rankin presents data from her thesis research at University of Nevada, Reno. In this report, she describes her initial findings for starch residue analysis on groundstone artifacts from high altitude village sites in eastern California and Wyoming. Finally, Paul Scott reflects on his recent visit to Serpent Rock near Walker Lake.

I hope you enjoy this year's journal, and I would like to encourage you to submit an article or report to the journal. I would also like to thank the authors, reviewers, and board for their help in completing this year's journal. Have a great 2016!

ACH
March, 2015
Boise, Idaho

Articles

The Ash Springs Site 26LN2978: New Data from 14C and Macrofloral Analysis

James Bunch
Eetza Research Associates

Linda Scott Cummings
PaleoResearch Institute Inc.

Peter Kováčik,
PaleoResearch Institute Inc.

Patricia DeBunch,
Eetza Research Associates

In 1999, the Cultural Resources Section of the Nevada Department of Transportation (NDOT) received notification that 26LN2978, the Ash Spring site located in the northern portion of Pahranagat Valley in Lincoln County, Nevada may had been disturbed by expansion of an adjacent material pit. Archeologists James Bunch and Steve Stearns were sent to assess the site at the request of Mark Henderson, Bureau of Land Management (BLM) Ely District Office Archaeologist. Because the size and the boundaries of 26LN2978 were unknown, the material pit expansion could have impacted a portion of the site thus test probing was initiated. Our testing revealed that the Ash Springs site was larger and more complex than originally recorded, and during the subsequent testing, a Fremont component was also discovered. Our effort to continue research of some significant sites in Nevada led to the formation of Eetza Research Associates after 30-plus years of state service for NDOT. Thus, in 2014 the archaeological data for this site was revised resulting in this article.

Euroamericans have historically adapted Lincoln County landscapes to suit the changing land use requirements; so they are constantly jeopardizing irreplaceable and fragile cultural resources. Archaeological sites in this region are also further impacted by significant natural environmental conditions. Particularly troubling to archaeologists is the loss of Formative/Fremont sites, which remain an enigma in this region.

The Fremont Culture, and to a minor extent other Formative groups (mostly Anasazi), are now gaining the attention of researchers working in eastern Nevada. In 1931

Noel Morss first documented the Fremont based on unique traits that he described from sites in the Fremont River region in south-central Utah. Initially, Fremont ceramics were attributed to trade or as left behind by excursions of small, Utah-based Fremont groups during logistical forays into present day Nevada. In eastern Nevada, surveys conducted by the Desert Research Institute (DRI) (Fowler et al. 1973) and others (Brooks et al. 1977; Elston and Juell 1987; White, Blair and Murphy 1997) identified more complex Fremont sites and redefined the western Fremont boundary. Evidence of Formative period occupation is meager in eastern Nevada with a sprinkle of ceramics indicating its existence. Excavations at O'Malley and Conaway Shelters (Fowler et al. 1973) provided additional verification of intensive Fremont occupations in Nevada. Cole (2012), while working on his dissertation area in upper Meadow Valley Wash, excavated a site that indicated long term Fremont occupation at 26LN4300, the "Sand Dune Site." Excavations at 26LN4300 exposed a collapsed and burned Fremont structure (Henderson 2000, 2001, 2005). A large structure containing timbers, pottery (Brownware and Snake Valley Graywares), Rosegate points, bifaces, large bone, maize cob fragments (dated at 1,000-1060 A. D.) and milling gear were excavated; however no prepared floors were found as the site sits on a sandy alluvial fan. Most recently, Far Western (Byerly and Duke 2011) surveyed selected parcels in Meadow Valley Wash (near Panaca, Nevada) and Pahranagat Valley recording open campsites associated with hunting incursions during the Fremont Period that contained Fremont pottery. However, no firm evidence of Fremont occupation has yet been found in Pahranagat Valley.

A review of the ethnographic literature in Isabel Kelly's field notes (Catherine Fowler personal communication 2014) stated that the vicinity of Pahranagat Valley was occupied by the Pahranagat Band of the Southern Paiute who settled around well-watered areas like Pahranagat Valley. The Panaca Southern Paiute Band in Meadow Valley Wash based their subsistence economy on the exploitation of specific resources that may have included a locally made pottery as evidenced at 26LN2969 the "Pioche Site", 26LN1775 Panaca Summit and 26WP647 Cave Lake Rockshelter (Dean 1985, 1987a, 1987b). Euler (1966) stated that prior to the historic period, corn and squash were cultivated. A Dent variety of corn from Etna Cave and Stine Canyon Shelter 26LN402 (Fowler et al. 1973) suggests that local residents practiced horticulture; however, sites further west lack similar evidence.

Madsen and Simms defined the Fremont as "a mixed group of sedentary farmers, forager-farmers and fulltime foragers" (Madsen and Simms1998). Fremont populations were far larger than hunter-gatherers and individual family or groups who moved about in networks that Simms calls "*dispersed communities*" (Simms 2010). Recent arguments contend that the Fremont invested more time as horticulturalists than in foraging (Janetski et al. 2000). Fremont adobe (jacal) houses may have a depression/tunnel around the perimeter assisted by a deflector, to direct air. Tucked away in the houses, there may be flaked lithic tools. After abandonment, perishables and the wood and brush structural elements may burn or collapse and the postholes that once held the structure would gradually fill with sediment, eventually leaving a subtle circular depression.

DESCRIPTION

Our paper presents new data from further analyses of the Ash Springs site (26LN2978), where as many as 10 shallow *pithouse* depressions were identified. The Ash Springs site is located in a lower alluvial fan in the northern portion of Pahranagat Valley on the western flanks of the Hiko Range (Figure 1). The site was originally described as a "small semicircle of rocks piles, two depressions, two rock features, metate, 20 CCS waste flakes in association with the blind area" and was first recorded almost 30 years ago by NDOT archaeologists while conducting a Class III survey of a material/borrow pit source. Following NDOT's policy, the site area was placed under avoidance. In 1999 possible encroachment from expansion of the adjacent material pit necessitated a review of the site's avoidance area. In light of possible compromise to the site's integrity, NDOT conducted the reexamination. At the request of Mark Henderson, BLM Ely District Office Archaeologist, probing of the site was initiated. Reassessment of this site provided the first empirical evidence for possible prolonged Formative settlement or possible incursion of a "dispersed community" (Simms 2010) in southeastern Nevada. The site was found to be more extensive than originally documented. Many shallow depressions containing ceramics, groundstone, lithics, and unique artifacts were encountered in the area of the 1986 recording, which led to additional investigation and data collection (Stearns 2002, 2009b; Stearns and Bunch 2004, 2006, 2008). During the 1999 test excavation a feature labeled House Pit 1 (HP1) (Figure 2) was exposed. Excavations revealed 2-4 cm of melted daub clay indicating prepared floors and walls, hearths, a metate/deflector, and pottery (Brownware, Moapa Grayware, Snake Valley Grayware, and a locally made pottery).

The data from the 1999 probes indicated 26LN2978 offered good site potential for presence of a *Fremont-occupation*. Since its National Register of Historical Places (NRHP) determination had not been addressed, further information was needed for a complete assessment of the site's NRHP eligibility. In 2004, Mr. Henderson requested further testing on a feature adjacent to HP1. This test probing led to the discovery of a second pithouse feature labeled HP2, similar to HP1. Evidence of prepared laminated clay floors and postholes clustered in groups of three were found, pointing to the probability of superimposed house structures (Figure 3), which is similar to Parowan Fremont Period pithouses (e.g., Garrison, Paragonah sites, Baker and Median Villages). The actual size of both features HP1 and HP2, their configuration, associated artifacts and internal features are unknown elements since only a small portion of each house feature was uncovered. Without doubt, these elements may provide further data of settlement and subsistence patterns. Short-term camp structures, if present, tend to be simple and comprised of fire hearths with stone tools reflecting specific procurement activities (Leavitt 2003). The labor invested in preparing floors comprising postholes from the Ash Springs site

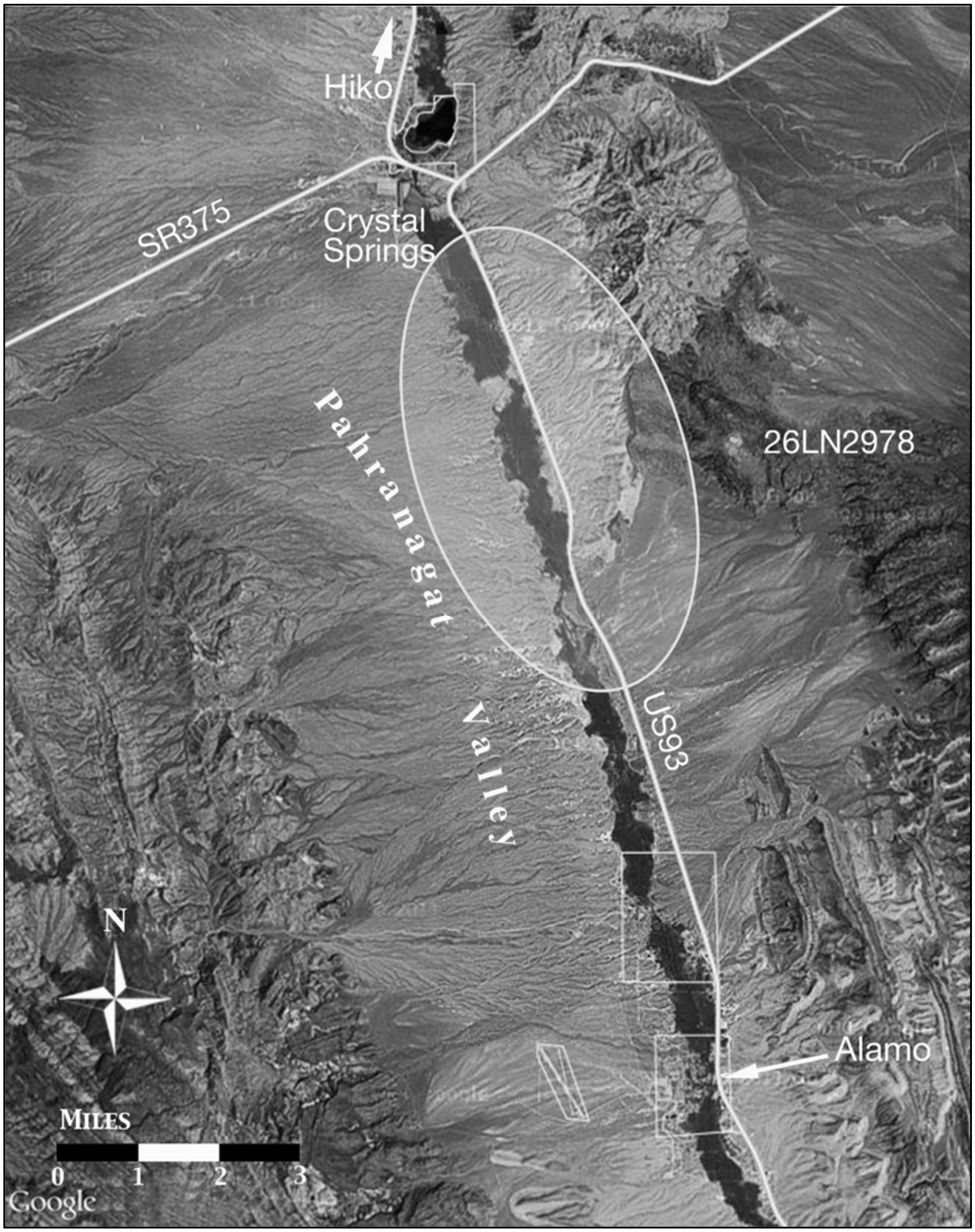

Figure 1. 26LN2978, the Ash Spring Site Location.

may suggest association with the Formative Period.

RECOVERED ARTIFACTS

Lithics

The lithic assemblage from the Ash Spring site is dominated by a great number of secondary and tertiary debitage suggesting late stage tool production and maintenance. Primary flakes and cores are rare. Unfortunately, a small workshop located in the right-of-way was destroyed by a fiber optic project. This feature could have provided more information regarding tool manufacture. Specialty tools such as utilized flakes, scrapers and perforator tips in the assemblage may suggest hide processing. A total of four small projectile points were recovered and classified as Cottonwood type series, however a literature review of point typology (Jennings and Sammons-Lohse 1981; Woods 2008) suggests these points are similar to Bull Creek types commonly associated with Fremont sites from Parowan Valley and south-central Utah (Figure 4), which could support why they are associated with the prepared clay floors.

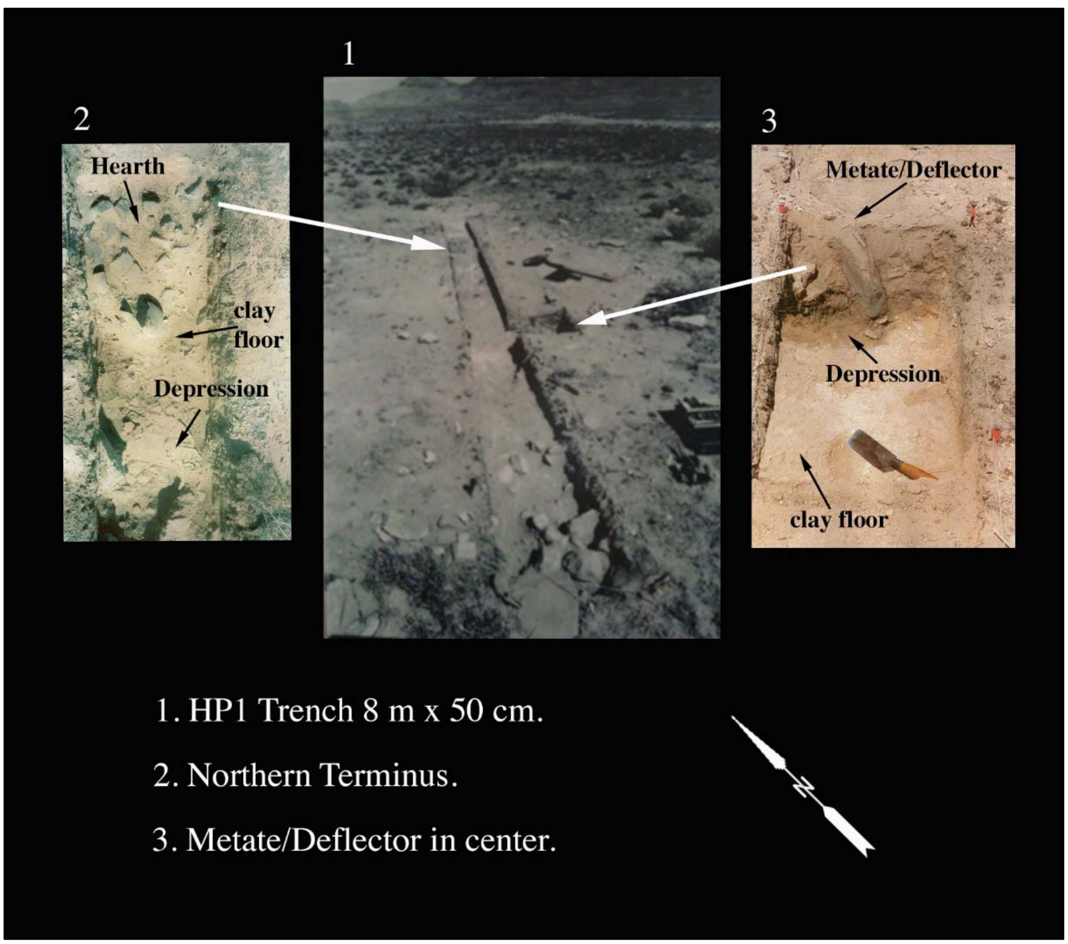

Figure 2. House Pit 1 (HP1) from 1999 Test Probing. Photos by James Bunch.

Ceramics

Pottery associated with the "pithouses" included Brownware, Moapa Grayware, Snake Valley Grayware and a locally made grayware. A total of 269 sherds were recovered (95 percent from HP1 and 5 percent from HP2). Margaret Lyneis first examined some of the sherds from HP1, concluding there were *Fremont-like* sherds in the assemblage. Greg Seymour also inspected the collection, and reported that most of the sherds were Numic. Patricia Dean, researcher from Idaho State University, conducted petrographic thin-section analyses on a few sherds from 26LN2978 (Ash Spring) and 26LN1775 (Panaca Summit). Her findings revealed a locally made grayware that she termed "Pioche Gray."

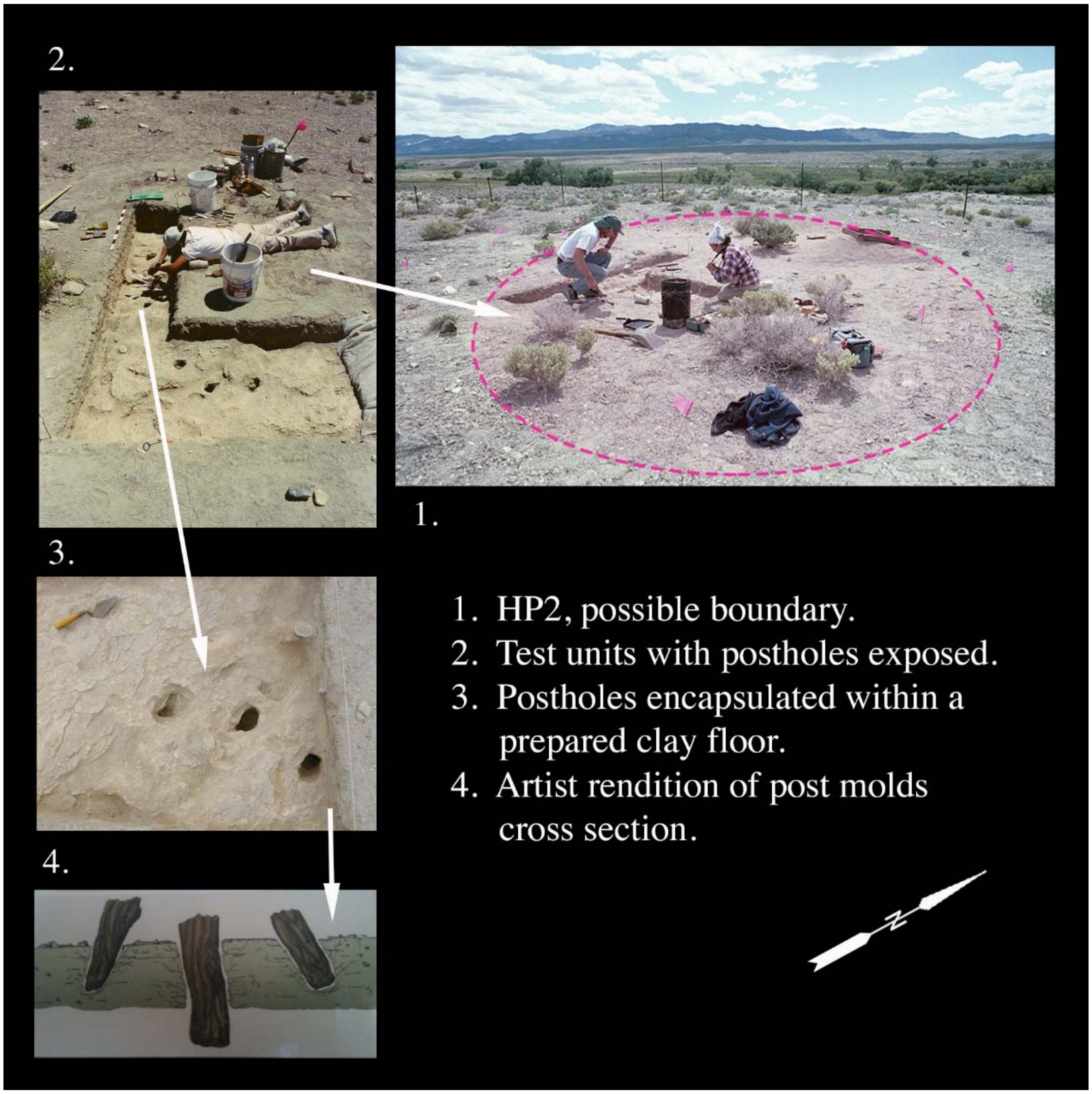

Figure 3. House Pit 2 (HP2) from 2004 Test Probing. Photos 1-2 by James Bunch. Photo 3 by Patricia DeBunch. Artist Rendition by Steve Stearns.

