CHANGING HYDROLOGIC REGIMES AND PREHISTORIC LANDSCAPE USE IN THE NORTHERN SAN LUIS VALLEY, COLORADO

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ABSTRACT

The rise of specialized, Paleoindian bison hunters in the Rocky Mountains accompanied the paleoecological transitions characterizing the terminal Pleistocene. In the closed-basin of the San Luis Valley, these climatic changes impacted the distribution and abundance of wetland resources. Water tables rose between ~10,900 and 10,500 yr B.P., creating grassland habitats, locally abundant playa lakes, and providing human populations with abundant prey and ready ambush locations during bison hunting. Extensive excavation (1300 m^2) and analysis of Stewart's Cattle Guard site provides an in-depth view of Folsom bison butchery, hide processing, and weaponry maintenance in a late Pleistocene, fall hunting camp. A trend toward warmer and drier conditions followed this mesic interval, punctuated by periods of increased moisture. Human populations adapted by varying their subsistence and settlement strategies. Greater reliance on plants such as Indian rice grass and hunting of smaller game distinguish Holocene adaptations. By 9500 yr B.P. pinyon trees were established in the area and their nuts became a dietary staple. A myriad of pinyon harvesting sites dot the foothills. On the valley floor, the archaeological remains of fishing camps document the use of former lakes and marshes. This paper discusses the archaeology of the San Luis Valley in light of paleoclimatic information provided by hydrological and palynological studies.

INTRODUCTION

Prehistoric human adaptations developed in relation to the changing ecosystems of which they were a part. The Paleoindian/Paleoecology Program at the Smithsonian Institution investigates the interplay between the earliest inhabitants of the New World and the dynamic reorganization of climatic, hydrologic and biotic regimes during the terminal Pleistocene. Of particular interest to our work in the San Luis Valley are the possible effects of the late Pleistocene Younger Dryas cold episode (~11,000 to 10,000 yr B.P.) on paleoenvironments, biotic carrying capacity, and hunting practices during the cultural transition from Clovis to Folsom ~10,900 yr B.P. (Haynes, 1993).

People are thought to have first entered the San Luis Valley ~11,200 yr B.P. Their archaeological remains are identified by diagnostic, fluted weapon tips, known as Clovis points, found in association with the butchered remains of extinct proboscidians, bison, turtles, and other fauna at a number of sites in North America (e.g. Frison and Todd, 1986; Haynes, 1987; Graham and Kay, 1988; Ferring, 1989). The disappearance of Clovis assemblages approximately three hundred years later may be a cultural reflection of the marked environmental changes and megafaunal extinctions at the end of the Pleistocene (Haynes, 1991, 1992).

Toward the end of Clovis, the Rocky Mountains and adjacent Plains became the domain of other hunter-gatherers (Frison, 1991, 1996), including members of the Folsom Culture, dated ~10,900 to 10,200 yr B.P. (Haynes et al., 1992). The predominant prey of Folsom groups was *Bison antiquus*, the largest herbivore to survive the late Pleistocene extinctions in North America. Communal bison hunting, as a focused rather than an opportunistic endeavor, apparently arose in the context of climatic conditions which favored the expansion of bison herds and habitat ~10,900 yr B.P.

The Smithsonian has investigated four Folsom sites in the San Luis Valley: Reddin, 5SH77; Linger, 5AL91; Zapata, 5AL90 ; and Stewart's Cattle Guard, 5AL101 (Figure 1). In conjunction with this research, palynological analyses of sediment cores from Como Lake in the Sangre de Cristo Mountains and Head and San Luis Lakes on the valley floor were initiated at the University of Arizona. These studies allow interpretation of post-glacial environmental and climate change in the Northern San Luis Valley.

GEOLOGIC AND HYDROLOGIC SETTING

The San Luis Valley is the largest of a series of high-altitude, intermontane basins located in the Southern Rocky Mountains. Geologically, this basin is a structural

