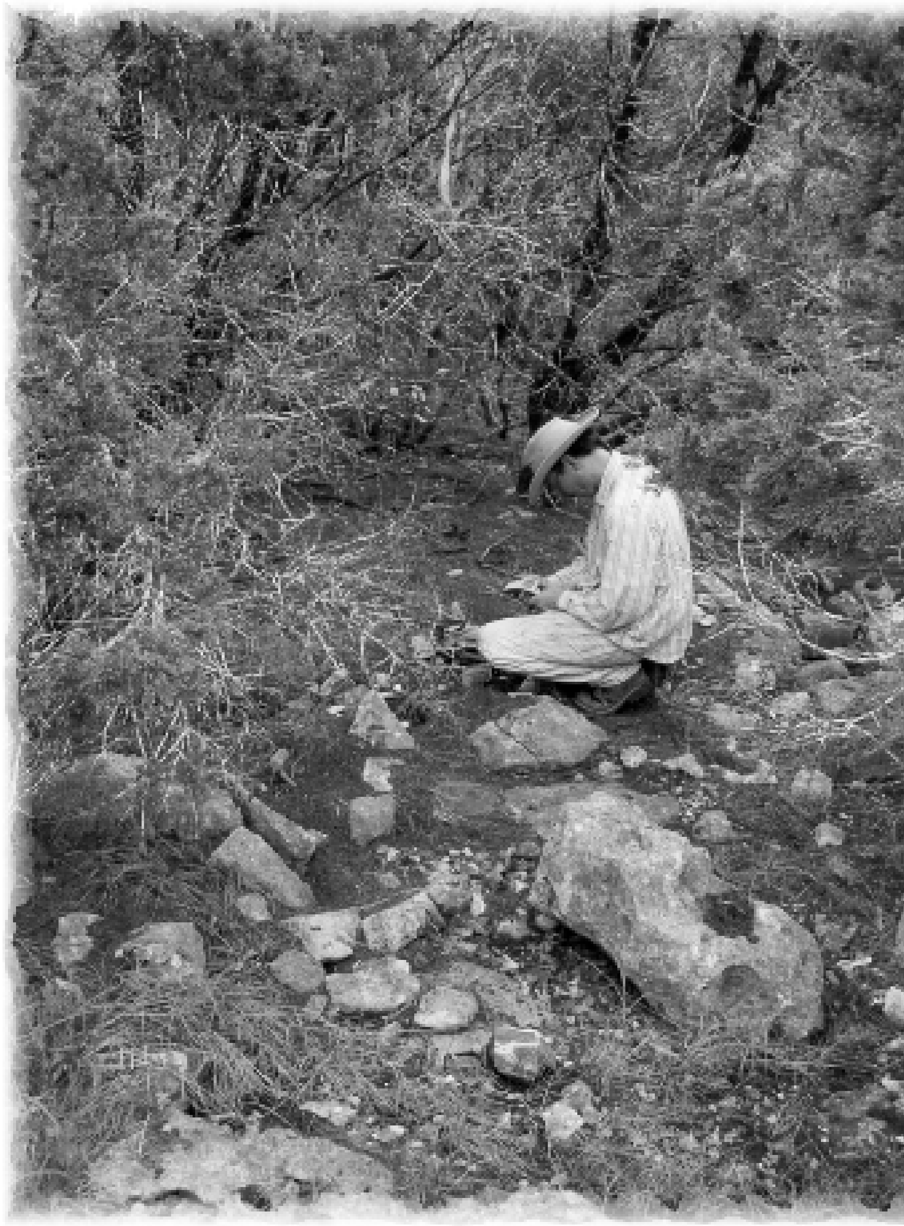
An Archaeological Survey of Trail Locations in a Portion of Government Canyon State Natural Area, Bexar County, Texas



Volume 1
Project Summary, Survey Results, and Recommendations

by
Russell D. Greaves,
Raymond P. Mauldin,
and
Steve A. Tomka

Prepared for:
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas

Prepared by:
Center for Archaeological Research
The University of Texas at San Antonio
Archaeological Survey Report, No. 329

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Texas Antiquities Committee Permit No. 2582

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Principal Investigator

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The following information is provided in accordance with the General Rules of Practice and Procedure, Chapter 26.24 (Investigative Reports), Texas Antiquities Committee:

1. Type of investigation: Survey and re-assessment of previously recorded sites

2. Project name: Survey of Trail Locations at Government Canyon State Natural Area

3. County: Bexar

4. Principal investigators: Steve A. Tomka

5. Name and location of sponsoring agency: Texas Parks and Wildlife Department, 4200 Smith School Rd., Austin, Texas, 78744-3292