Unlike Snake-Valley Grayware, 65 percent of the "Pioche Gray" sherd is comprised of a non-micaceous clay utilizing basalt and tuff as temper, which is consistent with the geology of the area. In the pottery assemblage, two sherds are decorated with fingernail impressions, and two other sherds have ground/smoothed edges. Diane Winslow (personal communication 2005), former Harry Reid Center for Environmental Sciences-University of Nevada-Las Vegas archaeologist as well as Wilde and Soper (1999:116) have suggested that sherds with rounded or ground edges could have been used as tools to smooth pottery during manufacture (Figure 5) conceivably supporting the claim of a locally made pottery.

Figure 4. Projectile Points. Photos by Patricia DeBunch.

This is further supported by ethnographic accounts from Bill and Maud China, Pahranagat Valley informants for Kelly (1933) (Catherine Fowler personal communication 2014). Winslow also suggested these sherds could have been used as a "chalk" to sketch a design to produce rock art motifs. The nearest rock art, however, is located about three miles from this site.

Groundstone

The artifact assemblage for 26LN2978 contained a small number of heavily used groundstone fragments in addition to a complete metate later utilized as a deflector found in the interior of HP1. Heavily used groundstone on sites often suggests lengthy habitation.

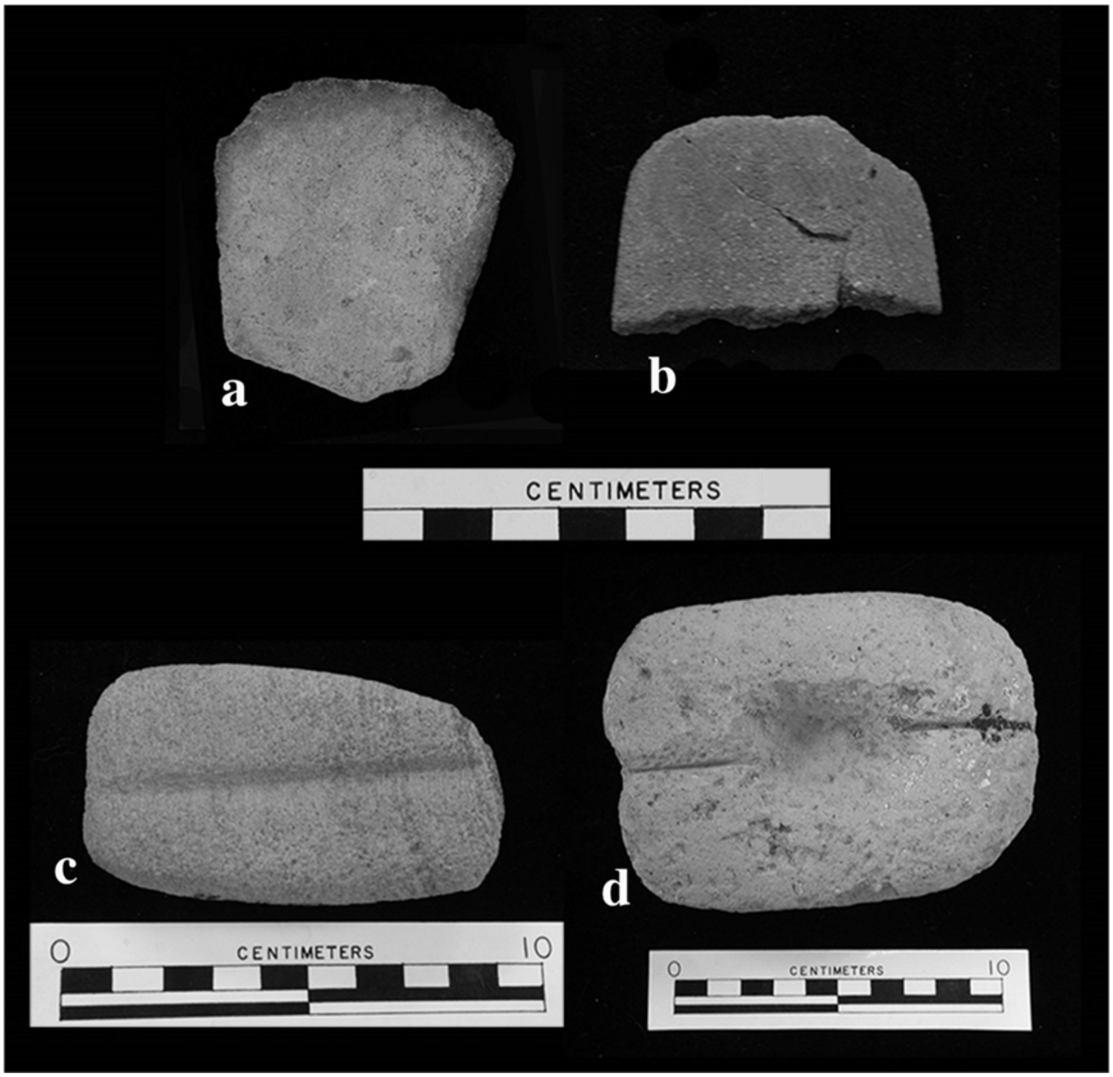

Figure 5. Ceramics and Groundstone: a-b) Potsherds Used as Possible Scraping Tools for Manufacture of Locally Made Pottery; c) Abrader; d) Paint Pot/Mano/Sinker Multi-Use Artifact. Photos by Patricia DeBunch.

Nearby sites such as 26LN214/26LN234 and 26LN216 also contain good examples of heavily used groundstone (Bunch et al. 2015).

Unique artifacts

Two unique artifacts recovered from HP1 are an abrader (Figure 5c) and a "paint pot/mano/sinker" identified by the late Don Tuohy (1999). This multi-use flattened cobble "paint pot/mano/sinker" (Figure 5d) has a depression on each face, which is dissected by a longitudinal notched groove that carries from end to end. The two grooves join at one end to form a notch and one of the depressions may have contained reddish pigment.

This artifact was most likely a mano before it was modified. The abrader also has a long groove over its flat side that extends along the tool's long axis. A few red ochre fragments were also found in the fill of this feature.

The faunal remains were principally, small bone fragments (c. f. rodent), however one unit yielded a large mammal bone (c. f. artiodactyl).

RADIOCARBON AND THERMOLUMINESCENCE DATES

After completion of the test probes in 1999, charcoal from HP1 and HP2 was sent to Beta Analytic for ^{14}C dating. The samples, however, were contaminated by atmospheric "bomb carbon" (in the 1950s) from the Nevada Test Site located 50-miles west of Ash Springs (Beta Correspondence 1999) and failed to provide reliable ^{14}C dates. This unforeseen problem prompted an alternative dating method. Thermoluminescence (TL) dating has successfully provided absolute dates on ceramics. Two sherds were submitted to James Feathers at the Thermoluminescence Laboratory, University of Washington. The dates from HP1 yielded a date of A.D. 531 +/-109 (sample #UW1146) with an optically stimulated luminescence (OSL) date of A.D. 1444 +/-104 (discrepancy from the two dates is attributed to low Infrared Stimulated Luminescence values from feldspar). Dates from HP2 yielded A.D. 1646 +/-139 (sample #UW1147), suggesting occupation of this site during the latter part of the Late-Archaic Period.

MACROFLORAL ANALYSIS (2006)

An ashy bulk sample from a hearth located inside HP2 was bagged for flotation. Flotation of this 7-liter bulk sediment sample yielded a 1-liter subsample after elutration (processed at the NDOT facility in Carson City). The dried fractions recovered from the flotation were sent to Jeanne Schaaf in 2006 for study and analysis. Her preliminary macrofloral analysis revealed more than 300 charred wild seeds and numerous plant fragments conservatively representing 10 tentative genera that suggested late summer/fall occupation near a wetland or marsh. Schaaf strongly recommended further work to confirm the preliminary identifications and to identify other unidentified seeds and plant parts.

NEW MACROFLORAL AND RADIOCARBON RESULTS (2015)

NDOT's preliminary report concluded that the macrofloral assemblage from theAsh Springs site (26LN2978) required additional analysis utilizing a more comprehensive comparative collection. In 2014, the collection of identified seeds and one small sample of unsorted light fractions was submitted to PaleoResearch Institute (PRI) for further analysis. The abundance of charred grass seeds provided an organic radiocarbon sample from feature fill without sacrificing the rarer seed types. PRI's report (Kováčik and Cummings 2015) concluded that Sample HP2, collected from the floor of House Pit 2, contained an abundance of charred seeds and charcoal.

Charcoal identification indicates use of locally available saltbush/winterfat (*Atriplex/ Krascheninnikovia*) wood and possibly other hardwood used as fuel. Grass (Poaceae A and C) caryopses (Figure 6: a-b) and grass rachises were the most common charred remains present, followed by bulrush (*Schoenoplectus*, formerly *Scirpus*-type) seeds (Figure 6c) and seed endosperms. Grasses with large (Figure 6a) and small-sized caryopses (Figure 6b) and bulrush seeds may reflect parching in House Pit 2. It is also possible that whole plants with seeds still attached were used as tinder. The few charred Solanaceae seed fragments suggest processing tomatillo/ground cherry (*Physalis*) or nightshade (*Solanum*). Charred *Juncus* seeds (Figure 6d), *Artemisia* seeds, and charred Amaranthaceae perisperms, including *Chenopodium* seeds, reflect use of rush, saltbush, and goosefoot by the site occupants. Although *Primulaceae* seeds found in this sample are charred, charring does not necessarily indicate their economic value. Most likely, seeds from a plant in the primrose family were accidentally collected with

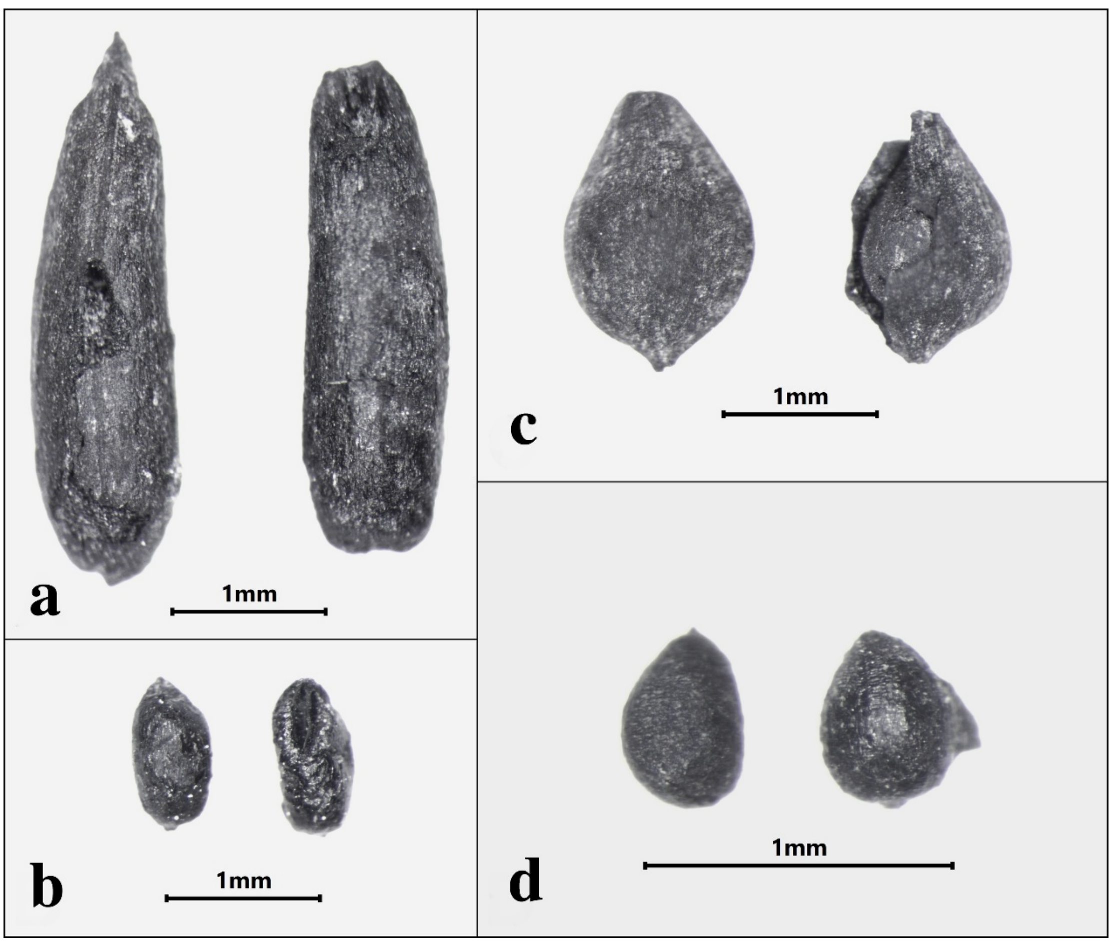

Figure 6. Photomicrographs of Selected Charred Plant Remains: a) Grass with Large-Sized Caryopses; b) Grass With Small-Sized Caryopses; c) Bulrush Seeds; and d) Rush seeds. Photomicrographs by Peter Kováčik.

seeds from other aquatic plants, such as bulrush or rush. They might have been discarded in the fire or lost accidentally along with the grass and bulrush seeds that were being processed.

Two separate dates on large Poaceae caryopses (Figure 6a) recovered from HP2 yielded ranges of A.D. 1680–1740 (PRI-14-123-HP2. A) and A.D. 1690–1730 (PRI-14-123-HP2. B), providing an accurate date of occupation for this structure. Neither of these dates produced a signature or date associated with contamination by "bomb carbon." Although both dates have additional calibrated ranges, those portions of the range fall within the historic era. If, this site was extant at that time, it likely would have been mentioned in historic documents. The Dominguez-Escalante expedition during A.D. 1776-77 observed Ute and Southern Paiute Lifeways but they were not near Pahranagat Valley. Government expeditions (Wheeler 1869:53) described the thermal springs in Crystal and Ash Springs. Martineau (1992:67) recounted a confrontation between Southern Paiutes and Euroamericans in Pahranagat Valley sometime between 1860 and 1870. In addition, plants introduced into the American Southwest should have been present in the macrofloral record. Their absence and recovery of evidence of a traditional prehistoric diet also lends support to the acceptance of this portion of the calibrated age range for occupation of HP2.

Factors that probably contributed to the issue of charred samples returning radiocarbon dates that are "too young" are centered on nuclear testing in the Nevada desert. The best remediation includes methods that remove all contamination, even at the cellular level (bacteria and fungi). This involves wet oxidation using either nitric or chromic acid after completion of the standard acid-base-acid (ABA) or acid-alkali-acid chemical pretreatment. Wet oxidation offers removal of bacterial and fungal bodies that grew during the recent past, approximately 65 years, also known as the "bomb era". Removing these microscopic remains prior to radiocarbon dating is an essential part of obtaining an accurate date. Also, it is possible that selection of appropriate datable material will contribute to the success of future dates; the more dense the material, the less likelihood of severe contamination by modern or recent organisms. Therefore, whole charred seeds are a better choice than more porous charcoal; bulk sediment samples should not be dated.

Seed harvesting likely results in incidental seed collection from other plants in the stand. These additional seeds undergo processing with the intended seed crop. Table 1 shows collected seeds for sample HP2. It appears that grass (Poaceae) and bulrush (*Schoenoplectus*) seeds were the desired seeds for processing, with more than 80 percent for grasses and about 13 percent for bulrush. Presence of charred *Chenopodium* (goosefoot) seeds, represents intentional seed collection by the inhabitants. The limited quantity of goosefoot seeds suggests that goosefoot was not available in quantities as large as grasses and bulrush at the time these seeds were collected.

Table 1. Relative Quantities of Collected Seeds from the Ash Springs site (26LN2978), Lincoln County, Nevada.

Samp. No.	Identification	Collection	% in Samp.
HP2	*Amaranthaceae,* perisperm	intentional	0. 52
	Chenopodium seed	intentional	0. 72
	Juncus seed	accidental	1. 54
	Poaceae A caryop-sis	intentional	36. 15
	Poaceae C caryopsis	intentional	45. 11
	Primulaceae seed	accidental	0. 31
	Schoenoplectus-type seed	intentional	13. 29
	Schoenoplectus-type endosperm	intentional	0. 10
	Solanaceae seed	intentional/ accidental	0. 82
	Total Seeds:		100

Presence of charred rush (*Juncus*) seeds (1. 54 percent) suggests they might have been collected at the same time as bulrush (*Schoenoplectus*) since they share the same habitat and grow to similar heights. Also, rush seeds are very tiny and were not anticipated to have been targeted as a resource for collection. They are, however, also not likely to have been avoided. Seeds from members of the primrose family (0. 31 percent) also probably were accidentally included rather than having been targeted for intentional collection and, thus, represent impurities in the seed collection. It is more difficult to assess the presence of Solanaceae seeds, as nightshade (*Solanum*) or tomatillo/ground cherry (*Physalis*) fruits might have been collected intentionally or they might have been collected incidentally with other resources.

Charred and uncharred *Echinocereus* seeds suggest roasting hedgehog cactus fruits. Charred spines recovered in this sample could not be identified to genus, but they may be from roasting hedgehog cactus fruits. Results from the 2014 analysis from PRI yielded a real surprise; *maize* was processed in House Pit 2. A charred maize cupule (Figure 7a) and kernel fragment (Figure 7b) were recovered.

Ethnobotanical Review for Native Plants

Review of ethnographic and/or ethnobotanic literature provides information on recent use of plants, but is not here, and should not be interpreted to indicate that all plants were used similarly during prehistoric periods. This discussion does, however, provide information concerning plants and their uses that expands our understanding of uses of plants on the landscape, as these uses often are unfamiliar to archaeologists.