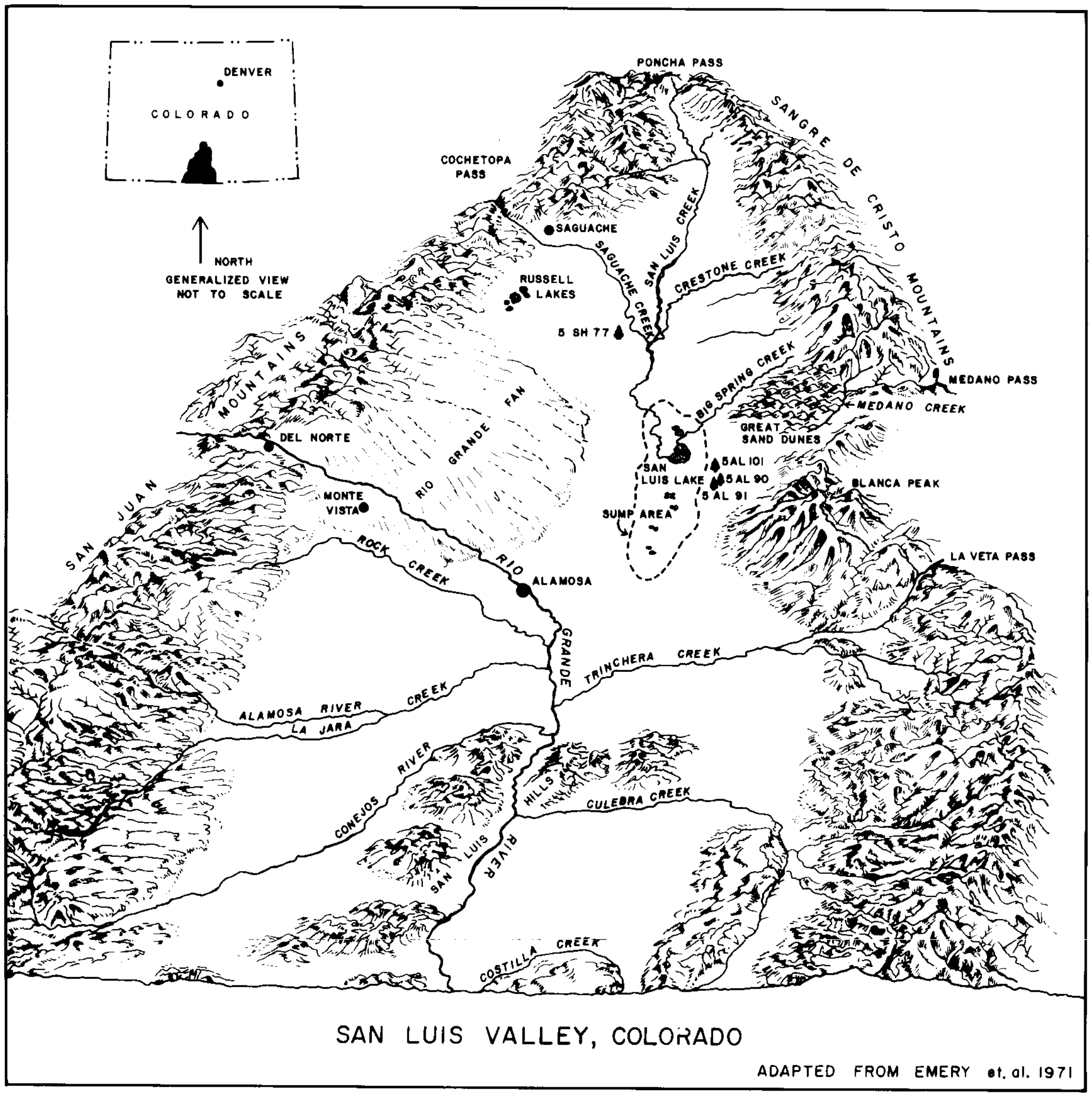


Figure 1 Map of the San Luis Valley showing the location of the Reddin (5 SH 77), Linger (5AL 91), Zapata (5 AL 90), and Stewart's Cattle Guard (5 AL 101) Sites.

depression (compound graben) that was down faulted along the base of the Sangre de Cristo Mountains and hinged at the base of the San Juan Mountains during the Cenozoic faulting of the Rio Grande Rift Zone (Chapin, 1971; Bachman and Mehnart, 1978). This created an asymmetrical basin with a topographic depression along the east side where aquifers are more extensive (Figure 2). The northern portion of the valley, from Poncha Pass to a few km north of the Rio Grande, is a closed hydrologic basin. Surface water drains toward the low-lying area currently occupied by San Luis and Head Lakes, where the piezometric surface is relatively shallow.

The shallow nature of this water table greatly influences the character of the San Luis Valley. Minor fluctuations in its level can result in dynamic shifts between wetland and xeric habitats. Our studies indicate that increases in effective moisture at various times in the past led to the enlargement of San Luis Lake, and the creation of interdunal ponds and marshes.

PALYNOLOGICAL EVIDENCE FOR ENVIRONMENTAL CHANGE

The closed-basin lakes of the western United States contain proxy records of the oscillations in temperature and precipitation which accompanied climatic change during the last deglaciation (Benson and Thompson ,1987; Forester, 1987; Smith and Street-Perrott 1983). Analysis of pollen and plant macrofossils from the sediments of Como, Head, and San Luis Lakes provide the first records of postglacial vegetation and climate history for the San Luis Valley (Shafer, 1989; Davis and Shafer, 1991; De Lanois, 1993), and temporally extend the detailed paleoenvironmental databases established for the Middle Pleistocene of this area by Rogers et al. (1985, 1992).

Como Lake

Como Lake is located on the east side of the San Luis Valley, south of the Great Sand Dunes. It is the lowest (3669 m) in a series of lakes occupying a glacial basin in the Holbrook Creek Drainage on Blanca Peak, the highest point (4373 m) in the Sangre de Cristo Mountains (Shafer, 1989). The lake currently lies ~110 m below upper treeline and has a discontinuous forest cover dominated by Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*) and bristlecone pine (*Pinus aristata*).

