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PERCEPTION, VISIBILITY, AND INTERVISIBILITY IN THE LATE ARCHAIC LANDSCAPE OF THE BLACK MESA REGION OF OKLAHOMA, NEW MEXICO, AND COLORADO

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PERCEPTION, VISIBILITY, AND INTERVISIBILITY IN THE LATE ARCHAIC LANDSCAPE OF THE BLACK MESA REGION OF OKLAHOMA, NEW MEXICO, AND COLORADO

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Abstract

Phenomenology, as an interpretive framework centered on perception and life experience, aids archaeologists in understanding past human relationships with landscapes and their features. In the Black Mesa region of Cimarron County, Oklahoma, six enigmatic stone circles may have formed part of a line-of-sight communications network during the late Archaic stage around 3,000 years ago. In all but one instance, the sites are accompanied by a nearby petroglyph feature that suggests some special or ritual significance beyond mere communication. Although it is challenging to craft a coherent narrative of late Archaic life in this transitional region, this study focuses on questions of visibility and intervisibility in order to investigate whether observers at each site could see and be seen by others at different locations (rather than specifically identifying the intended audience of signals emanating from these locations), and how phenomenological and ontological considerations, including language, may have affected Archaic peoples' perception of their landscape. Distinguishing between seeing, visibility, and perception, I utilize a GIS-based visibility to show that visibility and intervisibility among these stone circles may indeed have been an important consideration to Archaic people in the area.

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Chapter One. Introduction

Phenomenology is an interpretive framework focused on perception and lived experience that is frequently utilized by archaeologists to help illuminate past peoples' relationships with their landscapes and certain features on those landscapes. In contexts devoid of specific temporal, functional, or ethnographic attributes, it can be a useful, and often successful, means to approach questions of past human lifeways, and to gain a deeper insight into how ancient people lived in certain environments. Case in point: the central aspect of this thesis is the patterning of six enigmatic stone circles distributed across the landscape in the Black Mesa region of far western Cimarron County, Oklahoma that Bement and Carmichael (2003) speculate may have formed part of a line-of-sight communications network in, presumably, the late Archaic, which began around 3,000 years ago on the Great Plains (Bement and Carmichael 2003; Fagan 2005). Furthermore, in all but one instance, these sites are apparently accompanied by one or two nearby rock art features that perhaps implies some special or ritual significance beyond simple long-distance communication (Bement and Carmichael 2003).

In a perfect world, I would deftly weave these threads of visibility and intervisibility, landscape, rock art, and phenomenology with ethnography, ethnology, and linguistics in the pages that follow into a compelling—and, one would hope, coherent—narrative of late Archaic lifeway in a liminal frontier regions that is not *quite* the Great Plains, not *quite* the Southwest, not *quite* the Rocky Mountains, but a place that is truly transitional and *in-between*. For reasons that will become clear, this kind of narrative is, unfortunately not currently possible. For one thing, the Archaic stage in far western Oklahoma antiquity is not as well elucidated as either the earlier Paleoindian period or the later Formative period. But the threads are important, even if they cannot be easily or skillfully woven together at the present moment.

Research focus

The question of visibility and, especially, *inter*visibility between the six rock alignments, which Bement and Carmichael (2003) speculate are nodes in an ancient line-of-sight communications network, forms the primary research focus of this thesis. To be clear, this focus is on whether observers at each of these mesa-top sites could see, and therefore, be seen in return, by observers stationed at the other rock alignments, rather than whether someone could potentially see a signal (e.g. a fifteen or twenty meter plume of smoke) from a given point on the landscape. In other words, while an investigation into who the intended audience of such a signal might have been is an important line of inquiry, it is not one I am engaging with here. I am, however, interested in how these (positivist) questions are set within a broader (subjective) inquiry of how late Archaic people in the Black Mesa area conceptualized and related to their transitional landscape.

Definitions

In this study, I distinguish between seeing, visibility, and perception. I define *seeing* as the physical act of observing something, including as a biological process wherein light is captured by the eyes and transmitted to the brain, where it is processed to form an image. Seeing is an objective process that can be measured and described in terms of the physical properties of light and the physiological response of the human visual system (Sadun et al. 1986).

Visibility, on the other hand, has been variously defined by archaeologists (Gillings and Wheatley 2020), but ultimately refers to the ability to see—and be seen—in a particular environment. It is subjective in that it depends on a range of factors and considerations, including the position and angle of the observer, the properties of the environment (e.g. terrain, vegetation, or climatic concerns), including the presence or absence of other people or objects (Gillings 2012, 2015, 2017; Gillings and Wheatley 2020; Jerpåsen 2009).

Finally, I define *perception* as a process rooted in phenomenological and ontological outlooks that involves making sense of and deriving meaning from seeing and other sensory modalities. Perception is the most subjective of these three interrelated terms. For example, *my* sensory (and cognitive) experiences are those of an educated white American man in the twenty-first century, in good health, with no children, who prefers the city to the country, and who practices archaeology from a position of relative affluence and privilege, and my lived experiences as such inform how I make sense of what I can see, hear, smell, taste, and touch at any given moment. People in the past (and other people in the present) had very different lived experiences and cultural filters through which they perceived, made sense of, and related to the world. In this thesis, the word *looking* is perhaps synonymous with perception.

Structure of this thesis

Chapter Two offers a regional perspective of the study area, with particular emphasis on Cimarron County, Oklahoma, its environmental context, and the previous archaeological investigation undertaken over the last century, including Bement and Carmichael's (2003) pedestrian survey of the Black Mesa area that serves as the starting point for this study.

Chapter Three is an overview of the culture history of the Black Mesa area that covers the Paleoindian, Archaic, and Plains Woodland stages, as well as a brief discussion of the linguistic background. This is an important consideration, since language is often a window into worldviews and ontological realities that may seem very alien to our modern (Western) sensibilities.

Chapter Four develops the relationship between landscape and landscape archaeology, language, place, and identity; phenomenology and ontology; rock art as landscape art; as well as the theoretical basis of geographic information systems and visibility in archaeology.

Chapter Five discusses the ethnographic and archaeological background of signaling as a form of communication. I first introduce its global ubiquity across time and space, followed by a discussion of signaling behavior in North American contexts, especially in the Southwest, that is drawn heavily from Swanson's (2003) and Beers' (2012, 2014) previous summaries.

Chapter Six outlines the methodology and general process used in this visibility analysis, including my data gathering process, the preliminary mapping, including spatial analyses, used to explore how the sites are distributed across the landscape, before discussing the visibility analysis itself. The results of these various analyses are presented in *Chapter Seven*.

Finally, *Chapter Eight* discusses the implications and wider contexts presented in the previous chapters in terms of the late Archaic landscape of the Black Mesa region, offers several suggestions for future research that should be considered critical if understanding late Archaic lifeways in the area is an important line of inquiry, following by some general concluding remarks.

Appendices A and *B* are, respectively, a full list of sites initially chosen for this study and full descriptions of the Cimarron and Baca County sites that form the basis of this thesis.

Chapter One. Regional perspective

The study area encompasses nearly 34,000 square kilometers across Cimarron County, Oklahoma, Union County, New Mexico, and Baca and Las Animas Counties, Colorado, though it is primarily concentrated on the northwestern corner of Cimarron County.

Physiography and geology

The Cimarron County part of the study area is situated in the northwestern corner of the Oklahoma panhandle near the Oklahoma-New Mexico-Colorado borders in the southeastern area of the Chaquaqua Plateau. Geologically, this part of the United States is comprised of thick-bedded Triassic, Jurassic, and Cretaceous marine sediments "overlain by tertiary Ogallala formation outwash from the Rocky Mountains and lava flows" (Bement and Carmichael 2003:3; see also Schoff and Stovall 1943). It also includes marine and shoreline deposits from as early as the Permian period (Bement and Carmichael 2003).

The Cimarron River, the major drainage of the plateau, is fed by the North Carrizo, Tesequiet, and Carrizozo Creeks that converge near the easternmost point of Black Mesa itself. In turn, these streams are fed by seasonal and permanent springs that are "prone to flash flooding" (Bement and Carmichael 2003:4). The lower terraces of the main creek channel are almost never more than a few thousand years old due to active reworking (Bement and Carmichael 2003).

Table 1.1 The study area, comprised of Cimarron County, Oklahoma to the east; Union County, New Mexico to the west; and Las Animas and Baca Counties to the North, shown in its regional context

Topographically, the study area is fairly steep; most mesas rise about a hundred meters or more above the stream channels. Black Mesa, for example, rises 177 meters above the Cimarron River, and is capped by resistant basalt. The geologic stratigraphy “reflects a deep overburden of Ogallala deposits, in excess of [thirty] meters thick, overlying the local bedrock” (Bement and Carmichael 2003:4). Most erosional incision in the area is presumed to have occurred by the end of the Pleistocene (Bement and Carmichael 2003).

The geologic history is summarized in Table 2.1, though Bement and Carmichael (2003:4) caution that a "real world interpretation of local geology is far more complex." For example, the surrounding uplands of the High Plains are fairly flat or gently rolling in some areas, consisting of Permian redbeds, Ogallala formations, and more recent alluvial and aeolian deposits. Occasionally, remains of Dakota sandstone are found much further east in Beaver County, Oklahoma, and Kiowa County, Kansas, but typically, most formations are found east of the Sierra Grande Las Animas arch in Colorado and New Mexico (Bailey 2000; Bement and Brosowske 2001; Bement and Carmichael 2003; Schoff and Stoval 1943).

Age	Name	Description
Quaternary	Stream deposits	Sand, silt, and gravel on flood plains and stream terraces.
Quaternary 0–1.8 mya	Dune sand	Wind-blown sand mantling all formations. Most near the study region is north of the Colorado state line.
Tertiary 30 mya	Basalt	The lava flow capping Black Mesa is around thirty million years old. This is dense olivine basalt; black to greenish-gray and brown.
Tertiary 1.8–65 mya	Ogallala Formation	Calcareous sands, gravels, silts, and clays, sometimes capped by caliche.
Cretaceous	Colorado group	White to chocolate brown shale, marl, limestone, sandstone, and thin-bedded bentonite.
Cretaceous	Dakota sandstone	Thick buff, cross-bedded sandstone, separated by a middle shale layer. The lower sandstone makes conspicuous wall-like ledges that cap most bluffs on the canyons of the Cimarron and its tributaries. The middle shale and upper sandstone are exposed in the headwaters of the Tesequiet and South Carrizo Creeks.

Cretaceous 65–136 mya	Purgatoire formation	Contains the Cheyenne Sandstone and Kiowa Shale members. Cheyenne is thick, light-colored sandstone similar to Dakota, and makes wall-like ledges in the lower bluffs. Kiowa is dark gray to black calcareous shale.
Jurassic	Morrison formation	Variegated sandstone, limestone, marls, dolomites, shales, clay conglomerates, and quartzite. Contains many dinosaur bones and plant molds.
Jurassic 136–190 mya	Exeter sandstone	Massive white to buff, cross-bedded sandstone.
Triassic 190–225 mya	Dockum group	Variegated shale, clay, conglomerate, and marl. Colors range from purplish red, brick red, and buff or cream.
Permian 225–280 mya	Permian redbeds	Friable red gypsiferous sandstone and siltstone with some dolomite and massive gypsum in the Blain formation. The underlying formation is not exposed in the study region.

Table 1.2 Geologic sequence in the Black Mesa area (Bement and Carmichael 2003:3)

Soils

Five primary soil associations have been identified in the study area (Bement and Carmichael 2003; Murphy et al. 1960). *Spur soils* are typically found on lowland terraces, while *Berthoud loams* are common on gently graded benches with slopes of three to five percent. *Rough stony land soils* are sporadically found on steep talus slopes with grades of five to over sixty percent. Mesa tops are capped by *Travesilla stony loams*. Finally, *Apache stony clay loam* is generally found in cracks and occasionally in patches on the basalt that caps Black Mesa (Bement and Carmichael 2003).

Climate

Overall, the area's climate is mild, dry, and generally continental, with quickly changing and highly variable temperatures and precipitation. Annual countywide averages have ranged from a low of 219 millimeters in 1934 to a high of nearly a thousand millimeters in 1919. From 1925–56, Kenton saw an average rainfall of 435 millimeters (Murphy et al. 1956). The county also gets an average of about seven hundred millimeters of snow annually, with drought years typically occurring in three to five year clusters with below average precipitation (Murphy et al. 1956). Most precipitation occurs during the spring thunderstorm season, though winter storms. fueled by cold air from the relatively nearby Rocky Mountain front range, can arrive suddenly. Generally, precipitation on the High Plains diminishes from east to west; however, the elevation of the Sierra Grande Las Animas arch might cause the Chaquaqua Plateau to get nearly as much precipitation as the more eastern reaches of Cimarron County and the west and central areas of Texas County, particularly during drought years (Bement and Carmichael 2003; Johnson and Duchon 1995; Miender et al. 1960; Murphy et al. 1956). High winds are frequent, but the canyons offer some shelter (Bement and Carmichael 2003).

Vegetation

The mesa region's diverse plant life is sustained by a combination of unique soils and highly variable topography (Bement and Carmichael 2003), as summarized in Table 2.2. In the High Plains, short grasses (e.g. buffalo, blue grama, hairy grama) predominate, alongside occasional yucca, prickly pear, sage, and colla. Stream and draw areas may host riparian communities (Bartlett 1997; Bement and Carmichael 2003; Murphy et al. 1960). Floodplains are characterized by similar grasses, trees, and forbs, which are also found on slopes along with wild grapes and rushes. The uplands support juniper, piñon pine, Gambel oak, and wild currant; slopes may also host bunched tall grasses, such as blue stream (Bartlett 1997; Bement and Carmichael 2003; Murphy et al. 1960).

Common name	**Species**
Grasses	
Buffalo grass	*Buchloe dactyloides*
Blue grama	*Bouteloua gracilis*
Hairy grama	*Boutelous hirsute*
Little bluestem	*Andropagen scoparius*
Forbs	
Cholla	*Opuntia imbricata*
Prickly pear	*Opuntia imbracata*
Yucca	*Yucca baccata*
Brush	
Currant	*Ribes nigrum*
Gambel oak	*Quercus gambelli*
Sage	*Artmisia tridentate*
Trees	
Cottonwood	*Populus deltoides*
Hackberry	*Celtis reticulata*
Juniper	*Juniperus monosperma*
Mesquite	*Prosopis gladulosa*

Piñon pine	*Pinus edulis*
Black willow	*Salix nigra*

Table 1.3 Common flora in the study area (Bement and Carmichael 2003:7)

Fauna

A variety of ecological niches contribute to a rich and diverse faunal community on the Chaquaqua Plateau, including a mix of Rocky Mountain and High Plains species (Table 2.3). Although the prehistoric fluvial patterns are not well documented, mussel shells found in pond deposits from the protohistoric period to well over 3,800 years ago suggest that small fish and migratory waterfowl were dependable seasonal resources in prehistoric times (Bartlett 1997; Bement and Carmichael 2003; Dalquest et al. 1990). Late Pleistocene deposits indicate the possible presence of mammoth, horse, and *Bison antiquus* before the extinction of the North American megafauna (Bement and Carmichael 2003; Schoff and Stoval 1943).

Common name	**Species**
Mammals	
Beaver	*Castor canadensis*
Bighorn sheep	*Ovis* sp.
Bison	*Bison bison*
Black bear	*Ursus americanus*
Black-tailed jackrabbit	*Lepus californicus*
Black-tailed prairie dog	*Cynomys ludovicianus*
Bobcat	*Lynx rufus*

Cottontail rabbit	*Sylvilagus floridanus*
Cougar	*Felis concolor*
Coyote	*Canis latrans*
Elk	*Wapiti wapiti*
Gray fox	*Urocyon cineoargenteus*
Porcupine	*Erethizon dorsatum*
Mule deer	*Odocoileus hemiomus*
Pronghorn (antelope)	*Antilocapra americana*
Racoon	*Procyon lotor*
Squirrels	*Citellus* sp.
White-tailed deer	*Odocoileus virginianus*
Wolf	*Canus lupus*
Birds	
Bobwhite quail	*Colinus virginianus*
Dove	*Zenaida macroura*
Chihuahua raven	*Corvus* sp.
Golden eagle	*Aquila chrysaetos*
Hawks	*Buteo* sp.
Lesser prairie chicken	*Tympanuchus pallidicinctus*
Turkey	*Melegris gallapavo*
Other	
Opossum	*Didelphis virginianus*
Rattlesnakes	*Crotalus* sp.
Turtles	*Chelonia* sp.

Table 1.4 Common fauna in the study area (Bement and Carmichael 2003:8)

Previous archaeological work in the Black Mesa area

The previous archaeological work related to the project area is well documented (Albert 1984; Bell 1984; Bell and Baerries 1951; Bement and Carmichael 2003; Brooks 1983; Carlson et al. 2004; Lintz 1980; Lintz and Zabawa 1984; Wycoff and Brooks 1983; and many others). Archaeological *interest* over the previous century has been sporadic, though, probably owing to the fairly arduous environment in the region (Brooks 1983; Wycoff and Brooks 1983). Investigations began in the late nineteen twenties following the excavations at the nearby Folsom site in 1926–27 that provided conclusive evidence of human presence in the Americas much earlier than was previously supposed (Anon. 1927; Bement and Carmichael 2003; Brooks 1983; Carlson et al. 2014; Lintz and Zabawa 1984; Wycoff and Brooks 1983; and many others).

The Kenton Caves in the Tesequiet Creek Valley near Kenton, Oklahoma were the focus of many of these earlier investigations (Lintz and Zabawa 1984). Cimarron County farm agent and respected avocation archaeologist William "Uncle Billy" Baker—who remained an active contributor to Oklahoma panhandle archaeology until his death in 1957 (LaBelle 1997)—became aware of one cave, later designated 34CI50, that contained particularly well-preserved archaeological materials, though archaeologists at the University of Oklahoma were unable to commit to fieldwork in the panhandle at the time (W. Baker 1929a, 1929b; Lintz and Zabawa 1984; Rexroth 2010). At the same moment, the first survey and excavations at the caves were conducted by Étienne

Renaud for the Colorado Museum of Natural History in 1929. Renaud's primary goal was to discover further evidence of the Folsom tradition (Renaud 1930a, 1930b, 1930c, 1930d; Rexroth 2010). Though he was ultimately unsuccessful at finding such a connection in western Oklahoma, Renaud's survey and partial excavations at three caves, including the one discovered by William Baker the year before, produced an abundance of perishable (and now lost) archaeological materials (Bell and Baerries 1951; Bement and Carmichael 2003; Carlson et al. 2014; Lintz and Zebawa 1984; Renaud 1930a, 1930b, 1930c, 1930d; Rexroth 2010) that suggested a "simple semi-nomadic hunting people" (Bell and Baerries 1951:15) once utilized the myriad caves and rock shelters in the region. Renaud postulated these sparsely populated hunters represented an early iteration of the Archaic Basketmaker cultures more closely associated with New Mexico, Arizona, Utah, and elsewhere in the Southwest (Bell and Baerries 1951; Renaud 1930a, 1930b, 1930c, 1930d). He also documented parietal rock art at each of the three caves (Renaud 1930a, 1930b, 1930c, 1930d).

Following Renaud's initial work, Joseph Thorburn of the Oklahoma Historical Society was appointed to lead archaeological investigations at the Kenton Caves for the State of Oklahoma (Lintz and Zabawa 1984; Rexroth 2010). Collaborating with William Baker, Thorburn began an extensive series of excavations in the summer of 1930 at 34CI50 and 34CI49, though it is unclear if they also conducted fieldwork at 34CI48 as well (Lintz and Zabawa 1984). Lintz and Zabawa (1984:164) lament that "little has been published about this lengthiest of all organized expeditions, and nothing is known about the work or materials recovered."

After the Thorburn and William Baker excavations in 1930, archaeological interest appears to have waned as professional focus shifted to paleontology in the second half of the nineteen thirties (Lintz and Zabawa 1984). All archaeological investigations in Oklahoma, including those in the Black Mesa region, "abruptly terminated when the United States entered World War II at the end of 1941" (Albert 1984:47; see also Bement and Carmichael 2003; Carlson et al. 2010; Lintz and Zabawa 1984; Rexroth 2010).

Second half of the twentieth century and the beginning of the twenty-first

Major archaeological work in the state resumed following the end of the war in 1945. Many of the sites in this thesis were first recorded in the late nineteen seventies by Lintz (e.g Lintz 1978a, 1976b, 1976c, 1976d). Researchers from the Oklahoma Archeological Survey have continued archaeological investigations in the Black Mesa area throughout the waning years of the twentieth century and into the current century.

Basis for the current study

The Oklahoma Archeological Survey and the University of Oklahoma received funding from the Oklahoma State Historic Preservation Office to conduct an intensive pedestrian survey entitled *Archeological Survey of Mesa Environments in Cimarron*

County, Oklahoma (Project No. 02-407). This survey was conducted by Leland C. Bement and Casey Carmichael in 2002; their report, *From Top to Bottom: Pedestrian Survey of the Black Mesa Region, Cimarron County, Oklahoma*, was published by the Oklahoma Archeological Survey the following year. Their project continued a research methodology utilized in previous projects designed to elaborate and expand on prior investigations into the settlement patterns of prehistoric people in the Black Mesa area. Prior to this survey, well over three hundred sites were recorded in Cimarron County, nearly two hundred of which were within the mesa region (Bement and Carmichael 2003). The particular goals of the project was to collect descriptive data on the cultural resources found in and around mesas, using prevailing theories and methodologies of the day for categorizing site and resources beginning with Binford's famous 1980 paper, "Willow Smoke and Dogs' Tails," on hunter-gatherer settlement systems and archaeological site formation processes (Bement and Carmichael 2003).

Prior work the year before that focused on the tributaries feeding the Beaver River in Beaver and Texas Counties, Oklahoma (Bement and Brosowske 2001) ultimately found that Plains Village sites were primarily associated with the deep, fertile soils on floodplains (Bement and Brosowske 2001; Bement and Carmichael 2003). Likewise, they say, Woodland period sites saw correlations with lowland environments, while Archaic sites were more inclined to be "located along narrow stream courses lacking wide floodplains" (Bement and Carmichael 2003:21). They explain:

> The differences in locations between Archaic and Plains Village times was probably predicated on the need for protected settings with close vistas of upland areas to search for bison during the Archaic and the need for fertile, watered areas for cropland during the Plains Village. (Bement and Carmichael 2003:21)

The project area lies north of the Alibates agatized dolomite source that was widely exploited as a trade commodity by prehistoric people and provides evidence of trade and political alliances when found in archaeological contexts (Bement and Carmichael 2003). Other commodities, such as New Mexico and Wyoming-source obsidian, elucidate regional levels of contact and interaction during the Archaic (Bement and Carmichael 2003).

Similar work in the Oklahoma panhandle region, primarily by Bement in collaboration with others through the Oklahoma Archeological Survey, continued through the first decades of the twenty-first century, and is still undertaken today.

Chapter Two. Culture history and linguistic background

Questions about how and when the first people arrived in the Americas are still not settled (Bennett et al. 2021; Callaway 2021; Gunnerson 1987). Recent claims of a human presence in California 130,000 years ago (Holen et al. 2017) have been met with extreme skepticism (Callaway 2021), if not outright derision. Two sites in northeastern Colorado may be as ancient as 29,000 years old (Gunnerson 1987; Stanford 1979). Fossil human footprints left along an ancient lakeshore in White Sands National Park in southern New Mexico have been reliably dated to between 23–21,000 years ago (Bennett et al. 2021; Callaway 2021).

Paleoindian period (~11500 BCE – 5000 BCE)

On the Southern Plains, however, there is limited evidence of human occupation before Paleoindian people (Bement and Carmichael 2003; Willey and Phillips 2016) arrived around 12,000 years ago (C. Baker 2022; Bement and Carmichael 2003; Frison 1998; Gunnerson 1987; Haynes and Krasinski 1995). Broadly, the Paleoindian period is

> characterized by chipped-stone tools and weapons. These artifacts are found in environmental contexts of the late Pleistocene, under conditions indicating a climate quite different from that of the [mid-twentieth century] and often with the remains of extinct fauna. [There is] the possibility of a major division within [the Paleoindian] stage, an earlier era featuring crude percussion-flaked choppers and scrapers and a later era in which stone-chipping was much more finely finished and in which lanceolate point forms were a diagnostic. … Subsistence was based upon hunting and gathering, with emphasis varying according to environmental conditions. Populations were small and scattered, but by [the end

> of the Paleoindian period] or before, man had found his way over most of the New World. The stage is best represented, however, in the High Plains and the Greater Southwest of North America. (Willey and Phillips 2016:200–01)

Bison hunting became an important economic strategy to late Clovis and early Folson cultures following the mass extinction of ice age megafauna at the beginning of the Holocene epoch (Bement and Carmichael 2003), and “remained the primary resource over much if not all of the Holocene north of the Canadian and Washita drainages” (Bement and Carmichael 2003:9).