Amaranthaceae (Amaranth Family)

Recent revision to botanical taxonomy, using gene-based APG (1998) and APG II (2003) systems, subsumes Chenopodiaceae under Amaranthaceae and places *Sarcobatus* as the single genus in its own family (Sarcobataceae).

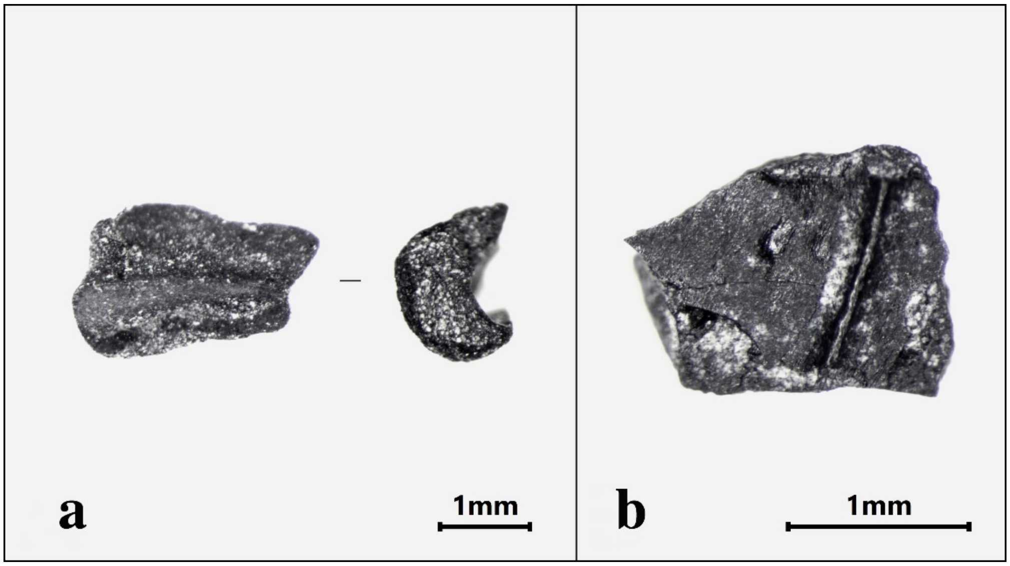

Figure 7. Charred Maize Fragments Recovered from HP2: a) Cupule; and b) Kernel. Photomicrographs by Peter Kováčik.

The term Cheno-am was widely used in pollen analysis to refer to many members of the Chenopodiaceae and the genus *Amaranthus*. With this change in family designation we report Cheno-ams under the new family designation Amaranthaceae. *Sarcobatus* is not associated with Amaranthaceae on the diagram, reflecting its new status in its own family.

Plants that produce similar pollen, termed Amaranthaceae here, include the genera *Amaranthus* (amaranth, pigweed), *Atriplex* (saltbush), *Chenopodium* (goosefoot), *Monolepis* (povertyweed), and *Suaeda* (seepweed). These plants are weedy annuals or perennials, often growing in disturbed areas such as cultivated fields and the vicinity of habitation sites. Plants in the family Amaranthaceae were used as food, both for their greens and seeds. Seeds were sometimes eaten raw but most often were parched, ground into meal, and used to make mushes and cakes. Leaves were eaten fresh or cooked as greens. The greens are most tender when young, in the spring, but may be used at any time. Various parts of Amaranthaceae plants were gathered from early spring through the fall (Harrington 1967; Kirk 1975; Sweet 1976; Tilford 1997). *Chenopodium* seeds, while they contain calories roughly equivalent to corn, provide significantly more protein and fat (Asch 1978:307 cited in Kindscher 1987:82). Young *Amaranthus* leaves contain significant amounts of protein, calcium, phosphorus, potassium, vitamin A, and vitamin C (Watt and Merrill 1963:6 cited in Kindscher 1987:22).

Chenopodium (Goosefoot)

Chenopodium includes herbaceous annuals or perennials with small, green flowers (Kearney and Peebles 1960:251). *Chenopodium* produces large quantities of seeds that are harvested in the late summer and fall. *Chenopodium* seeds were important resources for many Native groups, including the prehistoric Fremont (Madsen 1989). Rich in calcium, vitamin A and vitamin C, *Chenopodium* leaves were eaten to treat stomachaches and to prevent scurvy (Angier 1978:191-193). Leaf poultices were applied to burns, and a tea made from the whole plant was used to treat diarrhea. *C. ambrosioides* (Mexican tea, American wormseed) has been used to expel worms in animals and humans. It also has been used to season beans (Foster and Duke 1990:216; Krochmal and Krochmal 1973:66-67; Moore 1990:42). Leaves also were held in the mouth for toothaches (Sweet 1976:48). Crushed, fresh roots make a mild soap (Kirk 1975:56-57; Robinson 1979:88). *Chenopodium* is commonly found in cultivated fields, empty lots, open woods or thickets, and on stony hillsides. It is an opportunistic weed, often establishing itself rapidly in disturbed areas (Fernald 1950:592-596; Martin 1972).

***Echinocereus* (Hedgehog Cactus, Strawberry Cactus)**

Echinocereus (hedgehog cactus, strawberry cactus) is a small, cylindrical plant with juicy, edible fruits. The fruits have large spine clusters that readily detach when mature. The fruits were eaten raw after the spines were rubbed off, and are reported to taste very much like strawberries. *Echinocereus* fruits were important food resources for people throughout the Southwest. Southern Paiute ate the fruit fresh in late summer and cooked the fleshy stems. The fruit was dried and eaten by the Timbisha (Rhode 2002: 112). *Echinocereus* can be found from Utah to California and northern Mexico. *Echinocereus* plants flower from February to May, depending on the species and elevation (Kearney and Peebles 1960:570-571; Krochmal and Krochmal 1973:92; McDougall 1973:320; Shields 1984:92).

***Juncus* (Rush)**

Juncus (rush) leaves and stems were used primarily as wrapping, warp, woof or weft, and foundation material for making baskets. The stems were dried, then split three or four ways and soaked in water to make them pliable. Fresh shoots also were eaten raw. The Washoe are noted to have eaten the sweet-tasting pith of rush stems. *Juncus* most often is found in moist or wet areas (Barrows 1900: 42; Hedges and Beresford 1986: 9; Hickman 1993: 1157-1165; James 1901; Mead 1972: 109-111; Price 1980: 47).

***Poaceae* (Grass Family)**

Poaceae is a large and diverse family containing many economically important grasses. Grasses are widely distributed throughout many different climates and biome and provide fodder for wild game animals. Caryopses (seeds) of some wild grasses, such as *Achnatherum* (ricegrass), *Agropyron* (wheatgrass), *Agrostis* (bentgrass), *Bromus* (brome grass), *Elymus* (ryegrass), *Festuca* (fescue), *Hordeum* (wild barley), *Muhlenbergia* (muhly grass), *Poa* (bluegrass), *Sporobolus* (dropseed), and *Stipa* (needlegrass) have been used extensively for food. Grass grains were normally parched and ground into meal to make mushes and cakes. Several species of grass contain hairs (awns) that were singed off by exposing the seeds to flame. Roots were eaten raw, roasted, or dried and ground into a flour. Utilitarian uses for grass include as a floor covering, tinder, basketry material, and to make brushes and brooms. Grass seeds ripen from spring to fall, depending on the species, providing a long-term available resource (Chamberlin 1964:372; Harrington 1967:322; Kirk 1975:177-190; Rogers 1980:32-40).

***Eragrostis* (Lovegrass)**

Eragrostis (lovegrass) is an annual or perennial grass found throughout the United States. Lovegrass produces an edible seed that has been used as a food source for many Native American groups. The seeds were parched and ground and the flour eaten dry or cooked into mush. Lovegrass grows in a variety of conditions but favors open ground and waste places up to 7,000 feet (Kearney and Peebles 1960:85-87; Moerman 1998:217).

***Primulaceae* (Primrose Family)**

Several members of the Primulaceae (Primrose family) are found in the Great Basin, and most are indicative of moist sites such as meadows and streambanks. *Glaux maritima* (sea milkwort) and *Samolus valerandi* (seaside brookweed), the only members of the family documented in the project area, prefer salt marshes and moist sites at elevations under 1,300 meters (Hickman 1993: 908-909; USDA Natural Resources Conservation Service 2014). *Glaux maritima* is the only member of its genus native to North America, and its boiled roots were eaten by the Kwakiutl in British Columbia for food or to make one sleepy (Moerman 1998: 248; USDA Natural Resources Conservation Service 2014). Anagallis (pimpernel), another member of the Primulaceae, was documented as a drug to treat gonorrhea (Moerman 1998: 71).

Schoenoplectus (*Bulrush formerly *Scirpus)

Schoenoplectus (bulrush, tule) are mostly perennial herbs with hollow or pithy, triangular or circular stems. These were used extensively by native groups. Young shoots were gathered in the spring and eaten raw or cooked. Mature stems were woven into mats and baskets. Pollen was collected and mixed with other meal to make breads, mush, and cakes. Seeds were parched and ground into flour. The starchy roots of all species of *Schoenoplectus* are edible, although some are more palatable than others. Roots were eaten raw, roasted, or dried and ground into flour. Young rootstalks were crushed and boiled to make sweet syrup. *S. validus* roots are reported to contain as much as eight percent sugar and just over five percent starch. Bulrushes are found in wet ground and on pond, swamp, and lake edges throughout the West (Kirk 1975:175-176; Peterson 1977:230).

***Solanaceae* (Nightshade Family)**

Members of the Solanaceae (nightshade family) are herbaceous or shrubby plants with alternate leaves and a berry or capsule fruit. Plants in this family produce various alkaloids, chemical compounds that make some Solanaceae poisonous and others valuable for their medicinal properties and unique taste. Economic species include food crops such as tomatoes (*Solanum lycopersicum*), peppers (*Capsicum*), and potatoes (*Solanum*). Drug plants of the family include tobacco (Nicotiana) and jimson-weed (Datura), both of which have wild representatives in the region (Hickey and King 1981; Zomlefer

1994:213-215). Local members of the Solanaceae family, including *Physalis* (tomatillo, ground cherry), *Lycium* (wolfberry), and *Solanum* (nightshade), were exploited for food.

Physalis (groundcherry/tomatillo) was domesticated in Mexico and naturalized in eastern North America. Berries were eaten both raw and cooked. Berries taste best when fully ripe and can be made into preserves and pies, and boiled berries are frequently used in sauces such as chile verde. Some species are commercially grown for their berries, while others are common weeds of cultivated lands. Ground cherries are annual or perennial herbs found in moist to medium dry, open ground (Kearney and Peebles 1960:753-754; Kirk 1975). The berries and roots of *Solanum* also are edible (Robbins, et al. 1916:59, 70-73; Stevenson 1915:70). *Lycium's* (wolfberry) red fruit is edible and available in the spring. The fruit was palatable fresh, but also could be dried and stored, mashed and soaked in water, boiled into a soup, or otherwise cooked. The berries also were made into a beverage. This versatile berry appears to have been used by a number of native groups in North America (Elmore 1978:74; Kelly 1976:43; Spier 1930:59).

Cultigens

Zea mays (maize, corn) has been an important New World cultigen, originating from a wild grass (teosinte). Heiser (1990:89) notes that at the time of European contact:

> maize was the most widely grown plant in the Americas, extending from southern Canada to southern South America, growing at sea level in some places and at elevations higher than eleven thousand feet in others.

Maize shows great variability in kernel color, size, and shape; in ear size and shape; and in maturation time. Five types of maize exist, characterized by a different endosperm composition. Pop and flint corn have a hard starch and a high protein content. Flour corn has a soft starch and little protein. Dent corn has a localized deposit of soft starch on top of a hard starch that leaves a depression or dent in the top of the dried kernels. Sweet corn stores more sugar than starch (McGee 1984:241).

Innumerable ways of preparing maize exist. Green corn was eaten raw or boiled. Mature ears were eaten roasted or wrapped in cornhusks and boiled. The kernels were popped, parched, boiled, or ground and made into meal. Kernels also were soaked in water containing *Juniperus* (juniper) wood ashes and made into hominy. Cornmeal may be colored with *Atriplex* (saltbush) ashes. Black corn is used as a dye for basketry and textiles and as body paint. Maize may be husked immediately upon harvesting. Clean husks are saved for smoking and other uses, such as wrapping food. Corn also was sometimes shelled prior to storage. Ears were allowed to dry on the roof, and ristras of maize may be hung inside from the roof (Heiser 1990:89-98; Mangelsdorf 1974; Stevenson 1915:73-76). Shelled maize and ground maize flour were easily transported, and experimental processing reveals maize pollen in shelled maize and also ground maize flour.

HISTORICAL AND ETHNOGRAPHIC ACCOUNTS

The significant discovery of *Zea mays*

found in the unsorted light fraction sample from 26LN2978 by Kováčik (PRI 2015:14), prompted a review of historical accounts of early explorers, organized government expeditions that passed through the region and by priceless detailed descriptions from Kelly's informants who once lived in the vicinity of the Ash Springs site.

William L. Manly in his diary of 1849 documents corn being grown in the area of Sand Spring and Garden Valley located northwest of Ash Springs. Manly states:

> We now crossed a low range and a small creek running south, and here were also some springs. Some corn had been grown here by the indians. . . , [A]mong the sage grew also a bunch grass a foot high, which had seeds like broom-corn seeds. The indians had gathered the grass and made it in piles of one hundred pounds or so, and used it for food as I found by examining their camps (Manly 2011:91).

First Lieutenant George M. Wheeler made two early reconnaissance expeditions through southern and southeastern Nevada for the U. S. government (1869 and 1871). In his reconnaissance, Wheeler described: geography, Indians, early settlers, cultivation of the land and particularly availability of water, food, wood, and grass for livestock in his expedition. The indigenous people were described as:

> mountain Indians…, more hardy, intelligent, shrewd, and cunning, generally going into the valleys to plant and harvest, returning to their mountain-retreats after gathering their slender crops (Wheeler 1869:35).

Wheeler further described the "Utes or Piedes" he found from Pahranagat Valley to the mouth of the Virgin River. He noted they "cultivated the soil." He also described another Indian tribe named "Pah-Utes" as being not much different from the Utes except that "they plant but little" (Wheeler 1869:37).

In Pahranagat Valley "some parts saturated continually need no irrigation. It appears certain that lands in southeastern Nevada fit for agricultural production will, in time, be valuable" (Wheeler 1869:23). He observed Pahranagat Valley as "an exceptional spot" (Wheeler 1869:39). His first camp was near Pahranagat Valley remarking that "it was a good camp, water and grass plenty. . . [and that] corn and vegetables grow with certainty in Pahranagat Valley" (Wheeler 1869: 40 and 71) and "ranchers thrived growing barley, wheat, potatoes, and melons (Wheeler 1869: 64). He also observed that "irrigation was comparatively easy however lower Pahranagat Valley was highly alkali" (Wheeler 1869: 64) due to "An abundance of natural spring water at several thermal springs in the valley including Crystal Springs and Ash Springs" (Wheeler 1869:53). There was little game noted which he claimed was depleted from hunting by the Indians and settlers (Wheeler 1869:58).

Recently, Catherine Fowler synthesized Isabel Kelly's soon to be published field notes. Bill (b. 1877) and Maud (b. 1851) China husband and wife from Hiko and Grace Henry (interpreter, born in Pahranagat area in 1893) were Kelly's only informants from the Pahranagat Valley area. In 1931 when Kelly conducted her interviews, these informants were living at the Moapa Indian Reservation. Their accounts likely date from about 1880-1900s or earlier 1840s or 1850s when describing their parent's lifeways for the region. To the north of Ash Springs (*Tsimlwámitu*) is a small knoll in the vicinity of Crystal Springs (*Pikáguats*) called Black Knoll (*Tu'kandadi*). This location was referenced as a place where the China's relatives used to plant. In the spring people would plant their gardens at a lake south of Hiko at Crystal Springs and near edges of lakes. Not much was said about Ash Springs. In Pahranagat, the Chinas recalled corn was called *awíbi* and that it was "soft" (tender) unlike today's corn. Bill added there was only one crop of corn a year, and that they had plenty of corn that was shared among different camps. Seeds were hulled from the best ears and dried for next year's planting. In Pahranagat Valley, pumpkins, sunflower, wheat, melons, and amaranth were cultivated, but the China's thought these crops were introduced from the Moapa area. There were gardens in the valley (Pahranagat Valley) that were weeded in the summer. Generally, people from outside the valley did not have gardens but instead brought their wild food in to the valley and traded for garden goods. While Bill described tool making and hunting practices, Maud described making pottery, basketry, and gathering of plants. Mrs. Henry remembered that there were around 100 Indians living in Pahranagat Valley. Sometimes they lived at Crystal Springs and stayed there for about a month or more living off the land. Grace's maternal grandfather lived in Alamo part of the year. By around 1900, most people had left Pahranagat and were living in Moapa (Catherine Fowler, personal communication 2014).

OTHER REGIONAL STUDIES

26LN2921, the "Bead Bench" site, located near Ursine, Nevada to the northeast, shares similarities with the Ash Spring site. This site was impacted by road construction and was further disturbed by erosion from flash floods (1987) since the site sits on a slope. NDOT conducted excavations before reconstruction of the road. Bead Bench contained Snake Valley pottery, a locally made pottery, and Parowan basal-notched points (Leavitt 2003). In addition, a trench dug by a backhoe revealed a dish shaped structure (4-5 m in diameter) in the stratigraphy. Careful excavation of the structure uncovered a well-defined clay floor and walls (no postholes), associated with projectile points, bone awls, scrapers, stone beads and a small number of milling gear. Two ^{14}C dates fall within the Fremont Period (860+/-90 and 880+/-80 B.P.), the third date is Proto-Historic 310+/-110 B.P. (Leavitt 2003). Similarity of some features with the enigmatic site 26LN2978, including a "Fremont-like" house, suggest the Ash Spring site might represent a semi-sedentary group of terminal Fremont people. While the cited study has inventoried a Fremont period site, this project did not located post-molds similar to 26LN2978. In their research, archaeologists Byerly and Duke (2011) and Cole (2012) recently recognized the Ash Springs site as the only recorded prehistoric site comprising numerous pithouses in this region. However, they stressed the fact that there is insufficient site inventory data. The region requires additional surveys and excavations prior to reaching any conclusions about its place in the prehistory of this part of the Great Basin and its relationship to other adjacent Puebloan groups, especially in light of the renewed interest in Fremont occupation in eastern Nevada. They cited "a small 'village' at 26LN2978 yielding ceramics dating to ~A.D. 500 (~1450 B.P.) tentatively supports this although available data are currently insufficient to thoroughly assess the nature of the site's Fremont associations" (Byerly and Duke 2011:21).