6. Texas Antiquities Permit No.: 2582

7. Published by the Center for Archaeological Research, The University of Texas at San Antonio, 6900 N. Loop 1604 W., San Antonio, Texas 78249-0658, 2002

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Abstract:

In May of 2001, the Texas Parks and Wildlife Department (TPW) contracted with the Center for Archaeological Research (CAR) at The University of Texas at San Antonio to conduct an archaeological survey of trails and revisit previously recorded archaeological sites in the northern and central portions of Government Canyon State Natural Area (GCSNA). The trail survey covered a distance of approximately 41.52 kilometers (25.8 miles). The total area systematically surveyed was approximately 6.47 km^2 (1,599 acres). Fieldwork, conducted between May of 2001 and early February of 2002, resulted in the identification of 86 sites. Fifty-two of these represent newly recorded sites. Projectile points from sites suggest that the survey area was used, at some level, for portions of the last 11,000 years, with the principal occupation occurring from the Early Archaic through the Late Archaic periods. A consideration of occupational patterns within the study area suggests that areas close to drainages are characterized by more frequent re-occupation.

Twenty-four of the 86 sites are recommended for designation as State Archeological Landmarks (SAL). These sites all have subsurface deposits, low levels of disturbance, and a high number of artifact types relative to sample size. In addition, these sites either have projectile points that can be assigned to a particular period or have features that are thought to be intact and would therefore provide chronometric information. This combination of attributes makes these sites ideal for considering a variety of current as well as future research questions. The remaining 62 sites are not recommended for SAL designation. While aspects of some of these sites can potentially provide useful information, the overall quality and quantity of data available at these locations is limited.

Archaeological Survey of Trail Locations, Government Canyon State Natural Area, Bexar County, Texas

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Acknowledgments:

A variety of people conspired to make this project happen. Dr. Robert Hard was originally involved with the negotiations on the project. After his departure, CAR director, Dr. Steve Tomka, served as Principal Investigator. Dr. Russell Greaves, project manager, coordinated the overall field and laboratory efforts. Ms. Ruth Mathews was the field director during much of this project. She oversaw both the daily operations of the survey, as well as the relocation and documentation of previously recorded sites. The crew consisted, at various times, of Sylvia Reyna, Leonard Kemp, Floyd Jones, Brian Langner, Bryant Saner, Jason Weston, Toni Figueroa, Tony Lyle, Matthew Senn, John Spencer, Johanna Hunziker, and Shanti Morrell-Hart. A number of people volunteered on the project, including Emily Olson and David Thorn. A special thanks is due to David Thorn, who spent more time on this project than he should have. Many of the field crew also did significant work in the lab, especially Sylvia Reyna, Brian Langner, and Ruth Mathews. Rick Robinson and Jason Weston helped with artifact processing, and Dr. Steve Tomka identified the projectile points. Rick Young and Bruce Moses drafted the illustrations, and Bruce, along with Dr. Steven Brown and Ms. Marilyn Pfeiffer, provided help with various elements of ArcView GIS. The CAR laboratory staff, directed by Ms. Marybeth Tomka, prepared all the material for curation. Johanna Hunziker was responsible for report layout. The assistance of the CAR administrative staff, including Sherri Suñaz, Tammy Hosek, and Mike Wright was invaluable.

A number of people with the Texas Parks and Wildlife Department helped with aspects of the project. Foremost among these is George Kegley, whose enthusiasm, interest, and support of the project is gratefully acknowledged. A number of additional people at TPW, including Aina Dodge, Margaret Howard, and Logan McNatt have provided assistance along the way. Chris Beckcom and Michele Valek helped with finding those elusive trails and with the manipulation of GIS and GPS data. We thank Bruce Wilson of the Government Canyon Natural History Association for his help with locating trails. Finally, the park staff at Government Canyon, including Deirdre Hisler, Trey Cooksey, Eric Holmback, and John Freeman all provided invaluable assistance. It has been a pleasure to work with these folks. Thanks to all.

Chapter 1: Introduction to the Project

Introduction

In May of 2001, the Texas Parks and Wildlife Department (TPW) contracted with the Center for Archaeological Research (CAR) at the University of Texas at San Antonio to conduct archaeological investigations within a portion of Government Canyon State Natural Area (GCSNA). The investigations included four tasks: 1) eligibility testing at site 41BX1199, a site located in the southern portion of Government Canyon originally identified and described by McNatt et al. (2000a); 2) monitoring of road and facilities construction at 41BX1199; 3) a 100 percent pedestrian survey of trail locations in the north and central portions of the State Natural Area; and 4) relocation and additional documentation of previously recorded sites in the northern and central sections of the State Natural Area. In December of 2001, CAR completed a report on site 41BX1199 (Weston 2001). In addition, monitoring of road construction at 41BX1199 is complete, and as of the publication of this report, a letter report on the monitoring is in preparation. The current report presents the results of investigations associated with tasks 3 and 4 above.