A 300 cm composite core (collected through water using a 5 cm piston corer) consisted of gyttja becoming siltier with depth and terminating in basal deposits of glacial rock flour. Five radiocarbon dates from spruce (*Picea*) macrofossils and gyttja provide chronologic control (Shafer, 1989). Late Quaternary temperature change can be inferred from the fluctuating position of upper treeline as reflected in the lake's pollen and plant macrofossil records. In addition, signatures of valley-floor vegetation are represented due to upslope transport of pollen (Shafer, 1989; Jodry et al. 1989).

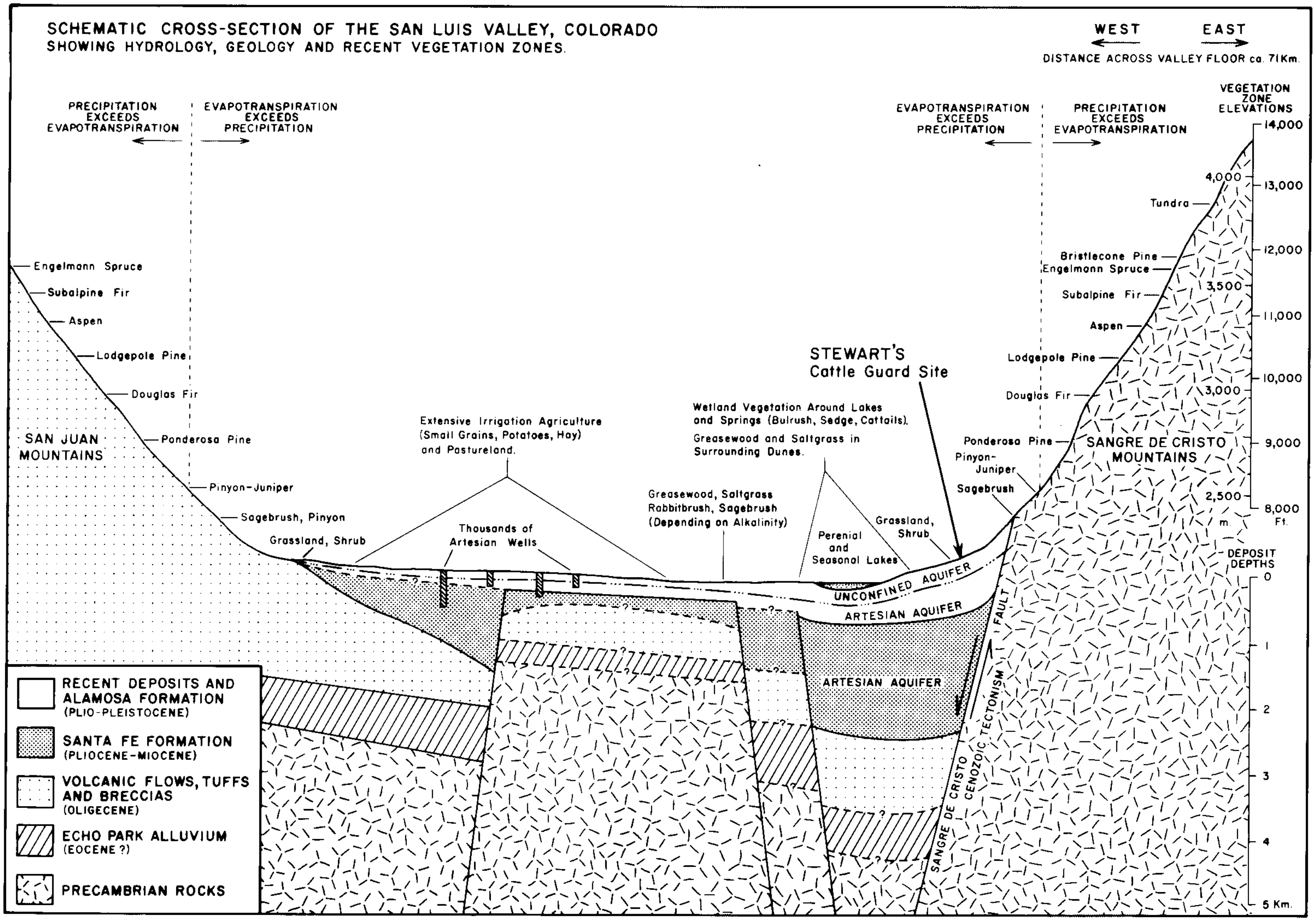
The late-glacial pollen assemblage is dominated by wide-spread sagebrush (*Artemisia tridentata*) and grasses (*Gramineae*) on the basin-floor. By ~10,500 yr B.P. a sharp increase in the percentages of spruce and pine pollen (including *Pinus aristata*) suggests that upper treeline had reached the lake following full-glacial lowering. Peaks in pine and spruce macrofossils suggest a maximum upslope advance of upper treeline from 9879 to 9571 yr B.P. (at least 175 to 203 m higher than present). This overlaps with the period of maximum July insolation values during the late Quaternary (~9600 to 9000 yr B.P.) predicted by the atmospheric general circulation models (Kutzbach, 1987). Continuous forest cover around Como Lake may have persisted until ~5500 yr B.P. when subalpine fir and bristlecone pine macrofossils last occurred. Reduced charcoal in sediments after ~4000 yr B.P. further indicates a lowering of timberline below Como. Just prior to ~2000 yr B.P. Engelman spruce macrofossils reappear, suggesting that timberline may have reached the elevation of the lake once again (Shafer, 1989).