DISCUSSION AND CONCLUSION

When 26LN2978 was threatened by the encroachment from the expansion of the adjacent material pit, the site's significance was assessed, and we believed that it had research potential. Mark Henderson, BLM archaeologist, requested additional data collection. Test probing conducted during two separate field sessions suggested the Ash Springs site was unique because it contained "Fremont-like features" such as prepared clay floors comprising postholes, Numic, Fremont and Anasazi ceramics and a locally made pottery, possible Bull Creek points, bifaces, perforators, groundstone and unique multi-use artifacts. Radiocarbon dates from Beta Analytical were discarded because the samples were contaminated by atomic testing of the 1950s. This prompted use of TL dating as an alternative dating method. Results from TL dating suggested the site was occupied between 675 - 230 years B.P. (Figure 8).

Subsequent radiocarbon dating from PaleoResearch Institute yielded age ranges from two grass seeds recovered from the floor of HP2 of A.D. 1680–1740 (PRI-14-123-HP2. A) and A.D. 1690–1730 (PRI-14-123-HP2. B). Preliminary macrofloral analysis by Schaaf (2006) concluded the site was occupied in summer/fall. Because the macrofloral remains contained seeds that mature in the late summer and fall, PaleoResearch Institute declined to indicate a season of occupation. That determination awaits further excavation of a pithouse and associated macrofloral, pollen, and faunal analysis from future samples.

Prepared clay floors associated with Bull Creek points, Fremont ceramics, and recovery of *Zea mays* macrofloral remains at the Ash Springs site suggest it may have functioned as a Fremont residential base camp. To connect the Ash Springs site to with occasional, possible Fremont intrusion and semi-sedentary occupation into Nevada, as has been suggested by Byerly and Duke (2011:21), it is necessary to fully excavate a "pithouse," one of several house features from 26LN2978. This may answer questions that earlier data recovery was unable to answer, more clearly define cultural identity, and ideally close the existing data-gap. The reassessment of the site concluded that the site's core was not damaged by the expansion of the material pit. Excavation of this site has good potential for a field school project. Future obsidian hydration analysis would provide another date. Alternately, to prevent further destruction, the site should be protected (fenced) before it is impacted by additional expansion of the material pit and by grazing.

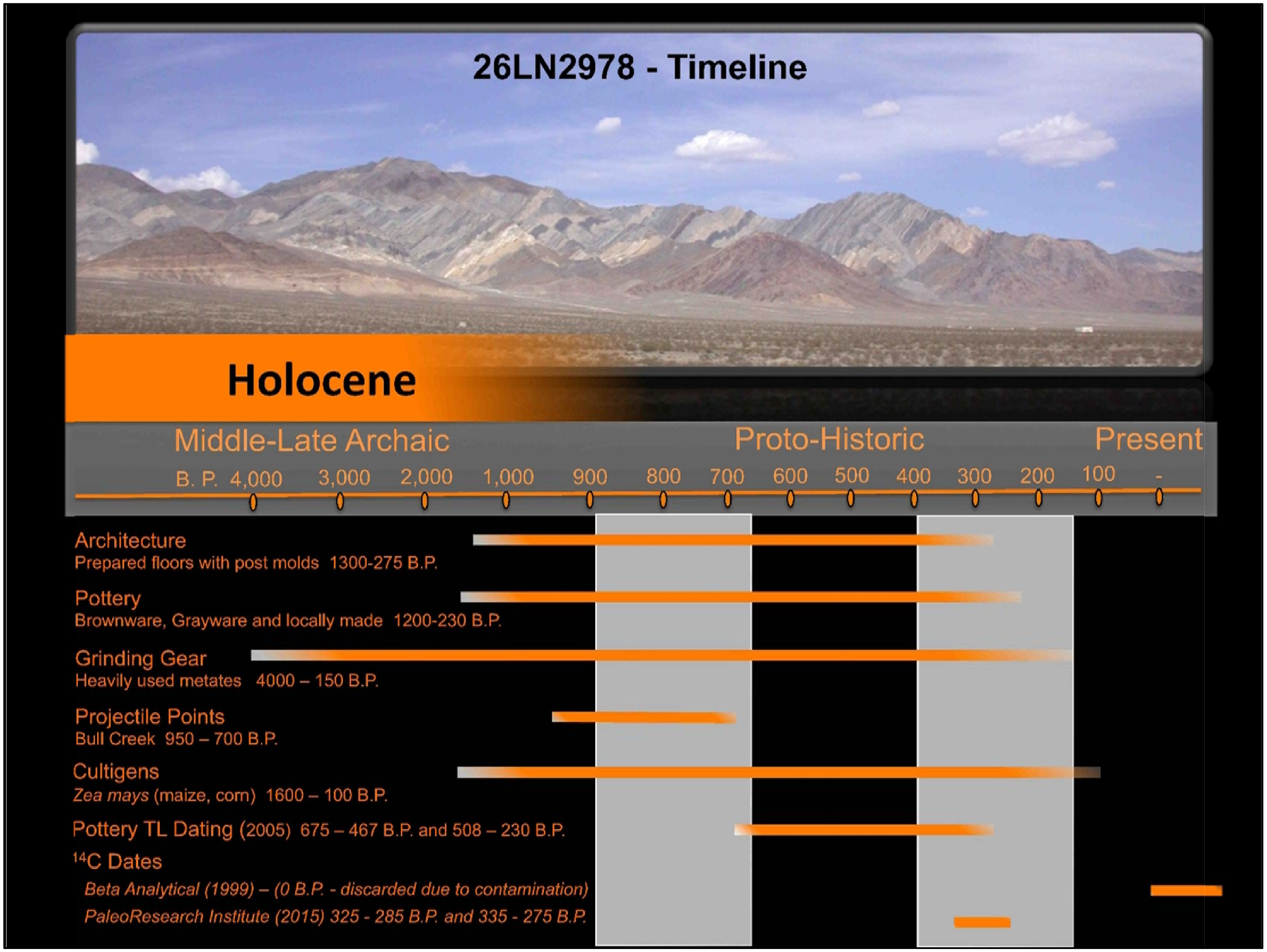

Figure 8. Site Timeline. Patricia DeBunch

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REFERENCES CITED

Angier, Bradford
1978 *Field Guide to Medicinal Wild Plants*. Stackpole Books, Harrisburg, Pennsylvania.

Asch, David L.
1978 The Economic Potential of *Iva annua* and Its Prehistoric Importance in the Lower Illinois Valley. In *The Nature and Status of Ethnobotany*, edited by R. I. Ford. Anthropological Paper. Vol. 67. University of Michigan, Ann Arbor, Michigan.

Barrows, David Prescott
1900 *The Ethnobotany of the Coahuilla Indians of Southern California*. University of Chicago Press, Chicago, Illinois.

Brooks, Richard
1977 *Survey for the Realignment of Highway SR318 through Hiko and the White River Narrows*. Report on file at NDOT Carson City, Nevada.

Bunch, James
1985 *Testing of 26LN2969, a Fremont Site near Pioche, Nevada,* NDOT LN85-068T. Report on file at NDOT, Carson City, Nevada.

1986 *Investigations of Two Rock Shelters Near Cave Lake, Ely, Nevada.* NDOT WP85-053T. NDOT Technical Report #1. On file at NDOT Carson City, Nevada.

2007 *Class III Cultural Resource Inventory for a Material Pit Extension in the Burnt Springs Range, Lincoln County, Nevada*. Report

LN07-003P/BLM NV04-07-1654P. Report on file at NDOT, Carson City, Nevada.

2009 *Probing of 26LN202 (Crystal Springs Site) near Hiko, Nevada for Highway Merge-lane SR375-SR318*. Memo on file, NDOT, Carson City, Nevada.

2010 *Reevaluation and Probing of 26LN2946 Rockshelter in Rainbow Canyon for SR317 Reconstruction Project*. Memo on file NDOT, Carson City, Nevada.

Bunch, James, and Patricia A. Deans
1988 *Spatial and Temporal Distribution of the Western Periphery of Fremont Pottery*. A paper presented at the Twenty-First Annual Great Basin Conference, Park City, Utah. October 6-8, 1988. Manuscript in possession of the authors.

Bunch, James, Steven Stearns, and Patricia DeBunch
2013 *The Ash Springs site, 26LN2978*. Updated IMACS site form. On file at the BLM Ely District Office, Ely Nevada.

2015 *Reevaluate Site Significance and Update Formative/Fremont site Records in Lincoln County Using Geographical Information Systems (GIS), Lincoln County Archaeological Initiative Round 5*. Report submitted to the BLM Caliente-Field Office, Caliente Nevada.

Byerly, Ryan M. , and Daron Duke
2011 *Fremont Settlement in Southeastern Nevada: An Archaeological Inventory of 1,025 Acres Selected in Pahranagat Valley and Meadow Valley Wash, Lincoln County, Nevada LCAI #L09PS00006.* Far Western Anthropological Research Group, Inc., Las Vegas, Nevada

Chamberlin, Ralph V.
1964 The Ethnobotany of the Gosiute Indians of Utah. In *American Anthropological Association Memoirs 2*, pp. 329-405. Kraus Reprint Corp. , New York, New York.

Cole, Clint
2012 Prehistoric Archaeology and the Fremont Frontier at North Meadow Valley Wash, Eastern Nevada. Unpublished Ph. D. dissertation, Department of Anthropology, University of California, Davis.

Cutler, H., and L. Blake
1973 Cultigen Remains from Stine Canyon Shelter I (26Ln402). In, *Prehistory of Southeastern Nevada*, by Don Fowler, David Madsen, and Eugene M. Hattori pp.143-145. Reno, Nevada

Dean, Patricia
1985 Petrographic Thin-Sectioning. In, *The Archeology of Two Rock Shelters near Cave Lake, Ely, Nevada.* Technical Report No. 1, 1985. Report on file at NDOT,

Carson City, Nevada.

1987a Petrographic Thin-Section Analysis of selected Sherds from 26LN1775. In *Archaeological Investigations at Panaca Summit* by R. Elston and K. Juell, Appendix A. Intermountain Research, Inc., Reno, Nevada

1987b *Thin Section Analysis from Testing at Bead Bench 26LN2921*. Report in possession of author and on file at NDOT, Carson City, Nevada.

2006 *Thin Section Analysis from Testing at the Ash Springs site 26LN2978*. Letter in possession of author and on file at NDOT, Carson City, Nevada.

Elmore, Francis H.
1978 *Ethnobotany of the Navajo*. University of New Mexico Bulletin with the School of American Research, Santa Fe, New Mexico.

Elston, Robert, and Kenneth E. Juell
1987 *Archaeological Investigations at Panaca Summit, Nevada*. BLM Cultural Resource Series No. 10. Nevada State Bureau of Land Management, Reno, Nevada.

Euler, Robert C., editor
1966 *Southern Paiute Ethnohistory.* Anthropological Papers No. 78. Glen Canyon Series 28. University of Utah, Salt Lake City.

Fernald, M. L.
1950 *Gray's Manual of Botany*. 8th ed. American Book Company, New York, New York.

Foster, Steven and James A. Duke
1990 *A Field Guide to Medicinal Plants: Eastern and Central North America*. Houghton Mifflin Company, Boston, Massachusetts.

Fowler, Catherine S.
In Press *Moapa and Pahranagat Southern Paiute Culture in the Late 19th Century: Ethnographic Perspectives: A Compilation of Isabel Kelly's field notes during early 1930's. Personal Communication 2010-2014*. HRA, Inc., Las Vegas, Nevada

Fowler, Don, David Madsen, and Eugene M. Hattori
1973 *Prehistory of Southeastern Nevada.* DRI Publications in the Social Sciences No. 6. Desert Research Institute, Reno, Nevada.

Harrington, H. D.
1967 *Edible Native Plants of the Rocky Mountains*. University of New Mexico Press, Albuquerque.

1972 *Western Edible Wild Plants*. The University of New Mexico Press, Albuquerque.

Hedges, Ken, and Christina Beresford
1986 *Santa Ysabel Ethnobotany*. San Diego Museum of Man, Ethnic Technology Notes No. 20. San

Diego Museum of Man, San Diego, California.

Heiser, Charles B., Jr.
1990 *Seed to Civilization: The Story of Food*. Harvard University Press, Cambridge, Massachusetts.

Hickey, Michael, and Clive J. King
1981 *100 Families of Flowering Plants*. Cambridge University Press, Cambridge, Massachusetts.

Hickman, James C. (editor)
1993 *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley.

James, George Wharton
1901 *Indian Basketry*. Reprinted by Kessinger Publishing, Whitefish, Montana.

Janetski, Joel C., Richard K. Talbot, Debora E. Newman, Lane Richens, and James D. Wilde
2000 *Clear Creek Canyon Archaeological Project: Results and Synthesis.* Museum of Peoples and Cultures. Occasional Papers No. 7. Brigham Young University, Provo Utah.

Jennings, Jesse, and Dorothy Sammons-Lohse
1981 *Bull Creek.* University of Utah Anthropological Papers No. 105. University of Utah Press, Salt Lake City.

Kelly, Isabel T.
1976 *Paiute Indians II*. Garland Publishers, Inc., New York, New York.

Kelly, Isabel T. and Catherine Fowler
1986 Southern Paiute. In, *Handbook of North American Indians*, Vol. 11, Edited by Warren L. d'Azevedo. pp. 368-397. Smithsonian Institute, Washington, D. C.

Kearney, Thomas H., and Robert H. Peebles
1960 *Arizona Flora*. University of California Press, Berkeley.

Kindscher, Kelly
1987 *Edible Wild Plants of the Prairie*. University Press of Kansas, Lawrence, Kansas.

Kirk, Donald R.
1975 *Wild Edible Plants of Western North America*. Naturegraph Publishers, Happy Camp, California.

Kováčik, Peter, and Linda Scott Cummings
2015 *Identification of Seeds and Charcoal and AMS Radiocarbon Dating of a Sample from the Ash Springs Site (26LN2978), Lincoln County, Nevada.* PRI Technical Report 2014-123. Eetza Research Associates, Reno, Nevada.

Krochmal, Arnold, and Connie Krochmal
1973 *A Guide to the Medicinal Plants of the United States*. Quadrangle, the New York Times Book Co., New York, New York.

Leavitt, Robert M.
2003 *Bead Bench (26LN2921) A Site*

Near Ursine, Nevada. NDOT Report LN102-85T. On file at NDOT Carson City, Nevada.

Madsen, David B.
1989 *Exploring the Fremont*. Occasional Publication No. 8. Utah Museum of Natural History, University of Utah, Salt Lake City.

Madsen, David B., and Steven R. Simms
1998 The Fremont Complex: A Behavioral Perspective. *Journal of World Prehistory* 12:255-336.

Mangelsdorf, Paul C.
1974 *Corn Its Origin, Evolution, and Improvement*. The Belknap Press of Harvard University Press, Cambridge, Massachusetts.

Manly, William Lewis
2001 *Death Valley in '49. The Autobiography of a Pioneer.* The Narrative Press, Santa Barbara, California.

Martin, Alexander C.
1972 *Weeds*. Golden Press, Western Publishing Company, Inc., New York, New York.

Martineau, LeVan
1992 *Southern Paiutes: Legends, Lore, Language and Lineage*. Gem Guide Book Company, Upland, California.

Marwitt, John P.
1986 Fremont Cultures. In, *Handbook of North American Indians*, Vol. 11, edited by Warren L. d'Azevedo, pp. 161-172. Smithsonian Institute, Washington, D. C.

McDougall, W. B.
1973 *Seed Plants of Northern Arizona*. Northern Arizona Society of Science and Art, Inc., Flagstaff, Arizona.

McGee, Harold
1984 *On Food and Cooking*. Charles Scribner's Sons, New York, New York.

Mead, George R.
1972 *The Ethnobotany of the California Indians: A Compendium of the Plants, Their Users, and Their Uses*. University of Northern Colorado Museum of Anthropology, Greeley, Colorado.

Moerman, Daniel E.
1998 *Native American Ethnobotany*. Timber Press, Portland, Oregon.

Moore, Michael
1990 *Los Remedios: Traditional Herbal Remedies of the Southwest*. Red Crane Books, Santa Fe, New Mexico.

Morss, Noel M.
1931 *The Ancient Cultural of the Fremont River in Utah.* Papers of the Peabody Museum of American Archaeology and Ethnology, Vol. 12, No. 3. Harvard University. Cambridge, Massachuttes.

Peterson, Lee A.

1977 *Edible Wild Plants*. Collier Books, New York, New York.

Price, John A.
1980 *The Washo Indians: History, Life Cycle, Religion, Technology, Economy and Modern Life*. Nevada State Museum Occasional Papers No. 4. Nevada State Museum, Carson City, Nevada.

Rhode, David
2002 *Native Plants of Southern Nevada*. University of Utah Press, Salt Lake City.

Robbins, W. W. , J. P. Harrington, and Barbara Freire-Marreco
1916 *Ethnobotany of the Tewa Indians*. Bureau of American Ethnology Bulletin 55. Government Printing Office, Washington D.C.

Robinson, Peggy
1979 *Profiles of Northwest Plants*. Far West Book Service, Portland, Oregon.

Rogers, Dilwyn
1980 Edible, Medicinal, Useful, and Poisonous Wild Plants of the Northern Great Plains-South Dakota Region. Biology Department, Augustana College, Sioux Falls, South Dakota.

Schaaf, Jeanne
2006 Preliminary Report on Macrofloral Remains from Site 26LN2978, Lincoln County, Nevada. Report submitted to NDOT, Carson City, Nevada.

Shields, Helen
1984 *Desert Plants: Recipes and Remedies*. Okesa Publications, Tularosa, New Mexico.

Simms, Steven R.
2010 *Traces of the Fremont.* Society and Rock Art in Ancient Utah. University Of Utah Press, Salt Lake City.

Spier, Leslie
1930 Klamath Ethnography. *University of California Publications in American Archaeology and Ethnology*, Vol. 30. University of California, Berkeley.

Stearns, Steven
2002 *Fremont of Pahranagat Valley, Nevada.* Poster presented at the 28th Annual Great Basin Conference, Elko, Nevada.

2009a *26LN2963: Reevaluation and Shovel Probing.* BLM# 8111-NV-040-2009-1841. NDOT LN014-086(P) addendum.

2009b Location, Location, Location: Prehistoric Structures and their Position on the Landscape in Lincoln County, Nevada. *In Situ: Nevada Archaeological Association Newsletter* 13(3):6-11.

Stearns, Steven, James Bunch, and Patricia DeBunch
2004 Fremont Pithouses in Pahranagat Valley. Poster Presented at the 29th Great Basin Conference, Sparks, Nevada.

2006 Fremont Colonization (?) and Southern Paiute Habitation in Pahranagat Valley, Nevada. Poster Presented at the 30th Annual Great Basin Conference, Las Vegas, Nevada.

2008 Finding Traces of Paiute Habitation Sites in Lincoln County, Nevada. Poster Presented at the Annual Meeting at the 37th Nevada Archaeological Association, Minden, Nevada.

Stevenson, Matilda Coxe

1915 Ethnobotany of the Zuni Indians. Thirtieth Annual Report of the Bureau of American Ethnology. Government Printing Office, Washington, D. C.