Project Background

Government Canyon State Natural Area (GCSNA), managed by the Texas Parks and Wildlife Department, is located in northwestern Bexar County, northwest of San Antonio near the town of Helotes, in south Texas (Figure 1). As outlined in the Government Canyon SNA Master Plan (TPW 1998), the facility is designed to provide a number of benefits. These include the protection and preservation of endangered species habitat, protection of cultural resources, and preservation of an undeveloped tract of land that overlies the Edwards Aquifer recharge zone. It is also designed to provide educational and recreational opportunities for park visitors. The southern section of the facility (Figure 2) will provide several different opportunities for park activities, including walk-in tent camping, group camping, picnicking, and equestrian use. Included in this area will be an interpretive center, a maintenance complex, and a variety of roads and parking facilities. The central and northern sections of the facility, much of which overlies the aquifer recharge zone and contains endangered species habitat, will have a more restricted use. Principal activities in this area of the facility will involve hiking, bicycling, and primitive camping.

As a state property, GCSNA is subject to the provisions in the Antiquities Code of Texas. The construction of the facilities previously noted, as well as opening the facility to the general public for hiking and camping, will increase the potential for artifact collecting and may result in the degradation of the cultural resources on the facility. Planning of development of GCSNA has consistently identified the need for additional archaeological survey (BEM Systems 1992). The southern section of the facility had been previously surveyed (McNatt et al. 2000a). In addition, testing was conducted on areas that potentially contained significant archaeological resources and that would be directly impacted by construction (Weston 2001). Monitoring of the construction activities, as per Texas Historical Commission (THC) recommendations, has also been completed. The current project is in response to recognition of the need for additional detailed and systematic survey along the trail systems in the central and northern sections of the facility, as well as the relocation and assessment of previously recorded sites on this portion of the facility (Figure 2). The current survey was designed to identify and assess the cultural resources within the central and northern portions of the facility. These data will allow TPW to more effectively manage the area as well as plan for the placement of primitive camping facilities.

Project Activities

At the time of this survey, Government Canyon State Natural Area (GCSNA) covered 6,643 acres (26.88 km^2). The survey reported here involved the 100 percent survey of all extant and proposed trail locations in the central and northern sections of GCSNA (Figure 3). The two sections cover 5,085 acres (20.6 km^2) of the State Natural Area. In addition, previously recorded sites were revisited and additional information collected. The fieldwork was conducted between May of 2001 and early February of 2002. Crew size varied, but usually consisted of two crew members and the field director for the survey, and three crew members and the field director for site relocation.

The trail survey covered a distance of approximately 41.52 km (25.8 miles). The total area systematically surveyed was approximately 6.47 km^2 (1,599 acres). This area includes both a 60-m corridor along all trails, as well as a 30-m buffer around all recorded sites.