Signatures of valley-floor pollen suggest the following trends. The high pollen percentages for sagebrush and grasses in the late Pleistocene vegetation decline markedly after ~10,000 yr B.P. After ~9500 yr B.P., the percentages of greasewood pollen (*Sarcobatus vermiculatus*) steadily rise, suggesting that soil alkalinity increased gradually through the Holocene. Maximum percentages occurred ~6500 to 3500 yr B.P. (Shafer, 1989). Higher percentages of conifer pollen (*Pseudotsuga, Pinus edulis*) from ~7000 to 5500 yr B.P. may indicate that lower ecotones migrated upward in response to drought stress (Shafer, 1989). The period of least effective moisture inferred from the Como core appears to be ~6500 yr B.P.

The Como Lake records seem to indicate shifts in the relative contribution of air masses as sources of precipitation in the San Luis Valley during the late Quaternary (Shafer, 1989). Prior to ~8000 yr B.P., high Artemisia/Cheno-Am ratios and lower ecotones for Pseudotsuga, and for summer precipitation dependent conifers such as ponderosa and pinyon pine, suggests the probability of enhanced monsoonal circulation. The appearance of pinyon pine pollen at Como Lake by 9500 yr B.P. may indicate its expansion during a warmer period of greater summer precipitation.

Head and San Luis Lakes

Head (2310 m) and San Luis Lakes (2300 m) are located adjacent to one another on the east side of the San Luis Valley, a few km west of the Great Sand Dunes. Sediment cores were collected from both localities through winter ice using a vibracorer. Preliminary data from Head Lake are reported in Shafer, 1989; Jodry et al., 1989; and Davis and Shafer, 1991. De Lanois (1993) reports sediment



Data Sources: Dixon 1971, Emery et al 1971, McCalpin 1983, Powell 1958, Tweto 1979.

Figure 2 Schematic cross-section of the San-Luis Valley.

and pollen analyses of San Luis Lake. Current vegetation around the lakes is dominated by greasewood (*Sarcobatus vermiculatus*) shadscale (*Atriplex* sp.) and rabbitbrush (*Chysothamnus sp*.).

Head Lake

The 260 cm core from Head Lake consists primarily of calcareous sand and sandy clay or silt. Four radiocarbon dates from bulk sediment samples provide chronologic control for the upper 130 cm, that portion of the core which post-dates 11,060 +/- 160 yr B.P. (uncalibrated) (Shafer, 1989; Davis and Shafer, 1991). The carbon content of the lakes' basal sediments is very low, so the standard deviations of the conventional dates are large (Davis and Shafer, 1991). The concentration of pollen decreases substantially in this core between depths of 130 and 190 cm, due to rapidly accumulating sand, and perhaps due also to low local pollen production.

Preliminary analysis indicates that oak (Quercus) pollen was most abundant at depths of 100-80 cm, prior to ~11,000 yr B.P. Sagebrush pollen was relatively abundant during this period and greasewood percentages were low (Jodry et al., 1987). The peak occurrence of oak in the Head Lake core is undated, but a similar rise in *Quercus* pollen at Bechan Cave in southeast Utah begins ~13,000 yr B.P. (Shafer, 1989).

The record of aquatic plants at Head Lake suggests that water levels were higher during the latest Pleistocene. Peak percentages of *Pediastrum* (algae) at a core depth of 50 cm (~11,000 to 10,700 yr B.P.) probably signifies that water levels and surface water area were at a maximum. The emergent aquatic plants appear to have been less abundant at maximum water levels. Today, Head Lake is closely bounded by sand dunes. If this setting occurred in the past, the dunes may have arrested development of a shallow water littoral zone at higher lake levels that would have supported emergent aquatic plants (Jodry et al., 1989).

By ~5200 yr B.P. lake levels had dropped precipitously; *pediastrum* disappeared and greasewood pollen reached maximum percentages, probably reflecting the expansion of this halophyte onto the saline margins of the receding lake (Jodry et al., 1989).

The lake levels on the San Luis Valley floor are today largely controlled by the shallow, unconfined aquifer, recharge to which is mostly from direct surface infiltration rather than runoff from the adjoining mountain ranges (Emery et al. 1971). If this relationship was true in the past, it suggests that higher water levels in Head Lake in the late Pleistocene/early Holocene were a result of greater precipitation (Jodry et al., 1989). The expansion of Gambel's oak and Colorado pinyon pine during this time period suggests that southwest monsoon precipitation may have been the source, as predicted by general atmospheric circulation models (Kutzbach, 1987; Kutzbach et al. 1993).

San Luis Lake

The San Luis Lake core records climatic change during the late Holocene, from ~1200 yr B.P. (A.D. 750) to the present. A 154 cm long core, consisting of coarse to silty sand, was removed from the southwestern portion of the lake (De Lanois, 1993). Four bulk sediment dates (uncalibrated) ranging from 920 +/- 60 yr B.P. to 17 +/- 56 yr B.P. provide chronologic control for the upper 90 cm of the core.