Sweet, Muriel

1976 *Common and Useful Plants of the West*. Naturegraph Company, Healdsburg, California.

Tilford, Gregory L.

1997 *Edible and Medicinal Plants of the West*. Mountain Press Publishing Company, Missoula, Montana.

Warren, Claude, and Robert Crabtree

1986 Prehistory of the Southwestern Area. In, *Handbook of North American Indians*, Vol. 11, edited by Warren L. d'Azevedo, pp. 183-193. Smithsonian Institute, Washington, D. C.

Wheeler, George M., and D. W. Lockwood

1875 *Preliminary Report upon a Reconnaissance through Southern and Southeastern Nevada made in 1869*. Engineer Department, U. S. Army. Government Printing Office, Washington D.C.

White, William, Lynda Blair, and Susan Murphy

1997 *Ash Springs: Where People Gather.* Harry Reid Center 1-1-35. Harry Reid Center for Environment Studies, University of Nevada, Las Vegas.

Wilde, James D., and Reed A. Soper

1999 *Baker Village Report of Excavations, 1990-1994.* Brigham Young University Museum of Peoples and Cultures Technical Series 99-12. Brigham Young Uiversity, Provo, Utah.

Woods, Aaron R.

2008 *Distribution, function and Value of Parowan Valley Projectile Points.* Unpublished Master's Thesis. Department of Anthropology, Brigham Young University, Provo, Utah

Zomlefer, Wendy B.

1994 *Guide to Flowering Plants Families*. The University of North Carolina Press, Chapel Hill.

A Bow Stave Site in White Pine County, Nevada and a Simple Probability Model for Bow Stave Trees

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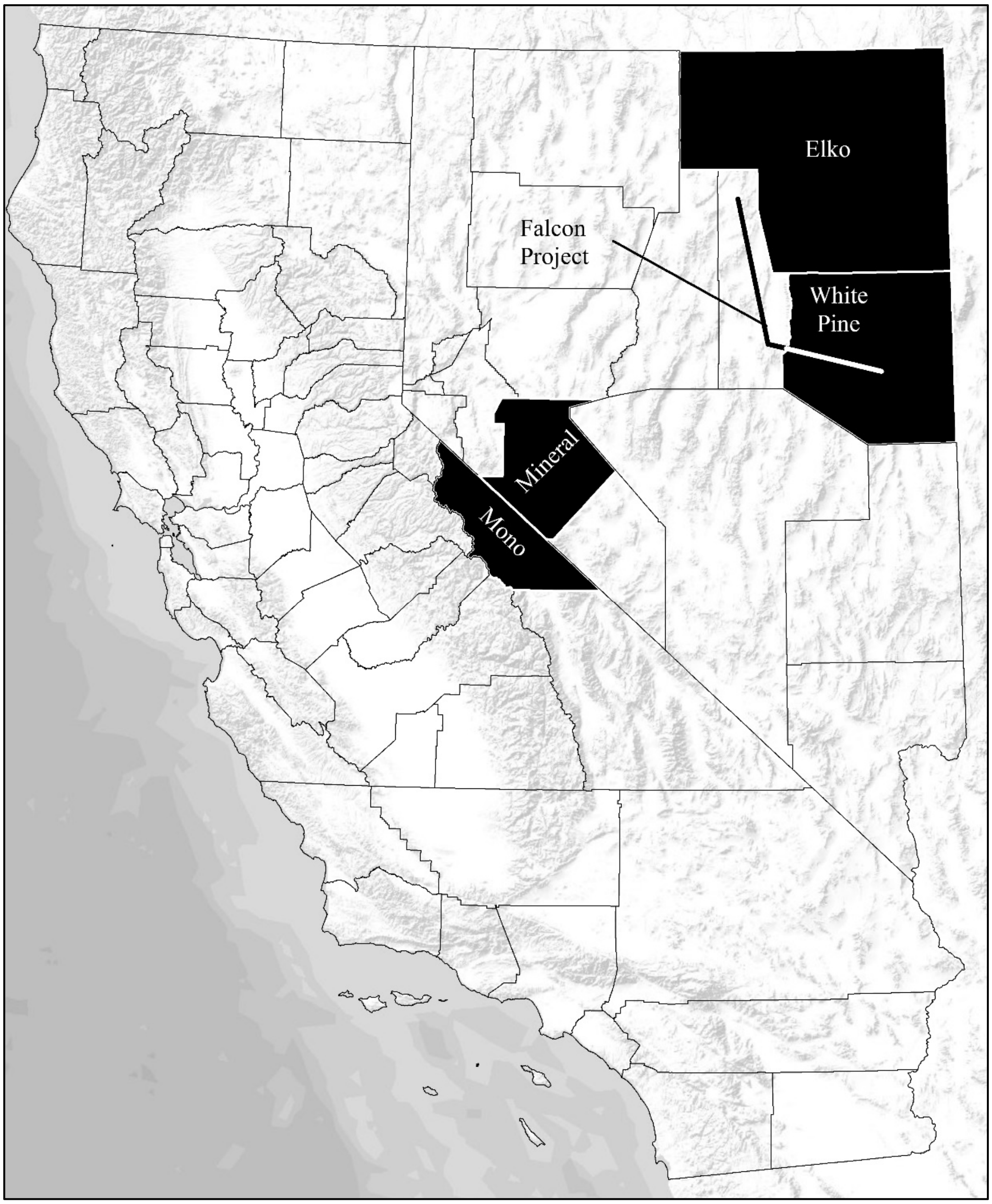
Between 2002 and 2003, Summit Envirosolutions, Inc. conducted data recovery for Sierra Pacific Power Company's Falcon to Gonder transmission line project near Ely, Nevada. While working for Summit, the author discovered what appears to be the first recorded bow stave tree in White Pine County. This paper describes bow stave trees and proposes a preliminary probability map for bow stave trees based on environmental zones, historic and modern impacts, and past fires. The model reduces the potential area where bow stave trees are very likely to be present in White Pine County from 1,688 km^2 to 1,320 km^2. A discussion on potential methods to refine the model is then presented.

In 2003, Summit Envirosolutions, Inc. conducted excavation at over 40 sites along the Sierra Pacific Power Company's Falcon to Gonder 240kV Transmission Line between Ely and Dunphy, Nevada (the Falcon Project; Figure 1). At two sites, four relatively rare and remarkable wooden artifacts and features were found. At site 26WP5373, a bow stave tree was discovered during the site walk over. At the same site, a probable windbreak with associated historic and prehistoric artifacts was identified. Nearby, at site 26WP5177, a pinyon pole and possible wooden mortar were also found. These discoveries serve as a reminder to archaeologists that not all archaeological resources are stone, bone, metal, or glass and that it pays to look up and around from time to time. More importantly, the identification of a bow stave tree leads to the question of where should archaeologists expect to find this resource type? This paper focuses on the bow stave tree in a landscape context and presents a simple probability model for locating these resources in White Pine County.

PREVIOUS RESEARCH AND DEFINITIONS OF BOW STAVE TREES

Within the Great Basin there is very little archaeological evidence of bow stave trees (Figure 1). To the author's knowledge, only two trees have been identified in the central and eastern Great Basin to date. These include a single bow stave tree previously recorded in Elko County, and the bow stave tree recorded during the Falcon Project in White Pine County. Other bow stave trees are known from western Great Basin localities in Mineral County, Nevada and in Mono County, California (Bowers 2008; Overly 2003; Wilke 1988). In the late 1980s, Phil Wilke recorded a stand of 47 Utah junipers in Mineral County with evidence of stave removal. Bowers (2008:44) recorded a single bow stave tree in Mineral County near Hawthorne, Nevada. This tree was similar to those recorded by Wilke. Wilke also recorded the locality in California that consists of at least 12 junipers in Long Valley, California. While not included in published material, the author visited this grove while on a separate project.

Figure 1. Locations of Bow Stave Trees Discussed in this Article: Elko County (Murphy 2003), Mineral County (Bowers 2008; Wilke 1988), Mono County (Hauer 2002; Wilke 1988), White Pine County (Hauer et al. 2003) and the Falcon Project.



Both groves recorded by Wilke are comprised of older trees that have large, straight-grained trunks from which the staves were removed. Overly (2003:102) also briefly mentions two bow stave trees near site CA-MNO-615 near Mammoth, California in Mono County. At this site, both trees are large junipers with straight trunks and at least one has several stave scars. The Elko County bow stave tree differs from the others in that the stave scar is on a large horizontal limb or trunk, while the upper tree is quite gnarled (Murphy 2003).

Focused research on Great Basin bow stave trees is limited to Wilke's (1988) publication covering the Mineral County grove. According to Wilke, bow stave trees are trees that bear scars from the removal of a stave, or bow. Within the Great Basin, bows have been made from mountain mahogany (*Cercocarpus*), serviceberry (*Amelanchier*), juniper (*Juniperus*), chokecherry (*Prunus*), oak (*Quercus*), maple (*Acer*), birch (*Betula*), willow (*Salix*), and mesquite (*Prosopis*), among others (Wilke 1988:4). The choice of wood was dictated by need and tree availability. In the western Great Basin, junipers were most commonly used. Bows were usually made from a single piece of wood and typically ranged in size from 1 to 1.2 m (3-4 ft) long for small game, and 1.2-1.5 m (4-5 ft) long for large game.

Ethnographic evidence for the manufacture of bows is rare. Edward Curtis (1926:61) provides the following description:

> The bow was about three feet long, recurved at the ends, and made from the trunk, not from a branch. The better ones were strengthened with a reinforcement of sinew glued to the back.

Omer Stewart (1941) also suggests that a bow stave is produced by first finding a tree with straight grain and few to no knots, such as juniper.

On a suitable tree, a notch is first made at the base of the future stave (Figure 2**).** This notch cuts off the growth of the stave allowing it to cure on the tree. After the stave is cured, a removal notch is made above the growth arrestment notch. This notch is asymmetrical and used as a purchase to pry the stave from the tree.

Typically, notches are made with large cobble tools. Wilke (1988) describes these tools as being fire-spalled basalt. However, the association of bow stave trees in Long Valley, California, and bifacially worked choppers likely indicates these kinds of tools were used as well. The cutting tool was then used to create the notches. during historic times, metal axes replaced stone cobbles as chopping implements. The type of scarring present in the notches can distinguish the type of tool used. Stone tools tend to compress the wood grain, whereas metal tools cut cleaner, damaging the grain less.

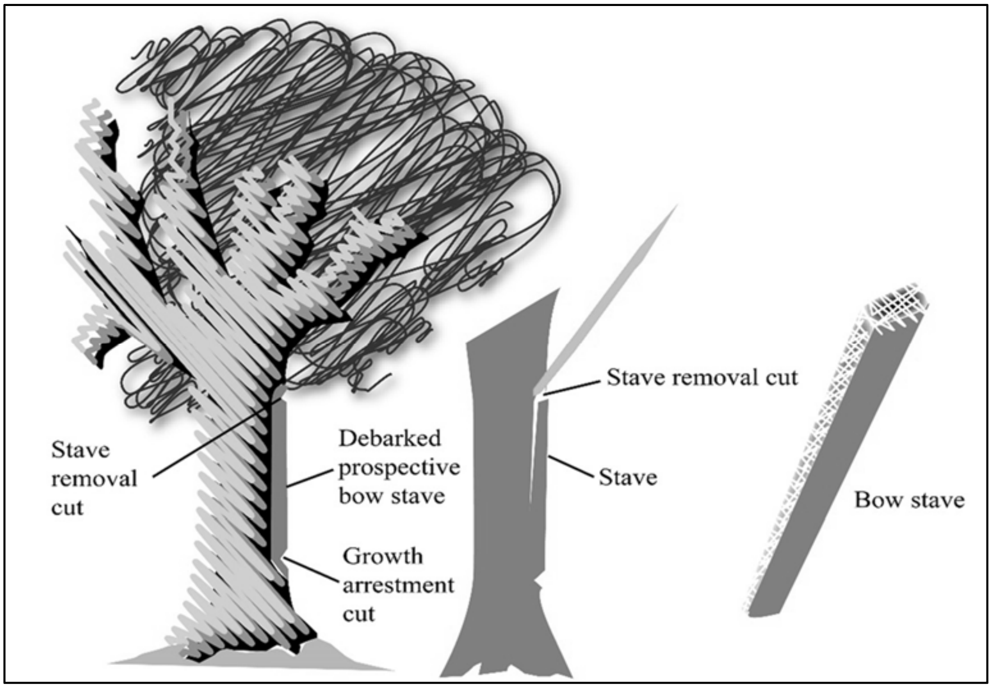


Figure 2. Schematic of Parts of a Bow Stave Tree (adapted from Wilke 1988: Figure 3).

Other Observations

Wilke (1988) also provides insight regarding the landscape context of stands of bow stave trees in western Nevada. In the Mineral County stand, 47 juniper trees exhibit evidence of stave removal or preparation. All trees are between elevations of 1,889 and 2,135 m above mean sea level (AMSL) and were located near aboriginal hunting sites. Thirty-three of the trees are situated within 2 km of two large wing-traps used to capture antelope and deer and are close to many associated camps in the Excelsior Mountains. Fourteen trees are located 18 km to the south clustered within a 2 km area. The southern cluster of trees is also near several small camps and a wing-trap (Wilke 1988:6). Wilke also notes that bow stave trees were occur in areas that are easy to relocate, and that they are found in dispersed groups. From this, it can be expected that bow stave trees to occur in groups, be confined to certain elevations, and be associated with areas of communal activities that are repeatedly used.

The Bow Stave Tree at Site 26WP5373

Site 26WP5373 has a commanding view of Long Valley with the Ruby Mountains in the far distance. The site is located between 2,072 and 2,286 m AMSL in the Butte Mountains. 26WP5373 is in a sheltered east-facing amphitheater formed by the surrounding hills. In the center of the site is a small valley floor with a spring. Pinyon/juniper woodland community occur above 2,097 m AMSL at the site, while big sagebrush community ringing the valley margin and a rabbitbrush community is confined to the valley floor. Vegetation communities conform to local landforms and soil depths, perhaps demonstrating spatial patterning related to local fire history.

Mitigation efforts in November 2002 found the site to be large, covering 140 acres. The site contains hundreds of bifaces, flake tools, projectile points, ground stone artifacts, and a single grayware sherd organized in a variety of concentrations and features (Bowers 2007). Hearths, tertiary deposits of toolstone quality raw materials, numerous lithic reduction loci, non-portable milling stations, several rock rings, and a likely ethnographic residential area were identified. Unique to the site is the Ethnohistoric bow stave tree and the probable windbreak.

The bow stave tree at 26WP5373 is a large Utah juniper approximately 7 m tall with a bifurcated trunk (Figure 3). A stave scar is located on the western trunk, while the other trunk has been cut off with a saw. The tree conforms to those described by Wilke (1988:15–21) in that it is tall with straight grain. The stave scar is 95 cm long and 8 cm wide. The arresting notch and removal notch are both 3 to 4 cm deep. The arresting or lower notch is symmetrical in shape, whereas the removal or upper notch is asymmetrical (Figures 4). Both notches appear to have been produced using stone implements. In addition, a central ridge extends parallel down the length of the scar, possibly indicating two staves were taken from this tree.

Twenty-five 1x1 m excavation units were excavated under the tree, but this yielded only a few pieces of debitage and no tree-notching implements. However, a short distance downslope along the intermittent drainage, a large 15 pound, two-handed rhyolite chopper was found. This may have been the tool used to cut the notches.

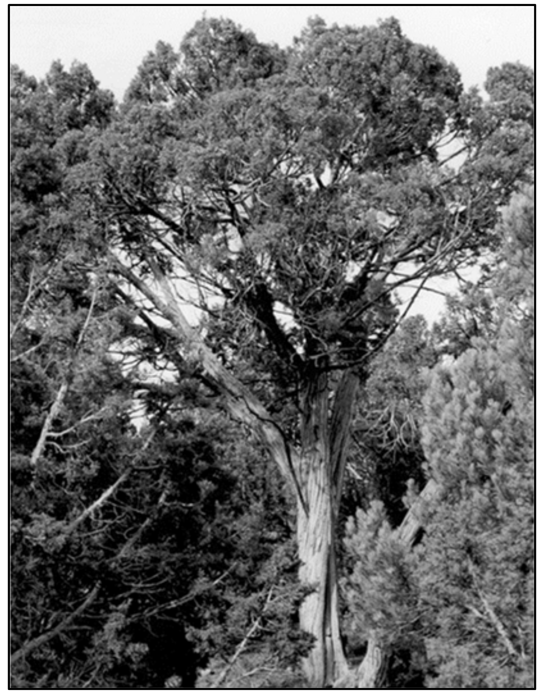


Figure 3. Bow Stave Tree at 26WP5373.

BOW STAVE TREE LOCATIONAL MODEL

Bow stave trees are a historic phenomenon directly associated with bow and arrow technology. Within the central great basin, this technology was used from 1,500 B.P. to contact. Considering the antiquity of the technology and that the majority of known bow stave trees are large trees with straight trunks, it is appropriate to consider these trees as constituting old growth trees. With this in mind, the first step in creating a probability model for bow stave location is to predict where old growth juniper are likely to occur and then accounting for historic and modern impacts. Three impacting factors are considered in the model: historic impacts, modern impacts, and fire.

Characteristics of Pinyon/Juniper Woodlands

Utah juniper (*Juniperus osteosperma*)

can grow up to 8 m tall and may live as long as 650 years. These trees thrive on very dry sites and commonly grow on alluvial fans and dry, rocky hillsides with shallow, alkaline soils. Utah juniper often occurs with pinyon pine (*Pinus monophylla*) as part of the Pinyon/Juniper Woodland community. in eastern Nevada, pinyon/juniper woodlands corresponds with the Carbonate Woodland Zone as defined by the Environmental Protection Agency (Wigand 2007:36). This zone is mid-elevation, with moderate to steeply sloping mountains and ridges that range between 1,829–2,743 m AMSL.

Figure 4. Arresting Scar (left) and Removal Scar (Right) of the Bow Stave Tree Recorded at 26WP5373.

It can have a diverse understory that can include: black sagebrush, Wyoming big sagebrush, mountain big sagebrush (*Artemisia*), little-leaf mahogany (*Cercocarpus intricatus*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), cliffrose (*Purshia mexicana*), green ephedra (*Ephedra viridis*), bluebunch wheatgrass (*Pseudoroegneria spicata*) Idaho fescue (*Festuca idahoensis*), pine bluegrass (*Poa scabrella*), bottlebrush, and squirreltail grass (Wigand 2007:36)

Historic Impacts to Pinyon/Juniper Woodlands

Historic development within an area needs to be considered when identifying the probability of current populations of juniper. Impacts from mining, urban growth, forest fires, and woodcutting for fuel are considered primary impacts. For example, the growth of the towns of Eureka and Ely, Nevada created a demand for local resources.