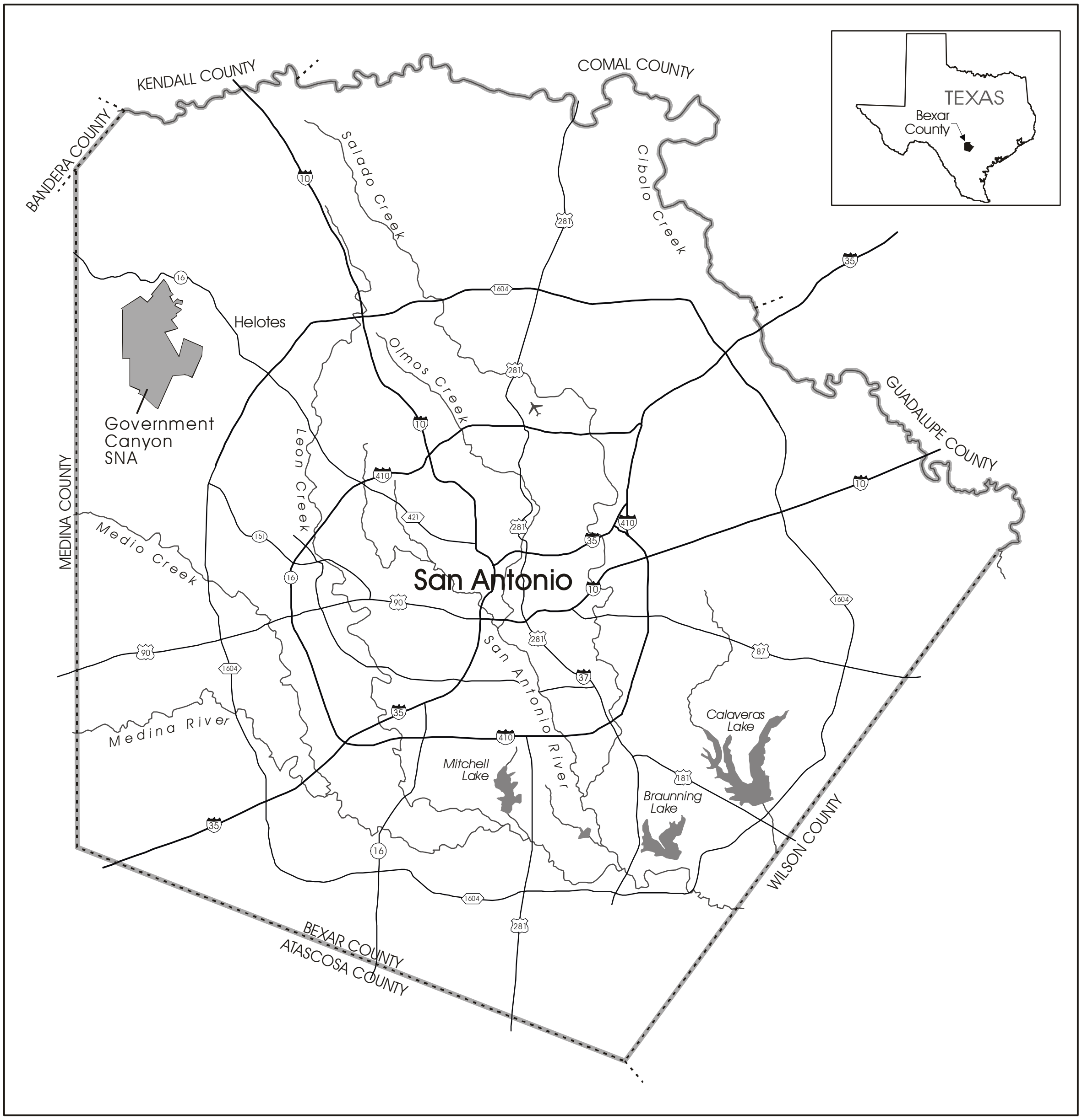

Figure 1. *Location of Government Canyon State Natural Area (GCSNA).*

A total of 515 shovel tests was excavated on the project. Two hundred and ninety (56%) shovel tests were excavated in the trail portion of the survey, and an additional 225 (46%) shovel tests were excavated to determine site-specific attributes. Overall, 407 (79%) of the 515 shovel tests were within site boundaries.

The field and laboratory efforts resulted in the recovery of over 4,100 pieces of chipped stone, as well as over 1,200 pieces of fire-cracked rock. In addition, a total of 104 projectile points, 105 bifaces, 21 cores, and a single ground stone were recovered from shovel testing and surface collection. Finally, a small number of items that are classified