Clovis period (~11500 BCE – 10900 BCE)

The Clovis culture, known from a large bifacial, lanceolate-shaped projectile point recovered from a mammoth kill site near Portales, New Mexico (C. Baker; Frison 1998; Haynes and Krasinski 1995), is the earliest defined archaeological culture in the Americas (C. Baker 2022; Waters and Stafford 2007), dating to at least 13,000 years ago (Morrow and Fiedel 2006). The Clovis toolkit is “versatile” (C. Baker 2022:24), and generally includes Clovis-style projectile points and darts; various bifacial knives, blades, and their cores; hammerstones; bone rods; and atlatls (C. Baker 2022; Bradley et al. 2010; Collins 1999). Large terrestrial mammals, such as mammoth, were occasional targets of Clovis hunters, though Clovis people were fairly unspecialized and highly mobile hunter-gatherers (C. Baker 2022; Waguespack and Surovell 2003). A Clovis burial in Montana—the only known Paleoindian burial known, in fact—of an infant of perhaps high status yields radiocarbon dates of around 13,000 years ago

(Morrow and Fiedel 2006). The Clovis type site, 29RV2 (also designated LA3324), is approximately 300 kilometers south of the study area.

Folsom period (~8900 BCE – 8000 BCE)

The Folsom tradition is known from a bifacial, lanceolate-shaped projectile point that is smaller than its Clovis predecessor, and features fluting down its entire length, that was recovered from a *Bison antiquus* kill site near Folsom, Colfax County, New Mexico in the late nineteen twenties (C. Baker 2022; Clark and Collins 2002; Fagan 2005; Flenniken 1978), but ultimately spans most of the Great Plains and central North America, including Canada. Bison appear to be the main prey choice for Paleoindians during this period (C. Baker 2022; Meltzer 2006), and may have been the focus of hunting rituals (C. Baker 2022; Bement 1999, 2003). Folsom toolkits retained many of the same items as Clovis ones, including bifacial knives and cores; darts; scrapers; drills; hammerstones; and atlatls (C. Baker 2022). The Folsom site (29CX1/LA8121) is approximately 100 kilometers from the study area.

Late Paleoindian period (~10000 BCE – 8000 BCE)

The late Paleoindian stage is characterized by seasonally mobile, bison-focused hunter-gatherers adapted to life on the Great Plains and Rocky Mountains (Bement et al. 2022). Seasonal exploitation of other resources, such as seasonally available plants and small game animals, was also common (Bamford 2007; Bement et al. 2022; M. Hill 2010; Hollenback 2010; LaBelle 2010). Late Paleoindian sites were typically large camps, large scape bison kill sites, lithic procurement areas, small camps, and various isolated artifact finds (Bement et al. 2022). Some Paleoindian base camps were be reoccupied at various times (Bement et al. 2022; LaBelle 2010).

Archaic period (~5600 BCE – 500 CE)

The Archaic period, unsurprisingly, begins with the end of the Paleoindian stage around 10,000 years ago, although classification of Archaic cultures on the Great Plains is challenging, and there is much overlap with preceding Paleoindian cultures, especially in the early Archaic (Willey and Phillips 2016). At the same time, Archaic assemblages, while typically occupying a smaller spatiotemporal footprint, "are generally richer in cultural content" (Willey and Phillips 2016:52). According to Willey and Phillips (2016:201), the Archaic in North America broadly

> sees the continuation of hunting and gathering cultures into environmental conditions approximating those of the [mid-twentieth century]. There is a dependence upon smaller and perhaps more varied fauna than in the [Paleoindian] stage and, in many places, an increase in gathering. Stone implements and utensils used in the preparation of wild vegetable foods first appear in this stage. Many of these were shaped by use rather than design, although, in many Archaic stage cultures, techniques of stone-grinding and stone polishing were known. Domesticated plants, including maize, are found in some Archaic contexts, but it should be stressed that the presence of these plant foods is not evidence for agriculture in the full sense of the term. As near as the archaeologist is able to tell, [Archaic cultures] had but slight economic dependence upon these primitive crops. In most instances where such domesticated plants do occur on the Archaic level, the prehistoric societies seem

to have been composed of smaller populations than other Archaic cultures, where fishing or gathering was the means of subsistence.

On the Great Plains, the Archaic begins around 7,600 years ago, and persists until roughly 1,500 years ago (Fagan 2005). Nearly all Plains Archaic cultures, according to Willey and Philips (2016:121), "show a mixed [Paleoindian]-Archaic typology." Although *Bison antiquus*, synonymous in many respects with the North American Pleistocene, was extinct by the advent of the Archaic, and the American buffalo, *Bison bison*, had not fully occupied its predecessor's habitat, bison hunting "reflects a strong continuity" (Willey and Phillips 2016:121) with the earlier Paleoindian period, which is also evident in certain projectile point types and other toolkit items. The Big Bend aspect in the Pecos River canyonlands of west Texas is typically known from rock shelters and open air sites, and is especially important as a link between the Archaic cultures in the east and southeastern United States and those in the Southwest (Willey and Phillips 2016).

In the Southwest, the Archaic terminates in some places as late as 500 CE, around 1,500 years ago, with the full adoption of agriculture in the northern expanses, and the development of pottery in the more southern reaches (American Southwest Virtual Museum "Archaic"). While agriculture was not completely unknown in the Archaic Southwest, hunting and gathering remained the primary mode of subsistence. During the stage, many Archaic cultures, such as Basket Maker II, for example, lived in crude, shallow pit-houses (Willey and Phillips 2016). At the same time,

> There are as yet not specialized religious structures (kivas) and in general only the faintest indications of developing ceremonialism. Thanks to favorable conditions for preservation in those regions where dry caves and shelters were utilized as storage, burial, and camp sites, there is an unusually large body of information about basketry, cordage, finger-woven bags, sandals, wooden implements, and weapons, including the atlatl, but not the bow. Pottery, however, has not yet appeared, though presumably already in use in the Mogollon and Hohokam regions. (Willey and Phillips 2016:130–31)

The onset of the Holocene climatic optimum (HCO) (or Altithermal) around 7,500 years ago was marked by sudden, long-term shifts toward hot, dry conditions (Anteves 1955; Bement and Carmichael 2003; Gunnerson 1987). Culturally, this shift was accompanied by the adoption of notched projectile points and mirrors the wider Archaic trend toward a more diversified tool portfolio that was, concurrently, more generalized in its scope (C. Baker 2022; Bement and Carmichael 2003; Willey and Phillips 2016).

Early (~6000 BCE – 3000 BCE) and middle (~3000 BCE – 1000 BCE) Archaic

The early and middle Archaic periods are not well understood in the far western reaches of the Southern Plains (Bement and Carmichael 2003). Relatively fewer Archaic sites are documented, which some researchers interpret as a depopulation of the region during the HCO (Bement and Carmichael 2003). Others hold that the paucity of known Archaic sites is due to the "erosional mass wasting of favorable streamside campsites during this dry period" (Bement and Carmichael 2003:9; see also Holliday 1997; Lintz 1993). Nevertheless, both Calf Creek people (3000 BCE) and McKean complex people

(1000 BCE), for example, are believed to have migrated into parts of eastern New Mexico and northern Texas during wetter cycles of the HCO (Bement and Carmichael 2003), then moving further east and northwest respectively during dryer phases (Bement and Carmichael 2003; Lintz 2002; Quigg et al. 1993; Wedel 1975).

Late Archaic (~1000 BCE – 500 CE)

Late Archaic groups maintained a generalized subsistence strategy, though bison was likely an ongoing faunal resource (Bement and Carmichael 2003; Hughes 1977, 1989). Stone tools during this period are typically characterized by corner-notched projectile points, such as Ellis or Marcos types, though some Ensor type side-notched points are known (Bement and Carmichael 2003). On the High Plains, hearths and burned rock middens are common (Bement and Carmichael 2003; Cassels 1983; Gunnerson 1987). Late Archaic technology sometimes temporally overlaps with the Formative stage at bison kill sites in eastern New Mexico, leading some authors (e.g. Hughes 1977; Mitchell 1975) to speculate that "atlatl technology is retained into the Formative stage as a specialized bison hunting assemblage" (Bement and Carmichael 2003:10).

Plains Woodland (early Ceramic) period (400 CE – 1050 CE)

The early, middle, and late Ceramic periods of the Formative period correspond to the Plains Woodland, Plains Village, and Protohistoric (Bement and Carmichael 2003), although this study is only concerned with the Plains Woodland period, which began on the Central Plains (Gunnerson 1987) around 400 CE, and persisted for roughly 650 yeas (Bement and Carmichael 2003). According to Gunnerson (1987:41),

> the most significant innovation [in the early Ceramic stage] was the appearance of tall, cord-roughened pottery vessels with pointed bottoms. Although there are various identifiable plains [sic] subtypes, pottery of this period closely resembles contemporary and earlier Woodland pottery found over much of the eastern United States. Of nearly equal value for identifying "Woodland" sites was the appearance of small, delicate, stemmed (corner-notched) projectile points of a size that could have been used on arrows. Other changes included a less nomadic lifestyle and, at least in the eastern Central High Plains, simple semipermanent dwellings, more elaborate burial practices and probably rudimentary horticulture. Subsistence, however, continued to be based heavily on gathering and hunting, utilizing a wide variety of resources. Basically, lifeway in the Early Ceramic period did not differ markedly from that in the preceding Late Archaic, from which culture it apparently evolved under eastern influences.

Plains Woodland sites in the vicinity of Black Mesa are exemplified by those of the Graneros complex on the upper tributaries of the Arkansas River on the Chaquaqua Plateau (Bement and Carmichael 2003; R. Campbell 1976), which Robert Campbell (1976) subdivides into three horizons. The twenty sites of the initial horizon primarily features corner-notched projectile points, though some more recently unnotched points are occasionally present (Bement and Carmichael 2003). Habitations are circular and small, generally between two to five meters in diameter, with dry-fit walls made of local stone. Some structures feature postholes around their perimeter (Bement and Carmichael 2003). Grinding implements are common aspects of Graneros assemblages

(Bement and Carmichael 2003; Gunnerson 1987; Lintz 1986). Early Graneros people likely practiced horticulture to some degree, but conclusive evidence is lacking (Bement and Carmichael 2003; R. Campbell 1976).

The middle Graneros horizon is represented by an additional twenty sites that Bement and Carmichael (2003) comment may date from 750 CE – 1000 CE. Evidence of agriculture, especially corn crops, is more compelling, while arrow-type projectile points become more common (Bement and Carmichael 2003). During the middle Graneros, "structures become contiguous multi-room habitations and some defensive walls are postulated in select sites" (Bement and Carmichael 2003:10; see also Gunnerson 1987, 1989).

The late Graneros, the final stage of the regional Plains Woodland period, is typified by thirteen sites spanning roughly a century from 950 CE to around 1050 CE. These sites variously feature "stone enclosures, open camps, and rock shelters," while "vertical slab architecture may date to this period" (Bement and Carmichael 2003:10), as well. Ceramic styles begin to resemble those more typically associated with the later Plains Village period (Bement and Carmichael 2003).

Linguistic background

Paleolinguistics as a field of study seeks to reconstruct and analyze ancient languages and linguistic systems, often with the goal of understanding the cultural and historical contexts in which they evolved. As a discipline, it is closely aligned with archaeology and archaeological investigations, since the study of ancient languages can provide important insights into the social, economic, and political structures of past societies.

One of the most important contributions of paleolinguistics to archaeology is its ability to help researchers understand the spread of ancient people and cultures. Linguistic analysis can reveal similarities and differences between languages spoken in different regions, providing clues about the movement of people and the exchange of ideas and commodities. For example, the similarities between ancient Greek and ancient Sanskrit, both Indo-European languages, suggest they emerged from a common source around 6,000 years ago, with occasional contact after that (Renfrew 1999; Watkins 1995; and many others). Similarly, the spread of Indo-European across Eurasia can be traced through linguistic analysis, thus illuminating long-term movement patterns of ancient people (Mallory and Adams 2006; Watkins 1995).

Linguistic analysis can also guide archaeologists as they work to interpret ancient sociocultural practices. Since language is intimately tied to culture, the study of linguistic patterns can provide important insights into the beliefs, values, and practices of past societies. The elucidation of ancient Mayan hieroglyphs, for instance, revealed much about the religious beliefs and ritual practices of Mayan civilization, including their calendar system and their understanding of astrological phenomena (Houston et al. 2000). Furthermore, paleolinguistics can also shed light on ancient economic and political structures. How language is used can denote social status and power (Bourdieu 1977b, 1979), and can reveal much about political hierarchies. Similarly, the analysis of languages used in trade and exchange can provide insight into ancient economic systems and exchange networks.

Of course, the relevance of linguistics to archaeology has been recognized for well over a century. For example, in *Time Perspectives in Aboriginal American Culture, A Study in Method*, Sapir (1916) aimed to develop a more precise methodology for determining the relative chronologies of various Native American cultures, arguing that conventional archaeological methods alone were insufficient for establishing accurate timelines of cultural development, especially when it came to prehistoric contexts. He advocated for an holistic approach, emphasizing the importance of both material culture and linguistic data to gain a more comprehensive understanding of Native American cultures. He argued the that linguistic evidence could be used to supplement and refine archaeological interpretations to illuminate a more precise and detailed picture of the cultural and historical relationships between different groups. Sapir's work centered on two primary concepts: time perspectives and linguistic stratification. Time perspective refers to the process of establishing relative chronologies of various cultural elements, while linguistic stratification involves the study of linguistic changes within a language or group of languages over time (Sapir 1916). He demonstrated how linguistic analysis could be used to trace the diffusion of cultural elements across different regions. Sapir also stressed the importance of collaboration between archaeologists and linguists to develop a shared methodological framework for studying Native American cultures (Sapir 1916).

(Or as Roman Jacobson once opined, "The archaeologists' data are like a motion picture without the sound track; whereas linguistics have the sound track without the film. Thus interdepartmental teamwork becomes indispensable" [quoted in Čapková 1989:157].)

Linguistic relatively

Critically for archaeologists, language is a window into how people, including ancient peoples, think about and perceived the world on a fundamental basis (Sapir 1929; Whorf 1940); languages are *structuring structures* (Bourdieu 1977b, 1979) in that they are "instruments for knowledge and construction of [the] objective world" (Bourdieu 1979:78). Commonly, but somewhat misleadingly, known as the Sapir-Whorf hypothesis of linguistic relativity, it postulates that language reflects a culture's unique way of thinking about and understanding the world. They argued, separately, that different languages encapsulate different cultural and cognitive models (i.e. structures), and that these systems shape perception of the material universe. Therefore, in archaeological contexts without corresponding ethnographic context, as is the case with the late Archaic in Black Mesa, even a high-level or bird's eye view of the language or languages that may have been spoken at specific times and places could supply vital clues interpreting material culture.

Languages of the late Archaic in Black Mesa

The late Archaic hunter-gatherers of the Black Mesa area probably spoke a pre-Numic Northern Uto-Aztecan language (Leland C. Bement, personal communication, 2022), which is not well documented. Similar languages are believed to have been spoken by ancient people across the Southwest, including parts of California, Nevada, Arizona, and New Mexico (L. Campbell 1997; J. Hill 2001; Wheeler and Whiteley 2015). This branch of Uto-Aztecan, one of the largest language families in North America, likely evolved during the early Archaic period around 4,000 years ago, and was in widespread use until around 1,500 years ago—coinciding with the end of Archaic in North America—when Numic languages, such as ancestral Shoshoni, Comanche, and Paiute, began to emerge (L. Campbell 1997). *Some* of its structure has been reconstructed (e.g. Freeze and Iannucci 1979l Simmons 1994; Thornes 2003). For example, it is believed to have utilized a complex system of verb prefixes and suffixes that indicated tense, aspect, and mood (Freeze and Iannucci 1979). It also likely had a relatively large number of consonants that probably allowed for a range of contrasts between sounds that are now similar in modern Uto-Aztecan languages (Freeze and Iannucci 1979).

Proto-Uto-Aztecan

Questions surrounding the origins of the Uto-Aztecan language family have not yet been settled, and there is still much debate among linguists about where and when it first came into use (J. Hill 2001, 2015). While most linguists believe Proto-Uto-Aztecan developed among hunter-gatherers in Arizona, New Mexico, and the northwestern Mexican states of Sonora and Chihuahua around 5,000 years ago (J. Hill 2001), other researchers suggest alternate localities and timelines for the origins of the ancestral language community. Jane Hill (2001), for instance, proposes that Proto-Uto-Aztecan emerged from a community of agriculturalists in central Mexico. Its spread, she contends, follows the domestication of maize, which began to be cultivated in central Mexico around 5,600 years ago, and was present in western New Mexico around 3,700 years ago. "Because the Uto-Aztecan language family is the only one that exhibits an unbroken chain of communities of cultivators from Mesoamerica to the U.S. Southwest," she says, "Uto-Aztecan are the most likely of several possible candidate groups to have been the migrants who brought cultivated maize north" (J. Hill 2001:913).

Uto-Aztecan

The Uto-Aztecan language family as a fully realized group of indigenous languages is currently and historically spoken primarily in the western and southwestern reaches of North America, extending from the Great Basin region in the United States to Central Mexico (Caballero 2011; L. Campbell 1997). It is generally divided into two branches: Northern Uto-Aztecan, which encompasses languages historically spoken from southern Arizona and northern Mexico along the west coast of Central America. One of the defining features of Uto-Aztecan is its complex morphological structure, such as an extensive use of prefixes, suffixes, and infixes to mark tense, aspect, and other grammatical categories. Many languages also feature complex verb structures with a variety of affixes to describe and convey data about the subject, object, and other grammatical relationships (Caballero 2011; L. Campbell 1997). Furthermore, Uto-Aztecan languages are tonal; tone and inflection is used to distinguish words that are otherwise spelled the same. For example, the Nahuatl word *tlacatl* can mean *man* or *corn* depending on the tone (As an aside, notice the similarities between *tlacatl* and *Tlaloc*, the Aztec god of rain associated with maize, whose likeness is depicted in petroglyphs in the Southwest.)

Northern Uto-Aztecan

The northern branch of Uto-Aztecan is spoken in the Great Basin region of the United States, stretching from the Sierra Nevada in California to the Rocky Mountains in Utah, Nevada, and Colorado, and perhaps experienced some overlap with the Algonquin and/or Tanoan language families (e.g. Fowler 1983; Sapir 1929). Similar to all Uto-Aztecan languages, Northern Uto-Aztecan languages feature complicated morphological structures that delineate tense and other grammatical categories, particularly in its verb and pronoun system, as well as in its use of pitch accent to distinguish between words. Pitch accent is a feature of some languages where the pitch of a syllable changes to distinguish it from other syllables, thus transforming the meaning of the word. For example, in Mono, a California Northern Uto-Aztecan language, the word *hah* can mean either *black* or *canyon* depending on the pitch accent employed. Sub-branches of this family include Numic (e.g. Shoshoni, Comanche, Paiute), Takic (e.g. Cahuilla, Serrano, Luiseño), and Tubatulabal comprised only of Tubatulabal itself. Sometimes included with the northern branch are the Hopi-Na'vi languages, but there is disagreement among linguists about the exact relationship of Hopi-Na'vi to other Uto-Aztecan languages (Caballero 2011; L. Campbell 1997). Numic sub-branch languages such as Shoshoni, Comanche, and Paiute—all of which show significant dialectal variation despite sharing many general features of Northern Uto-Aztecan as a whole—including complex grammatical structures and the use of pitch accent.

Chapter Three. Theoretical perspectives

Landscape and landscape archaeology

Landscapes are conceptual and relational structures that lie at the conflux of time and relative ontologies in space (e.g. Latour 1991; Tilley 1994). They are conceptually "volatile" (Bender 2006:303)—and sometimes *physically* volatile, as well, such as the Big Island of Hawai'i, home to Mauna Loa, the most active volcano on Earth—in that they are constantly negotiated and renegotiated in an unceasing process of becoming and unbecoming, construction and deconstruction. Furthermore, landscapes, especially ancient landscapes, cannot be fully realized in the prevailing—that is, Wester, dualistic, naturistic (Descola 2005)—conceptualization of them. In fact, more recent explorations and considerations of the phenomenological and, especially, ontological nuances of landscapes have shown that for most of humanity (and for most of history), nature and culture exist as a continuum or "gradient," interconnected and interdependent conceptual and actual spaces that have no meaning or existence without the other (Descola 2005; Kohn 2013; Latour 1991, 2006, 2012; Tilley 1994; Viveiros de Castro 2014; and many others).

In other words, landscapes, as a cultural constructs, embody subjective interpretations of space that are shaped by phenomenology and unique ontological dynamics. As I discuss below, phenomenology emphasizes the role of human perception in the subjective experience of landscape, while ontology investigate the nature of being and reality within it. Language, as mentioned in the previous chapter, further mediates this experience, transmitting the cultural knowledge of landscape. GIS visibility analyses, on the other hand, are grounded in positivist methodologies, and quantify (or attempt to) these experiences as both subjective and objective entities, encompassing human experience *and* spatial representation.

Landscape archaeology as a means of elucidating the past has only been in use as a term since the nineteen seventies (Aston and Rowley 1974; David and Thomas 2008), and has been variously defined ever since (David and Thomas 2008)—but all its myriad definitions focus on the relationship between people and their local environment (Ashmore and Blackmore 2008; Bender 2002, 2006; Parcero-Oubiña et al. 2014). In other words, on how culture and the physical landscape interact and feedback on each other through differential human and nonhuman agency in constant cycles of structural reproduction. "Landscape archaeology," says Ashmore and Blackmore (2008:1569), "attends to both sites and settlement remains and to spaces in between." As such, landscape archaeology focuses on the use, meaning, and management of landscapes by cultures in the past, encompassing a wide range of archaeological questions, from the study of settlement patterns and land use, to the exploration of ritual and symbolic landscapes in the construction of social identity and memory (Ashmore and Blackmore 2008; Basso 1996; David and Thomas 2008).

Theoretical approaches in landscape archaeology have evolved over time, as well (Ashmore and Blackmore 2008; Bender 2002, 2006; Parcero-Oubiña et al. 2014). The earliest explorations in landscape archaeology tended to focus on more environmental contexts of site and artifact distribution, "interregional dynamics," settlement pattern economics, demographic concerns, and the effect of the environment on agriculture productivity (David and Thomas 2008:28). In these processual-based models, archaeologists were more inclined to conceptualize landscapes as passive, arbitrary, and abstract (David and Thomas 2008; Tilley 1994). More nuanced postprocessual approaches to landscape emphasized the social and cultural dynamics of landscape (Ashmore and Blackmore 2008; Bender 2002, 2006; David and Thomas 2008; Parcero-Oubiña et al. 2014; Van Dyke 2014), recognizing landscapes as active participants—sentient even (e.g. Patterson 2011)—in the human sociocultural sphere. In this way, landscapes are not just physical realms, but imbued with cultural meaning, significance, and agency.

Archaeologists use a variety of means to explore physical landscapes, however, such as remote sensing and geographic information systems to map and analyze landscapes on various scales; ethnographic and ethnohistorical sources that help illuminate the sociocultural contexts of past landscapes; and rock art studies that can provide insight into the ways in which past societies understood, related to, and represented their environments. Regardless of the tools or approaches used, though, landscape archaeology, at its core, seeks to understand the complex relationships between people and their environments, and how those relationships have changed over time by studying the dynamic interplay between nature and culture.

Phenomenology and how people experience landscapes

How people experience and perceive landscapes is phenomenologically based. Phenomenology is an existential ontology developed in the twentieth century that is concerned with "the experience *of experience*" (Engelland 2020:2, emphasis in original) or as "an interrogation of lived experiences" (Johnson 2012:273) as human embodied conscious beings. While its origins are often traced to Descartes' famous axiom "I think, therefore I am" (Van Dyke 2014), the elaboration of phenomenology as a distinct philosophy is largely the result of Edmund Husserl (2012 [1913]), Martin Heidegger (2019 [1927]), and Maurice Merleau-Ponty (2001 [1945]). Husserl's approach is primarily an investigation of the structures of consciousness (Husserl 2012 [1913]), while Heidegger's conceptualization is more ontologically focused. He insists that duality—such as the duality between nature and culture—is an illusion; there is no credible difference between subject and object, observer and observed. In other words, Heidegger attempts to mitigate the inherent duality that permeates Western thought. Merleau-Ponty, whose work forms the basis of many existential explorations of the second half of the twentieth century, came to believe that the underlying structures of perception and consciousness "are irreducibly embodied and social" (Jay 2019:160; see also Merleau-Ponty 2001 [1945]).

Phenomenology and the ontological turn in the twenty-first century

In the twenty-first century, an interest in *cognitive* phenomenology, which explores the relationship between consciousness and cognitive processes, continues to gain prominence as an avenue of philosophical inquiry. It posits that cognitive states, such as beliefs, desires, and emotion, have a qualitative aspect that is directly experienced by the individual, and that this subjective experience is essential to understanding cognitive processes and structures (Bayne and Montague 2011; Chudnoff 2015).

More broadly, cognitive phenomenology relates to traditional phenomenological inquiry in that it shares its focus on subjective lived experiences as the key to understanding the nature of reality. Whereas Husserl, Heidegger, and Merleau-Ponty sought to uncover structures of consciousness through careful attention to the way the world is experienced, cognitive phenomenology extends this thread to the cognitive process itself, arguing that the experience of thinking, reasoning, and decision making involves a rich and complex qualitative dimension. In this way, it seeks to shed light on the relationship between mind and world, observer and observed, and the nature of mental content and how that content is interpreted and represented (Bayne and Montague 2011; Chudnoff 2015).