Historically, smelting process employed

in central Nevada required large amounts of charcoal. This was produced locally using charcoal ovens (*e.g.,* Ward Charcoal Ovens near Ely, Nevada), or on charcoal platforms such as those located in the Roberts and Cortez mountains in Eureka County, Nevada. Close to Eureka, Italian immigrants, referred to as Carbonari, carried out charcoal production. This industry, according to Ron Reno (1996), affected woodland areas within 60 miles (mi.) reaching production levels of 16,000 acres in the late 1870s. While the Carbonari preferred pinyon to make charcoal, juniper was also utilized during the construction of charcoal platforms. Juniper was used more intensely as a building material. The use of juniper as a building material is likely the result of construction associated with the multitude of mining booms during the late nineteenth and early twentieth centuries. Ely retained a small population until the early 1900s, at which time there was a population boom, which corresponds to a building spree. Other more localized impacts can be tied to mining techniques. The use of hydraulic mining destroyed large portions of hillsides, as did the cumulative effects of pit mines. The cumulative effects of these impacts decrease the likelihood of encountering bow stave trees around historic mines and urban areas.

Modern Impacts

Wildfires are some of the most visible impacts to pinyon-juniper woodland populations. Fire will kill an individual juniper if over 60 percent of the crown is scorched (Elena 1999). However, as a juniper matures juniper suppresses understory growth, creating natural fire breaks giving some protection (Elena 1999; Tausch and West 1988).

Less visible, but probably more destructive are modern wood gathering efforts. Roads are frequently utilized to gain access to firewood and fence post material. In general, wood and fence post cutting can be expected to take place fairly close to road access.

MODEL METHODS

Areas where it is more likely to encounter bow stave trees can be defined using a weighted overlay method. This method allows multiple cost layers to be combined using a common scale according to its importance (ESRI 2010). Four sets of cost overlays consist of raster files representing (Figure 5):

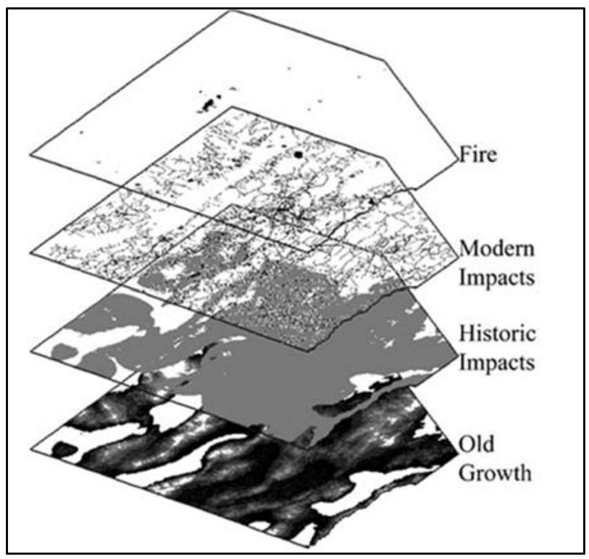


Figure 5. Raster Input Used in the Probability Model.

1. The potential old growth pinyon/juniper ecotone
2. A buffered area around historic urban areas and mines
3. Buffered areas around existing roads
4. Known locations of forest fires

An arbitrary value is given to each overlay. This can be either positive or negative, depending on whether the likelihood of encountering old growth juniper increases or decreases. These values are summarized in Table 1. Fundamental to accomplishing this goal is the identification of areas with old growth woodlands. Studies have indicated that old growth woodlands are likely in protected areas, particularly those having increased slopes and southern aspects (Miller et al. 1999; Tausch and West 1988). Initially, the pinyon/juniper zone can be extracted based on elevation. This area between 2,730 and 1,890 m AMSL is divided into nine equal classes. Classes were given a value of 1 to 9 with increased value given to increased elevation.

Table 1. Weighted Index Table including Description and Sources.

Raster Input	Category and Class	Influence (Weight)	Description/Source
Pinyon/juniper Old Growth [a]	9 Classes, 1 = Low 9 = High	75	1,830–2,730 m elevational zone following EPA weighted towards south facing slopes and steeper terrain (Miller et al. 1999:382). Using 1:24,000 DEM, 1:100,000 accuracy)
Historic Impacts [b]	-1 = Present	10	60 mi. buffer around Eureka, NV (Reno 1996), 10 mi. around historic towns, ranches, and mines to account for use of juniper as construction material using Nevada Place Names shape file (1:24,000 effective accuracy)
Modern Disturbance [C]	-3 = . 25 mi. -2 = 0. 5 mi. -1 = 1. 0 mi.	10	Buffered areas along mapped roads. Derived from 1:100,000 Nevada BLM Road Layer.
Historic Fire Areas [c]	-1 = Present	5	NV Fire History 1910-1999 (1:100,000 effective accuracy)

Data Source
[a] http://heritage. nv. gov/gis
[b] http://heritage. nv. gov/gis_details#GNIS
[c] http://www. blm. gov/nv/st/en/prog /more_programs/geographic_sciences/gis/ geospatial_data. html

This was done in part due to the recent (within the past 100 years) advancement of juniper as the result of climate change and human impacts (Miller et al. 1999). In addition, areas with south facing slopes (*i.e.*, aspect of 134 to 324 degrees) were also identified in ArcGIS. Similarly, slope was classified as steep if it was over 27 degrees. Slope was classified into three equal zones that were each assigned a value between 1 (low) and 3 (high) with value increasing with slope. These three layers, elevation, aspect, and slope, were then combined by weighted sums found in the ArcGIS spatial analysis extension (Figure 6). The weighted sums overlay tool adds the values of raster cells within each layer to get a cumulative value between 1 and 9 (the seven classes of elevation + southern aspect + steep slope). Areas with higher values are more likely to contain areas of old growth juniper, while areas with lower values are likely to be dominated by younger trees (Figure 6, Table 1).

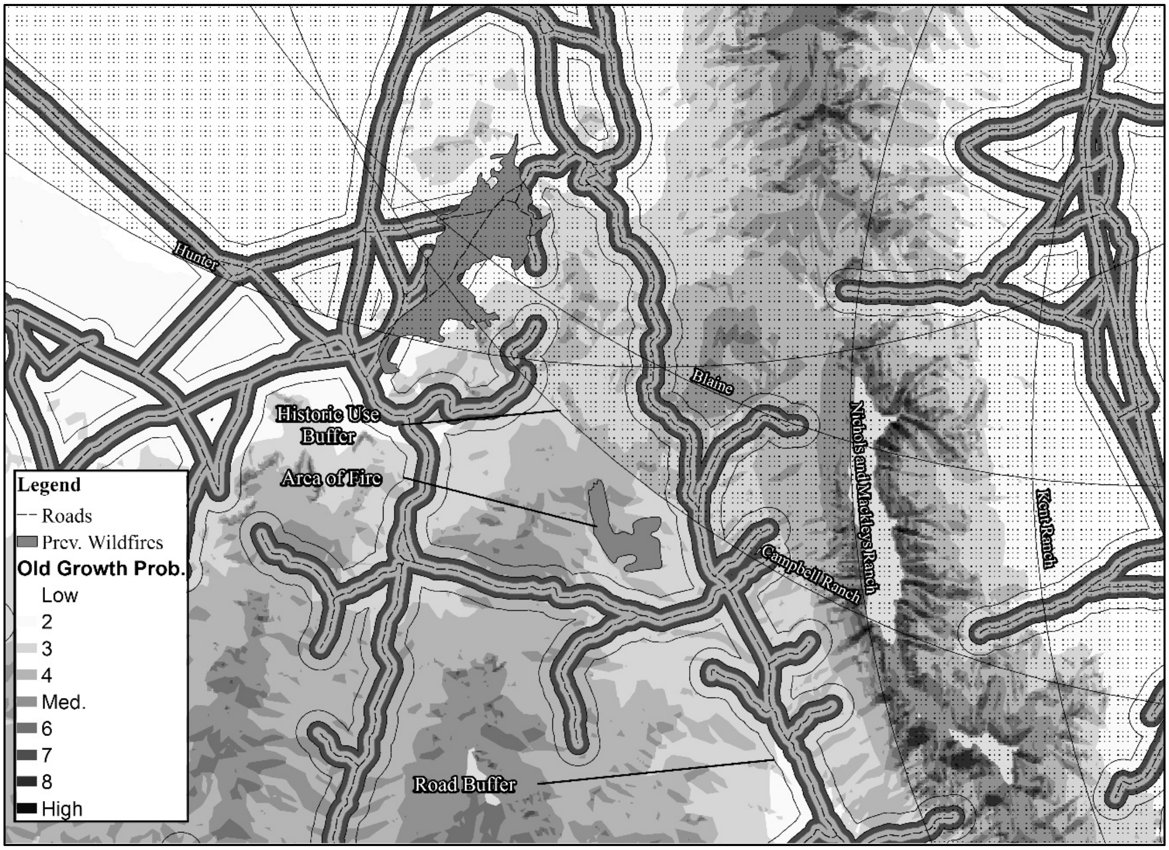


Figure 6. Example of Overlays used to Build the Probability Model.

Historic impacts were identified using the Nevada Place Names shapefile available online. Historic locales within White Pine County were selected and buffered using the proximity tool in ArcGIS. One hundred and one locations were selected within the shape file. In addition to these, a 60 mi. buffer around Eureka was generated based on data presented by Reno findings (1996). This buffer was to account for the charcoal industry that supported smelting operations in that area.

Modern disturbances were modeled based on proximity to known roads. Over 12,070 km of roads are mapped in White Pine County.

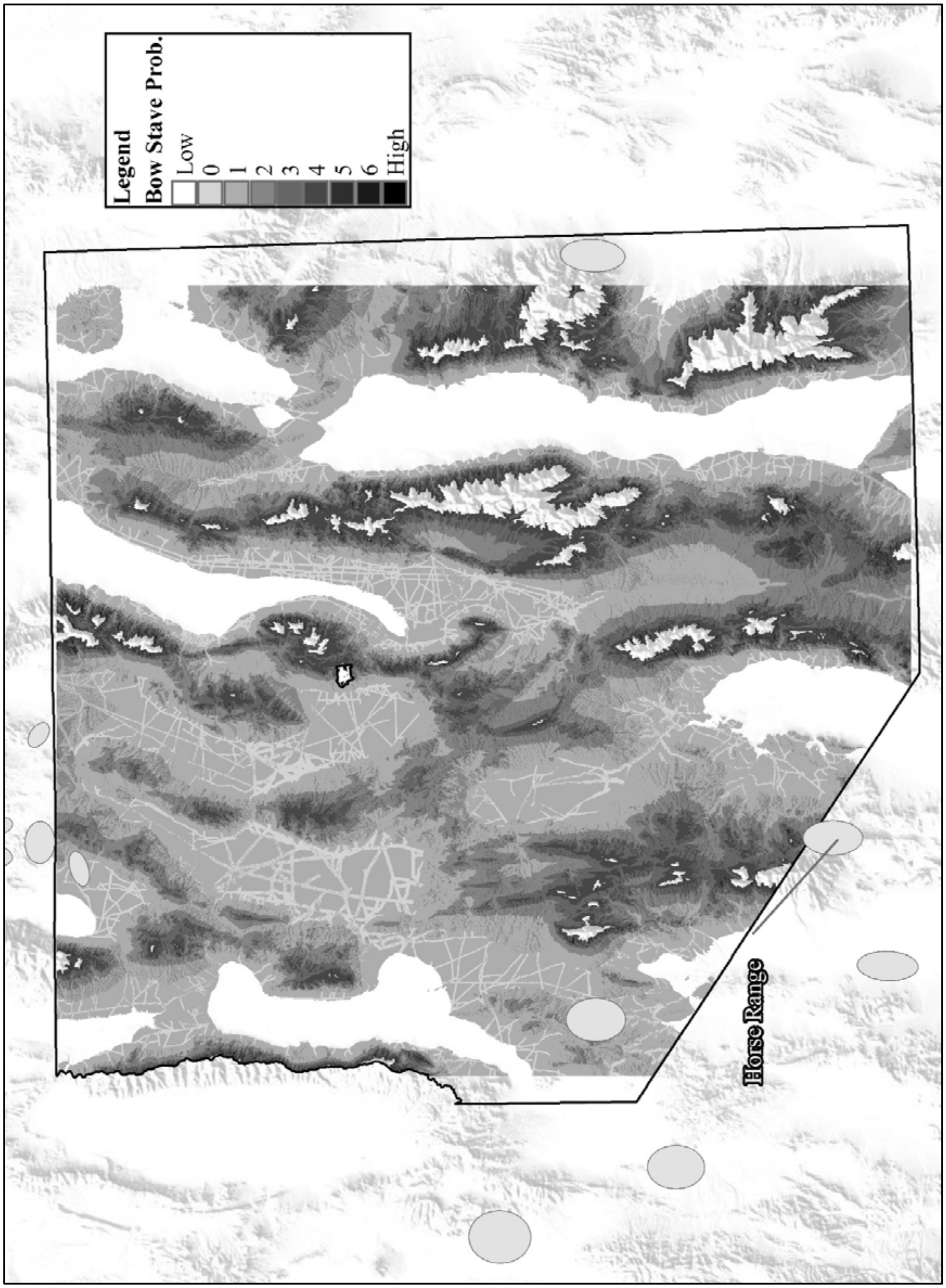


Figure 7. Probability Map for Bow Stave Trees in White Pine County. Gray Ellipsis Denote areas where Game Drives have been Reported (Arkush 2013; Hockett et al. 2013; Hockett and Murphy 2009).

Arbitrary buffers were created for three distances, 161 m (0.1 mi.), 322 m (0.2 mi.), and 805 m (0.5 mi.). It was assumed that pinyon/juniper woodlands closer to roads would be subject to greater impact from wood collection.

This resulted in 2,009 km^2 being attributed to the 0.1 mi. zone, 1,761 km^2 attributed to 0.2 mi. zone, and 2,973 km^2 attributed to the 0.5 mi. zone. Fire data was obtained from the Nevada BLM Geospatial web site. Between 1910 and 1999, 95 fires took place in White Pine County. This accounted for 3.5 km^2 (863 acres).

MODEL RESULTS AND DISCUSSION

As Figure 7 shows, the likelihood of encountering old growth pinyon-juniper woodland (and the potential for the presence of bow stave trees) increases with elevation and in areas with south-facing slopes. Although the cumulative impact of historic use and modern impacts reduces the area of potential old growth pinyon/juniper from 1,688 km^2 to 1,320 km^2, this is not significant ($t = .9$, $df = 15$, $p = .05$).

Two additional refinements may help refine the model: (1) including archaeological data; and (2) refining pinyon/juniper occurrences using aerial imagery of contemporary pinyon/juniper woodland. As noted above, (Wilke 1988) observed that bow stave trees in western Nevada occurred in moderate proximity to habitation sites and game drives. These features represent sites that would have been persistently revisited prehistorically and, at least in the case of game drives, are easily identifiable at the landscape level. Repeated use and easy identification of a location would allow Native American peoples to relocate the bow stave tree with relative ease.

Site 26WP5373, location of the White Pine County bow stave tree, is a large multicomponent site around a spring that has several hearths, a locally utilized lithic source, and an ethnographic camp with a wooden wind break structure. Close by a pinyon pole and possible wood mortar were recorded at a nearby site (26WP5177). The archaeological assemblages at both sites suggest persistent long-term use of the location. The bow stave tree recorded by Bowers (2008) was also within a site with a possible windbreak and hunting blind. The bow stave trees recorded by Overly (2003) are within a persistently reoccupied habitation site (CA-MNO-615) in a canyon drainage. In all three cases, the association with recurrent use seems clear and is likely due to these being persistent places on the cultural landscape.

Within White Pine County, large mammal game drives have been reported in northern Butte Valley, Newark Valley, and at the eastern base of the Snake Range (Arkush 2013; Hockett et al. 2013; Hockett and Murphy 2009, Figure 7). Just outside of the county in the Horse Range near Currant, Nevada, archaeological surveys recorded large game drives, Ethnohistoric features such as wickiups, pinyon caches and pinyon cone roasting pits, and many Desert Side-notched points (Vickie Clay, personal communication 2003). By using these types of archaeological data, we can buffer known locations for major sites and game drives to improve the model.

Accuracy in identifying old growth woodlands would also aid in refining the model. For example, the bow stave tree at 26WP5373 falls within an area of low probability (1 on a scale of 0 to 7, Figure 8). This tree is located at 2,099 m AMSL on a gentle 3-5 degrees east facing slope.

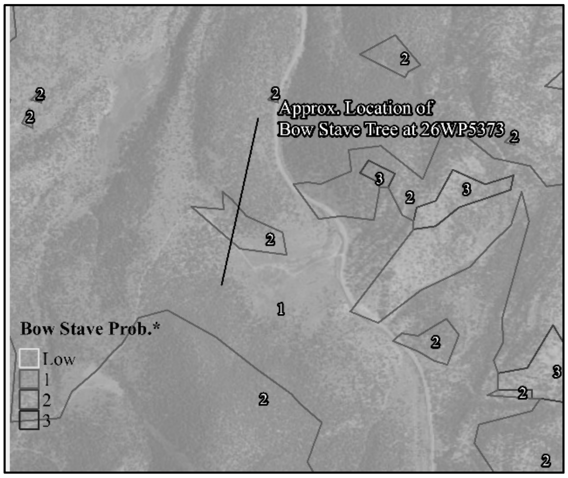
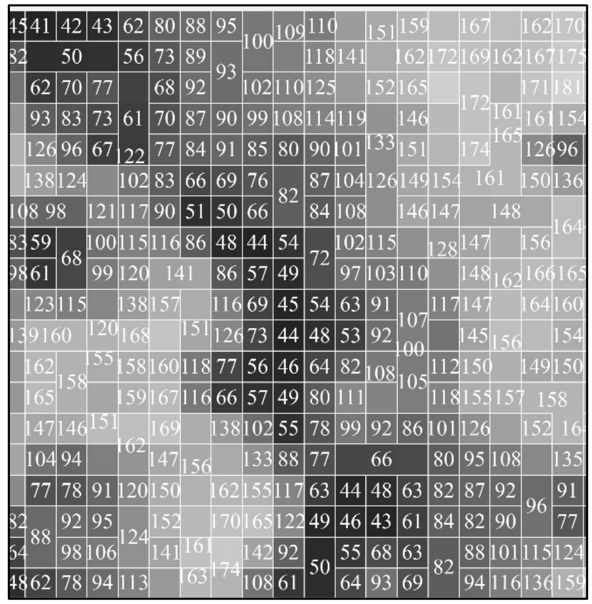


Figure 8. Bow Stave Probability Values Near the Bow Stave Tree at 26WP5373.
***Only probability zones within the view extent are shown.**

However, as the aerial image in Figure 8 shows, the bow stave is within a relatively dense woodland.