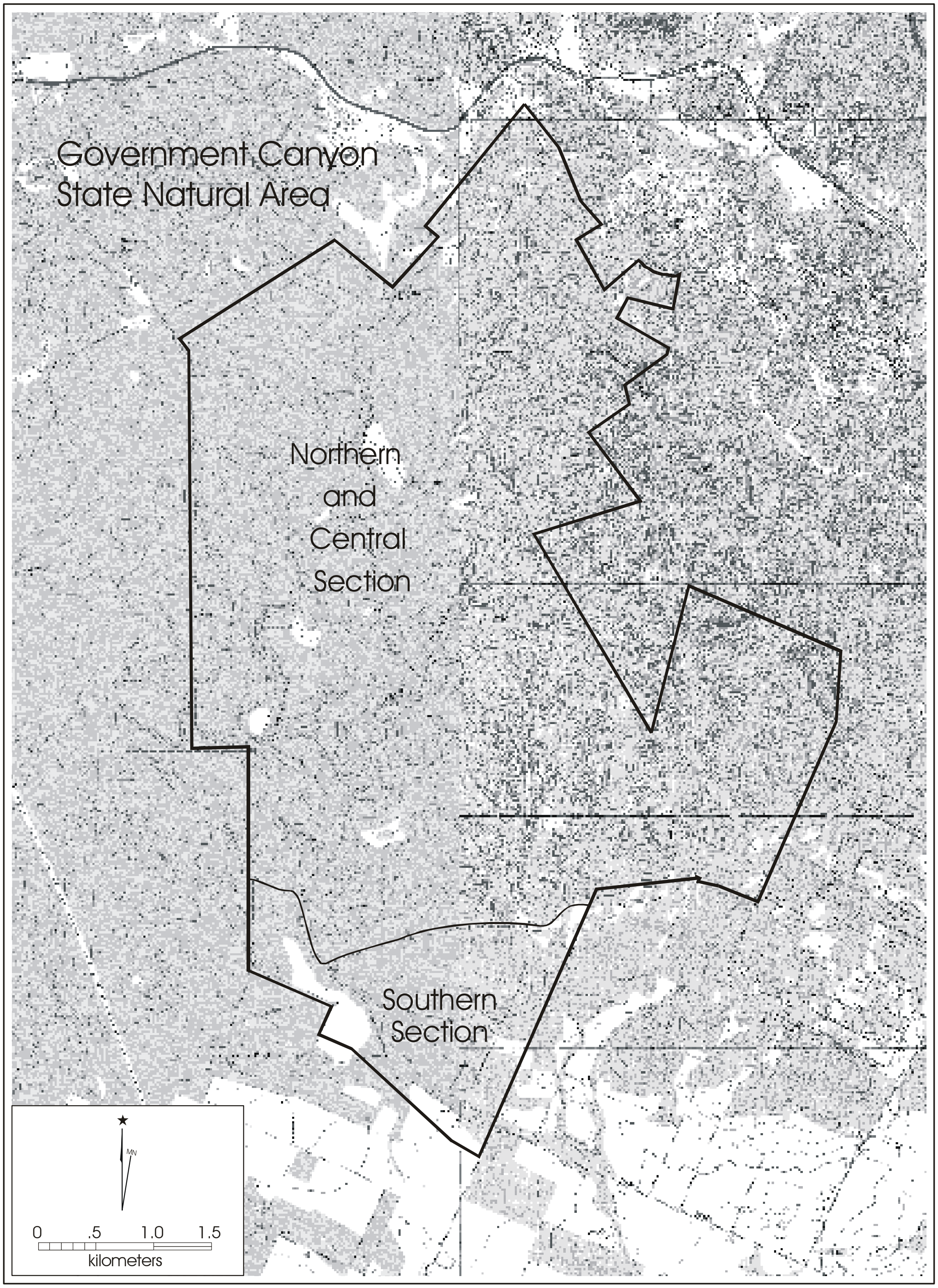

Figure 2. *GCSNA boundaries.*

as possibly historic also were collected. These are primarily glass and metal. Upon laboratory examination, the vast majority of these appear to be modern. All artifacts for this project, along with notes, site forms, shovel test forms, and photographs, were prepared for curation in accordance with federal regulation 36 CFR part 79.

Project Results

The survey identified a total of 86 sites, covering an overall area of roughly 4 km^2, within the 6.47 km^2 survey area. Fifty-two new sites were recorded. In addition, 34 previously recorded sites within the project area were expanded in size, frequently resulting in the combination of several previously recorded sites into a single, large site. We have assigned these sites the lowest 41BX trinomial number of the incorporated sites.

Sites within the project area are frequently extremely large. The sites, as a group, also are shallow, with deposits generally confined to the upper 30 cm. A variety of materials were observed on the sites, suggesting that a variety of activities were conducted within GCSNA. Projectile points from sites suggest that the survey area was used, at some level, for portions of the last 11,000 years, with the principal occupation occurring from the Early Archaic through the Late Archaic periods. A consideration of land use patterns within the study area suggests that areas close to drainages are characterized by more frequent re-occupation. Multicomponent sites are clearly associated with drainages, and the highest intensity of occupation, measured both by higher debitage and fire-cracked rock recovery in shovel tests, as well as the number of different types of artifacts on the surface of sites, are associated with drainages. In addition, all burned rock features are located close to drainages.