The deepest levels producing pollen (zone A) are tree-ring calibrated by De Lanois (1993) to date between 1014 and 1230 yr B.P. (~A.D. 950-750) (Stuiver and Becker, 1986). Temperatures warmer than modern climate are suggested by the increases in pine and greasewood at the expense of sagebrush. Non-arboreal pollen dominates and algae percentages are low. The warmest/driest interval represented in the core occurs A.D. 1090. This is temporally consistent with a regional climatic warming event, the Medieval Warm Period, dated A.D. 1149 (De Lanois, 1993).

Zone B, 520 to 988 cal B.P. (~A.D. 430-960), shows a cool/wet period characterized by abundant non-arboreal pollen and peaks in charcoal and algae (*Pediastrum* and *Botryococcus)*, followed by somewhat warmer and drier conditions.

Zone C, from 174-520 cal B.P. (AD 1776-1430), indicates conditions which were cooler and wetter than present with arboreal pollen dominance (including *Pinus, Abies*, *Picea*, *Juniperus*, and *Quercus)* and low algae percentages. These data correlate with the Little Ice Age climatic event dated elsewhere between A.D. 1500-1800.

Zone D, from the present to 100 cal B.P. (A.D. 1850-1978), documents the appearance of Russian Thistle (*salsola*, 1%) and increases in dung fungus *(sporomiella* , 6%) associated with the introduction of cattle and sheep in the historic period. High percentages of non-arboreal pollen (i.e *Chenopodiaceae-Amaranthus* and *Sarcobatus)* and algae suggest a return to warmer and drier conditions, with a cooling trend toward the present (De Lanois, 1993).

Sporomiella and Biomass

Palynological studies (Davis, 1987; Davis and Shafer, 1991, 1992) suggest that increases in the abundance of spores from the dung fungus, *sporomiella,* are good proxy indicators of expanded herbivore biomass. Peaks in *sporomiella* are associated with increased concentration of historically-introduced livestock. Similar peaks are also noted during the late Pleistocene (Davis, 1987; Davis and Shafer, 1991).

Sporomiella is common on the dung of domestic herbivores, of living megaherbivores, of some smaller herbivores, and is documented in the Pleistocene dung from Bechan Cave in southeast Utah (Davis et al., 1984). Values greater than 3% are characteristically associated with maximum grazing intensity in historic sediment samples and this percentage is used as a comparison with Pleistocene occurrences (Davis and Shafer, 1991).

All three of the lakes cored in the San Luis Valley contain *sporomiella* spores. However, the spores at San Luis Lake are limited to the historic period when they occur above 2% for the first time in zone D (De Lanois, 1993). At Como Lake, "Sporomiella percentages range from 0.2 - 0.7% in the historic period, from 0.2 - 1% from 4390 +/- 80 to 7720 +/- 100, and from 2.0 - 4% in sediments from 10,260 +/- 330 and 11,730 +/- 290 yr B.P. These Pleistocene percentages are among the highest recorded for sediments of this age, and the transition to lower Holocene values is abrupt" (Davis and Shafer, 1991:5).

Similar values are documented at Head Lake: 0.7 - 2% in the historic period, <0.3% in the Holocene, and up to 4.8% in samples between 10,920 +/- 200 and 11,060 +/-160 yr B.P. (Davis and Shafer, 1991). The Head lake sediments produced the highest percentages of *sporomiella* yet recorded by Davis and Shafer for Pleistocene lakes. *Sporomiella* percentages decline after ~10,800 yr B.P. at Como Lake and subsequent to 11,010 yr B.P. at Head Lake. "At both sites, the *Sporomiella* decline is immediately followed by a major climatic oscillation from cold-wet (10,500 at Como; 10,750 at Head) to hot/dry (10,190 at Como; 10,490 at Head)" (Davis and Shafer, 1991:6).

This evidence suggests that the carrying capacity for large herbivores was particularly high during the mesic interval coincident with the Folsom occupation of the San Luis Valley. The greater abundance of Folsom sites relative to sites attributed to either Clovis or Late Paleoindian periods appears to reflect the especially attractive nature of the basin environment at this time.

ARCHAEOLOGICAL EVIDENCE FOR PREHISTORIC USE OF PLUVIAL LAKES

Late Pleistocene

Paleoindian settlement patterns strongly support the former presence of playa lakes in the San Luis Valley during the Folsom time period. Interdunal pond deposits are present at the Linger and Zapata sites in the partially-stabilized sand sheet lying to the southwest of Great Sand Dunes National Monument. Playas are also associated with the Folsom occupations at the Reddin site situated in the currently dry, alkaline flats near Saguache Creek.

Smithsonian excavations at the Linger site (5AL91) in 1977 uncovered a Folsom bison kill (Dawson and Stanford, 1975; see also Hurst, 1943). At least five animals were apparently ambushed while watering at a small pond (delineated by a buried limonitic sand). A hunting camp was established about thirty meters upslope where the remains of additional butchering and weaponry repair were uncovered. Limited testing at the nearby Zapata site (5AL90) in 1978 also revealed butchered bison in association with Folsom tools near the edge of a pond (denoted by cemented lacustrine deposits).