The goals of cognitive phenomenology align well with the ontological turn in the social sciences, including anthropology. While cognitive phenomenology focuses primarily on the experience of thinking and cognitive processes, ontological approaches are concerned with the nature of reality. Such approaches propose new theoretical frameworks for apprehending the complex relationships between humans and the world around them, including nonhuman agents, such as animal, plants, objects, and, yes, even landscapes (Bird-David 1999; Boellstorff 2016; Descola 2005, 2006; Kohn 2007, 2009, 2013, 2015; Effingham 2013; Latour 1991, 1996a, 1996b, 2005, 2009, 2014; Peterson 2011; Sahlins 2022; Viveiros de Castro 1998, 2012, 2014, 2015a, 2015b; Zedeño 2009; and many, many, *many* others).

Ontological theorists maintain that human beings do not exist in a vacuum or separate from the rest of the world, but rather are deeply enmeshed within it, in intricate and often surprising ways. Furthermore, ontology lies at the conflux of epistemology and phenomenology (Harris and Cipolla 2017); the ontological turn therefore pushes us as Western people—or Moderns, in Burno Latour's (1991) parlance—to consider that other non-Western cultures may have very different realities and ways of understanding the world. This has led to a renewed interest in animism, which Descola (2005) defines as the belief that humans share their interiority (e.g. their psychology and their possession of a soul) with other lifeforms, both not their physicality. In animistic societies, animals and plants are people with similar interior worlds as ours, and they have their own societies and shamans. Descola (2005, 2006, 2014) contends that this form of animism is widespread among hunter-gatherers and horticulturalists. This is relevant, because late Archaic hunter-gatherers in the Black Mesa area likely embraced animism as their primary ontological outlook.

Phenomenology as a tool for archaeological inquiry

Phenomenology, as a theory-driven interpretive method concerned with perception, the senses, and lived experiences is one approach that can help extract meaning from landscapes and their associated material culture (including rock art, which I discuss below) as archaeologists work to decipher and interpret the past (Van Dyke 2014). Since such investigations begin from the standpoint of modern human bodies moving in spaces with multiple temporal dimensions—that is, they exist simultaneously in the past, the present, and presumably they will endure long into the future—and the assumption that since contemporary and past people share the same default physical form, we must also share similarities in how we orient ourselves in those spaces (Van Dyke 2014). Modern phenomenological inquiries also acknowledge and incorporate considerations of gender, age, and other bodily differences, as well as exploring senses other than site.

However, archaeologists must be critical in their application of phenomenology, including GIS-assisted phenomenological studies such as visibility analysis, and must situate such studies alongside other theoretical positions. For example, Bourdieu's notion of habitus aligns well with Heidegger's concept of *Dasein* (Van Dyke 2014). Habitus, a core tenet of practice theory, is "systems of durable, transposable *dispositions*, structured structures predisposed to function as structuring structures, that is, as principles which generate and organize practices and representations" (Bourdieu 1977:72). Put another way, habitus is a set of ingrained habits, skills, and dispositions that individuals acquire through socialization that influence their behaviors and perceptions in particular social contexts. Of course, Bourdieu's practice theory is nearly synonymous with Giddens' (1984) theory of structuration and agency that argues that social practices are both the product and the condition of social structures. Giddens suggests that structures are not external forces that constrain or determine human agency, but are instead produced and reproduced through human action.

Landscapes can be considered structures in the sense Giddens means in that they are socially produced and reproduced—or regenerated is perhaps a better word—through human practice and interactions with the physical environment. For instance, cityscapes are built landscapes that are the result of collective human actions and decisions over long periods of time. The layout of buildings, roads, and public spaces reflects changing and evolving long term social and economic priorities, and is also influenced by cultural and historical factors. The city of Paris is a perfect example, since it reflects more or less 11,000 years of occupation beginning with Mesolithic hunter-gatherers who camped in what is today the fifteenth *arrondissement* (Musée d'Archéologie Nationale "Les chasseurs-cueilleurs du Mésolithique"). The landscape, and later cityscape, was transformed over and over in a constant, unending negotiation between nature and culture, society and environment that reflects the prevailing practices and traditions of the people who shaped it over time. In this way, landscapes (and cityscapes) can also be viewed as structured structures in Bourdieu's conceptualization, since they are both products and producers of social practices and relations.

Language and phenomenology

Phenomenology and language are intrinsically connected. Phenomenology explores lived experiences and the structures of consciousness, while language serves as the primary means to express ideas and communicate those experiences. Thus, the study of language as an aspect of phenomenological inquiry investigates how language shapes perception and the fundamental aspects of human existence. In fact, Heidegger and Merleau-Ponty both wrote extensively about the role of language in shaping perception.

For Heidegger, language is not merely a tool for representing or communicating experiences, but rather an essential aspect of the human mode of existence or being. Language, in Heidegger's estimation, discloses the world to us, bringing things into existence by making them intelligible (Heidegger 1982 [1959], 2019 [1927]). Heidegger's concept of *Dasein*, or Being-in-the-world, emphasizes the situatedness of human beings in a linguistically constituted universe. He also explores how language allows for new possibilities for apprehending and engaging with the world (Heidegger 1982 [1959], 2019 [1927]). Put another way, Heidegger's phenomenological project is concerned with the ontological dimensions of language and human existence.

Merleau-Ponty brings his own unique perspective to the relationship between language and phenomenology. In *Phénoménologie de la perception* (2001 [1945]) and *La prose du monde* (1992 [1969]), he stresses the embodied nature of human experience and the role of perception in shaping our understanding of the world. He argues that language is fundamentally rooted in our perceptual experience, and that it emerges from our embodied interactions with the world. This emphasis on the living body as a source of meaning and linguistic expression sets Merleau-Ponty apart from Husserl and Heidegger, as he seeks to bridge the gap between phenomenology and the natural world. For Merleau-Ponty, language is not an abstract systems of signs and symbols, but rather a dynamic, expressive force that is grounded in our bodily experience, positing that that meaning is generated and mediated through the interplay between our bodily experiences, perception, and language (Merleau-Ponty 1969).

The later work of Ludwig Wittgenstein offers another unique perspective on the relationship between language and phenomenology. While Wittgenstein does not explicitly engage with phenomenology in the same manner as Husserl, Heidegger, or Merleau-Ponty, his ideas on language align well with phenomenological concerns. Wittgenstein challenges traditional views of language as a system of representation, focusing instead on the pragmatic aspects of language use in everyday life. For example, in his posthumously published *Philosophical Investigations* (2009 [1953]), he develops the concept of so-called "language games" that emphasize the diverse ways in which language is used in various social practices. He argues that meaning is not determined by a fixed correspondence between linguistic signs and external objects or experiences, but rather by the rules and conventions of governing different language games. This view of language as a dynamic, context-dependent system resonates with Heidegger's notion of disclosure and Merleau-Ponty's emphasis on the interplay between perception, embodiment, and language.

Furthermore, Wittgenstein's (2009 [1953]) notion of "family resemblances" further highlights the multifaceted nature of meaning. He argues that linguistic concepts do not have fixed definitions or essences, but rather display a network of overlapping similarities, akin to the resemblances between family members. This idea challenges the idea of fixed structures of meaning, aligning with phenomenological concerns for the fluidity and context-dependence of human experience.

Wittgenstein's (2009 [1953]) later work also engages with issues related to private language and the limits of expression. He famously argues against the possibility of a truly private language, contending that language is inherently public and social. This has significant implications for phenomenology, as it raises questions about the limits of language in expressing and communicating subjective experiences.

This seems to resonate with Merleau-Ponty's contention that consciousness and perception, while ostensibly private, is nevertheless an embodied, social enterprise (Jay 2019; Merleau-Ponty 1945). Although Wittgenstein's work is not explicitly phenomenological, his insights into language, meaning, and expression offer a valuable perspective into the relationship between language and phenomenology.

As an aside, while Wittgenstein's early work—i.e. the *Tractatus Logico-Philosophicus* (2021 [1921])—and his later *Philosophical Investigations* (2009 [1953]) offer distinct perspectives, their points of agreement, namely their focus on language, the relationship between language and the world, and the limits of what can be said, may serve as a bridge between logical positivism, and more subjective or metaphysical explorations, such as phenomenology. While logical positivism and metaphysical inquiries are often seen as opposing philosophical perspectives, the commonalities in Wittgenstein's thought may highlight some connections between these two approaches.

Rock art and landscape

Rock art is "landscape art" (Whitely 2011a:23, 2011b:307; see also Boyd 2016) in that it is a relatively permanent addition to the landscape by human agents. More specifically, it is human-produced markings, such as paintings, engravings, or even large-scale geoglyphs on natural stone surfaces *en plein air*, within caves, and elsewhere, including abris and rock shelters (Whitley 2011a, 2011b)—in the case of the study area, petroglyph panels are typically found on large boulders in close proximity to the rock alignments (see Chapter Six). Antarctica notwithstanding, rock art is found on every continent (Whitley 2011a, 2011b; Rafferty 2021). One of the most intriguing examples of cave art in the world, consisting of red and black animal paintings, abstract geometric signs, and positive and negative handprints found at the caves of Maltravieso, Ardales, and La Pasiega in Spain, have been dated to more than 64,000 years old, indicating a middle Paleolithc Neanderthal origin (Hoffmann et al. 2018). Of course, rock art, specifically prehistoric examples, is not "art" in the aesthetic sense (Collingwood 1938; Conkey 1987; Whitley 2011a), which Conkey (1987:413) notes "presumes a link between us and the makers/users of the imagery" that may or may not reasonably exist (see also Whitley 2011a). Nevertheless, rock art remains an integral aspect of cultural heritage to many Native and Indigenous peoples worldwide (Whitely 2011a).

Of course, interpreting the "meaning" and significance of rock art can be challenging, since it often requires special cultural knowledge and information about the historical context in which the images were created. Some rock art researchers focus on identifying recurring motifs or patterns in rock art, while others attempt to link specific images to particular cultural practices and beliefs. Still others emphasize the linguistic dimension of rock art, suggesting a role in storytelling and oral tradition, arguing that images convey complex cultural narratives tied to mythology, spiritual beliefs, and ritual practice involving memory and identity. For example, *my* hypothesis regarding the White Shaman Mural, a large rock art panel that depicts a complex Southern Uto-Aztecan creative narrative (Boyd 2016) in the lower Pecos canyonlands near the Texas-Mexico border, contends that the rock art was used in conjunction with ritual peyote use. I hypothesize that the subjective hallucinatory effects of mescaline, they psychedelic molecule produced by the peyote cactus, *Lophophora williamsii*, would have altered the phenomenological experience of the local environment in such a way that that not only transformed the images into living, breathing, moving pictures, but transformed *peyoteros* (pilgrims) to the panel into active participants in and creators of foundational cultural narratives, thus reinforcing cultural memories, regenerating cultural structures, and strengthening cultural cohesion and narratives of identity.

GIS and visibility analysis in modern archaeology

Visibility and intervisibility are important concepts in archaeology that allude to possible visual relationships between various elements within a landscape, and are particularly relevant in the study of ancient landscapes. Specifically, visibility refers to the ability to see one place on the landscape from another. Intervisibility is similar in that it refers to the ability for observers at two or more points to each other. For example, Bement and Carmicahel (2003) remark on the threeway visibility between 34CI339, 34CI466, and 5BA953 observed during their pedestrian survey of the Black Mesa area (see Figure 4.1).

Archaeological approaches to visibility

Viewshed analysis is one method for quantitively analyzing potential visibility of different elements of the landscape, typically using GIS software, such as ArcGIS Pro, although non-GIS visibility studies "can be traced back considerably further" (Lake and Woodman 2003:689) than the forty-odd years that computer-based methods have been in common usage. Lake and Woodman (2003) categorize such studies as informal, statistical, or humanistic. Informal visibility studies lack any explicit methodology such as Drewett's (1982) analysis of the view from various kinds of Neolithic burial mounds in the British countryside (see also Lake and Woodman 2003). Statistical studies, on the other hand, are rooted in positivism, and are primarily concerned with "quantification and inferential rigour" (Lake and Woodman 2003:690). Humanisitic approaches, such as the phenomenological approaches to landscapes by Tilley (1994) and others discussed earlier that essentially begin with human bodies on the landscape and their experience of it. But as I will discuss in Chapter Eight, the *ontological* considerations of visibility, perception, and experience cannot be overstated, and they cannot be ignored—what we Moderns, in the Latourian sense (Latour 1991) consider important may or may not have held the same significance to ancient people.

Of course, the importance of visibility studies, including viewshed analysis, to archaeologists lies in their potential to reveal information about past human behavior, social organization, and cultural significance of places on the landscape. For example, the distribution of visible and invisible sites on a landscape can reveal patterns of settlement and land use, while intervisibility between sites can provide insight into the social relationship between those sites (as agents) and the people who used them.

However, viewshed analyses are not the be-all-end-all of visibility studies or landscape archaeology, and should be combined with other analytical techniques, such as geophysical survey, to gain a more comprehensive and nuanced apprehension of past landscapes or of culturally significant landscapes today. In their analysis of Craig Mound at the Spiro Mounds Archaeological Center in eastern Oklahoma, for instance, Regnier and colleagues (2019) used a landscape approach to examine the spatial organization, the relationships between different architectural features, and how the landscape was used for ritual practices through a variety of methods, including geophysical survey, excavation, and the analysis and interpretation of material culture to reconstruct social and ritual practices in late precontact eastern Oklahoma.

GIS and visibility

GIS software, such as ArcGIS, uses a variety of methods to calculate visibility, including viewsheds and line-of-sight analysis. These methods typically use digital elevation models (DEMs) to create three dimensional representations of the landscape from which visibility or line-of-sight is calculated between various points on the landscape. For viewsheds, GIS software divides the landscape into a grid of cells, calculates the height and slope of each cell relative to the observer, and determines which cells are visible to the observer, generally based on a user-defined distance or height threshold. Since GIS software calculates what is visible to an observer, 1.5 meters is conventionally used as the average height of people in the past. The resulting map color codes areas of the landscape that are visible to the observer.

Intervisibility

Line-of-sight analysis is a related method that calculate the visibility or line-of-sight between two or more observers on the landscape. Such analyses can be used to identify areas of the landscape that are obfuscated from view by natural or cultural features, and works by creating straight lines between each pair of observers, then determining whether any objects or features on the landscape occlude the line-of-sight between those two observers. This calculation can obviously be repeated for multiple pairs of observers, thus allowing for the calculation of intervisibility between, theoretically, any number of points (Brughmans and Peeples 2020).

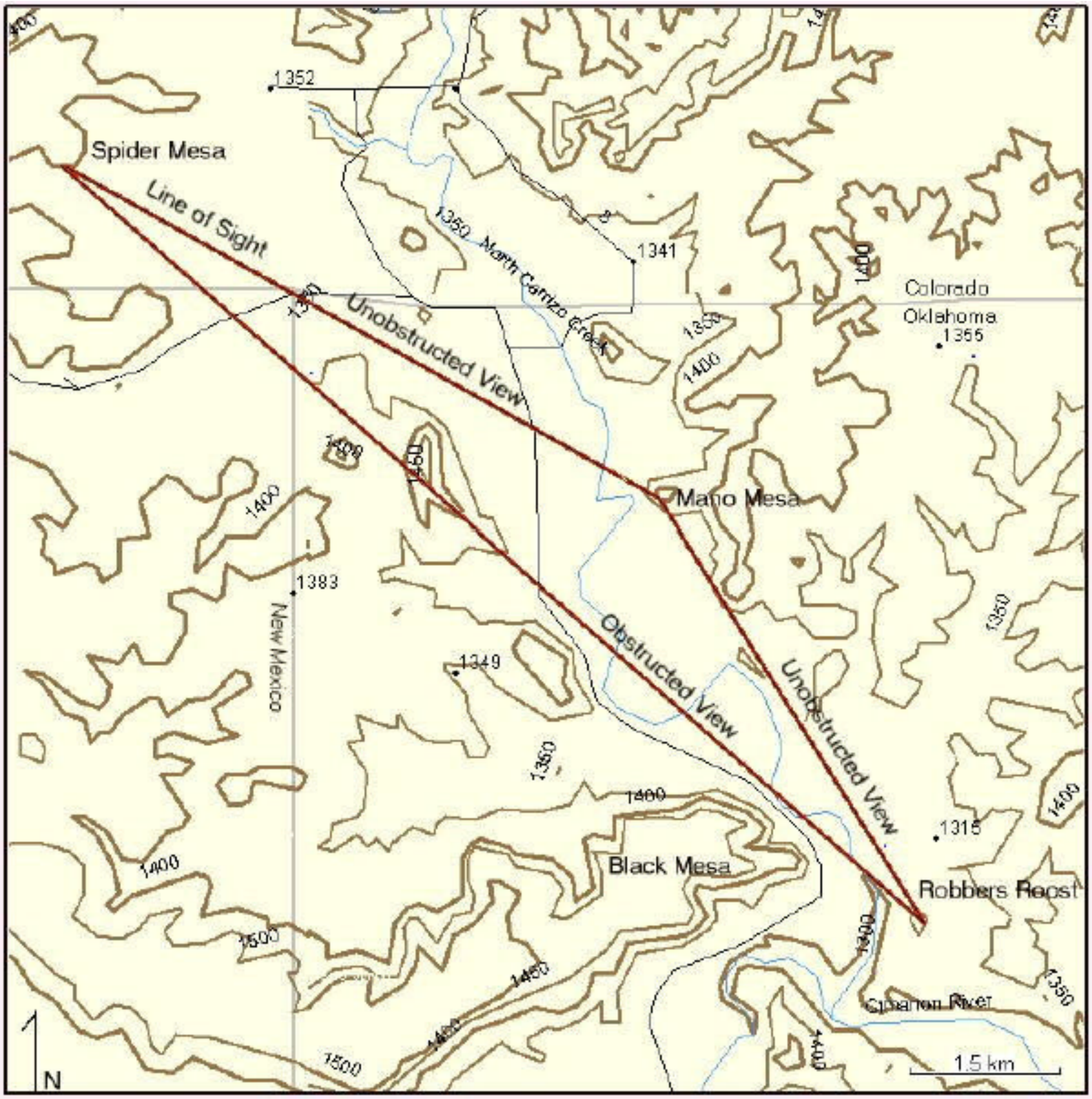


Figure 3.1 Intervisibility between 34CI339, 34CI366, and 5BA953 observed during Bement and Carmichael's 2002 pedestrian survey of the Black Mesa region (Bement and Carmichael 2003:50)

Chapter Four. Ethnographic and archaeological background of ancient signaling

The use of signaling systems to facilitate long distance communication is well known globally in both ethnographic and archaeological contexts since ancient times. Messages could range from simple alerts to more complex communiqués. In ancient China, for example, a network of fire beacon towers along portions of the Great Wall were used as early as the Western Zhou Dynasty (1045 – 771 BCE) through the Qing Dynasty (1636 – 1912 CE) to quickly transmit military information along borders and coastal areas (Djordjevic et al. 2010; Du et al. 2021; Tan et al. 2021a, 2021b). In ancient Greece, encoded messages were sent via fire signals (Shuckburgh 1889). Furthermore, Thucydides (2009; see also Pattenden 1983) recorded the Peloponnesians in Corfu were warned by nighttime signal beacons of an impending Athenian attack during the Peloponnesian War (431 – 404 BCE). Fire signals were utilized by the Byzantine Empire to transmit messages from the frontier to the imperial palace at Constantinople during the Arab-Byzantine wars of the tenth century (Pattenden 1983).

In more recent American history, Paul Revere, William Dawes, and Samual Prescotts' "midnight rides" on the night of April 18, 1775 to activate a signaling system that included bonfires and acoustic warnings to quickly alert colonial minutemen of the approach of British soldiers prior to the Battles of Lexington and Concord that sparked the American Revolution (Fischer 1994) is well known. A twentieth century example is the use of kerosene lanterns and reflectors by the Native Hawaiian residents of Niʻihau Islands to signal neighboring Kauaʻi Island for help on the night of December 7, 1941 during the so-called "Niʻihau Incident." Imperial Japanese Navy Air Service pilot Shigenori Nishikaichi, following his participating in the Japanese attack on Pearl Harbor, crash landed his damaged Mitsubishi A6M Zero on Niʻihau believing the island to be uninhabited. Nishikaichi subsequently terrorized the island's residents for six days (Beekman 1982).

Reasons for signaling

In these examples, and in the Native American ethnographic contexts that follow, signaling typically falls into a few general categories:

1. *Defense*. One of the primary reasons for signaling in the ancient world was to warn or communicate actual or potential threats. Early warning systems, facilitated by signaling, allowed groups to mobilize in order to protect their resources and people.
2. *Coordination and governance*. Ancient societies needed to coordinate activities across long distances, particularly for administrative or military purposes. Signaling enabled the transmission of messages and instructions, facilitating governance of territories and the coordination of military campaigns, troop movements, and logistics. In Native American contexts, signaling was often used to coordinate hunting groups or guide parties traveling on the landscape.

3. *Ceremonial and religious purposes*. Ancient people often used signaling to, well, signal important religious or ceremonial events, such as the beginning or end of ritual cycles, the sighting of celestial phenomena, or the death of a prominent figure. These signals helped synchronize religious observances, create a sense of shared identity, and maintain social cohesion among communities separated by distance.
4. *Requests for parlay and other miscellaneous communications*. Requests for parlay and other miscellaneous communications via signaling helped facilitate diplomacy, civil communications, conflict resolution, and the establishment of alliances, thus contributing to the stability and cooperation within and between ancient societies.
5. *Emergency communication and requests for help*. As in the Niʻihau Incident, low tech signaling can be used to communicate in an emergency situation and/or to request assistance from afar in the absence of other means of communications. (In the case of the Niʻihau Incident, the island's residents lacked both electricity and telephones [Beekman 1982]).

In Chapter Six, I discuss types of signals and how archaeologists could potentially use GIS software and methodologies to test hypotheses regarding various kinds of signals. I also discuss how understanding the potential or intended audience of signal systems is an important consideration, as well.

Signaling by Native Americans

The use of signaling systems by Native Americans is also well known ethnographically (Beers 2012, 2014; Swanson 2003; Turpin 1984) and archaeologically (Beers 2012, 2014; Swanson 2003). As summarized by Beers (2012, 2014), the earliest ethnographic description of smoke signals by Indigenous people in North America as a mode of communication was made by Fidalgo de Elvas, known as the Gentleman of Elvas, in west-central Florida in 1539 in his chronicle of Spanish explorer and *conquistador* Hernando de Soto's ruthless and brutal exploration of what is now the southeastern United States (Duncan 1995). Following the removal of the Seminole Tribe from Florida to Indian Territory from roughly 1835–58, this practice continued well into the twentieth century by the Seminole of Oklahoma who used smoke signals during hunting excursions to communicate by using a blanket to parse smoke columns into puffs that relayed specific meanings (Beers 2012, 2014; Swanton 1928). Similarly, says Beers (2012, 2014; see also Densmore 1979 [1929]; Hilger 1951), this Chippewa in the Great Lakes region used smoke puffs to communicate across water.

A number of tribes along the Pacific Coast, including the Tlingit (Beers 2012, 2014; Krause 1956; Swanton 1908) and Youkuts (Beers 2012, 2014; Fremont 1846; Vancouver 1984 [1801]), utilized fire-based signaling to send detailed messages very quickly over hundreds of kilometers (Beers 2012, 2014; Latta 1949), while the use of smoke and line-of-sight signals by Plains tribes is well documented throughout the nineteenth and early twentieth centuries (Beers 2012, 2014). For example, Beers (2012, 2014), drawing on Berlandier (1969 [1830]) and Wallace and Adamson (1952) comments that the Comanche used a very similar system as the Seminole and Chippewa. In Canada, the Nakoda, Assiniboine, and Pawnee (Beers 2012, 2014; Blaine 1990; Denig and Hewitt 1930; Lowie 1909; Maclean 1896) used sophisticated line-of-signt signaling systems that employed "mirrors, fires, blankets, and bison robes" (Beers 2012:6; 2014:23) to communicate over long distances.

Signaling in the southwestern United States

As with elsewhere in the North America, there is extensive ethnographic evidence for the use of signaling systems by ancient Native Americans to communicate over long distances in the American Southwest and northern Mexico (Beers 2012, 2014; Swanson 2003; Turpin 1984), which Beers (2012, 2014) and Swanson (2003) helpfully summarize. One of the earliest European chroniclers in the region, Marcos de Niza, a Spanish missionary and Franciscan friar, observed what may have been many signal fires in what is today the Sonora Valley, Arizona (Beers 2012, 2014; Hallenback 1949). Obregon, chronicler of the Ibarra expedition, records that Indigenous people in northern Mexico in 1565 gathered for war using smoke signals (Beers 2012, 2014; Hammond and Rey 1928). Native communities along the Pecos River in Texas and New Mexico utilizing smoke signals were observed by the de Sosa expedition of 1590–91 (Beers 2012, 2014; Schroeder and Matson 1965), while in 1681, smoke signals were used by Native Americans to communicate over two hundred kilometers during the attempted reconquest of New Mexico near the town of Truth or Consequences (Beers 2012, 2014; Hackett and Shelby 1942). Smoke signals were also documented in northern Mexico in the early eighteenth century (Beers 2012, 2014; Griffen 1969), and on the Texas coast in 1828 (Beers 2012, 2014; Berlandier 1969 [1830]). Additionally, signaling systems may have been utilized by Pueblo communities of the northern Rio Grande around Brandelier National Monument in the north and extending south toward Chilili, and from the Continental Divide to San Cristobal in the Galisteo Basin (Beers 2012, 2014; Ellis 1991).