Twenty-four of the 86 sites recorded on the current project are recommended for State Archeological Landmark (SAL) designation. These sites all have subsurface deposits, low levels of disturbance, and a high number of artifact types relative to sample size. These 24 sites either have a temporally identifiable component (i.e., a typed projectile point) or have features that are thought to be intact, and would therefore provide chronometric information. These 24 sites have data that can contribute to a better understanding of the prehistory of the region and the state, and thus qualify for SAL status under that criterion. As the central and northern sections of the State Natural Area will be opened to the general public for hiking and bicycling along trails, as well as camping in selected areas, the potential impacts to the 24 sites include artifact collection, as well as more invasive vandalism and increased erosion associated with trail use and maintenance. This is especially the case for 19 (79%) of these 24 sites, as they are currently intersected by trails. SAL designation is also warranted, then, because of the high likelihood of vandalism and artifact collection on these 24 sites. The remaining 62 sites are not recommended for SAL designation. While aspects of some of these sites can potentially provide interesting data, the overall quality and quantity of available data are limited and these locations do not meet the SAL criteria.

Document Outline

Volume 1 contains seven chapters, including this introduction. Chapter 2 provides an introduction to the environment of Government Canyon, including discussions of the physiography and geology, climate, hydrology, soils, and flora and fauna. The chapter also provides an overview of paleoenvironmental conditions during the Late Pleistocene through the Holocene. Chapter 3 presents an overview of the cultural history of the project area, including a discussion of previous archaeological research conducted within Government Canyon. Chapter 4 discusses the research perspective that guided the work and outlines a series of analytical issues that can be addressed with aspects of the Government Canyon data. The fifth chapter discusses the survey methodology, as well as outlines laboratory procedures. Chapter 6 presents a summary of the survey results. The seventh and final chapter summarizes the results, and discusses the SAL status of the sites. Included in that chapter are suggestions for mitigating the impacts to SAL sites associated with use of the State Natural Area, as well as suggestions for quantifying aspects of those impacts.

Volume 2 contains four sections. Appendix A presents site descriptions for all 86 archaeological sites. Appendix B presents shovel test information for each of the 515 shovel tests excavated on the project, while Appendix C lists collected items. Sensitive maps containing detailed site location information are included in a map pocket at the back of volume 2.