The Reddin site (5SH77) consists of several piece-plotted Folsom surface localities distributed between two playas on the south and Saguache Creek to the north and west. The broken tips of Folsom points were concentrated near the playa edges and suggest that hunting occurred there. The primary camping locality appears to have occupied a low ridge adjacent to Saguache Creek where a greater variety of Folsom tools were recovered (Stanford, 1990).

Ongoing excavations at Stewart's Cattle Guard site provide a detailed view of campsite activities associated with Folsom bison hunting in the San Luis Valley. At least forty-five bison were killed and processed here in a briefly occupied, fall site. Immediately next to the kill area, the hunting group established a campsite where domestic activities (i.e. eating, sleeping, weaponry maintenance) were undertaken around a series of closely-spaced hearths (Jodry, 1987; Jodry and Stanford, 1992). Primary butchery and the processing of hides took place in adjacent locations. Conjoined fragments from broken or refurbished tools interconnect the different activity areas and suggest their contemporaneity (Jodry, 1992). Tool stone from source areas as far away as the Texas Panhandle and the Chuska Mountains of northwest New Mexico indicate far-reaching patterns of travel and social interaction.

The paucity of Clovis and later Paleoindian artifacts at known Folsom-age playas in the valley suggest that these lacustrine features were not present and support palynological indications for less effective moisture immediately pre- and post-Folsom. Geohydrologic and paleolimnological data from Texas, New Mexico, and Arizona (summarized in Jodry et al., 1989; Haynes, 1991, 1993) support the regional nature of a late Pleistocene/early Holocene stratigraphic sequence characterized by a Clovis dry period, followed by a Folsom-age mesic interval, and then a drying and warming trend during late Paleoindian times (10,000 to 8000 yr B.P.).

Haynes (1993) notes that the dry period ~11,000 yr B.P. immediately followed by the emergence of pluvial lakes and elevated water tables correlates well with climatic fluctuations observed in the oxygen isotope records of Greenland ice cores and European lacustrine sediments (Peterson and Hammer, 1987). "Both show a marked decrease in $\delta^{18}O$ during a cold, dry period that ended the Pleistocene in 10,750 $\pm$ 150 B.P. The period of decreased $\delta^{18}O$ is correlated with the Younger Dryas of Northern Europe" (Haynes 1993:233). The apparent peak in the San Luis Valley of Paleoindian populations during Folsom is coincident with the period of rapid warming which followed the Younger Dryas. The especially, well-watered dune field covered in nutritious grasses, at that time, apparently supported a significant bison and bison-hunter population.

Holocene

While Folsom sites on the valley floor were often situated near relatively small ponds, a number of later (poorly dated) Holocene sites appear to be oriented toward a larger wetland system overlapping the Blanca Wildlife Refuge in the vicinity of Dry Lakes (Jodry et al., 1989). The distribution of archaeological sites in this area indicates the former presence of interconnected lakes and marshes at least 17 km long by 1.5 to 5 km wide (Jones, 1977).

Archaeological survey by Adams State College in conjunction with the creation of Blanca Wildlife Refuge documented the presence of 134 prehistoric sites (Dick, 1975). Four of these localities were tested by Colorado State University (Jones, 1977). Their excavation of site 5AL80, uncovered a 50 cm thick midden deposit containing large amounts of charcoal and fishbone. The midden contained three strata, the uppermost of which yielded a radiocarbon date of 1670 yr B.P. ± 55 (A.D. 280; UGA-1429) (Jones, 1977). Cultural material associated with the midden was not temporally diagnostic, but the fish remains were most informative.

Rio Grande Chub (*Gila nigriscens*) dominated the fish assemblage. Also present were two species of buffalofish (*Ictiobus sp.).* While Rio Grande chub may be caught using a hook and line; buffalofish were more likely recovered in traps or nets when the fish moved into shallow areas to spawn (Jones, 1977).

As buffalofish require water depths of ~3.65 to 4.5 meters to survive, these figures provide a basis for preliminary reconstructions of the former wetland habitat. When 3.65 meters is added to the common elevations (2288 m/7507 ft) of the old lake bottoms still visible near the site, a hypothetical lakeshore falls along the 7520 foot (2292 m) topographic contour (Jones, 1977). Strong support for this reconstruction is provided by the distribution of archaeological sites in the vicinity. Over ninety percent of the 134 sites lie adjacent to, or slightly higher than, the reconstructed shoreline at 7520 feet (Jones, 1977; Figure 3).

A topographic map, superimposed with the reconstructed wetlands, delineates irregularly-shaped ponds interspersed with low, marshy areas and peninsulas of relatively dry land (Jodry, 1987; Figure 4). In addition to fish, these wetlands offered human groups a wide array of plant and waterfowl resources.

The radiocarbon date of 1670 yr B.P. temporally places the site containing the buffalofish (5AL80) within the Little Ice Age climatic episode documented in zone C at Head Lake. The presence of middle to late Archaic artifacts (typologically dated between ~5000 and 1450 yr B.P.) in the area, suggests that there were additional periods of wetland availability.