Additionally, the use of mirrors, fires, and smoke, including smoke rings, for communication has been observed among the Diné (Beers 2012, 2014; Downs 1972; Newcomb 1964; Reagan 1930; Roberts 1951), while the Western Apache used smoke signals to coordinate for war (Beers 2012, 2014; Bender 1974; Cremony 1981 [1868]; Goodwin 1971; Sweeney 1991), as well as requests for parlays, to coordinate hunting expeditions, and for general guidance for parties traversing the landscape (Beers 2012, 2014; Griffen 1988; Matson and Schroeder 1957).

Chapter Five. Methods

Research questions

The primary research question this geospatial analysis sought to answer was one of visibility and intervisibility between the stone circles, and to confirm Bement and Carmichael's (2003) observation of clear intervisibility between 34CI366 and 5BA953, clear intervisibility between 34CI366 and 34CI339, and obstructed visibility between 34CI399 and 5BA953. Beyond this, this analysis hoped to understand the relationship ancient people may have shared with their landscape.

The primary study sites

The primary stone circle sites and accompanying rock art components are summarized in Table 6.1, and described in detail in Appendix B. All sites are recorded as "unknown prehistoric," but were probably created and used during the late Archaic or early Formative period based on the artifacts, such as diagnostic lithic scatter, manos, and petroglyph style, as well as their general conditions. With the exception of 34CI424, there is no surface evidence of fire at the stone alignment sites. At site 34CI424, Bement and Carmichael (2003:97) note that the sandstone is "visibly reddened around the edges," which *may* hint at past fires at this location. This is not conclusive evidence that fires were lit at this location, however, since other natural processes and anthropogenic practices can cause similar reddening. The petroglyph features are typically large boulders found at the base of mesas, though petroglyphs depicted seem fairly inconsistent from site to site. Overall, though, images range from

Site ID	Type	Affiliation	Site area	Elevation	Depth	Association
34CI339	Stone circle	Unknown	400 m^2	1,350 m AMSL	Surface	34CI341
34CI366	Stone circle	Unknown	500 m^2	1,420–30 m AMSL	Surface	34CI36/38
34CI410	Stone circle	Unknown	100 m^2	1,460 m AMSL	Surface	None
34CI424	Stone Circle	Unknown	350 m^2	1,390 m AMSL	Surface to 200 cmbs in crevasse	34CI422
34CI572	Stone Circle	Unknown	Unknown	Unknown	Surface	34CI87/188
5BA953	Stone Circle	Unknown	300 m^2	1,440 m AMSL	Surface	5BA951
34CI87/188	Rock art	Unknown	Unknown	1,353 m AMSL/1,341 m AMSL	Surface	34CI572
34CI341	Rock art	Unknown	400 m^2	1,350 m AMSL	Surface	34CI339
34CI36/38	Rock art	Unknown	Unknown	1,312 m AMSL	Surface	34CI366
34CI422	Rock art	Unknown	400 m^2	1,350 m AMSL	Surface to ±30 m cmbs	34CI424
5BA951	Rock art	Unknown	20 m^2	1,416 AMSL	Surface	5BA953

Table 5.1 Primary sites in the study area; see Appendix B for more information

possible anthropomorphs to animals such as deer and bighorn sheep to abstract or geometric signs and symbols (Bement and Carmichael 2003). Interestingly, one large vertical panel at site 34CI341 features pecked lines that local people who have seen the site under various lighting conditions report show anthropomorphic figures in the right light (Bement and Carmichael 2002d, 2003). The preservation of the sites ranges from undisturbed to some natural disturbance to extensively looted or vandalized.

The average elevation for the stone alignments is 1,413 meters above mean sea level (AMSL), while the petroglyph panels are, on average, approximately sixty meters below. While the site area is not available for 34CI572, the average area of the stone circles is 330 square meters. (Bement and Carmichael's 2003 report records the area of site 5BA953 as 3,000 square meters, which I assumed to be a typographic error. It seems more likely they meant the site is 300 square meters instead.) Likewise, the site area information for the rock art panels is only recorded in three instances; however, by extrapolating the missing area information by assuming these sites are approximately 400 square meters, the average area for the rock art components becomes 324 square meters.

Data gathering and preparation and exploratory mapping

Initially, this thesis would have included a predictive model that one hoped would identify a pattern of sites that extended down the Dry Cimarron River in New Mexico through the myriad mesas, canyons, and arroyos that could be used to form the basis of a more nuanced and informed discussion late Archaic people had when they created and used these sites. As such, I searched the cultural resource databases in New Mexico and Colorado to identify archaeological sites in Union County, New Mexico and Baca and Las Animas Counties, Colorado that fit certain criteria, such as “Archaic,” “rock art,” “petroglyphs,” “stone circles,” and “rock alignment.” Much of the information about the Oklahoma sites used in this study was provided by Leland Bement. A request for information and files pertaining to other sites in Cimarron County, Oklahoma were requested from the Oklahoma State Archaeologist’s office at the Oklahoma Archeological Survey, which is more proprietary with its records.

Any sites, upon closer review, that did not meet the full criteria for inclusion were rejected. For example, rock art sites that were wholly historic in nature were removed. Once all sites had been reviewed for suitability, a geodatabase using information in the remaining files was created in Google Sheets that contained, at minimum, the sites’ Smithsonian trinomial (e.g. 34CI410); its cultural affiliation, such as “Archaic” or “Prehistoric”; the type of site, such as “Rock Art”; state and county information; and UTM coordinates. In cases where only decimal degrees were noted, these were converted to UTM coordinates using the conversion tool (*rcn.montana.edu/resources/Converter.aspx*) provided by the Yellowstone National Park Research Coordination Network at Montana State University. For the principal sites used in this study, the tract followed in Bement and Carmichael’s (2003) pedestrian survey was included, along with mesa height information in both meters and feet. The final geodatabase ultimately contained twenty tabs that organized the data in various ways. The completed geodatabase was exported as a Microsoft Excel spreadsheet. A complete list of sites ultimately chosen for this study is included in Appendix A. Full site descriptions of the primary sites are found in Appendix B.

Shapefiles of four site (34CI339, 43CI366, 34CI410, and 34CI424) were provided by the Oklahoma Archaeological Survey from which the center points for these sites were determined using ArcGIS Pro 3.1.0. At the same time, geospatial data was gathered from a variety of United States government sources. One meter LiDAR elevation for not available across the entire four county area from the National Map provided by the United States Geological Survey. Ten meter, county-specific digital elevation data was therefore downloaded from the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) geospatial data gateway. Other geospatial data obtained from the NRCS included climate data, geological information, state and county shapefiles, land use data, soil data, and topographic images. The National Hydrology Dataset (HDRPlus HR), however, *was* downloaded from the National Map.

The Output Coordinate System and Cartography environments in the geoprocessing environments dialog were immediately set to use the North American Datum 1983 Universal Transverse Mercator Zone 13 North (NAD 1983 UTM Zone 13N) projected coordinate system. The county shapefiles were added to the project, and the

Feature Class to Shapefile geoprocessing tool was used to create a single shapefile of the entire four county study area. The Pairwise Dissolve tool was then applied to dissolve the borders between each county, which was then saved as a shapefile. The Mask option under Raster Analysis in the geoprocessing environments was updated to use this shapefile. The Clip Layers tab on the Map Properties dialog was also updated to use the "Clip to an outline" option using the four county shapefile.

Finally, the Excel to Table tool was used to convert each of the twenty tabs in the geodatabase compiled earlier to standalone tables in ArcGIS Prop containing location data and other information about the sites. The XY Table to Point Tool was repeatedly used to map the various versions of the data. The sites were grouped based on various criteria, and their symbology updated to allow for easier identification.

Digital Elevation Models (DEMs)

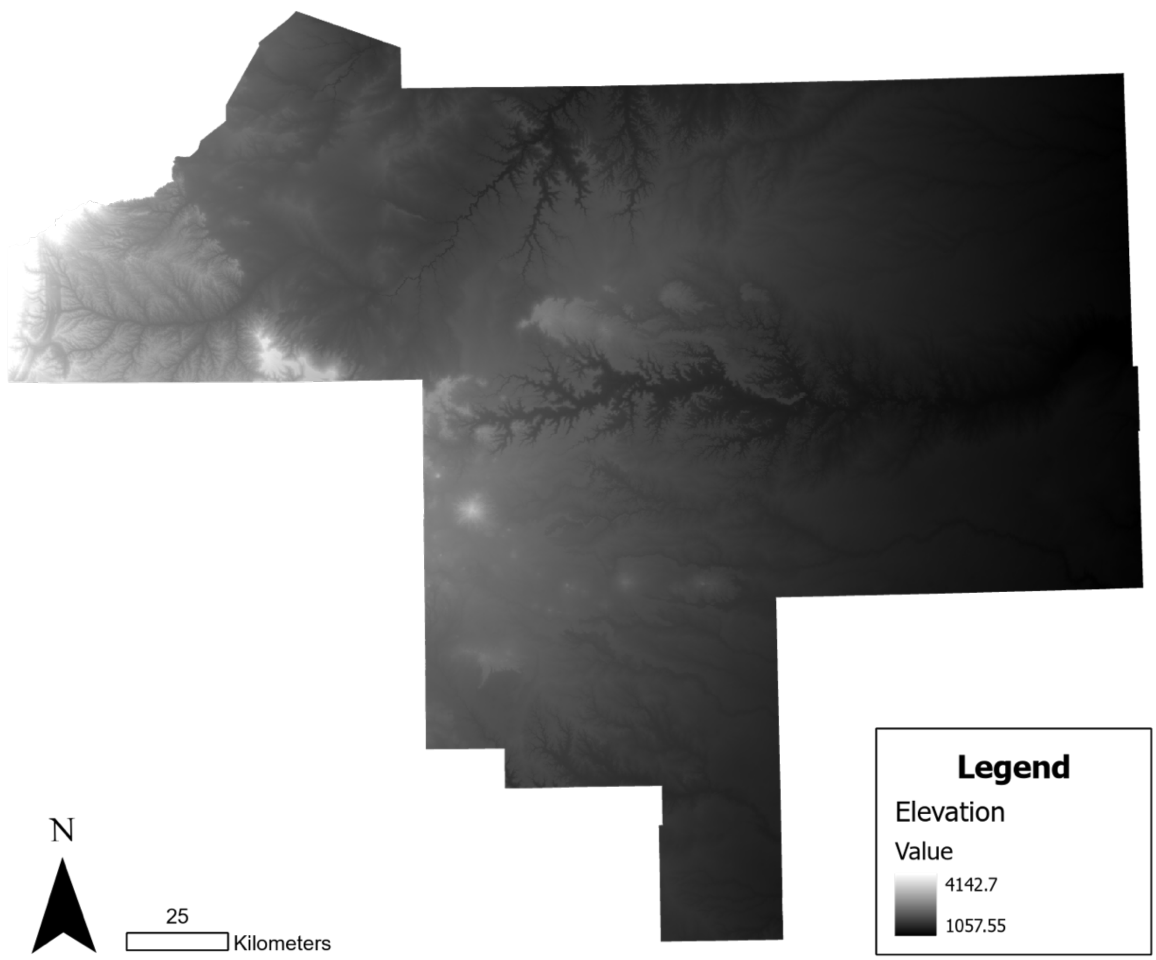


Figure 5.1 Ten meter DEM of the study area

DEMs for each county included in this study were added to the project in ArcGIS Pro, and the Mosaic to New Raster geoprocessing tool was used to combine the parts into one DEM with a 64 bit pixel type for the entire county. Once DEMs for each individual county were created, the Mosaic to New Raster geoprocessing tool was used again to create one combined DEM using TIFF compression for the entire study area. The Processing extent, Raster Analysis, and XY Values in the geoprocessing environment were updated to use this DEM as their basis.

Hydrology and major rivers

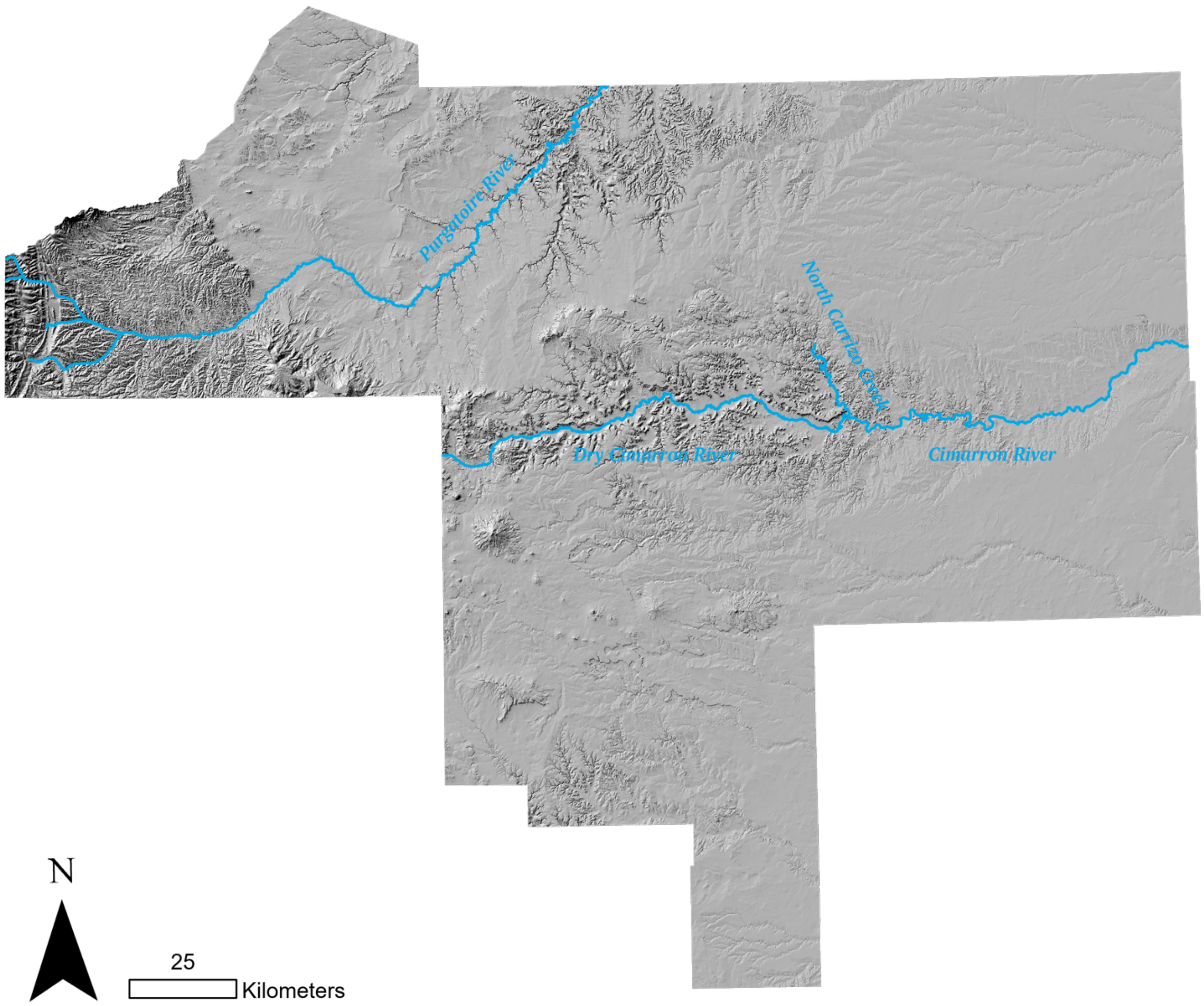


Figure 5.2 Major rivers in the study area

The National Hydrology Dataset is a behemoth, since it contains extremely detailed hydrology information encompassing the entire United States, though most of the layers were ultimately irrelevant and unnecessary for this study, and were eventually discarded. The *NetworkNHDFlowline* layer, however, was retained since it contained all the rivers and streams in the study area. The Pairwise Clip tool was used to trim the *NetworkNHDFlowline* layer to the extent of the study area. The Export Features geoprocessing tool was the used to export the Cimarron River, Dry Cimarron River, and North Carrizo Creek flowlines to a new feature layer. Then the Feature to Raster tool was utilized to create a single, merged raster of these rivers. The same process was used to export the Purgatoire River in Colorado, ultimately creating a single raster of the Purgatoire River, as well.

Exploratory mapping and spatial analysis

Informal exploratory mapping and spatial analysis was undertaken to gain a better understanding of how the sites were distributed on the landscape. Overall, these explorations indicated that sites are not randomly scattered, but are clustered at larger scales, but distributed at smaller scales. These results are not presented in Chapter Seven, however since they do not contribute to the overall visibility analysis in a meaningful way.

Kinds of signals and how to test for them

As detailed in the previous chapter, ancient societies relied on various forms of signaling to communicate over long distances, share vital information, and coordinate various activities. The most relevant of these systems (and sometimes combination of systems) include:

1. *Fire and/or smoke signals.* Ancient people often used fire or smoke signals to transmit messages or alert others of important events. These signals were typically visible from far away, and could be used during both day and night. To test for the effectiveness of fire or smoke signals, a GIS visibility analysis, such as viewshed or line-of-sight analysis (similar to the ones used in this study), would be useful. These tools could help archaeologists determine if a signal originating from a specific location would be visible from other sites of interest, taking into consideration the terrain and other relevant factors.
2. *Reflective signals.* Ancient (and modern) people might have used reflective surfaces, such as mirrors, polished metal, or even shields, to send messages or signals by reflecting sunlight. The feasibility of this method could possibly be tested in a GIS application by using line-of-sight analysis that takes into account visibility at specific times of day. This might permit archaeologists to determine if a reflective signal would be visible from other locations, as well.

In this study, however, I am not testing an hypothesis centered on any one kind of of signaling that may have been utilized by Archaic people—plumes of smoke, for instance—but only examining visibility and intervisibility between mesa-top rock alignments.

Visibility and viewsheds

In this study, the Visibility geoprocessing tool was used to calculate the visible portions of the study area from each stone alignment using Observers as the basis for analysis. The Visibility tool relies on the DEM as a representation of the surface of the Earth, and utilizes an algorithm to evaluate each cell in the DEM to determine whether it is visible from an observation point, taking into account the height of the observer and potential obstructions (Gillings and Wheatley 2020). Earth curvature corrections were used, and the default refractivity coefficient of 0.13 was kept. The observer offset was set to 1.5 meters as the average height of an adult human.

The values I used in generating the viewsheds in this study bring up an important point; namely that despite the utility of viewshed calculations, it is crucial to recognize that such analyses involve inherent or default assumptions—for example, the presence of vegetation, atmospheric conditions, or the uniformity of observer height—that can affect the outcome, and, subsequently, the interpretations of these results. One common assumption in viewshed analysis, for instance, is the absence of vegetation or manmade structure. By default, ArcGIS Pro only considers the bare Earth data (i.e. the DEM) to calculate visibility. While unlikely to have affected my results here, these assumptions could lead to an overestimation of visible areas, since trees and other obstructions may have obstructed visibility between specific sites. While this issues can be addressed by incorporating vegetation data into the calculations, obtaining such data for ancient landscapes may be difficult, if not impossible. Therefore, it is important to understand the limitation of available data and how it may affect the outcome of the analysis.

Likewise, atmospheric conditions, such as haze or fog, can significantly impact visibility over long distances, but most viewshed analyses do not take these factors into account by default. This can lead to an overestimation of visibility, particularly in regions where atmospheric conditions regularly limit long-range visibility. In this study, for example, I assume that every day in the late Archaic was sunny, warm, and beautiful, allowing for maximum visibility.

Another assumption in viewshed analysis is that everyone was the same height—in this case, 1.5 meters as the average height of an adult human—which could be critical when analyzing archaeological sites located on varying terrain. It is highly unlikely that everyone in the late Archaic grew to a mere 1.5 meters tall (even with the 365 days of sun they apparently received), but assuming such a uniform human height may lead to an under- or overestimation of visibility patterns depending on the terrain and site characteristics.

These assumptions matter, because the reliability of viewshed analysis outcomes directly impacts the interpretations and conclusions drawn from the results. If the assumptions lead to inaccurate visibility calculations, archaeologists may draw incorrect conclusions about the relationships between sites, their functions, and their cultural significance. But by understanding what assumptions are inherently being made and, where possible, addressing them with additional data or methodological adjustments, more accurate results and, ultimately, more reliable archaeological interpretations of spatial relationships can be determined.

Construct Sight Lines and Lines-of-Sight

Like viewshed analyses, line-of-sight analyses in GIS applications are subject to various assumptions that may influence the accuracy and reliability of the results. The assumptions mentioned above, such as the absence or presence of vegetation, variable atmospheric conditions, and uniform observer height, can similarly impact a line-of-sight calculation for many of the same reasons, but with their own unique nuances and considerations that impact the outcomes. The assumption of the absence of vegetation or other objects that may obstruct line-of-sight can lead to a false positive (or false negative), suggesting intervisibility between sites that may not have existed in reality. In the same way, atmospheric conditions or weather events can reduce visibility over long distances (as anyone who has driven in heavy rain or snow knows), leading to false positives or negatives depending on whether it’s a clear day or rainy one. And, again, uniform observer height is fairly unrealistic; what is visible to a really tall person may be occluded to a shorter person—believe me, I know from experience! These assumptions matter in line-of-sight analysis, since inaccurate assumptions can result in misguided or misaligned hypotheses about ancient people, their interactions, and the cultural landscape they inhabited.

The Construct Sight Lines 3D analyst geoprocessing took was used to compute hypothetical sight lines from each of the stone alignments (observer points) to every other stone alignment (target features) in this study. The observer height field and target height field were both left blank, and therefore no Z values were assigned in the resulting sight line features. Finally, the Line of Sight tool was used to compute lines-of-sight from each site to all the other sites.

Chapter Six. Results

To reiterate, the primary goal of this geospatial visibility analysis was to understand, if possible, whether the stone circle sites represent nodes in an ancient line-of-sight signaling network, and to elucidate or elaborate a deeper comprehension of the relationship between late Archaic people and their environment. Additionally, these sites, with a single exception, are associated with at least one nearby petroglyph feature that perhaps hints at a significance beyond long distance communication. Therefore, visualizing the entire study area, including the rock art sites, other similar stone alignments, as well as other known Archaic sites in the region, their locations in space, as well as their relative locations to each other may help identify patters that may not be readily apparent at first glance, but which may be essential in order to meaningfully answer questions about late Archaic people in the Black Mesa area.

Results

In the context of this thesis, both viewsheds and line-of-sight calculations are ideal for addressing the question of visibility and intervisibility between the six stone circle sites. Viewsheds allow for the visualization and quantification of the areas that are visible from each site, thus providing insight into the potential interactions and connections between each location. Lines-of-sight, on the other hand, determine direct line-of-sight between specific pairs of sites. Together, these two analyses examine the spatial relationships between the sites, allowing for a more comprehensive apprehension of the possible intervisibility between them, which is central to the primary research focus.

To put it another way, intervisibility between archaeological sites is a significant factor when considering the potential for communication and interaction on various scales among ancient people. In the case of the stone circles, understanding their intervisibility could shed light on their purpose, whether they served as some kind of markers, for example, or communicated messages, or, given the nearby petroglyphs at five of the sites, were perhaps areas of ritual or ceremonial significance. A comprehensive assessment of visibility and intervisibility allows for a more nuanced understanding of the spatial relationships between these sites and the people who utilized them, thus illuminating potential insights into possible cultural or functional connections between these sites and the groups they served.

Calculating viewshed size is an essential step in understanding the overall visibility of each site, which, in turn, helps determine the extent of the area that was potentially under observation or within the sphere of influence of each site. A larger viewshed may (but not necessarily) indicate a more strategic location, suggesting a greater potential for communication or control over surrounding areas. Conversely, a smaller viewshed could imply a more secluded or protected site, perhaps serving a more specific or exclusive purpose. By comparing the viewsheds of the six rock alignments, it may be possible to infer the relative importance of each site within the broader context of the late Archaic landscape.

Assessing the combined viewshed size (e.g. Figure 7.1) brings a more holistic perspective to the analysis, as it takes into account the overlapping visible areas between the sites. This information can be particularly useful for determining the degree of interconnectedness between the sites, and how they may have functioned as a network. A larger combined viewshed may suggest a higher degree of cooperation or interaction, perhaps hinting at a more integrated cultural landscape. A smaller combined viewshed, on the other hand, could suggest a more fragmented or independent set of communities or groups, each focused on their respective sites.