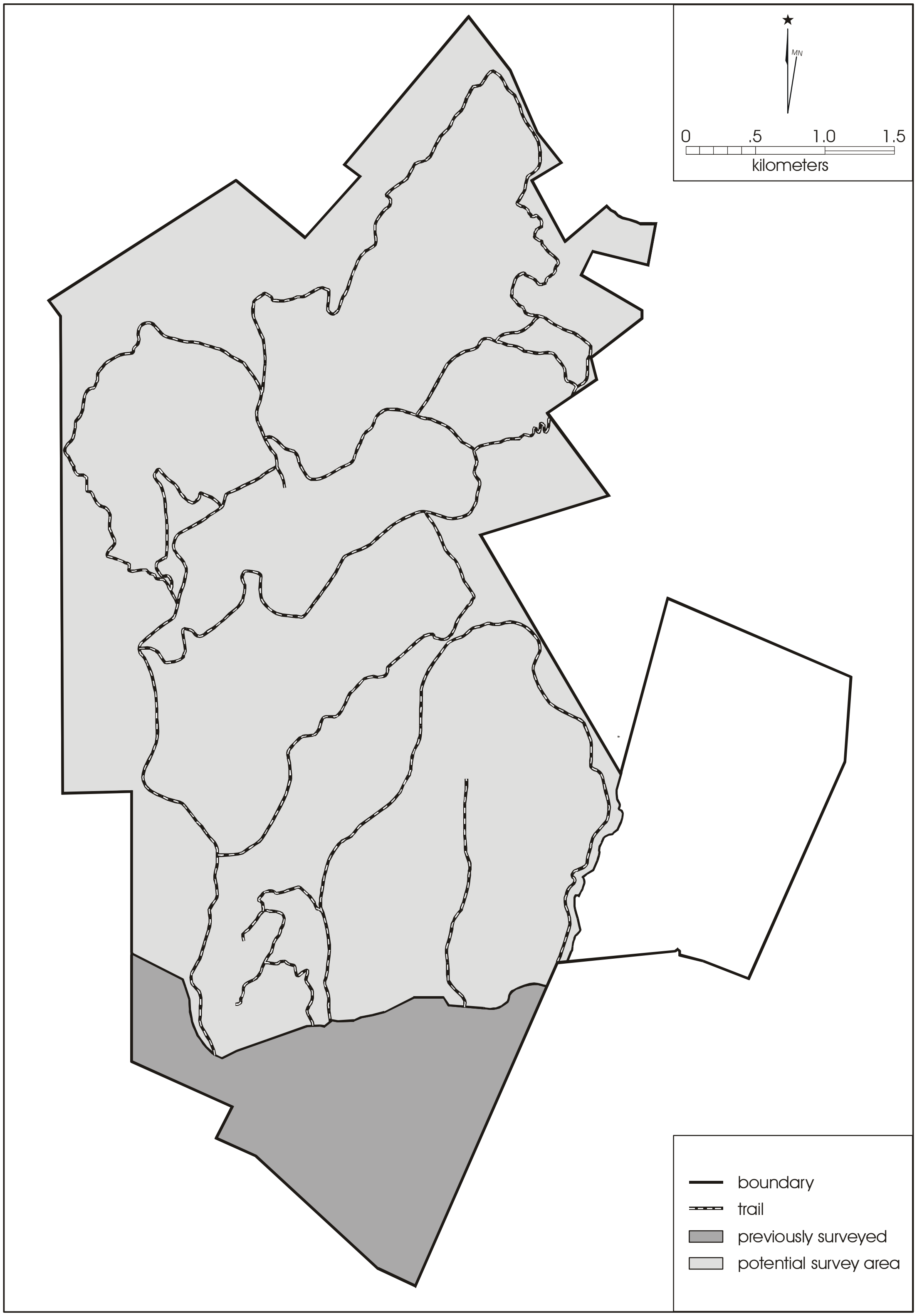

Figure 3. *Trails and survey areas within GCSNA.*

Chapter 2: The Physical Environment

This chapter provides an overview of the physical setting of the project. The chapter has two principal sections. The first section provides an introduction to the environment of Government Canyon. Included are discussions of the physiography and geology, climate, hydrology, soils, and flora and fauna in the project area. The second section provides an overview of paleoenvironmental conditions during the Late Pleistocene and through the Holocene. A variety of different data sets from a variety of different locations throughout Central, South, and North Texas are used to shed light on general environmental trends that impacted Government Canyon.

Environment

Climate

The climate of the region is subtropical and subhumid, with mild winters and warm to hot summers (Taylor et al. 1962). January highs average 60.8º F and lows average 37.9º F. July highs average 95.0º F with lows of 75.0º F (Bomar 1999:214–222). The growing season at San Antonio averages about 267 days a year (Bomar 1999:214–222).

Bomar (1999:228–230) notes that normal annual precipitation at San Antonio is 30.98 inches. Precipitation during the year tends to be bimodal, with an initial peak occurring in May (mean = 4.22 inches) and June (mean = 3.81 inches), and a secondary peak in September (mean = 3.41 inches) and October (mean = 3.17 inches). The driest period of the year is between December and March, when precipitation averages roughly 1.64 inches per month. These average precipitation totals mask considerable variability. For example, average annual precipitation has varied from a high of 52.28 inches in 1973 (Bomar 1999:228) to a low of 10.11 inches in 1917.

Physiography and Geology

Government Canyon State Natural Area is at the junction of three natural regions –the Balcones Canyonlands, the Blackland Prairie, and the South Texas Brush Country. More specifically, the area encompassed by GCSNA is at an ecotone between the Edwards Plateau and the Blackland Prairie (Black 1989a:Figure 6). Most of GCSNA represents the lowest portion of the Balcones Uplift, while a small portion of the southern area is a flat pediment that falls within the Blackland Prairie region. McNatt (2000:5) characterizes GCSNA as a transitional zone between the Gulf Coastal Plain and the Edwards Plateau.

The project area slopes from north to south. Elevations of the uplands commonly range from approximately 1,400 ft (427 m) in the north of the State Natural Area to 1,200 ft (366 m) AMSL at the base of the escarpment. Black Hill is the highest local feature within GCSNA at 1,589 ft (484 m) AMSL. The southern area of GCSNA is a broad, flat pediment with elevations of 1,070 ft (326 m) to 960 ft (293 m) AMSL.

The central and northern portions of GCSNA are situated in rugged, hilly limestone topography cut by several north to south trending ephemeral drainages. The limestone of the northern portion of GCSNA has been uplifted and exposed to solution. This has resulted in the erosion of relatively deep canyons creating dramatic relief. This is a karst landscape. Caves, sinkholes, and solution fissures are common within GCSNA. Typical of karst landscapes (Ritter 1986:446), surface flow is ephemeral and the majority of local water is funneled into underground drainages. Thin soils mantle much of this karstic area.

Government Canyon State Natural Area is located in the Balcones fault zone. A series of faults cut through the southern boundary of the uplands in a southeast to northwest direction (Figure 4). The Haby Crossing Fault (Macaly 1995) occurs in the southern section of GCSNA, dividing the Lower Cretaceous Edwards Limestone formation (Ked) from the Upper Cretaceous Austin Chalk formation (Kau). The Edwards Limestone formation is the dominant lithofacies in the central and northern sections of GCSNA. Many portions of the uplands have extensive areas of exposed bedrock (Barnes 1974). Surface expressions, including flat exposures, boulders, and stepped depositional units are found throughout GCSNA (Figure 5).