CONCLUSIONS

The archaeological record of the San Luis Valley suggests nearly continuous human occupation beginning during the Younger Dryas Climatic Episode ~11,200 yr B.P. Clovis weapon tips, made by the earliest inhabitants, are relatively scarce. They were reportedly associated with the remains of a mammoth at a disturbed archaeological locality near Great Sand Dunes (Stanford, 1990,) and as isolated finds in scattered locations across the valley. More effective moisture ~10,800 yr B.P. transformed the basin into a biomass-rich habitat well-suited to human groups, such as Folsom, with specialized, bison-hunting economies.

Warmer, drier conditions, and the apparent waning in strength of the southwest monsoon, ~10,000 yr B.P. initiated large-scale changes in hydrologic and biotic regimes. Human groups adapted by more intensively utilizing a variety of plant resources such as Indian rice grass. Plant processing equipment (ground stone and fire-cracked rock) appears after ~10,000 yr B.P. and dominates the archaeological record of the Holocene. Some economically important species (pinyon pine) became established; while others (bison) appear to have declined.

Campsites occupied by Archaic and more recent prehistoric populations (post-8000 yr B.P.) typically parallel the streams and are densely clustered near springs and wetlands on the valley floor. They are also commonly found in the pinyon-juniper woodlands on the mountain flanks and in rock shelters, adorned with rock art, along the western valley margin.

In summary, palynological analyses of lacustrine sediments from Como, San Luis and Head Lakes document changing climatic conditions in the San Luis Valley and adjacent Sangre de Cristo Mountains in postglacial times. Wide-spread climatic episodes, including the Younger Dryas, the Altithermal, the Medieval Warm Period, and the Little Ice Age appear to be represented and variably contributed to changing biotic communities, movements of upper treelines and lower ecotones, and fluctuations in pluvial lake levels. Present archaeological information suggests that there are greater frequencies of sites typologically dated to the Folsom portion of the Paleoindian period (~10,900-10,300 yr B.P.) and to the Middle and Late Archaic and Late Prehistoric Periods (~5000-450 yr B.P.)(Button, 1987). These apparent peaks in human population densities are coincident with intervals of more effective moisture and greater abundance of lacustrine resources. Fewer archaeological sites are attributed to the Late Paleoindian and Early Archaic periods (~10,000-5500 yr B.P.) when the lakes were either dry or at lower levels with higher salinity.

Acknowledgments

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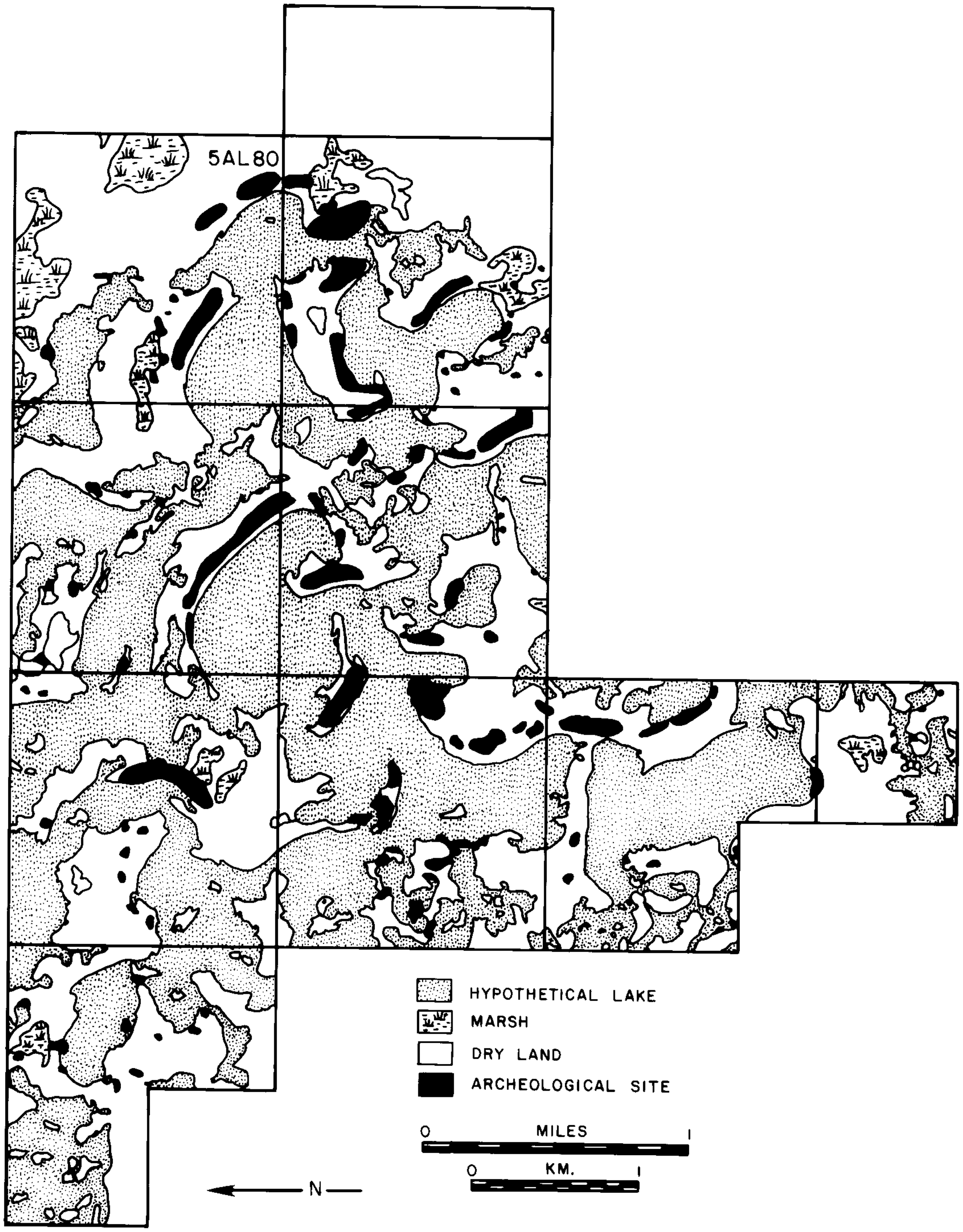