As elaborated in more detail later, there is *some* intervisibility between the principal sites in this study, but not to an extensive degree based on these results. The most prominent example of inter-site visibility is between sites 34CI339 and 34CI366, sites 34CI366 and 5BA953, and limited intervisibility between sites 34CI399 and 5BA953, confirming Bement and Carmichael's 2003 observations. Whether this indicates they were nodes in an ancient communications network, however, remains unresolved.

Visibility and viewsheds results

The total combined viewshed is approximately 694,000 square meters, which includes much overlap between various viewsheds. The visibility and viewshed analysis identifies two major visibility “zones” in the study area. The first, consisting of sites 34CI339, 34CI366, 34CI410, and 5BA953, is focused on the canyon area to the west of the North Carrizo Creek, extending from site 5BA953 to site 34CI339. The viewshed of site 34CI366 is clearly focused here, too, as is the viewshed of 34CI410, despite its scattered pattern. As mentioned previously, there is intervisibility between sites 34CI399 and 5BA953, confirming Bement and Carmichael’s (2003) prior firsthand observations.

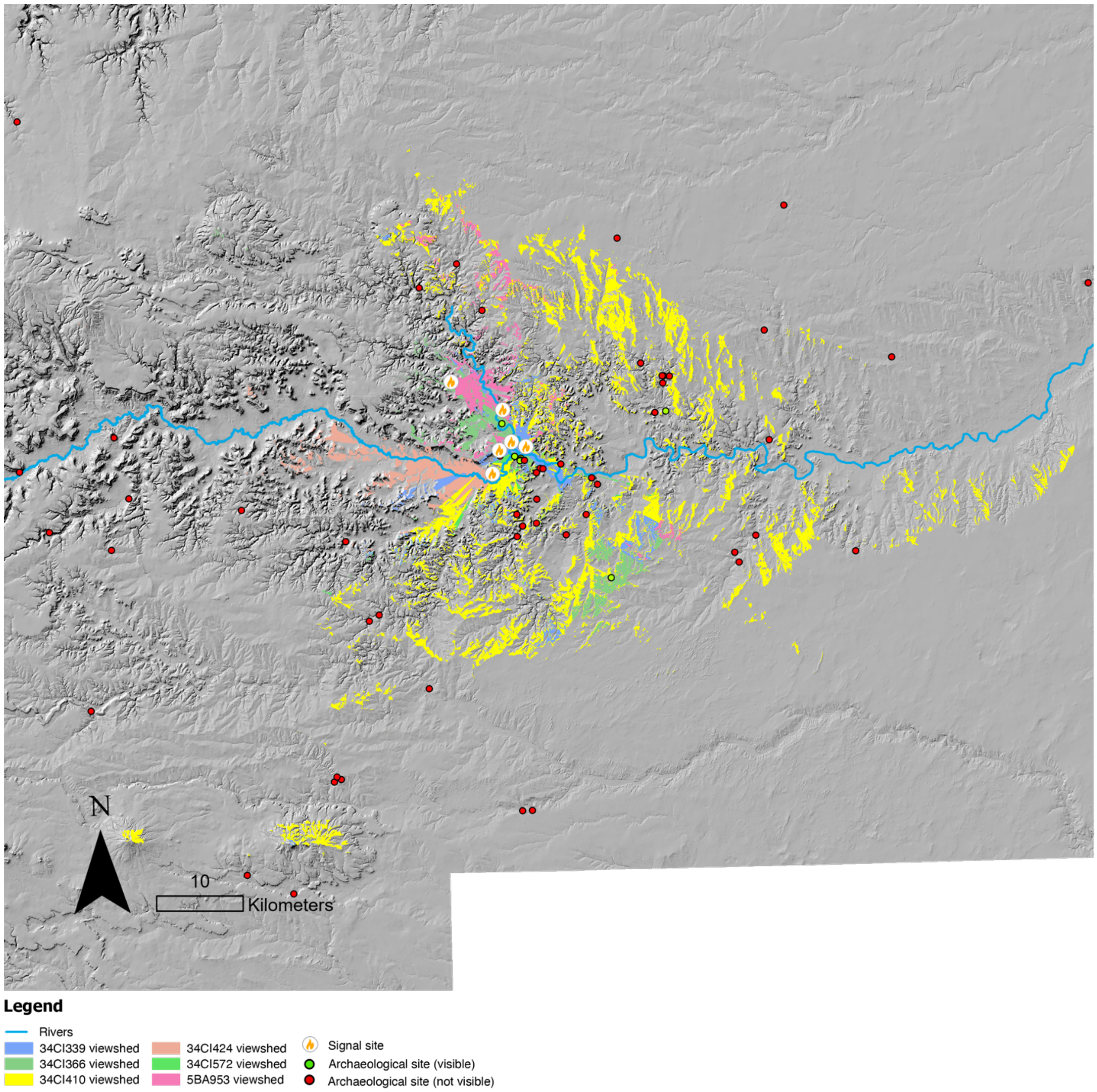


Figure 6.1 Combined viewshed of the six signal ring sites

Zone 1 visibility

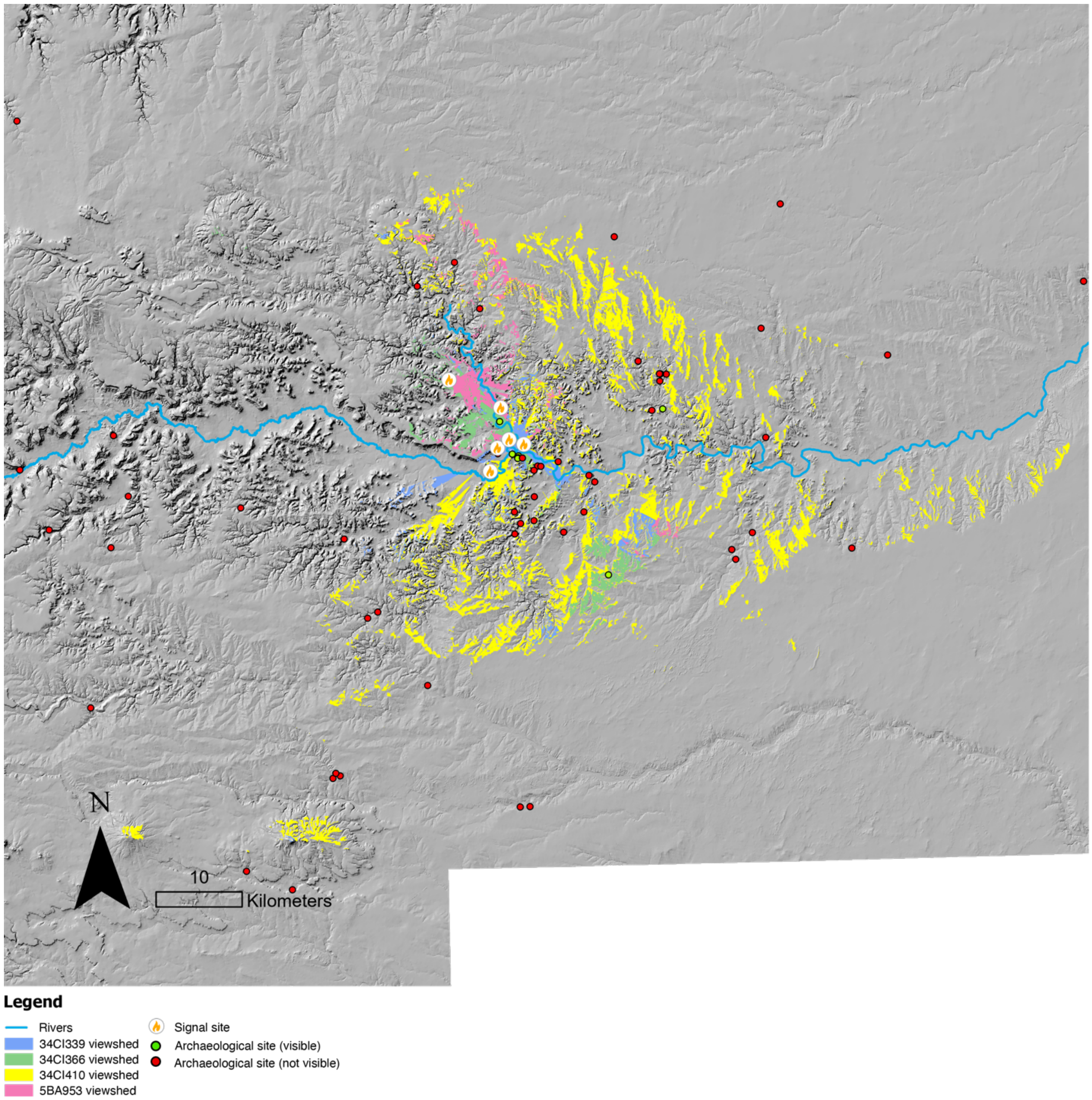


Figure 6.2 Zone 1 visibility, encompassing the viewsheds of sites 34CI339, 34CI366, 34CI410, and 5BA953

The combined visible area of this zone is 525,300 square meters, though much of that includes overlapping viewshed, as summarized in Table 7.1. With the exception of

34CI410, its extent is fairly limited by the surrounding mesas, though the viewshed for 34CI366 extends somewhat further to the northwest.

Zone 2 visibility

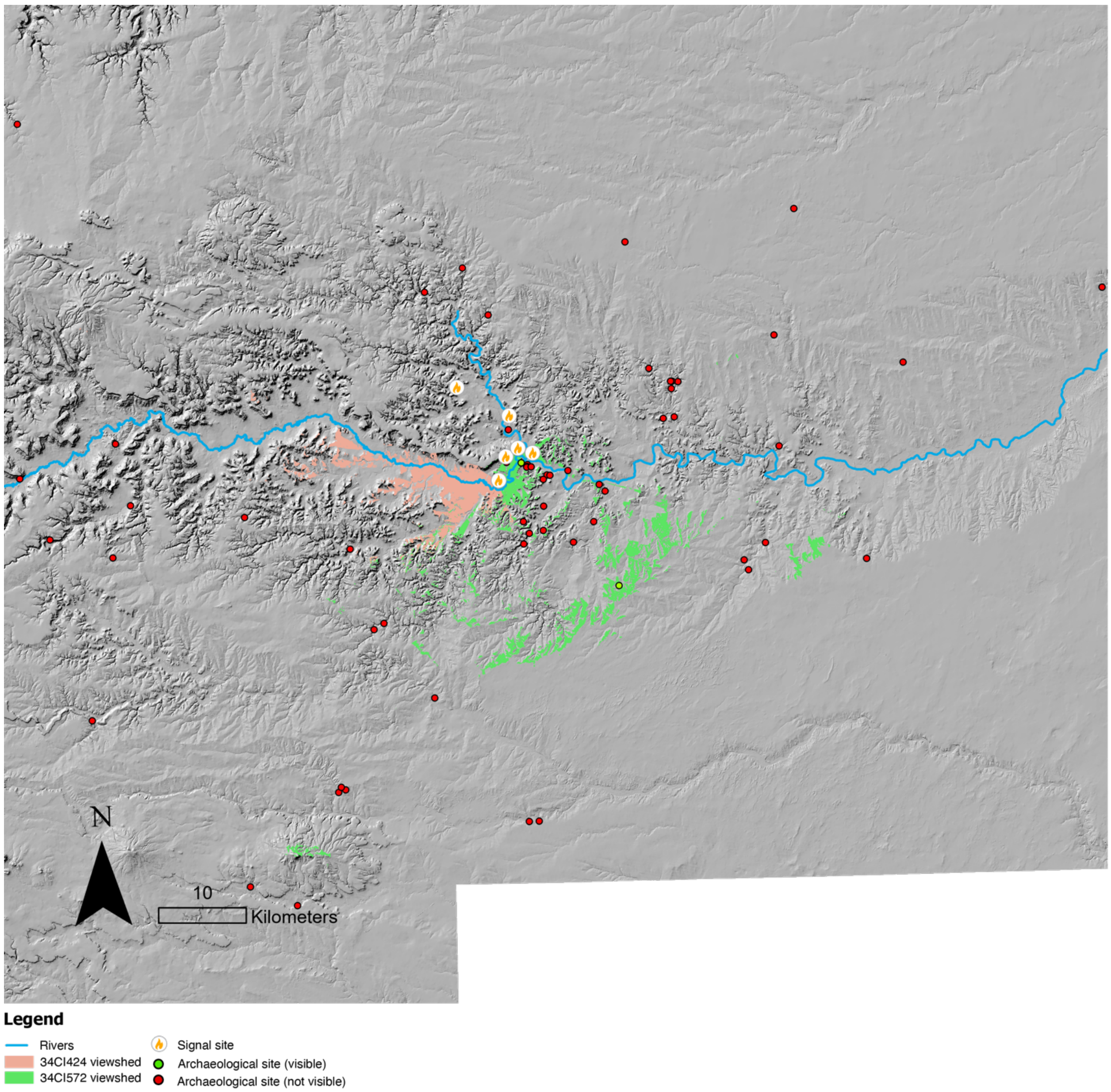


Figure 6.3 Zone 2 visibility, encompassing the viewsheds of sites 34CI424 and 34CI572

The second zone consists of site 34CI424 and 34CI572, and is classified as such due to the nature of their viewsheds, which are oriented south of Black Mesa itself, and continue west down the Dry Cimarron River. Its total area is approximately 168,400 square meters. Site 34CI572 seems to act as a “visibility bridge” between the North Carrizo Creek and the Dry Cimarron River; its viewshed just includes the southernmost part of the canyon area of the first zone, and is only intervisible with site 34CI339. An observer at 34CI339 would need to travel to 34CI572 in order to pick up visibility with site 34CI424. However, site 34CI424 lacks any intervisibility with the other study sites. It is oriented almost due west, and affords clear visibility of the Dry Cimarron River. The viewsheds of both sites are fairly restricted by Black Mesa. Though an observer at 34CI572 would be able to see some distant areas toward the southwest, these were likely not the focus of ancient people’s attention.

34CI339 viewshed

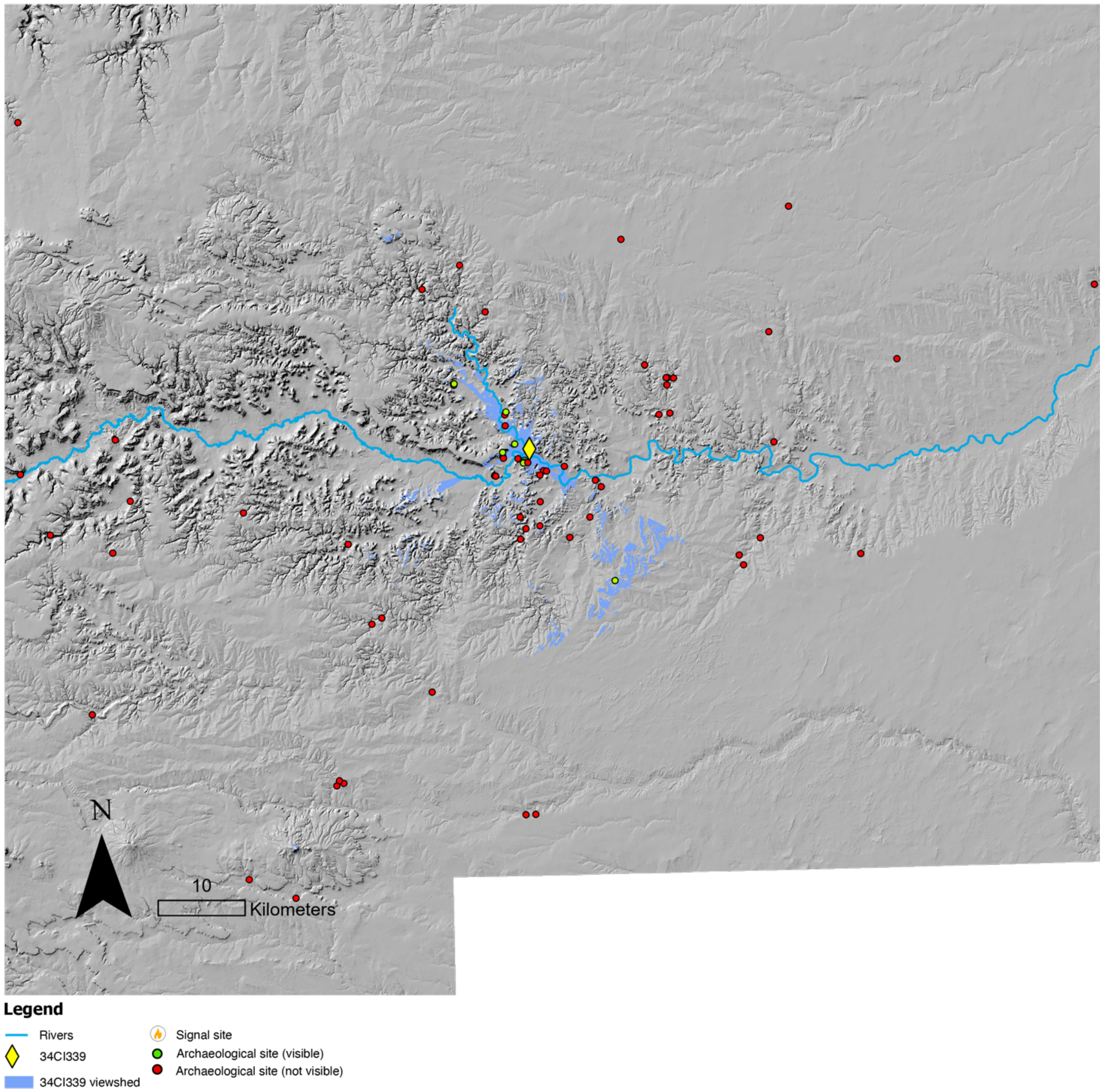


Figure 6.4 Site 34CI339 viewshed

The total viewshed for site 34CI339 is approximately 69,800 square meters, and runs nearly the entire length of the North Carrizo Creek. Eight sites intersect this viewshed; see the intervisibility section for this site for the full list. It is especially focused on the left bank of the creek, though visibility with some points south of the Cimarron River, including the summit of Rabbit Ear Mountain, is possible. Further visibility to the west of the creek is limited by the mesas that surround the canyon area. Intervisibility is possible, as Bement and Carmichael (2003) observed, with sites 34CI366 and 5BA953, (albeit at very close resolutions), as well as 34CI572.

34CI366 viewshed

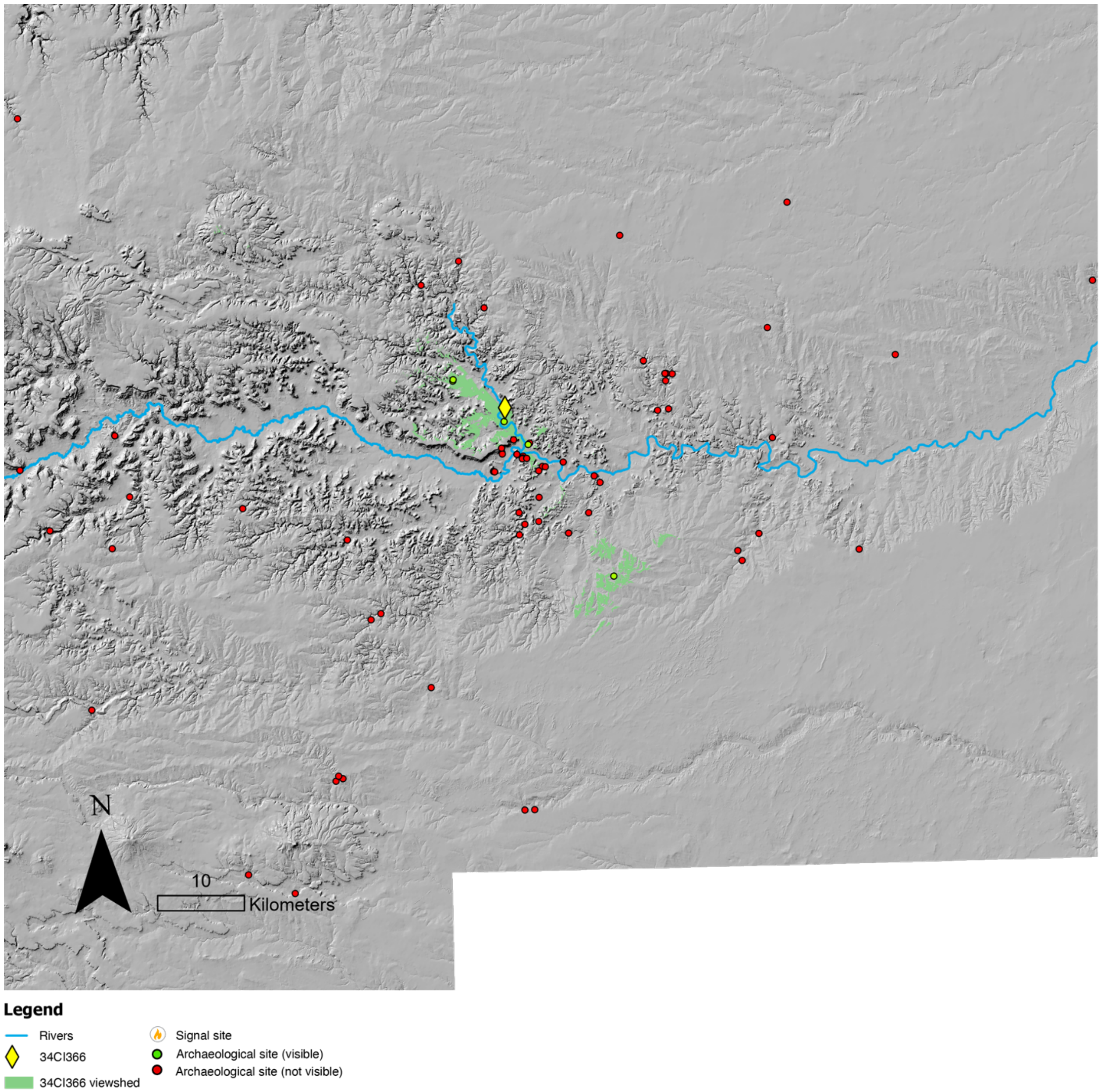


Figure 6.5 Site 34CI366 viewshed

The total area of the viewshed of site 34CI366 is approximately 52,000 square meters, and similar to 34CI339, it is focused on the canyon area and the west side of the North Carrizo Creek, but with some visibility south of the Cimarron River. Six sites intersect this viewshed; see the intervisibility section for this site for the full list. And also like 34CI339, it is limited by the mesas directly across the river to the east. This site is intervisible with 34CI339 and 5BA953.

34CI410 viewshed

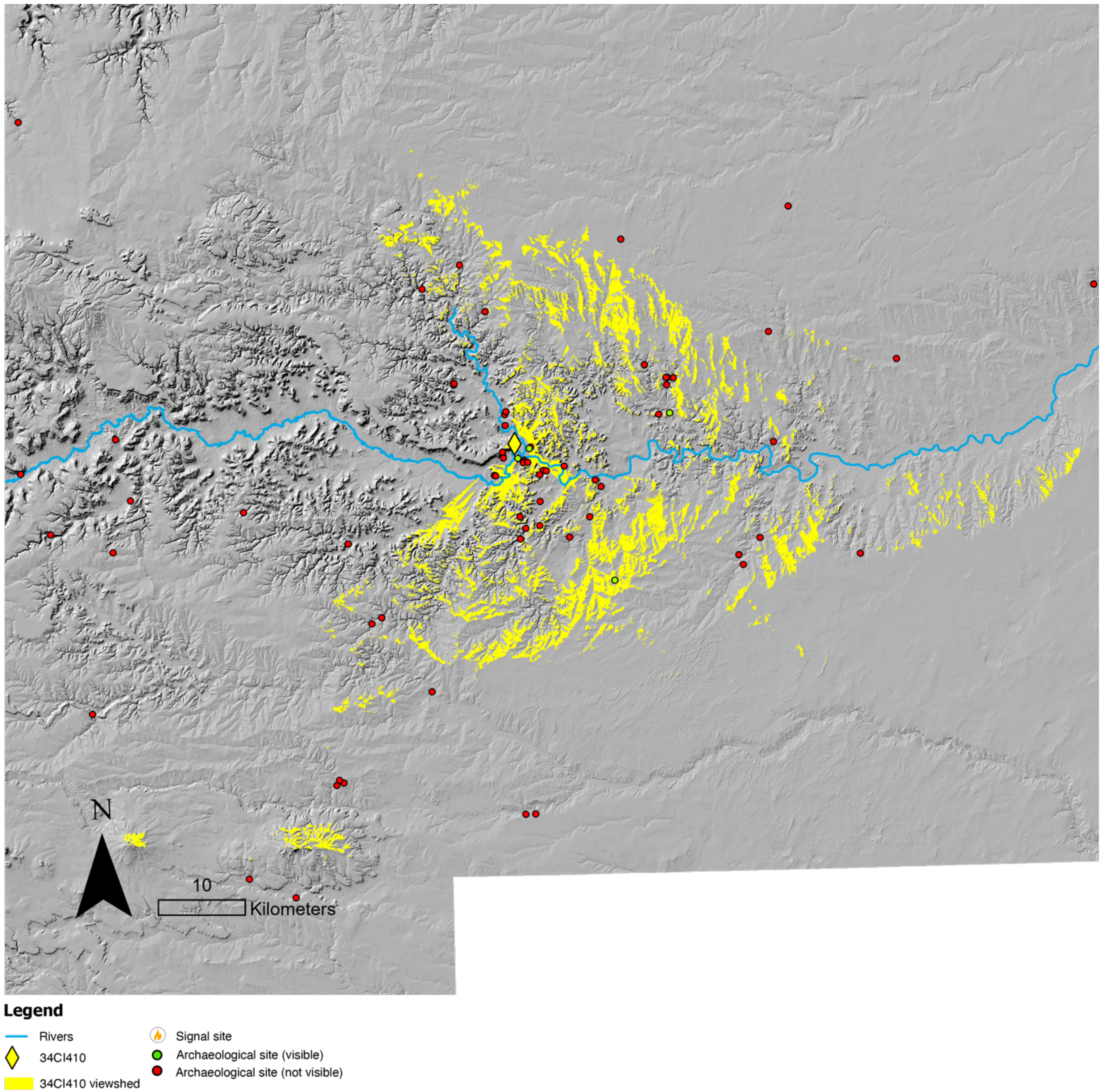


Figure 6.6 Site 34CI410 viewshed

The viewshed for site 34CI410 forms a highly dispersed, east-facing delta shape with a total area of approximately 361,300 square meters encompassing the Cimarron River watershed to the east. Four sites intersect this viewshed; see the intervisibility section for this site for the full list. Most of the visible area is south of the Cimarron River in Oklahoma, though if the viewshed is focused anywhere, it is adjacent to the western aspect of the North Carrizo Creek overlapping the viewsheds of sites 5BA953, 34CI366, and 35CI339, as well as overlapping the viewshed of site 34CI572, but according to this analysis, it only shares intervisibility with site 34CI339.