One possible method for identifying old growth trees, regardless of slope and aspect, is through aerial photography. By selecting for pixel values corresponding to those of the woodland canopy, a more refined pinyon/juniper layer can be achieved (Figure 9a). For example, in the area depicted in Figure 9b (19,857 m^2), there is almost a 34 percent reduction in area when using pixel value to identify pinyon/juniper (6,929 m^2). This is compared with the original pinyon/juniper layer where the entire area was evaluated to have a medium potential to have old growth pinyon/juniper. The pixel approach has the potential to strengthen the predictive model by reducing the target area where old growth pinyon/juniper are found.



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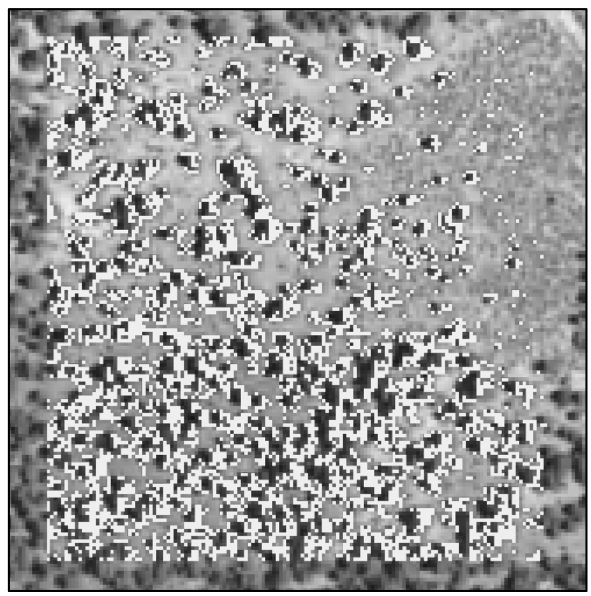

b

Figure 9. Schematic Representation of Pixel Values for an Aerial Image of Area Shown in Figure 8 (9a) and Highlighted Values (white, pixel value = 78-116) Associated with Pinyon/juniper (9b).

CONCLUSIONS

It is a simple fact that archaeologists rarely encounter bow stave trees. Part of the reason for this is because of the scarcity and difficulty in locating these resources in the best of circumstances; however, a lack of archaeological awareness is also a factor. As a result, we know little about their distribution across the Great Basin and even in regions where they have been identified. In addition, bow stave trees are frequently located in areas that were frequented prehistoric and historically. It also appears that bow stave trees occur in groups, so, once a bow stave tree is found, it is likely that more are present in the same area. In the model presented here, proximity to roads, historic use, and fires were used as the main indicator of the probability of destruction of bow stave trees, but there are a number of other factors that can also be considered and other methods that can improve the model. Creating a probability model of bow stave tree locations can be a useful tool to help manage this unique resource. This paper is meant as a starting point. In the future, it is hoped that the validity of the model will be demonstrated through fieldwork using a stratified sampling strategy.

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REFERENCES

Arkush, Brooke S.

2013 Communal Pronghorn Hunting in the Great Basin: What Have We Learned Over the Last Twenty-Five Years? *Pacific Coast Archaeological Society Quarterly* 49(3 and 4): 17–35.

Bowers, Robin F.

2007 Chapter 38-Site 26WP5373 (CrNV-04-8530) “North Spring.” In *The Sierra Pacific Falcon Project: Archaeological Excavations in Central and Eastern Nevada*, edited by Angus Quinlan and Kathy Ataman, pp. 843–882. Summit Envirosolutions, Inc., Carson City, Nevada.

2008 Borealis II: A Class II Cultural Resources Inventory for Gryphon Gold, Mineral County, Nevada. Summit Envirosolutions, Inc., Carson City, Nevada.

Curtis, E. S.

1926 *Southern California Shoshoneans. The Diegueños. Plateau Shoshoneans. The Washo.* Vol. 15. The North American Indian. The University Press, Cambridge, Massachusetts

Elena, Zlatnik

1999 Species: Juniperus osteosperma. *Fire Effects Information System, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory*.

ESRI
2010 Weighted Overlay (Spatial Analyst). *ArcGIS Help Library for ArcGIS 10.2*.

Hauer, A. Craig
2002 Observations about the Bow Stave Trees in Long Valley, California.

Hauer, A. Craig, Vickie L. Clay, and C. Lynn Furnis
2003 Bow Stave Trees: A Simple Predictive Model of a Threatened Archaeological Resource Boulder City, Nevada.

Hockett, Bryan, Cliff Creger, Beth Smith, D. Craig Young, James Carter, Eric Dillingham, Rachel Crews, and Evan Pellegrini
2013 Large-scale trapping features from the Great Basin, USA: The significance of leadership and communal gatherings in ancient foraging societies. *Quaternary International* 297: 64–78.

Hockett, Bryan, and Timothy W. Murphy
2009 Antiquity of Communal Pronghorn Hunting in the North-Central Great Basin. *American Antiquity* 74(4): 708–734.

Miller, Rick, Robin Tausch, and Wendy Waichler
1999 Old-Growth Juniper and Pinyon Woodlands. In *Proceedings: Ecology and Management of Pinyon-Juniper Communities Within the Interior West* pp. 375–384.; U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Provo, Utah.

Overly, Stephen Anthony
2003 Using a Comparative Approach to Investigate a Persistently Used Landscape: Site and Off-Site Archaeology at Little Hot Creek, Mono County, California. Unpublished Thesis, California State University-Sacramento, Sacramento.

Reno, Ronald L.
1996 Fuel for the Frontier: Industrial Archaeology of Charcoal Production in the Eureka Mining District, Nevada 1869-1891. Unpublished Dissertation, University of Nevada, Reno, Reno, Nevada.

Stewart, Omer C.
1941 *Cultural Elements Distributions: XIV- Northern Paiute*. Vol. 4. Anthropological Records. University of California Press, Berkeley.

Tausch, Robin J., and Neil E. West
1988 Differential Establishment of Pinyon and Juniper Following Fire. *The American Midland Naturalist* 119(1): 174–184.

Wigand, Peter E.
2007 Chapter 6: The Environmental Context of Human Occupation in

Central Nevada. In *The Sierra Pacific Falcon Project: Archaeological Excavations in Central and Eastern Nevada*, edited by Angus Quinlan and Kathy Ataman, pp. 83–111. Summit Envirosolutions, Inc., Carson City, Nevada.

Wilke, Philip J.
1988 Bow Staves Harvested from Juniper Trees by Indians of Nevada. *Journal of California and Great Basin Anthropology* 10(1): 3–31.

REPORTS

Starch Residue Analysis from Two High-Altitude Village Locations in the Intermountain West: Preliminary Results

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This paper is a preliminary report on starch residue analysis of ground stone implements from two high-altitude village locations: High Rise Village in Wyoming's Wind River Range and the White Mountain alpine village sites in eastern California. Rare and intensive residential use of the alpine zone in North America has been attributed to either population pressure or climate degradation that forced hunter-gatherers to intensively exploit marginal resources at high-altitude (Bettinger 1991). Preliminary starch residue analyses may indicate that hunter-gatherers were intentionally targeting geophytes, a seasonally productive yet also low return resource. Throughout the world, intensive residential human use of the high-altitude zone is rare. The high-altitude zone is defined as 2,500 meters above mean sea level (m AMSL) and is characterized by a decrease in biotic productivity due to lowered rates of atmospheric oxygen, a shortened growing season, and a lack of summer water (Aldenderfer 2006). Early permanent and intensive residential use of high altitudes dates to 3,600 B.P. on the Tibetan Plateau after agriculture was introduced into the region (Brantingham and Xing 2006; Chen et al. 2015). Semi-permanent settlement of the Andes may date to as early as 10,000 B.P., but truly intensive residential use is not well documented until 2,100 B.P., particularly in the southern Andes, well after the establishment of agriculture in the region (Neme in press). In North America, intensive high-altitude residential use occurs in the very Late Holocene and is found in two areas within the Great Basin: Alta Toquima in central Nevada (the village pattern dating to perhaps 1,500 B.P. (Thomas 1994) and the White Mountains of California (the village pattern dating to after 600 B.P., Figure 1). A similar but less intensive pattern dating between 2300 and 850 cal B.P. is found in the Wind River Range of Wyoming (Adams 2010: Figure 1; Koenig 2010; Losey 2013; Morgan et al. 2012; Trout 2015). For the North American sites, shifts in subsistence strategies are not from foraging to farming but rather expansion of diet breadth marked by intensive plant processing.

Explanations for this shift from logistical to residential use of the alpine zone in North America have been explained in two ways: there are those who see high-altitude resources as productive and effecting a "pull" on hunter-gatherers to the high-altitude sites in summer and early fall, and those who see them as marginal, producing low-ranked resources with a high energy cost that are only exploited if given a "push" by external factors. Some researchers (Adams 2010; Bender and Wright 1988; Benedict 1992; Black 1991) believe that high-altitude resources "pulled" hunter-gatherers to exploit them based on the fact that these resources mature in a short and temporal interval, creating a small and concentrated, but highly productive and easily exploitable zone. These elevation zones move up the mountain as the season progresses and the snowpack recedes. Therefore, when the lowlands are dry in midsummer the high elevations become productive and continue to do so through mid-autumn, drawing hunter-gathers into the high-altitude zone (Wright et al. 1980; Benedict 1992).

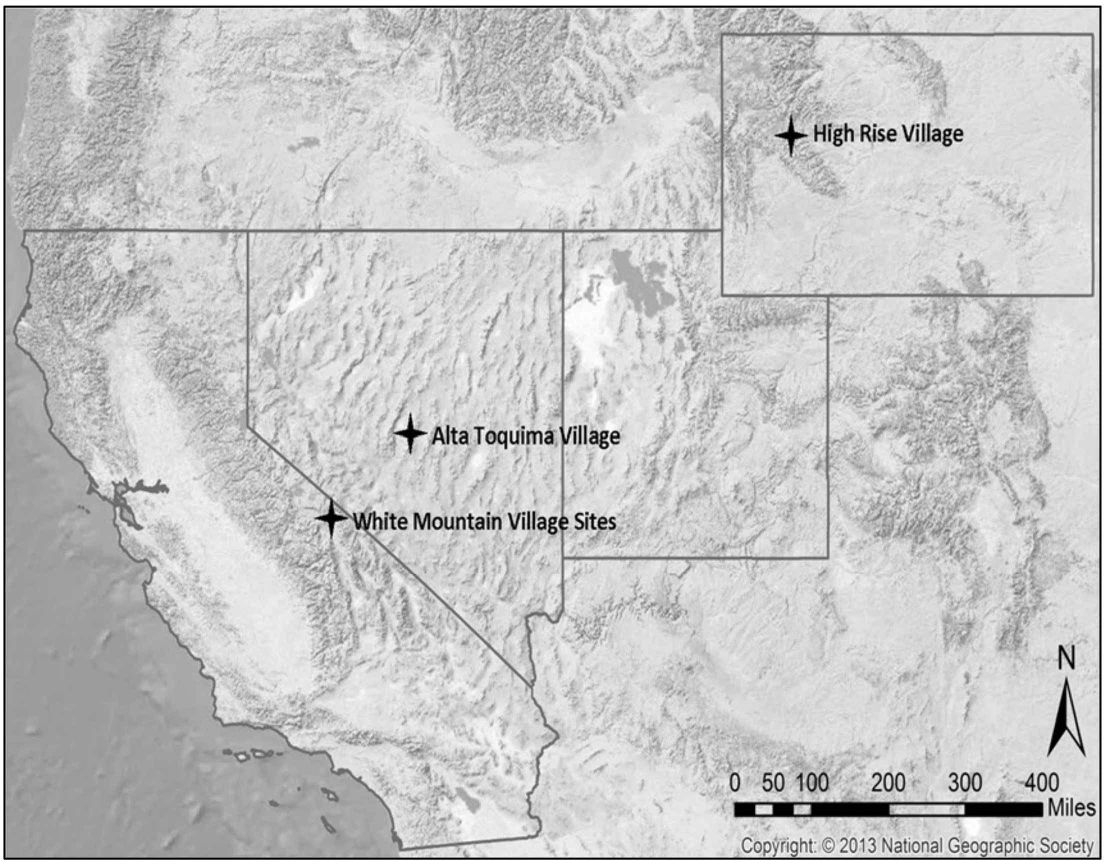

Figure 1. Locations of Known High Altitude Village Sites in the Western United States.

An alternate explanation is that a change in climate led to a degradation of lowland resources "pushing" hunter-gatherers to intensively exploit marginal areas such as the alpine zone (Bettinger 1991). In the Late Holocene there was an increase in temperature: the Medieval Warm Period (MWP) 1,150-550 B.P., which corresponds with intensified use of the alpine zone after 1,000 B.P. but does not account for the residential use of the White Mountains during the Little Ice Age (550-150 B.P.), a cooler and wetter time (LaMarche 1974), nor does it account for the intensive residential use of the Wind River Range 2300-1150 BP (But see Mensing et al. 2012; 2013 who document a warm/dry period 2800 – 1850 cal BP). Conversely, an increase in temperature may have favored resources of the alpine zone, causing treelines to rise and allowing longer growing seasons for plants to mature which may be the case at High Rise Village (Stirn 2014; Morgan et al. 2014).

Bettinger (1991) proposes that population pressure from immigrating groups may have "pushed" hunter-gatherers in the White Mountain region to intensify marginal environment use to cope with reduced resources. This hypothesis is perhaps applicable as well to the Toquima Range, though as-yet unpublished redating of the site may push its occupation earlier and may link these occupations to climate (Thomas personal communication). This is based on the idea that if hunter-gatherer populations were large and resources were at carrying capacity, a climate induced drop in resource productivity may have caused hunter-gatherers to adopted new and more costly subsistence economies such as those focuses on costly-to-process alpine roots. Bettinger (1991) proposes that such intensification may have paid for the greater caloric costs of living at altitude.

Table 1. Proposed High Elevation Sites Sample Design for Starch Residue.

Site	Elevation (m AMSL)	Date (cal B.P.)	Sample Size	Sample
High Rise Village	3,200	2300-850	20	11 milling slabs, 9 manos
White Mountains	3,130-3,154	After 600	15	15 milling slabs

This study focuses on two of these locations, the Wind River Range and the White Mountains. The White Mountain village sites located in southeastern California, include 12 residential sites in the alpine zone. Sites date to after 600 B.P. and are characterized by rock-ringed structures, well developed middens, and large quantities of ground stone (Bettinger 1991). High Rise Village, located in the Wind River Range of western Wyoming is at an elevation of 3,320 m AMSL and contains large quantities of ground stone and cut and fill residential structures dating to between 2300 and 850 cal B.P. (Morgan et al. 2012). At each of these high-altitude village sites intensive residential use is indicated by well- developed middens, rock ring or cut and fill lodge structures, and large amounts of ground stone compared to flaked stone. This indicates a shift in focus from hunting to plant processing. Because of this, many researchers (Adams 2010; Stirn 2014; Rhode and Rhode 2015) have sought to explain the scarcity of high-altitude sites in North America by their relationship to pine nut processing, a high-return activity, believing that pine nuts may have been a determining factor in high-altitude occupation. To test whether hunter-gatherers were in fact processing pine at these high-altitude village sites, starch residue analysis will be conducted on 35 ground stone pieces from High Rise Village and several of the White Mountain village sites (Table 1). At present, only nine samples have been processed from High Rise Village; the other analyses and results are pending.

METHODS: RESIDUE ANALYSIS

Starch residue analysis is founded on the idea that organic materials have chemical and biomolecular structures that can survive in archaeological deposits in varying ways, and that all organic materials carry a "fingerprint" that can be identified, either through chemical or optical analysis (Evershed 2008). Residue analysis uses chemical extraction and chemical and biomolecular analysis to identify organic residue from archaeological contexts that cannot otherwise be identified (Evershed 2008). Starches are extracted using a sonic toothbrush and distilled water. Residue and water is collected in a pipette and placed in a centrifuge for separation and reduction. After reduction Lithiumhetero-phyltungstates (LST) water is added to the solution and placed in the centrifuge for further separation. The light fraction (residue and pollen) are removed from the surface of the solution and placed on a slide for analysis. The typological analysis is done using a cross-polarized incident light microscope, and compared to a comparative collection of possible starches from the study area (Balme et al. 2014; Torrence and Barton 2006).

Five physical traits of starches relating to how light passes through it, morphology, and internal structure are useful for determining taxonomy. These traits include:

1. The birefringent property that all starches exhibit due to the highly order molecular structure of the grains.
2. Faceted or rounded shape of the grain.
3. The eccentricity of the hilum, which is the cross section in the middle of the grain.
4. The presence or absence of a vacuole which is the area of initial growth of the grain and can vary among taxa.
5. The presence or absence of lamellae or growth rings which can be taxon specific. (Torrence and Barton 2006).

PRELIMINARY RESULTS

Fifteen grains were found on the six of the nine specimens processed thus far from High Rise Village (Table 2). All of these grains will undergo metric analysis to positively identify them to specific taxon when possible and for now the results are tentative. Eleven of the grains found share morphological characteristics with geophyte grains, having a faceted shape, centric hilum, and vacuole present at the center of the hilum. Ten of these grains share characteristics with *Lomatium roseanum* or biscuitroot and one shares characteristics with *Lewisia rediviva* (bitterroot). None of the grains share morphological similarities with either pinyon or whitebark pine nut starch grains, which are much smaller, round in shape, have a centric hilum with straight arms, and no vacuoles or lamella. It is important to note, however, that these results still need to be verified and therefore must be considered preliminary and prone to revision.

IMPLICATIONS

Many researchers have sought to explain the shift to intensive residential use of the high-altitude zone. In the White Mountains it has been proposed that pinyon pine nuts were used to subsidize alpine villages (Scharf

Table 2. Preliminary Results of Starch Residue Analysis from High Rise Village Ground Stone.

Taxon	Common Name	Number of Starch Grains
Lewisia rediviva	Bitterroot	1
Lomatium roseanum	Biscuit root	10
Pinus monophyla	Pinyon pine	0
Pinus albicaulis	Whitebark pine	0
Unidentified-broken		4

2009; see also Watkins 2000 for a similar argument from Utah's Uinta Range). In the Wind River Range researches have long thought that alpine villages were specifically occupied to target whitebark pine in the late summer to early fall (Adams 2010). Excavation of High Rise Village revealed the main residential occupation of the site corresponded with an upward advance of the whitebark treeline by over 100 m (Morgan et al. 2014). To test this theory Stirn (2014) developed a predictive model for known village locations in the Wind River Range and large whitebark pine stands and found a correlation. He then ground-truthed his model and found 13 more small residential sites leading him to conclude that Wind River "village locations were targeted specifically for the optimal procurement of pine nuts" (Stirn 2014:523).

A similar model was developed by Hildebrandt (2013) in the Toquima and Toiyabe Ranges of central Nevada. He found that alpine villages in these ranges occur only in areas where limber and pinyon pine groves have a large enough extent and are easily accessible from the alpine zone to subsidize alpine villages. This explains the lack of village sites in the Toiyabe Range and the presence of Alta Toquima in the Toquima Range (but see Morgan et al. 2015).