Figure 3 Distribution of recorded archaeological sites relative to lakeshore reconstruction for AD 280. Figure adapted from Jones, 1977, Figure 18.

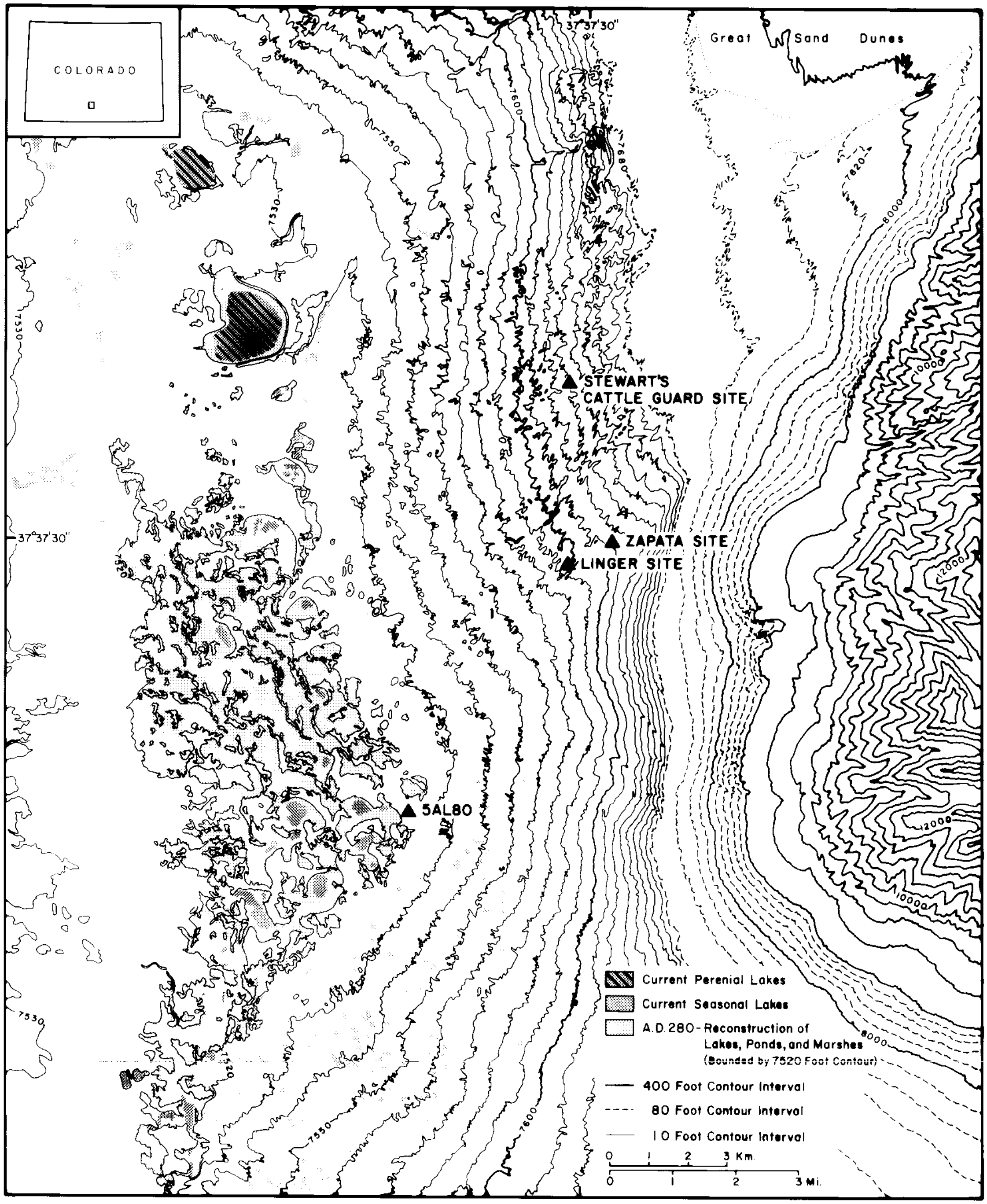

Figure 4 Topographic map showing A.D. 280 lake reconstruction relative to Folsom site locations.

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