34CI424 viewshed

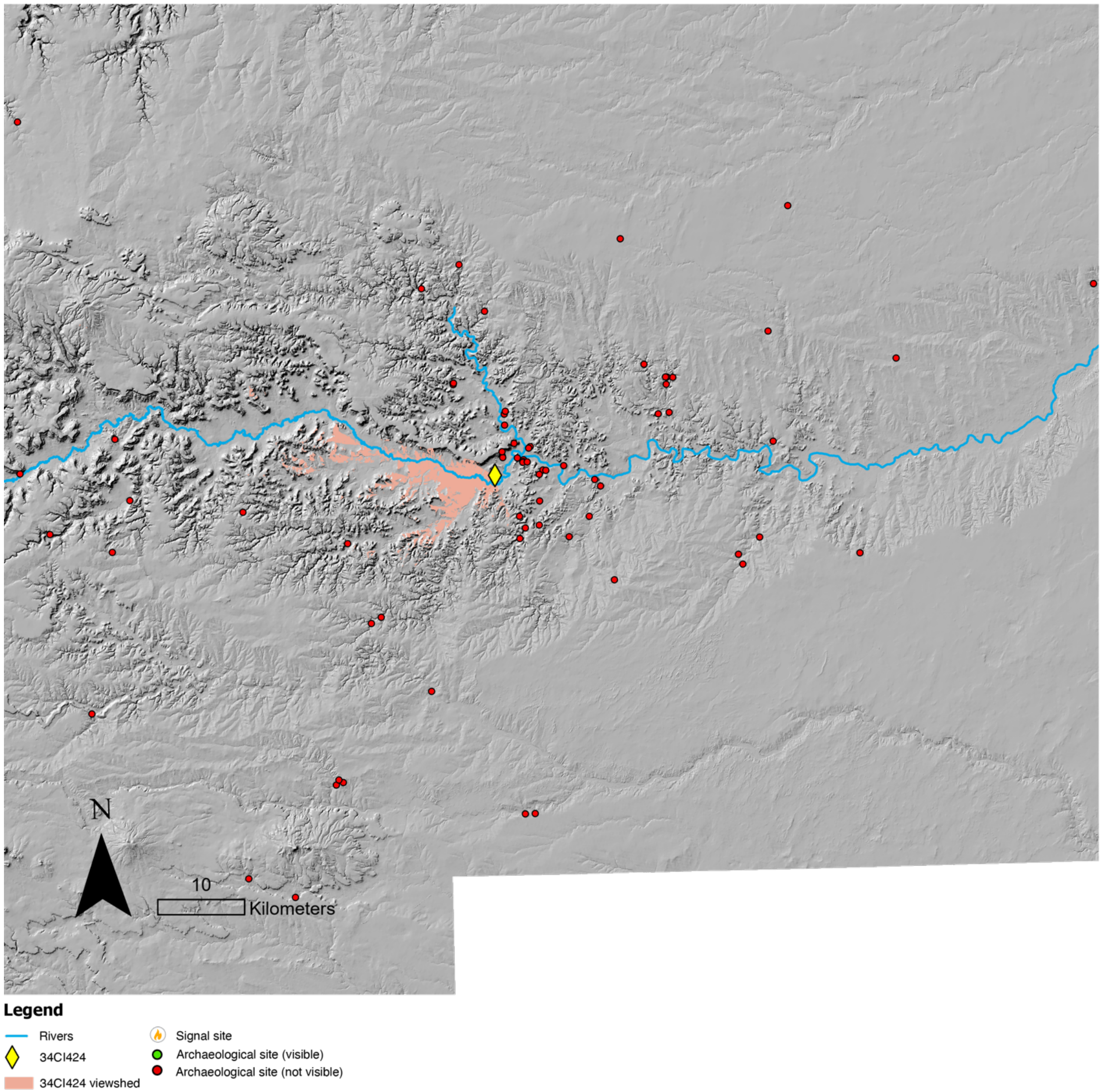


Figure 6.7 Site 34CI424 viewshed

The viewshed of site 34CI424 is approximately 62,300 square meters, and generally projects due west, offering clear vistas of the Dry Cimarron River. It is limited to the north by Black Mesa itself. It may be the case that examining the viewsheds of

New Mexico sites described as stone circles or rock alignments would yield useful information about possible intervisibility along this part of the river. Furthermore, the exploratory kernel density analysis of all stone circles does indicate some concentrations of similar sites further east along the river. This site is not intervisible with any other sites in the study area; a single other site, 34CI422, is visible from this location.

34CI572 viewshed

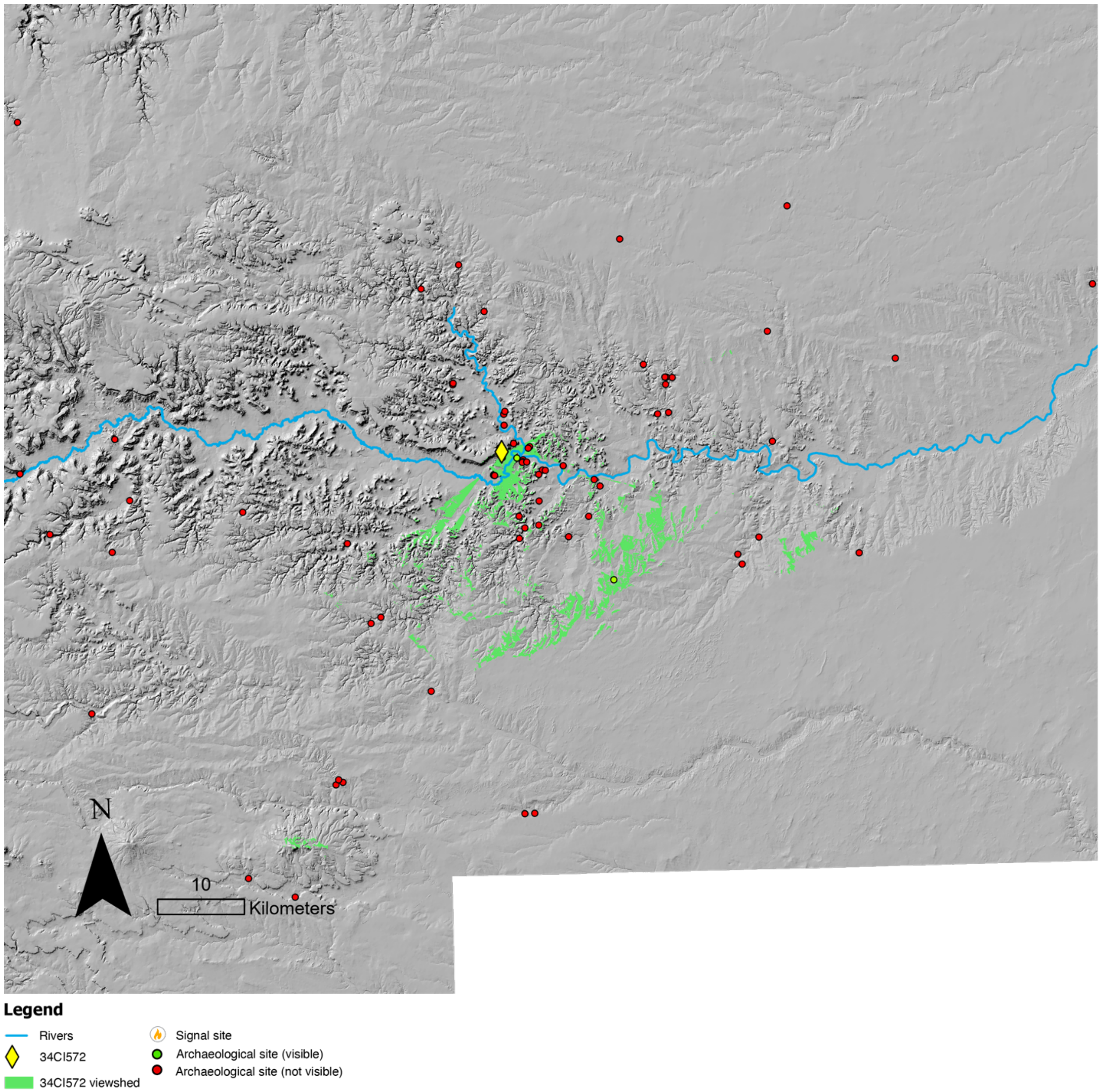


Figure 6.8 Site 34CI572 viewshed

The total viewshed area of site 34CI572 is 106,100 square meters, and mainly follows the Dry Cimarron River from the point it splits from the North Carrizo Creek and the Cimarron River, though higher points further to the south of the river are visible. The main area of the viewshed, however, seems to be centered on the small area of the Dry Cimarron River that flows around the southeastern point of Black Mesa. Four sites intersect this viewshed; see the intervisibility section for this site for the full list.

It is only intervisible with site 34CI339. It does permit visibility with some of the taller mesa areas to the southeast.

5BA953 viewshed

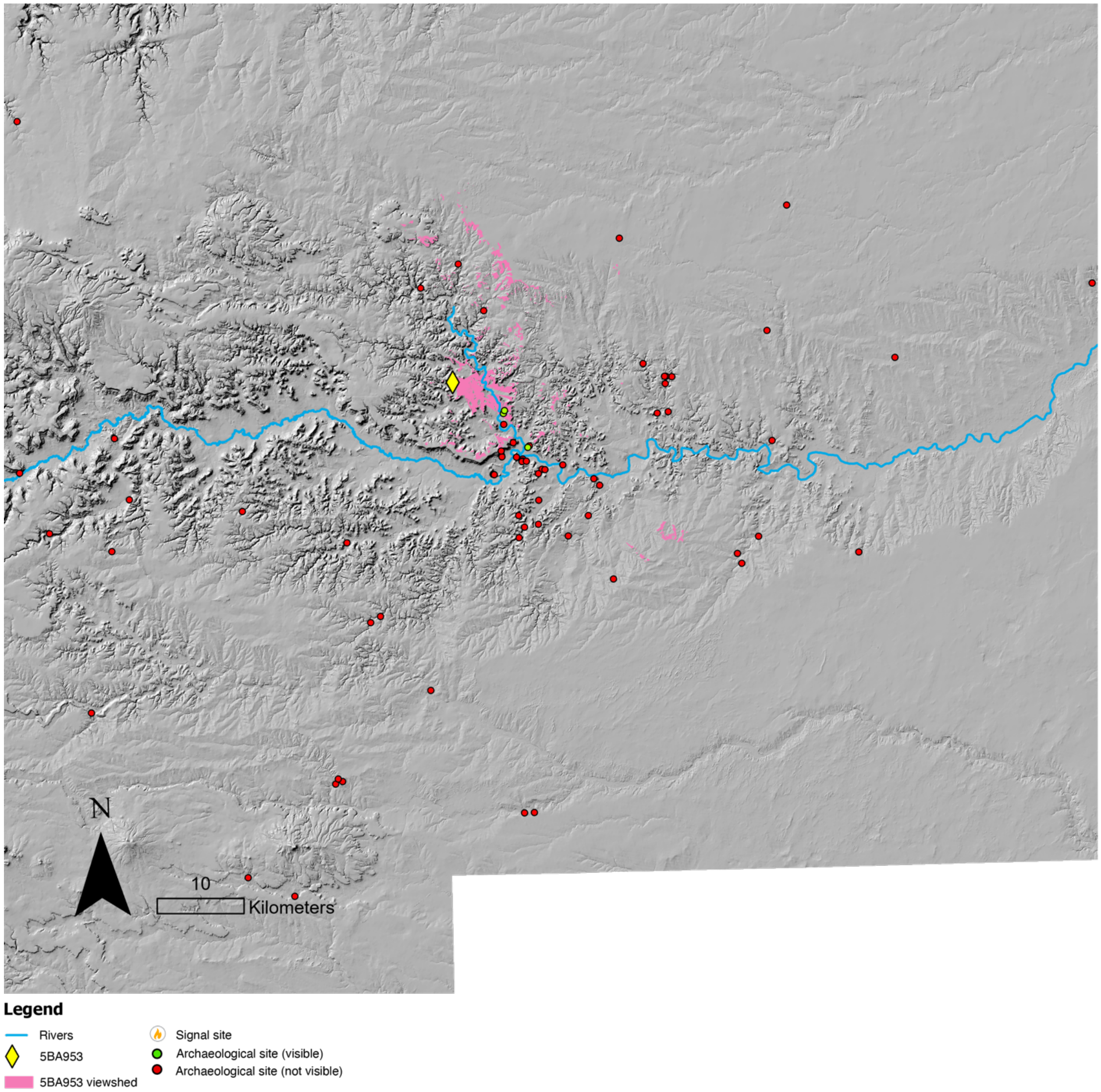


Figure 6.9 Site 5BA953 viewshed

Finally, the area of the viewshed of site 5BA953 is approximately 42,200 square meters, and is primarily concentrated on the canyon area between the North Carrizo Creek and the mesas to the west and south, including Black Mesa. Three sites intersect this viewshed; see the intervisibility section for this site for the full list. This viewshed suggests that Furnish Canyon and the adjacent section of North Carrizo Creek is the most prominent landscape feature visible from site 5BA953. From here, both sites 34CI366 and 34CI339 are visible as observed by Bement and Carmichael (2003).

Intervisibility in archaeological contexts

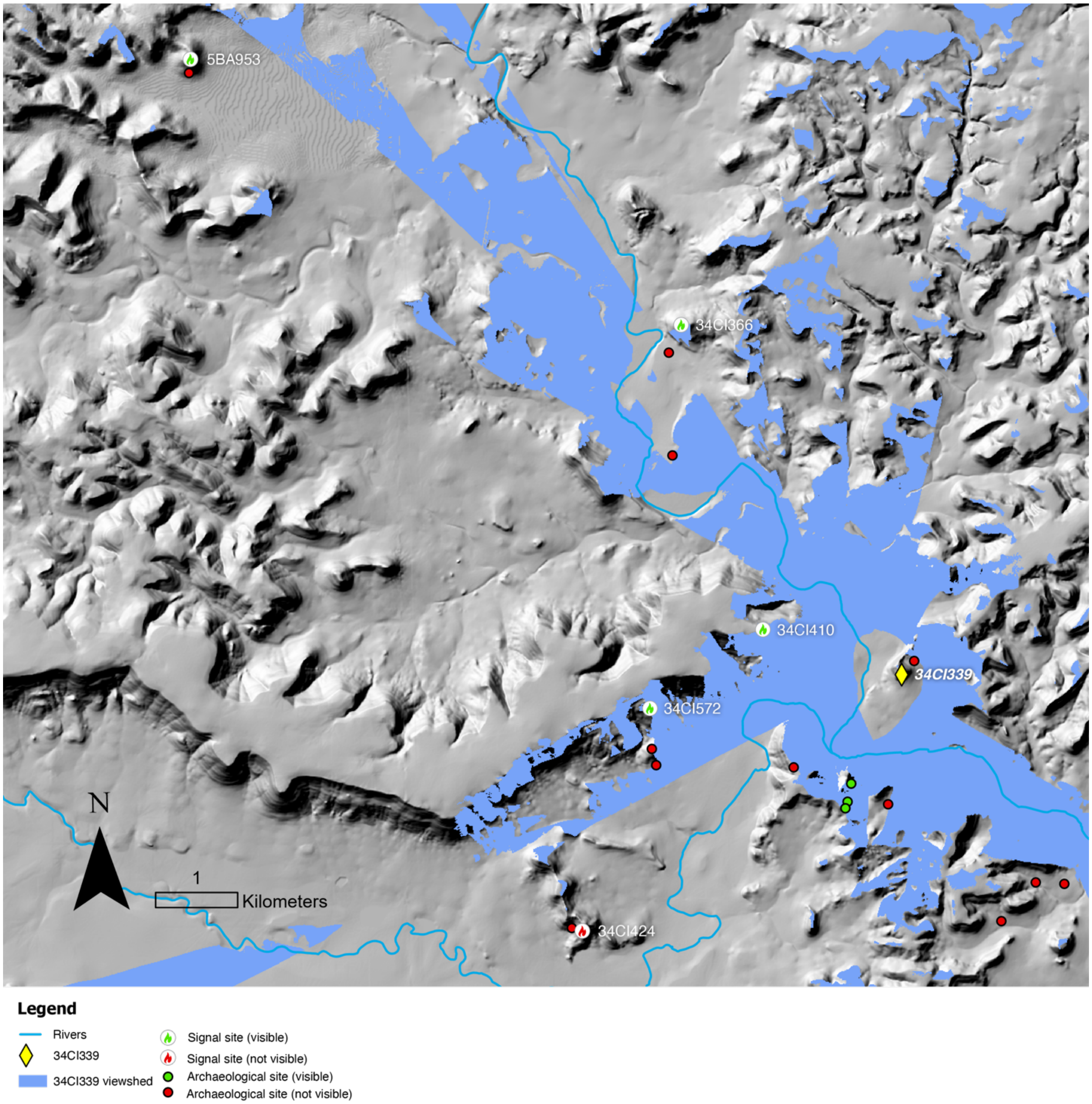
Intervisibility in archaeological contexts refers to the ability of observers at two or more locations to see and be seen in return, due to their specific spatial positioning in the landscape (Llobera 2003). This has significant implications for comprehending various aspects of past societies, such as social interaction, communication, and territorial control (Gaffney and Watson 1996). Intervisibility can be considered a strategic factor in site selection, since being intervisible with other sites have afforded advantages in terms of maintaining contact, defense, or trade (Gilman 1981). For example, hillforts in Iron Age Europe were often constructed in locations that allowed them to see and be seen by other hillforts, facilitating communication, and potentially aiding in cooperative defense strategies (Cunliffe 2005). Similarly, settlements in prehistoric societies could have been situated to maintain visual connections with sacred sites, such as burial grounds or ritual centers, highlighting the importance of these sites in their cultural landscape (Tilley 1994). And, of course, the study of intervisibility in modern archaeological contexts relies on the use of GIS to analyze these connections and elucidate patterns that may not otherwise be apparent (Llobera

2003). However, it is important to note that intervisibility is only one aspect of site selection and should not be considered the sole determining factor. Other considerations, such as proximity to resources, agricultural potential, and defensive landscape features, should also be taken into account when analyzing site locations (Gilman 1981).

Intervisibility results

The stone alignments do not display a high degree of computed intervisibility, which here is determined by which sites intersect the viewsheds for each signal location. At very close resolutions, however, sites 34CI339, 34CI366, and 5BA953 are intervisible, confirming Bement and Carmichael's (2003) observation.

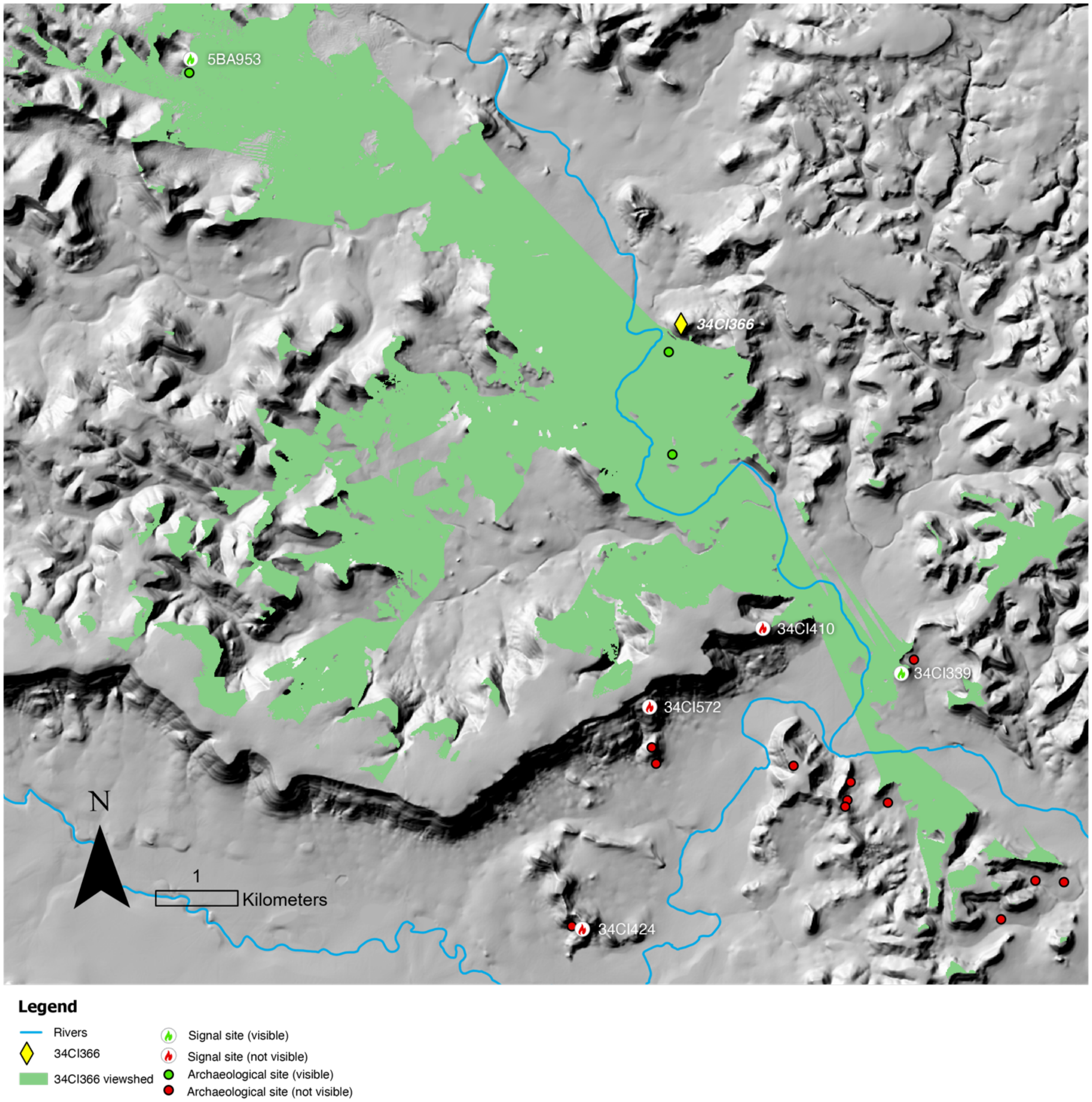
34CI339 intervisibility



Visible sites:	34CI174, 34CI175, 34CI176, **34CI366**, **34CI410**, **34CI572**, **5BA593**, LA48877