However, if we consider return rates of alpine and subalpine resources (Table 3) we see pinyon pine has a similar return rate (1,125 kcal/hr) to biscuitroot (1,300-1,400 kcals/hr), an alpine plant traditionally harvested by Great Basin peoples. If we consider the seasonality of the two types of resources pine becomes a less favorable resources. Pine ripens in the fall, in the alpine zone this time would be marked by unpredictable weather with an increased threat of snow as well as a lack of water in alpine springs and streams. Biscuitroot on the other hand, ripens in the early spring and summer when snow is melting at high elevations, thus the alpine springs and streams would be full and the threat of inclement weather would be lower.

If we then consider the predictability of the two resources pine becomes even less favorable of a resource. Researchers have found that changes in moisture and temperature at key points in the development of pine cones can cause fluctuations in masting years and no development of seeds in some instances (Mutke et al. 2005). Specifically high temperatures during cone growing season has the most significant effect and trees located in higher generally cooler elevations are the most susceptible (Redmond et al. 2012). Geophytes however, show evidence of a high resiliency or orthoselectivity (Prouty 1995).

Geophytes are plants that contain underground storage organs (USO) full of carbohydrates and polysaccharides used for survival during dormancy. The nature of these USOs allow them to be well adapted to variations in temperature and moisture (Smith and McNees 2005). This means that during large scale fluctuations in climate, geophytes are able to remain in place without large scale changes in distribution and production (Prouty 1995). If hunter-gatherers sought to avoid risk though targeting predictable resources, then geophytes would be selected over pine nuts.

Prehistoric root use has been documented in the ethnographic record as having varying importance in hunter-gatherer diets in the western United States (Smith and McNees 2005). In the Pacific Northwest, root procurement was an integral part of forager diets, with some researchers (Ames and Marshall 1995; Prouty 1995; Thomas 1989) concluding that root use provided a stable, storable resource that allowed for a seasonal sedentary settlement pattern. Ethnographic work has demonstrated that for northern groups, root procurement was an important social and subsistence activity in the late spring and early summer (Couture et al. 1986).

Table 3. Return Rates for Great Basin and Rocky Mountain Resources.

Resource	**Low Return Rate (Kcal/Hr)**	**High Return Rate (Kcal/Hr)**	**Average Return Rate (Kcal/Hr)**	**Resource References**
Sheep	17,971	31,450	24,711	Simms 1987
Marmot	15,725	17,971	16,848	Losey *2013*
Pinyon Pine	841	1,404	1,125	Simms 1987, Barlow and Metcalfe 1996
White Bark Pine			1,941 (Unprocessed)	Adams 2001
Limber Pine			13, 437 (Unprocessed)	Rhode *2010*
Biscuitroots (*Cyompterus Bulbosus)*	1,054	1,867	1,461	Smith and M: Nees 2005
Lomatium Hendersonii			3,831	Couture et al .1986
Lomotium Cous			1,219	Couture et al. 1986
Bitterroot (*Lewisio Redivivo)*			1,374	Couture et al .1986
Sunflower	467	504	486	Simms 1987
Pickle Weed			402	Simms 1987, Barlow and Metcalfe 1996

However, evidence for root procurement in the archaeological record is scarce due to the lack of preservation of root remains, their lack of disposable parts, and the minimal amount of processing tools required for root procurement, the most important of which, the digging stick, does not preserve well in archaeological contexts (Smith and McNees 2005). The appearance of ground stone in archaeological sites indicates some sort of processing occurred and starch residue analysis is well suited to answers questions of which, if any, plants were being processed at archaeological sites.

It has long been assumed that alpine environments were mainly used to procure high ranked animal resources. In the Great Basin, Steward's work with the Shoshone and Paiute showed that valley and foothill resources dominated subsistence patterns with high-altitude resources playing only a minor role for hunting (Steward 1933;1941). In the Great Basin and Rocky Mountain region, however, there is evidence of high-altitude residential sites in both the White Mountains of eastern California, the Toquima Mountains of central Nevada, and the Wind River Range of western Wyoming. These sites appear to be anomalous in that they contradict previously held ideas about hunter-gatherer adaptive choices, specifically that groups will intensively utilize plant resources in lieu of hunting (Bettinger 1991). Thus far starch residue analysis from two high-altitude village locations shows that at High Rise Village in Wyoming hunter-gatherers were intensively processing roots, possibly exclusively. This may indicate that root processing led people in Wyoming, and perhaps the White Mountains to shift their use of the alpine zone to an intensive residential pattern.

REFERENCES

Adams, Richard
2010 Archaeology with Altitude: Late Prehistoric Settlement and Subsistence in the Northern Wind River Range, Wyoming. Unpublished Ph. D. dissertation, Department of Anthropology, University of Wyoming, Laramie.

Aldenderfer, Mark
2006 Modelling Plateau Peoples: the Early Human Use of the World's High Plateaux. *World Archaeology* 38(3): 357-370.

Ames, Kenneth M., and Alan G. Marshall
1995 Villages, Demography and Subsistence Intensification on the Southern Columbia Plateau. *North American Archaeologist* 2(1): 25-52.

Balme, Jane, Glenn Garbin, and Richard A Gould
2014 Residue Analysis and Palaeodiet in Arid Australia. *Australian Archaeology* 53(53): 1-6.

Barlow, K R, and D Metcalfe
1996 Plant Utility Indices: Two Great Basin Examples. *Journal of Archaeological Science* 23 (August 1994): 351-371.

Bender, Susan J., and Gary A. Wright
1988 High-Altitude Occupations, Cultural Process , and High Plains Prehistory : Retrospect and Prospect. *American Anthropologist* 90(3): 619-639.

Benedict, James B.
1992 Footprints in the Snow: Cultural Ecology of the Colorado Front

Range, U. S. A. *Arctic and Alpine Research* 24(1): 1-16.

Bettinger, Robert L.
1991 Aboriginal Occupation at High Altitude: Alpine Villages in the White Mountains of Eastern California. *American Anthropologist* 93(3): 656-679.

Black, Kevin D.
1991 Archaic Continuity in the Colorado Rockies: The Mountain Tradition. *Plains Anthropologist* 36(133): 1-29.

Brantingham, P. Jeffrey, and Gao Xing
2006 Peopling of the Northern Tibetan Plateau. *World Archaeology* 38(3): 387-414.

Chen, F. H., G. H. Dong, D. J. Zhang, X. Y. Liu, X. Jia, C. B. An, M. M. Ma, Y. W. Xie, L. Barton, X. Y. Ren, Z. J. Zhao, X. H. Wu and M. K. Jones
2015 Agriculture Facilitated Permanent Human Occupation of the Tibetan Plateau after 3600 B.P. *Science* 347(6219):248-250.

Couture, Marilyn D., Mary F. Ricks, and Lucile Housley
1986 Foraging Behavior of a Contemporary Northern Great Basin Population. *Journal of California and Great Basin Anthropology* 8(2): 150-160.

Evershed, R P
2008 Organic Residue Analysis in Archaeology: The Archaeological Biomarker Revolution. *Archaeometry* 6(August): 895–924.

Hildebrandt, Tod W.
2013 Intensification, Storage, and the Use of Alpine Habitats in the Central Great Basin: Prehistoric Subsistence Strategies in the Toquima and Toiyabe Ranges, Unpublished MA Thesis. Department of Sociology, Social Work, and Anthropology, University of California, Davis.

Koenig, Orrin
2010 Does this Hearth Have a Home? A Hearth Centered Spatial Analysis, Unpublished MA Thesis. Department of Anthropology, University of Wyoming, Laramie.

LaMarche, Valmore C.
1974 Paleoclimatic Inferences from Long Tree-Ring Records. *Science* 183(4129): 1043-1048.

Losey, Ashley
2013 Risk and Climate at High Elevation: A Z-Score Model Case Study for Prehistoric Human Occupation of Wyoming's Wind River Range. M. S. Thesis, Department of Sociology, Social Work, and Anthropology, University of Utah, Logan.

Mensing, Scott, John Korfmacher, Thomas Minckley and Robert Musselman
2012 A 15,000 year Record of Vegetation and Climate Change from a Treeline Lake in the Rocky Mountains, Wyoming, USA. *The*

Holocene 22(7):739-748.

Mensing, Scott A., Saxon E. Sharpe, Irene Tunno, Don W. Sada, Jim M. Thomas, Scott Starratt and Jeremy Smith
2013 The Late Holocene Dry Period: Multiproxy Evidence for an Extended Drought Between 2800 and 1850 cal yr BP across the central Great Basin, USA. *Quaternary Science Reviews* 78(0):266-282.

Morgan, Christopher, Mark Giambastiani, Robert Bettinger, Marielle Black, and Amanda Rankin
2015 Environmental Limitations, Alpine Villages and Logistical Strategies in the Northern White Mountains. Paper presented for the 80th Annual Meeting for the Society for American Archaeology San Francisco, California.

Morgan, Christopher, Ashley Losey, and Richard Adams
2012 High-Altitude Hunter-Gatherer Residential Occupations in Wyoming's Wind River Range. *North American Archaeologist* 33(1): 35-79.

Morgan, Christopher, Ashley Losey and Lukas Trout
2014 Late Holocene Paleoclimate and Treeline Fluctuation in Wyoming's Wind River Range, USA. *The Holocene* 24(2):209-219.

Morgan, Christopher
2015 Is it Intensification Yet? Current Archaeological Perspectives on the Evolution of Hunter-Gatherer Economies. *Journal of Archaeological Research* 23:1-51.

Mutke, Sven, Javier Gordo, and Luis Gil
2005 Variability of Mediterranean Stone Pine Cone Production: Yield Loss as Response to Climate Change. *Agricultural and Forest Meteorology* 132(3-4): 263-272.

Neme, Gustavo
2015 El Indígino and High-Altitude Human Occupation in the Southern Andes. *Latin American Antiquity*, in press.

Prouty, Guy Lee
1995 *Root and Tubers: Prehistoric Plant Use, Settlement and Subsistence Intensification, and Storage in the Fort Rock Basin, Northern Great Basin, Oregon*. University of Oregon, Bend.

Redmond, Miranda, Frank Forcella, and Nichole Barger
2012 Declines in Pinyon Pine Cone Production Associated with Regional Warming. *Ecosphere* 3(12): 1-12.

Rhode, David
2015 Plant Resources in Great Basin High Altitude Foraging. Paper Presented at the 80th Society for American Archaeology Annual Meeting, San Francisco.

Rhode, David and Allise A. Rhode

2015 Energetic Return Rates from Limber Pine Seeds. *Journal of California and Great Basin Anthropology*, in press

Scharf, Elizabeth A.
2009 Foraging and Prehistoric Use of High Elevations in the Western Great Basin: Evidence for Seed Assemblages at Midway (CA-MNO-2169), California. *Journal of California and Great Basin Anthropology* 29(1):11-27.

Simms, Steven R.
1987 *Behavioral Ecology and Hunter-Gatherer Foraging: An Example from the Great Basin.* British Archaeological Reports International Series 381, Oxford, England

Smith, Craig S., and Lance M. McNees
2005 *Cymopterus bulbosus and Prehistoric* Foragers: Patch Size, Plant Density, and Return Rates. *Journal of Ethnobiology* 25(1): 1–23.

Steward, Julian
1933 Ethnography of the Owens Valley Paiute. *University of California Publications in American Archaeology and Ethnology* 33(3): 233–250.

1941 Cultural Element Distributions, 1: Nevada Shoshone. *University of California, Anthropological Records* 4(2).

Stirn, Matthew
2014 Modeling Site Location Patterns Amongst Late-Prehistoric Villages in the Wind River Range, Wyoming. *Journal of Archaeological Science* 41(0):523-532.

Thomas, David H.
1982 The 1981 Alta Toquima Village Project: A Preliminary Report. Desert Research Institute Social Sciences and Humanities Publications No. 27. Desert Research Institute, Reno.

1994 Chronology and the Numic Expansion. In *Across the West: Human Population Movement and the Expansion of the Numa*, edited by D. B. Madsen and D. Rhode, pp. 56-61. University of Utah Press, Salt Lake City.

Thoms, Alston Vern
1989 The Northern Roots of Hunter-Gatheressr Intensification: Camas and the Pacific Northwest, Unpublished Ph. D. dissertation, Department of Anthropology, Washington State University, Seattle.

Torrence, Robin, and Huw Barton (editors).
2006 *Ancient s* Coast Press, Walnut Creek, California.

Trout, Lukas
2015 Subsistence, Mobility and Intensity of Residential Site Use: Results of Flaked Stone Analysis at High Rise Village, Unpublished M. A. Thesis, Department of Anthropology, University of Nevada, Reno.

Watkins, Robyn
2000 Site 42DC823: Evidence for High Elevation Foraging in the Uinta Mountains. *Utah Archaeology* 13(1):45-51.

Wright, Gary A., Susan Bender, and Stuart Reeve
1980 High Country Adaptations. *Plains Anthropologist* 25(89): 181-197.

QUITE A SITE – SERPENT ROCK

By Paul Scott

I am an amateur archaeologist. Recently I was asked to write an article about something I was very impressed by that might be of some interest to NAA members.

In March 2015, I visited a pictographs site near the shores of Walker Lake in Southwest Nevada. The site tour was guided by BLM Carson-Stillwater Archaeologist Kristen Bowen and Nevada Regional Site Stewardship Coordinator Jeff Thelen.

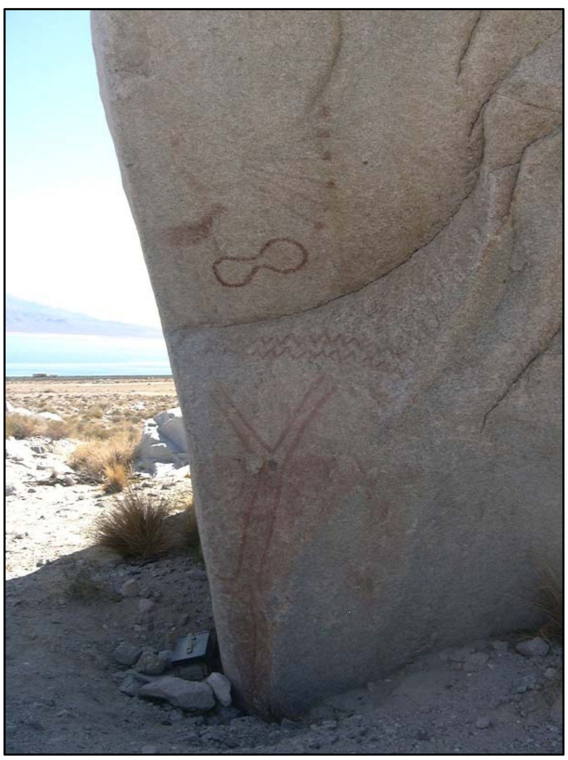

Figure 1. Visible Pictographs on North Side of Boulder.

The tour involved five vehicles and 16 people, including three children under 10 years old. The youngsters had a good time and were taught to respect the ways of ancient people and the things they left behind.

The site, which is generally referred to as "Serpent Rock," is a large granite boulder approximately 3-3.5 m high and 6-6.5 m in diameter (10-12 ft by 20-22 ft in diameter). It displays two panels of red pictographs that, according to local Paiute legend, depict a creation myth about a great flood, a giant serpent, and the formation of Walker Lake. This site is very sacred and religious to the contemporary Walker Lake Pauite.

In talking with Melvin Brown of the Walker Lake Paiute Tribe (Melvin Brown, personal communication 2015), I was told that the pictographs were created by the "Old Ones" and that there are four important aspects to the site: (1) the spatial relationship between the boulder and the lake; (2) the shape of the boulder; (3) the visible pictographs on the north side of the boulder; and (4) a nearly invisible pictograph on the east side of the boulder.

According to Melvin, the visible pictographs record the story of a "Great Flood" which created the body of water that is now Walker Lake (Figures 1 and 2).

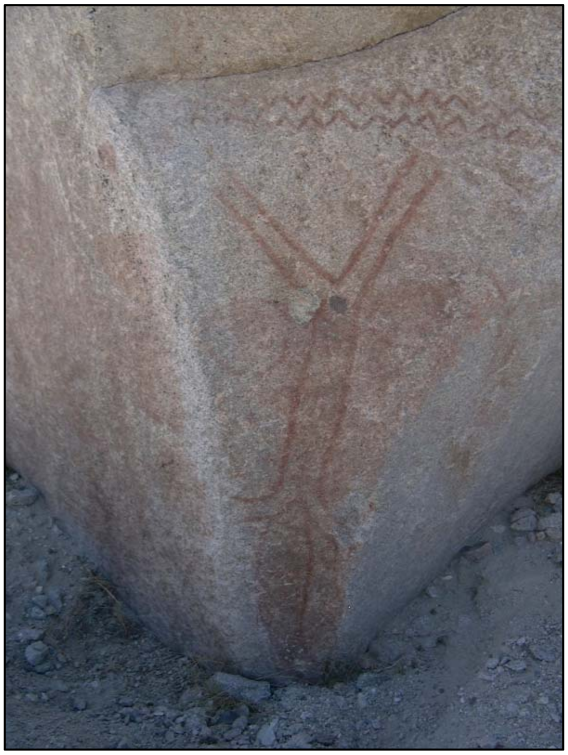

Figure 2. Closeup of Lower Pictographs on North Side of Boulder.

The story tells that local Paiute tribes were "trout eaters" who acquired most of their sustenance from fish caught in Walker Lake. The pictographs also tell of the gift of fire, and how the fire was saved by the Sagehen, transferred by the Sagehen to the Rabbit, and then ultimately given to local tribes by the Rabbit.

The nearly invisible pictograph is of a serpent with a long neck and a big body (Figures 2 and 3). It is very hard to see, possibly due to weathering given its eastern aspect or perhaps because of its greater age. The entire boulder is also very similar in shape to the serpent depicted in this glyph, seemingly with a small head and a large body. I was told that the serpent protects the rock.

But there are other legends and stories about the site as well. One story I heard suggests that Serpent Rock is a treasure map which shows where gold, silver, and gemstones were stashed – never to be found. I was also told that there were two serpents living in Walker Lake at some time in the ancient past.

In my opinion, the nearly invisible pictograph and the rock it was placed on resemble a prehistoric ichthyosaur. At one time, Walker Lake was part of ancient Lake Lahontan and probably also part of a much, much older body of water. I might speculate that an ichthyosaur could have lived in the area of contemporary Walker Lake during ancient times, or more likely that the "Old Ones" may have encountered the fossilized remains of the serpent-like animal near the Serpent Rock site. We know that Berlin-Ichthyosaur State Park, located less than 75 miles from Walker Lake, contains fossil remains of ancient ichthyosaurs. Could this be the origin of the pictographs at Serpent Rock? We may never know.

REFERENCES

Heizer, Robert F. and Martin A. Baumhoff
1962 *Prehistoric Rock Art of Nevada and Eastern California*. University of California Press, Berkeley.

Figure 3. Nearly Invisible Pictographs on East Side of Boulder.

Figure 4. Same Photo As Figure 3 with D-Stretch Applied.

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