Figure 6.10 Site 34CI339 intervisibility

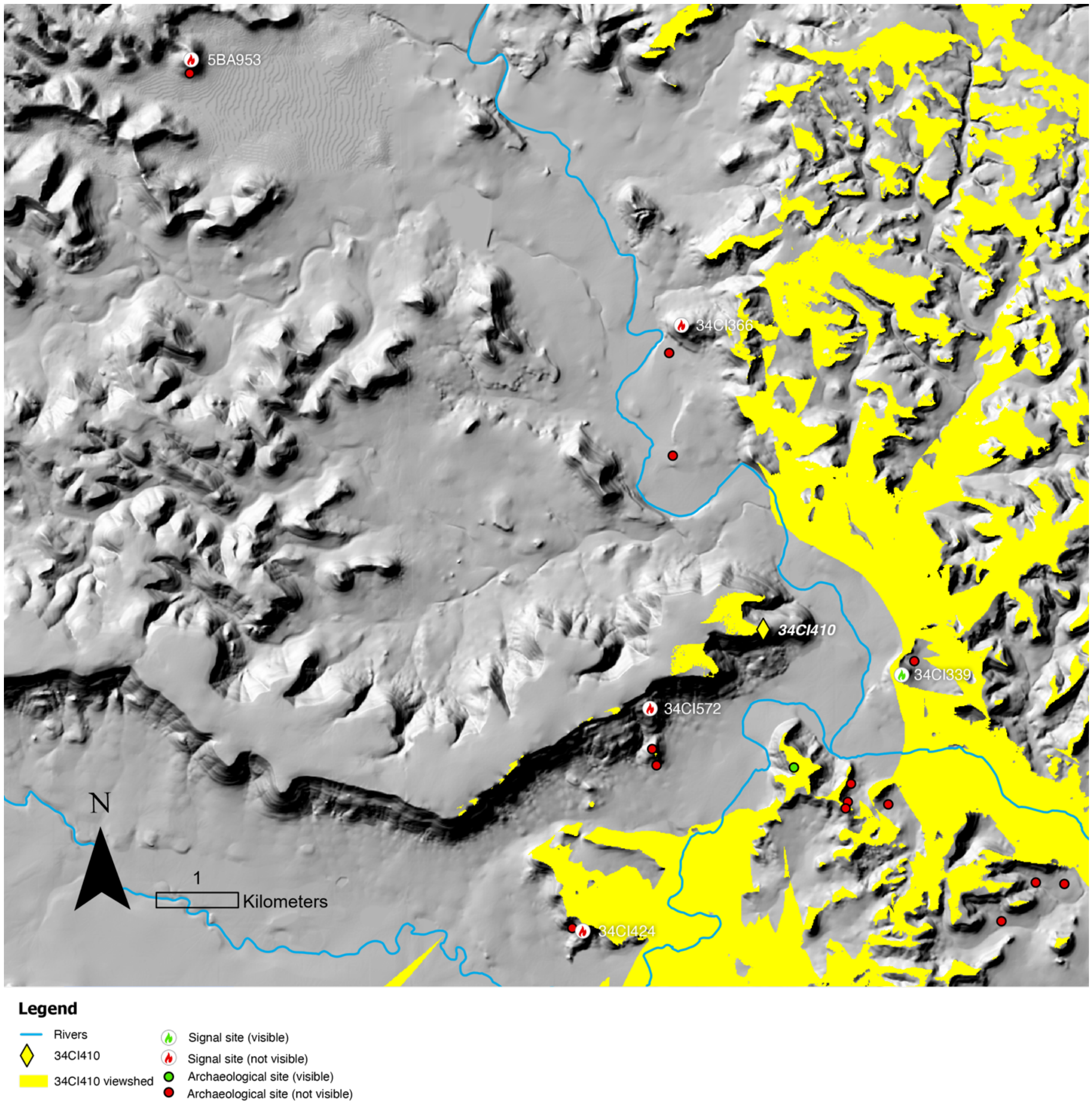
34CI366 intervisibility



Visible sites: 34CI36/38, 34CI37, **34CI339**, 5BA951, **5BA953**, LA48877

Figure 6.11 Site 34CI366 intervisibility

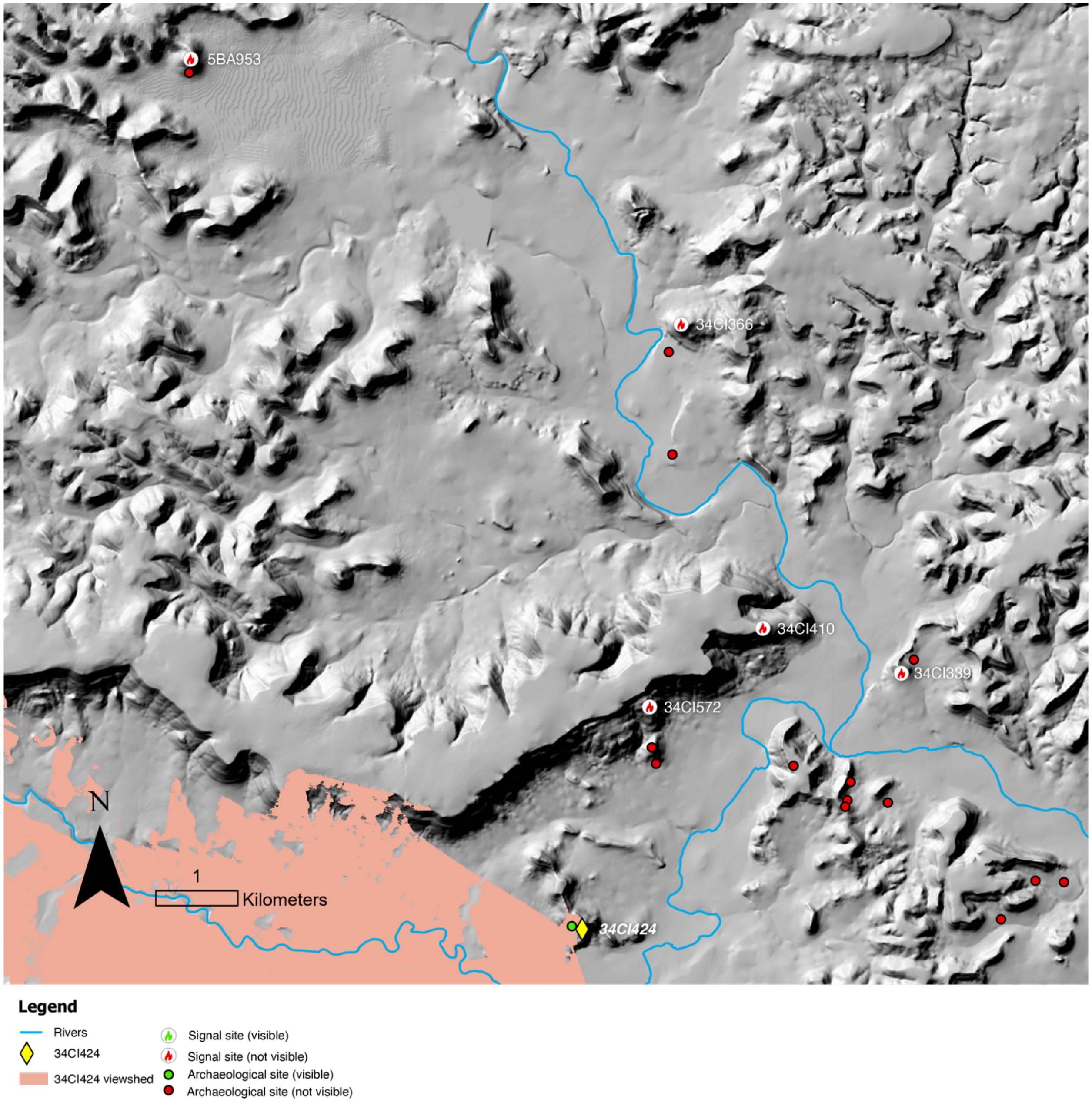
34CI410 intervisibility



Visible sites: 34CI40, 34CI298, **34CI339**, LA48877

Figure 6.12 Site 34CI410 intervisibility

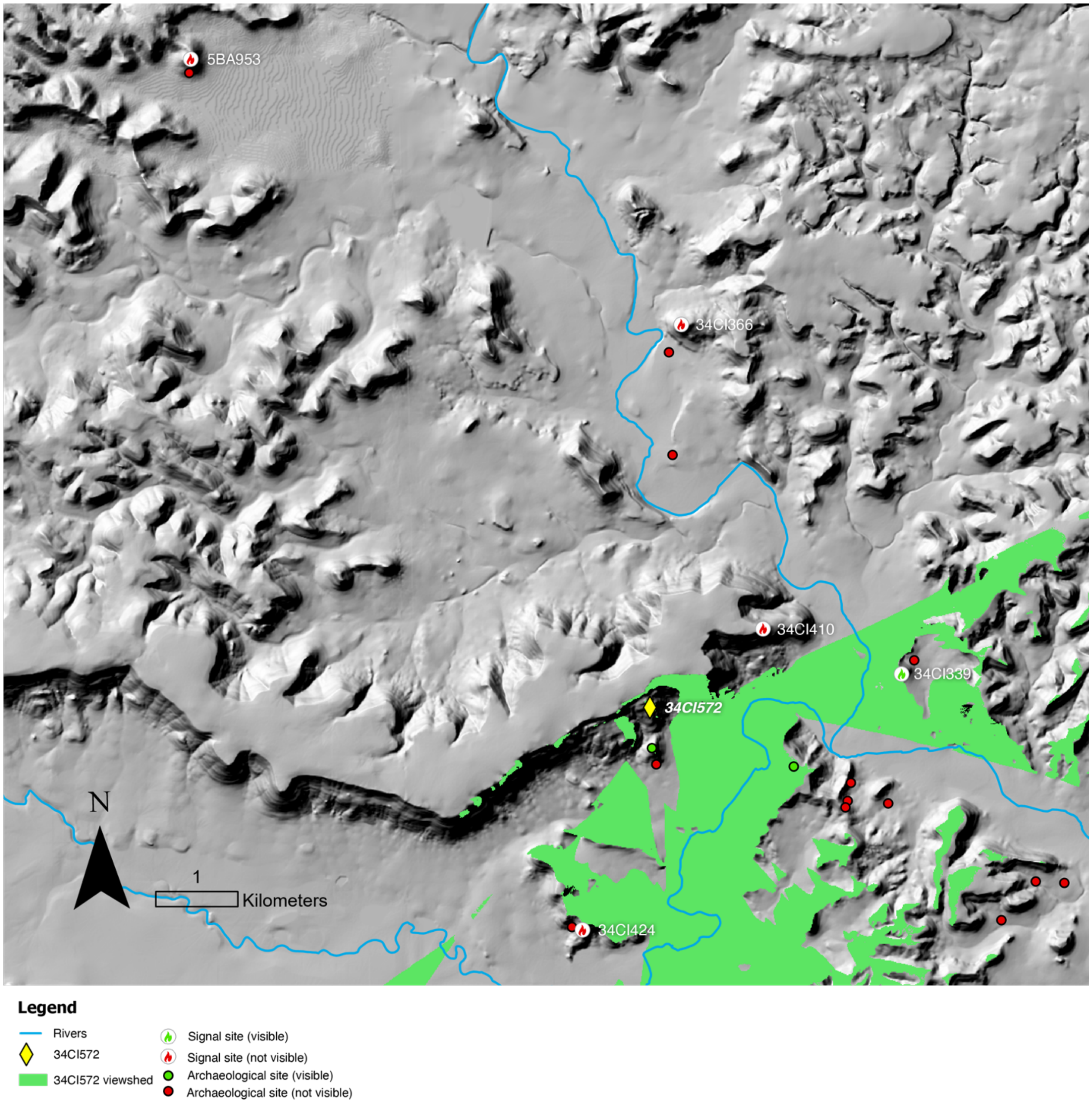
34CI424 intervisibility



Visible sites: 34CI422

Figure 6.13 Site 34CI422 intervisibility

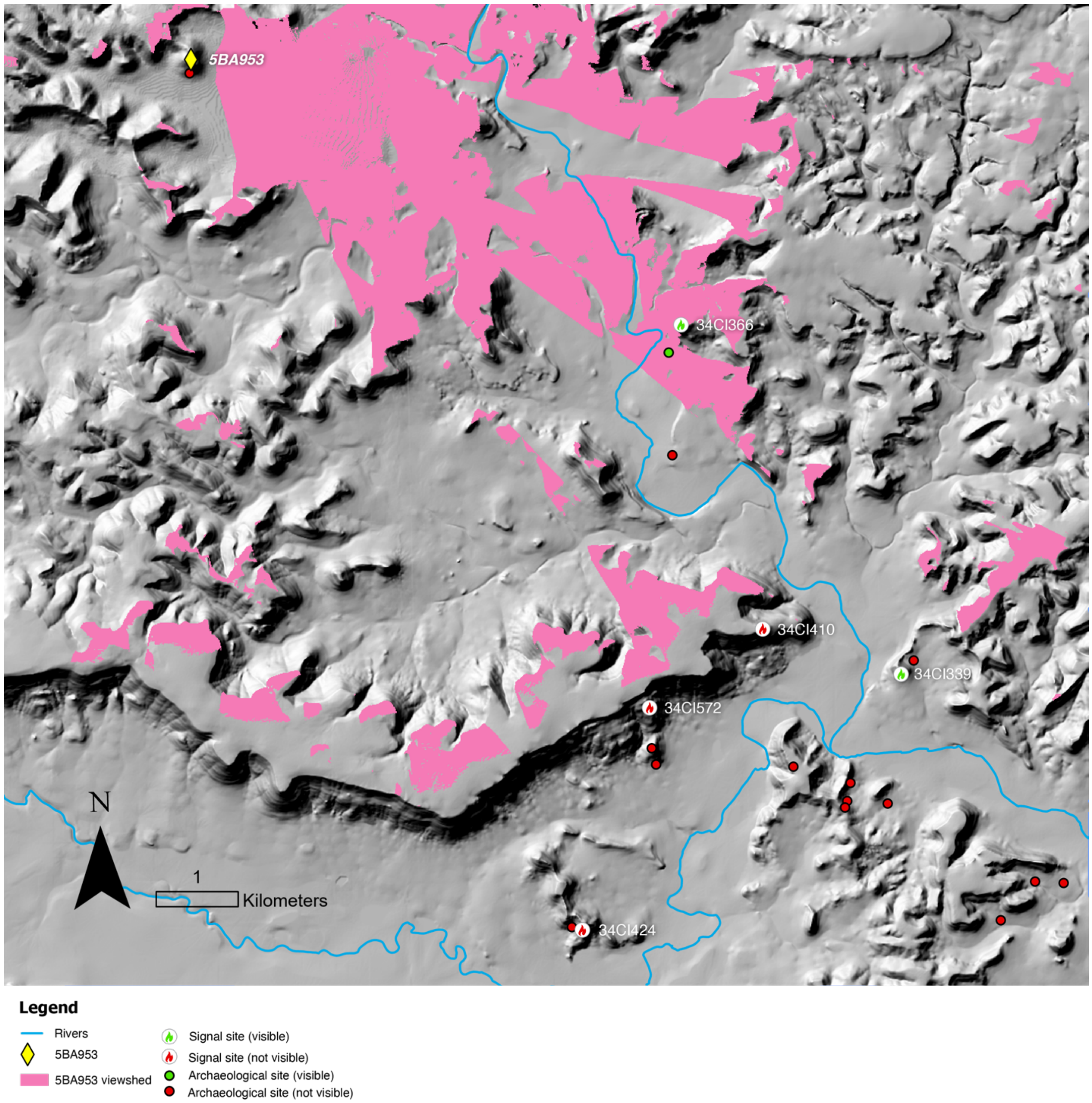
34CI572 intervisibility



Visible sites: 34CI87, 34CI298, **34CI339**, LA48877

Figure 6.14 Site 34CI572 intervisibility

5BA953 intervisibility



Visible sites: 34CI36/38, **34CI339**, **34CI366**

Figure 6.15 Site 5BA953

Chapter Eight. Perception, landscape, and visibility in the late Archaic: discussion and conclusions

Throughout this project, I have struggled with reconciling the myriad unknowns in order to elucidate a coherent and compelling narrative about late Archaic life and lifeway on the transitional landscape of the Black Mesa region. Positivist approaches such as calculating viewsheds and intervisibility in a GIS can only ever really answer positivist-oriented questions, such as whether or not there was intervisibility between presumed mesa-top signaling sites. (Answer: yes. Done.) That said, such methods can assist in verifying suppositions in the absence of ethnographic data. For example, the rock art associated with the supposed signal sites provides as means to date or identify the probable time period in question, while providing a cultural reference to other rock art that might be associated with other similar sites in the area. Yet, such methods cannot address in a meaningful way more interesting and thoughtful questions of perception, for example, which, as I laid out in the introduction to this thesis, is fundamentally subjective in nature and not easily quantified. As I see them (no pun intended), these limitations stem from the fact that positivist methodologies prioritize empirical, quantitative data and objective analysis that does not, in any way, come close to capturing the nuanced and context-dependent aspects of human perception and experience, especially in ancient contexts.

Human perception of landscapes is influenced by a complex—to say the least—interplay of cultural, social, and individual factors that are difficult, if not completely impossible, to model within a positivist framework. Additionally, the reliance on contemporary spatial data and assumptions in GIS as discussed in previous chapters may not adequately represent the dynamics of the late Archaic landscape of Black Mesa. In other words, GIS and other positivist approaches may provide valuable insights into certain aspects of the human-environment continuum, yet they are severely limited in their ability to capture and address the full spectrum and complexity of the perception of such landscapes.

Landscapes, the construction of landscapes, and the perception of landscapes are performances of certain narratives; that is to say, they are practices that regenerate and reproduce, though differential human and nonhuman agency, certain cultural structures (Giddens 1984). But landscapes are, in a way, even more complex in that they are structuring structures; they represent complex systems with interconnected and interdependent physical, social, and symbolic elements (Bourdieu 1977b, 2000 [1972], 2001). The perception of landscapes in this sense is influenced by societal norms, values, and power relations that determine what is considered meaningful, aesthetic, or valuable (Ingold 2000). Rock art, as landscape art, can be viewed as another performance of these narrative structures, as it reflects and reinforces particular cultural and symbolic meanings that are embedded within landscapes.

Agency, of course, refers to human (and nonhuman) individuals' ability to act independently and make choices within the constraints of the overarching social structure (Giddens 1984). The perception of landscape in terms of agency involves individuals actively engaging with the landscape, interpreting it, and influencing it through their actions. Rock art, again, is an ideal example of this: as a form of landscape art, it can be seen as an expression of agency, as it allows individuals to leave a permanent mark in the environment, and communicate their personal or collective beliefs and values in a symbolic manner that reflects aspects of their language and elements of perception (Whitley 2001). Agency and structure are interdependent and mutually constituted (Giddens 1984), meaning individuals actively shape the landscape and their perception of it through their actions *at the same time*, while simultaneously being influenced by other existing social structures. In the context of rock art, this implies that people create and interpret rock art as a practice of their unique background, language, and experiences, while also transforming the landscape and contributing to the ongoing negotiation and development of social structures and related cultural practices. Practice theory, as the natural extension of agency theory, emphasizes the importance of routine actions, habits, and embodied knowledges in shaping human experiences and social life (Otner 1984). The perception of landscape as a practice involves recognizing the ways individuals interact with their environment through everyday activities such as traversing the landscape in their particular body, working, or creating rock art, which involves embodied knowledge and the skills required to create it in the first place (Tilley 2004).

The role of language in these practices is paramount. As a fundamental aspect of human cognition and communication, language shapes the way people perceive and interact with their environment. The pre-Numic Uto-Aztecan languages likely spoken by late Archaic people in the Black Mesa area would have contributed to the formation and practice of specific cultural landscapes, providing a critical framework for people to apprehend and engage with their surroundings in a meaningful way. This linguistic framework would have been crucial in the creation of rock art, for example, or stone circles on mesa-tops, as it would have informed the symbolic meanings and cultural narratives embedded in the art or in the stone circles. In such as way, language, too, is a structuring structure that establishes a framework for understanding the world and enabling people to communicate their beliefs, values, and experiences, thus playing a crucial role in shaping cultural landscapes (Crumley 1994; Ingold 2000).

Moreover, the interplay between landscape, perception of landscape, rock art, and language can be understood in terms of placemaking, as in the case of the Western Apache (Basso 1996), for instance. Placemaking refers to the process through which people imbue meaning and create connections with particular points on the landscape (Cresswell 2004; Zedeño and Bowser 2009). Through practices such as the creation of rock art, engaging with the landscape, and utilizing language, people actively construct their sense of place, identity, and belonging (Basso 1996; Cresswell 2004; Zedeño and Bowser 2009; and many others). Language, in particular, is essential to this process, as it permits people to communicate their experiences, share knowledge, and create shared narratives about the landscape (Crumley 1994).

Landscapes, as I defined them in Chapter Four, can be said to sit at the intersection of time and relative ontologies in space. Thus, the dimension of time and the role of change over time are important considerations in the practice and performance of landscape. Obviously, landscapes are not static; they *physically* evolve and transform through natural processes and human interventions (Bender 1993), and evolve *conceptually* in never-ending cycles of negotiation and renegotiation. It goes without saying, therefore, that perceptions of landscape and the meanings attributed to things upon it, such as rock art, can also change over time as new generations interpret, reimagine, and remix their connections to the land and its associated cultural heritage (Tilley 1993, 1994).

Late Archaic people would have been no different in this regard. The dynamic nature of *their* landscapes and *their* perceptions of landscape has implications for understanding the role of their pre-Numic Northern Uto-Aztecan language in these practices. As languages change and develop—or become extinct—over time, the ways in which people perceive and engage with their environment must also change (Maffi 2005). This is particularly relevant in the context of ancient languages, such as pre-

Numic Northern Uto-Aztecan languages, spoken in the late Archaic. As these languages shifted and diversified over time, the cultural landscape and associated perceptions of the environment would have shifted, too.

In addition to language, other factors, such as cultural elaboration in terms of technology or politics, or issues such as climate change in the HCO, would have impacted the ways in which people would have impacted the ways in which people negotiate landscapes both physically and conceptually (Sauer 1925). For example, the innovation of new tools or techniques for creating rock art may have influenced the types of images produced or the meanings associated with them. Similarly, environmental or political upheavals might lead to the abandonment or reoccupation of certain landscapes, thus altering their cultural significance and ways in which people interact with them.

To gain a comprehensive understanding of how late Archaic people in Black Mesa (or anywhere else) perceived the landscape, it is necessary to understand all of these factors and the myriad ways they interact and intersect with each other. Interdisciplinary and holistic approaches my help archaeologists appreciate the dynamism of the human-environment continuum, and the diverse ways people engage with, perceive, and shape their surroundings. More modern ontologically focused theoretical approaches, such as actor-network theory (ANT) (Latour 1999, 2005), posits that both human and nonhuman entities or actors, including what may be conventionally called objects (or simply *things*), are part of vast networks or webs that are constantly in flux. These actors link to one another through a process of translation by which they constantly interact and negotiate their interests and goals, and come to an agreement on how to navigate or act in particular situations and circumstances (Latour 2005). By rejecting the traditional view of social structures as being static and external (i.e. dualistic) to individuals, ANT is a tool that emphasizes the complex and dynamic nature of social structures and interactions, highlighting the recursive nature of structure, structuration, agency, and practice. Within these "webs of significance" (to borrow Geertz's [2000 (1973):5] turn of phrase), the perception of landscape involves understanding the myriad relationships between humans, their environment, language, and other nonhuman elements such as rock art. Rock art, in actor-network theory, is an actor within the network, influencing (human) perception of the landscape, and mediates human and other nonhuman interactions with it.

All this said, one is still no closer to reconciling the positivist nature of computational analysis, such as GIS-based ones, with subjective realities. Using GIS and various visibility analyses as tools to answer questions such as whether a handful of stone circles may or may not have been part of an ancient communications network created by an unknown culture is as good a starting place as any. Certainly, GIS is an indispensable tool in modern archaeology, enabling researchers to analyze and visualize spatial data in order to better understand ancient landscapes, such as the late

Archaic landscape of the Black Mesa area. Yet, as with any analytical tool, GIS models are not infallible, especially when ethnographic context is missing. A highly visible location may have been significant for ritual purposes, defensive strategies, or simply for its topography—or not at all. Without an apprehension of the cultural context, archaeologists risk misinterpreting the significance (or otherwise) of visibility in ancient landscapes.

At the risk of repeating myself, phenomenology as an approach to understanding landscapes, including past landscapes in archaeological contexts, seeks to understand within those contexts the subjective, lived experiences of ancient people within their cultural and natural environments (Tilley 1994). This approach, as I discussed in Chapter Four, emphasizes the importance of bodily experiences, sensory perceptions, and the interconnectedness of people and their surroundings (Descola 2005; Ingold 2000). Thus, while phenomenology begins with human bodies moving in space, its subjective nature is one of its major challenges (Flemming 1995, 2005, 2006; Van Dyke 2014). This theoretical framework is based on the archaeologist's own experiences and perceptions, which are inevitably colored by their own cultural background, personal biases, and preconceived ideas about the past (Shanks 1992). This raises certain questions and concerns about the validity and reliability of phenomenological interpretations, as different archaeologists may have very different experiences and perspectives when engaging with the same landscape. Consequently, phenomenological studies can be criticized for their apparent lack of objectivity and replicability (Flemming 1995, 2005, 2006; Van Dyke 2014). As such, while methods such as GIS and statistical analysis are at least quantitative in nature, this difficulty in verification and replicability can make it difficult for archaeologists to critically evaluate phenomenological studies and integrate them with other lines of evidence (Gillings 2012, 2017).

In fact, Gillings (2017:122), in discussing the critical frameworks in which archaeologists should situate GIS-based visibility models, says that "viewshed analysis has been shackled to an uncritical notion of phenomenology." The fault, he contends, is not with phenomenology as an interpretive framework that archaeologists can and should use, but with archaeologists who lack a deep understanding of the philosophical underpinnings of phenomenology as elucidated by Husserl, Heidegger, and especially Merleau-Ponty, which Gillings (2017:122) labels "intellectual laziness." Indeed, Aldenderfer (1996:2, quoted in Gillings 2017:121) puts the issue even more bluntly: "The calculation of viewsheds," he says, "can be used in lieu of thinking about the problem."

A big part of the problem, though, in the case of the late Archaic of far western Oklahoma is that next to nothing is known about it, and the material artifacts recovered in excavations decades ago (see Chapter Two) have long since vanished. There are no ethnographic sources to fall back on, and the most compelling window into late Archaic lifeway in and around Black Mesa—rock art—is, as far as I can tell, extremely poorly documented. More recent pedestrian surveys, such as Bement and Carmichael's (2003), are useful in documenting the existence of sites, and even describing their surface features, but literally do not dig deep enough—without comprehensive archaeological investigations, there is little chance for the true nature of the stone alignments or the rock art panels that usually accompany them, to be resolved.

As they say in TV mysteries, too many questions, not enough answers.

What *can* be said about these sites? Not much with certainty. The location of the rings on prominent, high-up places is certainly suggestive that the Archaic people who constructed them sought out places on the landscape where they could see or be seen at a distance. Furthermore, the visibility analysis is likewise suggestive that ancient people may have been interested in seeing or being seen from the canyon area adjacent to the North Carrizo Creek. The viewshed then sweeps around Black Mesa itself to follow the Dry Cimarron River west. Beyond this, it seems impossible to draw any meaningful conclusions apart from theoretical generalities.

Suggestions for future research

This is disappointing, but it does open up the possibility for much compelling future research. In some respects this entire thesis is, at least, a partial roadmap for pointing out potential future work to undertake if understanding the late Archaic stage in far western Oklahoma in a meaningful way is any kind of genuine research priority. In fact, I could highlight any number of possible avenues, but I will limit myself to two only, both of which I briefly alluded to before.

Comprehensive survey of the rock art sites in the Oklahoma panhandle

There has not, as far as I can tell, been any kind of comprehensive, dedicated survey and recording of rock art in the Oklahoma panhandle along the lines of Neel and Sampson's 1986 study of the rock art at the Cross Timbers Management Unit in east central Oklahoma or, especially, Dowdy's 1992 survey of northeastern New Mexico rock art. In fact, rock art and its documentation in the panhandle is always an afterthought, rather than the primary focus of investigation. "Archaeological documentation of this region must be improved," Dowdy (1992:3) says, "to better our understanding of the complex cultural developments [in northeastern New Mexico] and elsewhere." I agree. Documentation and recording of such sites using modern digital imaging tools, including 3D imagining of rock art panels as well as the surrounding landscape, would not only permit virtual access (in augmented or virtual reality) to such sites for future study, but accurate digital replicas—not just photographs or drawings. These replicas would permit analysis by artificial intelligences and machine learning algorithms (which *is* the future of all four fields of anthropology), foster collaboration, education, and a deeper understanding of the past, while safeguarding priceless cultural heritage treasures against time and damage.

More survey and comprehensive archaeological testing

Along these lines, more survey in the region, not just to document rock art sites, including resurvey of existing known sites. For example, site 34CI78 was recorded by Hanggi in 1965, which he notes is situated on the meas-top overlooking the Cimarron River not far from 34CI339. He recorded five tipi rings about five meters in diameter, two collapsed rubble rings several courses high, and "at least [two] stone rings [1.52 meters] in diameter at [the southeast] cliff edge" (Hanggi 1965:1). While he makes no mention of possible signal fires at this location, nor does he mention any nearby rock art component, this site *does* potentially fit the pattern of the other sites in this study. Future research into visibility and signaling at Black Mesa might consider revising this site.

But while pedestrian survey is a good start, if a more nuanced—or even just more *anything*—picture of ancient lifeways in the area is an important line of investigation, it is, by itself, inadequate. Comprehensive archaeological investigations and excavations where possible is also necessary. Such work could provide badly needed data, such as the presence of charcoal, ash, or burned materials, heat affected rock, or even associated changes in sediment layers (such as visibly reddened soil) associated with such materials would answer more conclusively whether fires were lit in these spaces—and, potentially, when. As it stands, only site 34CI424 offers any surface hints of fires in the past in the form of reddened sandstone, which is not especially diagnostic in and of itself without additional indicators. Additionally, excavations at these sites could potentially recover other archaeological materials that could be used to determine what activities took place at these locations. Likewise, excavations at nearby rock art sites would possibly provide the missing links between these panels and the stone circles.

Conclusions

This thesis began with an overview of the Black Mesa region, including a broad summary of its environmental context, as well as emphasizing the previous archaeological work in Cimarron County, Oklahoma, including Bement and Carmicahel's (2003) survey that formed the basis of the current analysis.

Next, I discussed the culture history of the area, summarizing the Paleoindian, Archaic, and Formative periods, as well as offering a discussion of the possible linguistic situation in the late Archaic. As I noted in the introduction, language offers an unparalleled view into ontological worlds that may be very different to our own. It is likely that that the late Archaic people in the region spoke a pre-Numic Uto-Aztecan language, and embraced an animistic ontological reality.

I then discussed the relationship between landscape and landscape archaeology; phenomenology and how people experience landscapes; rock art as landscape art; as well as the theoretical background of GIS-based visibility studies in archaeology.

Then I summarized the ethnographic and archaeological contexts of signaling as a form of communication all over the world from ancient to modern times, followed by signaling in North American contexts, and then signaling specifically in Southwestern settings.

I next discussed the methodology behand my GIS analysis, followed by the somewhat inconclusive results of that analysis. Nevertheless, I suggest there are two visibility zones: the first centered on the canyon area west of the North Carrizo Creek, and the second on a visibility corridor south of Black Mesa itself that generally follows the Dry Cimarron River. I also confirmed Bement and Carmichael's (2003) assertion that intervisibility is possible between sites 5BA953, 34CI366, and 34CI339.

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Appendix A. Complete list of sites

Note: primary sites are represented in ***bold****.*

Site ID	Culture	Type	State	County
34CI78	Prehistoric	Stone circle	OK	Cimarron
5LA11450	Archaic	Rock art	CO	Las Animas
LA88057	Paleoindian	Rock art	MN	Union
5LA11883	Archaic	Rock art	CO	Las Animas
LA8123	Unknown	Rock art	MN	Union
34CI50	Prehistoric	Rock art	OK	Cimarron
34CI49	Prehistoric	Rock art	OK	Cimarron
5BA108	Unknown	Rock art	CO	Baca
5LA6027	Archaic	Rock art	CO	Las Animas
LA48887	Unknown	Rock art	NM	Union
34CI410	**Prehistoric**	**Stone circle**	**OK**	**Cimarron**
34CI195	Prehistoric	Rock art	OK	Cimarron
5BA31	Archaic	Rock art	CO	Baca
5LA1115	Archaic	Rock art	CO	Las Animas
5BA474	Unknown	Rock art	CO	Baca
34CI174	Unknown	Rock art	CO	Cimarron
5BA520	Archaic	Other	CO	Baca
34CI422	**Prehistoric**	**Rock art**	**OK**	**Cimarron**
LA48848	Unknown	Rock art	NM	Union
34CI510	Prehistoric	Rock art	OK	Cimarron
34CI86	Prehistoric	Rock art	OK	Cimarron
34CI40	Unknown	Rock art	OK	Cimarron
34CI194	Unknown	Rock art	OK	Cimarron
LA48815	Archaic	Other	NM	Union
34CI87	**Archaic**	**Rock art**	**OK**	**Cimarron**
34CI188	**Prehistoric**	**Rock art**	**OK**	**Cimarron**
34CI572	**Prehistoric**	**Stone circle**	**OK**	**Cimarron**
34CI191	Prehistoric	Rock art	OK	Cimarron
34CI366	**Prehistoric**	**Stone circle**	**OK**	**Cimarron**
LA48803	Archaic	Other	NM	Union

5LA22	Archaic	Other	CO	Las Animas
34CI177	Unknown	Rock art	OK	Cimarron
5LA3475	Archaic	Rock art	CO	Las Animas
34CI341	**Prehistoric**	**Rock art**	**OK**	**Cimarron**
LA31674	Archaic	Rock art	NM	Union
LA48802	Archaic	Other	NM	Union
34CI39	Unknown	Rock art	OK	Cimarron
34CI68	Unknown	Rock art	OK	Cimarron
5LA4471	Archaic	Rock art	CO	Las Animas
34CI48	Prehistoric	Rock art	OK	Cimarron
34CI36/38	**Prehistoric**	**Rock art**	**OK**	**Cimarron**
34CI37	Unknown	Rock art	OK	Cimarron
34CI339	**Prehistoric**	**Stone circle**	**OK**	**Cimarron**
5BA953	**Archaic**	**Stone circle**	**CO**	**Baca**
5BA951	**Archaic**	**Rock art**	**CO**	**Baca**
5BA256	Archaic	Rock art	CO	Baca
34CI175	Archaic	Rock art	OK	Cimarron
5LA5841	Archaic	Rock art	CO	Las Animas
34CI56	Prehistoric	Rock art	OK	Cimarron
5LA11448	Archaic	Rock art	CO	Las Animas
5BA30	Archaic	Other	CO	Baca
5LA12616	Archaic	Rock art	CO	Las Animas
5LA2674	Archaic	Rock art	CO	Las Animas
34CI176	Unknown	Rock art	OK	Cimarron
34CI424	**Archaic**	**Stone circle**	**OK**	**Cimarron**
5BA519	Archaic	Rock art	CO	Baca
34CI83	Unknown	Rock art	OK	Cimarron
5BA317	Unknown	Rock art	OK	Baca
5BA93	Unknown	Rock art	CO	Baca
5BA162	Archaic	Other	CO	Baca
5BA194	Archaic	Other	CO	Baca
5BA350	Archaic	Other	CO	Baca
5BA450	Archaic	Other	CO	Baca
5BA600	Archaic	Other	CO	Baca

5BA617	Archaic	Other	CO	Baca
34CI278	Unknown	Rock art	OK	Cimarron
34CI297	Unknown	Rock art	OK	Cimarron
34CI298	Unknown	Rock art	OK	Cimarron
34CI304	Prehistoric	Rock art	OK	Cimarron
34CI503	Prehistoric	Rock art	OK	Cimarron
34CI504	Prehistoric	Rock art	OK	Cimarron
34CI506	Prehistoric	Rock art	OK	Cimarron
34CI559	Prehistoric	Stone circle	OK	Cimarron
5BA1284	Archaic	Other	CO	Baca
5LA5264	Archaic	Rock art	CO	Las Animas
5LA5418	Archaic	Rock art	CO	Las Animas
5LA5503	Archaic	Rock art	CO	Las Animas
5LA5728	Archaic	Rock art	CO	Las Animas
5LA6314	Archaic	Rock art	CO	Las Animas
5LA6612	Archaic	Rock art	CO	Las Animas
5LA7123	Archaic	Rock art	CO	Las Animas
5LA7303	Archaic	Rock art	CO	Las Animas
5LA7700	Archaic	Rock art	CO	Las Animas
5LA8028	Archaic	Rock art	CO	Las Animas
5LA8303	Archaic	Rock art	CO	Las Animas
5LA8620	Archaic	Rock art	CO	Las Animas
5LA9186	Archaic	Rock art	CO	Las Animas
5LA9811	Archaic	Rock art	CO	Las Animas
5LA9812	Archaic	Rock art	CO	Las Animas
LA8120	Archaic	Other	NM	Union
LA8122	Archaic	Other	NM	Union
5LA10000	Archaic	Rock art	CO	Las Animas
5LA10060	Archaic	Rock art	CO	Las Animas
5LA10100	Archaic	Rock art	CO	Las Animas
5LA10283	Archaic	Rock art	CO	Las Animas
5LA10286	Archaic	Rock art	CO	Las Animas
5LA10407	Archaic	Rock art	CO	Las Animas
5LA10942	Archaic	Rock art	CO	Las Animas

5LA10945	Archaic	Rock art	CO	Las Animas
5LA11049	Archaic	Rock art	CO	Las Animas
5LA11050	Archaic	Rock art	CO	Las Animas
5LA11051	Archaic	Rock art	CO	Las Animas
5LA11052	Archaic	Rock art	CO	Las Animas
5LA11429	Archaic	Rock art	CO	Las Animas
5LA11500	Archaic	Rock art	CO	Las Animas
5LA11838	Archaic	Rock art	CO	Las Animas
LA10945	Unknown	Rock art	NM	Union
LA10947	Unknown	Rock art	NM	Union
LA13280	Unknown	Stone circle	NM	Union
LA46968	Archaic	Other	NM	Union
LA48250	Archaic	Other	NM	Union
LA48806	Unknown	Stone circle	NM	Union
LA48827	Archaic	Other	NM	Union
LA48849	Archaic	Other	NM	Union
LA48877	Unknown	Rock art	NM	Union
LA48886	Archaic	Other	NM	Union
LA102653	Archaic	Other rock alignment	NM	Union
LA102654	Archaic	Stone circle	NM	Union
LA102655	Archaic	Other rock alignment	NM	Union
LA160312	Unknown	Stone circle	NM	Union
LA160322	Archaic	Other rock alignment	NM	Union
LA160323	Archaic	Other rock alignment	NM	Union
LA160323	Archaic	Other rock alignment	NM	Union
LA186264	Archaic	Other rock alignment	NM	Union
LA193131	Archaic	Other rock alignment	NM	Union

Appendix B. Primary study sites

Stone alignments

Site 34CI339

Site ID:	34CI339
Cultural affiliation:	Unknown prehistoric
Site area:	400 m^2
Elevation:	1,350 m AMSL
Depth:	Surface
Disturbances:	Looting
Materials observed:	Bedrock mortars and petroglyphs
Associated with:	34CI341

This site comprises three rock shelters and several clefts and overhangs that feature a variety of rock art, and one habitation site that has been heavily disturbed by relic hunters.

Site 34CI366

Site ID:	34CI366
Cultural affiliation:	Unknown prehistoric
Site area:	500 m^2
Elevation:	1,420–30 m AMSL
Depth:	Surface
Disturbances:	None
Materials observed:	Flakes, a biface mano, and possible disturbed signal fire ring
Associated with:	34CI36/38

This site is a mesa-top concentration of lithic debris and a possible signal fire ring. The top of the mesa is approximately fifteen meters by thirty meters, nearly level except for a few large, blocky boulders, and has only light patches of residual soil and vegetation. No trees or bushes are present, but during the 2002 survey, Bement and Carmichael (2003:78) observed "a few stunted yucca, sage, cholla, and prickly pear cling in the cracks of the caprock. Several dry tinajas were present." Additionally, they say, "a scatter of large cobbles may be a dispersed signal fire ring" (Bement and Carmichael 2003:78). There is a very light scatter of rolled chert and Dakota quartzite, a single biface preform encountered on the backside of the mesa top, and a well-worn, fifteen centimeter long by ten centimeter wide oval mano. This artifact is nestled in a small alcove or niche on the north cliff face at about eye level. Over time, lichen spread from the cliff surface to the mano, suggesting it has been there for a considerable time. Bement and Carmichael (2003) left the artifact untouched.

Site 34CI410

Site ID:	34CI410
Cultural affiliation:	Unknown prehistoric
Site area:	100 m^2
Elevation:	1,460 m AMSL
Depth:	Surface
Disturbances:	Some vandalism
Materials observed:	Large stacked basalt ring
Associated with:	Unknown

This circular stone alignment is situated on the easternmost rim of 34CI410, and has an inside diameter of approximately 1.2 meters. It "appears to have been rebuilt and stacked higher repeatedly, as part of the lower structure seems to have tumbled down and then added to. The entire feature is made of basalt pulled up from the surrounding mesa cap" (Bement and Carmichael 2003:91). The lowest level consists of large slabs of vesiculated material; the upper levels are smaller slabs of basalt, which Bement and Carmichael (2003) estimate weigh up to eighty kilograms. This site

> offers a good view of [34CI339 and 34CI366], and most of the cave sites to the south. [5BA953] is just barely obscured by [a landform] and some buttes further north. The little butte just south of petroglyph site 34CI87 is visible, as is the mesa crest above petroglyph site 34CI424. A fire built in this ring would be highly visible. (Bement and Carmichael 2003:91)

Site 34CI424

Site ID:	34CI424
Cultural affiliation:	Unknown prehistoric
Site area:	350 m^2
Elevation:	1,390 m AMSL
Depth:	Surface to 200 cmbs in crevasse
Disturbances:	None
Materials observed:	Discrete Dakota/Morrison flake scatter; rubble-filled crevasse; burned tinaja ring
Associated with:	34CI422

Site 34CI424 is a lithic scatter with a possible signal fire ring and rubble-filled crevasse on the southerly tip of the mesa overlooking the Cimarron River valley. The lithic scatter consists primarily of flakes and local quartzite debris. A tinaja with burned edges forms a natural alcove approximately 100 centimeters wide and forty centimeters deep, though it is highly eroded and no longer holds water (Bement and Carmichael 2003). According the Bement and Carmichael (2003:97), "the naturally golden sandstone is visibly reddened around the edges of this feature," suggesting it may have been used as a signal fire location. However, they continue, "the stones they typically ring such a feature may have been scavenged" (Bement and Carmichael 2003:97) at some point. This site also features a rubble-filled crevasse. Bement and Carmichael (2003:97) note that "since there are no loose cobbles on the mesa top, this material had to have been transported to the crevasse," though the nature of the crevasse is currently unclear. This site offers good vistas of the Cimarron River valley, and the possible signal ring at Black Mesa is easily visible from this location (Bement and Carmichael 2003).

Site 34CI572

Site ID:	34CI572
Cultural affiliation:	Unknown prehistoric
Site area:	Unknown
Elevation:	Unknown
Depth:	Surface
Disturbances:	Unknown
Materials observed:	Circular rock alignment
Associated with:	34CI87, 34CI188

According to Bement (personal communication, 2022), this site consists of a circular rock alignment similar to the other stone circles in this study. No other details, including any other surface materials, are recorded.

Site 5BA953

Site ID:	5BA953
Cultural affiliation:	Unknown prehistoric
Site area:	300 m^2
Elevation:	1,440 m AMSL
Depth:	Surface
Disturbances:	None
Materials observed:	A stacked stone ring
Associated with:	5BA951

This site is a possible signal fire ring on the mesa top above 5BA951. The ring is approximately 1.5 to two meters in diameter, and consists of many small, stacked boulders (Bement and Carmichael 2003). The ring is isolated from the rest of the mesa by a meter wide crevasse that is more than three meters deep. “No cultural material is found in the immediate area of this feature” (Bement and Carmichael 2003:102). The western part of the mesa is heavily wooded with piñon and cedar. This locality offers “sweeping views of lower Furnish Canyon and the broad plain extending 3.5 kilometers eastward to North Carrizo Creek. The top of [34CI366] is easily seen from this vantage point” (Bement and Carmichael 2003:102)

Petroglyph sites

Sites 34CI87 and 34CI188

Site ID:	34CI87 and 34CI188
Cultural affiliation:	Unknown prehistoric
Site area:	Unknown
Elevation:	34CI87: 1,353 m AMSL
	34CI188: 1,341 m AMSL
Depth:	Surface
Disturbances:	34CI87: historic graffiti
	34CI188: slight erosion
Materials observed:	34CI87: broken rocks; lithic scatter; planing tables; smoothing stones
	34CI188: scraper; abundant, large Dakota quartzite flakes
Associated with:	34CI572

Site 34CI87 is a large boulder approximately 2.5 meters high by 1.8 meters wide (Lintz 1976c) that features "crudely pecked marks, some with recognizable geometric form, haphazardly arranged on [its] west face" (Lintz 1976c:4). There is historic graffiti scratched into the south face of the rock (Lintz 1976c). Lintz (1976c:4) notes that the site has "the general appearance of a workshop, but not quarry," and that the Dakota sandstone and Amarillo alibates must have been brought to the site from elsewhere. Site 34CI188 is a slightly eroded open site situated slightly below 34CI87 on an isolated mesa just to the south (Lintz 1976d). This site is less documented than 34CI87, though Lintz (1976d) remarked on the presence of a scraper and abundant and large Dakota quartzite flakes on the surface.

Site 34CI341

Site ID:	34CI341
Cultural affiliation:	Unknown prehistoric
Site area:	400 m^2
Elevation:	1,350 m AMSL
Depth:	Surface
Disturbances:	Extensive looting
Materials observed:	Bedrock mortars and petroglyphs
Associated with:	34CI339

Site 34CI341 is a series of three rock shelters, including a habitation shelter and rock art site at the base of the 34CI399 mesa. According to Bement and Carmichael (2003:33), the rock shelter components have "an extensive talus slope of burned rock and lithic debris." The habitation shelter features small petroglyph panels. One of the petroglyphs consists of "[thirteen] deep round holes about a centimeter in diameter and half a centimeter deep in alternating rows of six and seven, which local enthusiasts suspect to be a lunar calendar" (Bement and Carmichael 2003:33). Additionally, a series of grooves is scratched into the east wall. Another petroglyph of note is seen in a cleft shelter approximate thirty meters to the west and at a slightly lower elevation consisting of a series of crossed and parallel grooves that are lightly patinated despite their sheltered location, which may indicate a considerable age. Finally, a large vertical panel was pecked to form possible large petroglyph images that local people who have visited the site report depict anthropomorphic figures under certain lighting conditions (Bement and Carmichael 2002d, 2003).

Site 34CI36/38

Site ID:	34CI36/38
Cultural affiliation:	Unknown prehistoric
Site area:	Unknown
Elevation:	1,312 m AMSL
Depth:	Surface
Disturbances:	Probably extensive looting, historic graffiti
Materials observed:	Myriad petroglyphs
Associated with:	34CI366

This site was originally recorded as two sites (Lintz 1976a, 1976b), but is more accurately described as two rock art panels on the same large boulder (Bement and Carmichael 2002a, 2002b, 2003). "Most notably," say Bement and Carmichael (2003:6), "there are a series of deer with exaggerated antlers[,] several shield bearer figures, one of which seems to overlap a deer's antlers. and a number of historic names and initials." Other motifs include a few visible circles, several amorphous shapes, and others. Furthermore, "several bedrock metates are evident below this panel and there is a lot of debitage" (Bement and Carmichael 2002b:6), suggesting a multi-component site.

Site 34CI422

Site ID:	34CI422
Cultural affiliation:	Unknown prehistoric

Site area:	400 m^2
Elevation:	1,350 m AMSL
Depth:	Surface to ±30 cmbs
Disturbances:	Packrat activity in Shelter 1, and some sheet wash erosion in Shelter 2
Materials observed:	Three bedrock metates; smoothed vertical surface; painted petroglyphs in Shelter 1; rubble wall in Shelter 2
Associated with:	34CI424

Site 34CI422 is two small rock shelters dubbed Shelter 1 and Shelter 2 in this thesis that were created by adjacent boulders on the west side of 34CI424. Shelter 1 measures three meters by 2.3 meters. On the boulder shadowed by a leaning rock slab are several bedrock mortars and a smoothed vertical area on one rock face. Several petroglyphs are seen drawn on the back wall, including a single "horned" anthromorphic figure; two panels feature stick figures in groups of three and five respectively; and a large deer motif with exaggerated antlers (Bement and Carmichael 2002g, 2003). Other than some packrat activity, Shelter 1 does not appear disturbed.

Shelter 2 "is a low slung slope shelter that generally lacks habitable clearance" (Bement and Carmichael 2003:96), while the upslope area is filled with uniform tumbled rubble that may have once been reinforced with adobe to make a small area separate from the rest of the shelter. The space may have been a secure area to store food, equipment, or other supplies. Shelter 2 is also undisturbed, but runoff from the talus slope has resulted in some sheet washing (Bement and Carmichael 2003).

Site 5BA951

Site ID:	5BA951
Cultural affiliation:	Unknown prehistoric
Site area:	20 m^2
Elevation:	1,416 m AMSL
Depth:	Surface
Disturbances:	Minor vandalism
Materials observed:	Abundant petroglyphs
Associated with:	5BA953

Site 5BA951 is a large rock art panel on a boulder at the foot of 5BA951 between Furnish Canyon and another short, unnamed canyon. Similar to 34CI36/38 (Bement and Carmichael 2002a, 2002b; Lintz 1976a, 1976b), this rock art panel is situated on the upslope (north) aspect of the boulder, facing the mesa. Bement and Carmichael (2003:101) report "a variety of figures cover a [six] square meter area of desert varnished sandstone. Figures include several bighorn sheep forms, some anthropomorphic figures, a ladder-like form, a centipede-like form, and [a] 'spider' glyph with five long lines radiating out from a tri-segmented center." There are two handprints, and a motif resembling a food with six toes. Some of the images near the bottom are covered in desert varnish, suggesting considerable age. The most heavily varnished glyphs "often feature radiating lines and amorphous shapes, and are difficult to see" (Bement and Carmichael 2003:102). There are no deer, horned anthropomorphic figures, or shield bearers represented on the panel. Other than the initials “RT” incised on the west aspect of the boulder, the site is relatively undisturbed (Bement and Carmichael 2003).