Knappable chert is extremely common within some limestone units. This limestone contains abundant chert resources. Cherts within the Edwards Limestone formation represent a readily available source of high quality raw materials. They are available as exposed veins, nodules, and as eroded fragments in many portions of the uplands. Banks (1990:60–61) characterizes these cherts as occurring primarily in nodules and discontinuous beds. On the present

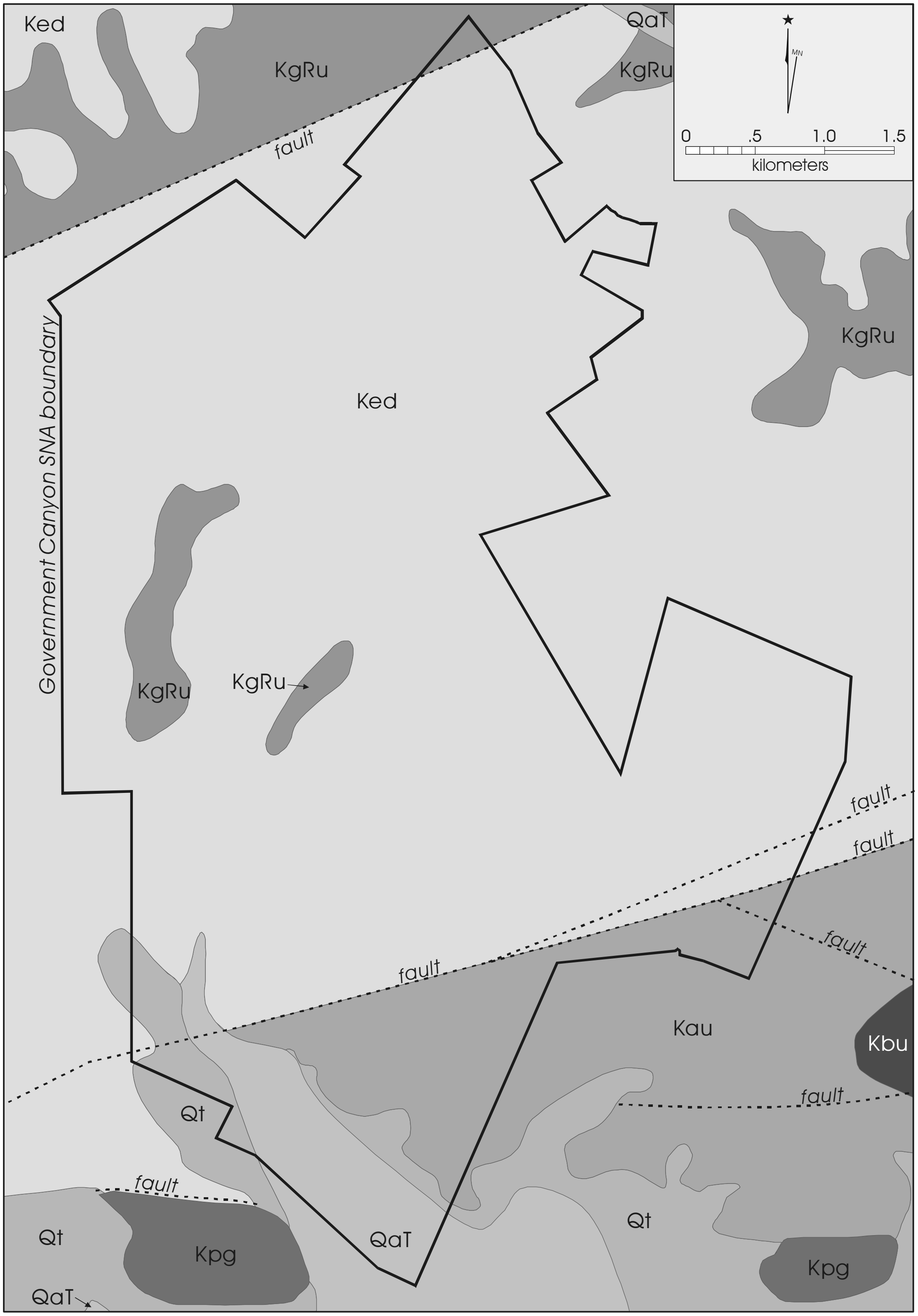

Figure 4. *GCSNA geological formations and major fault lines.*

survey, few locations were identified with exposed chert, but thin soils may blanket some exposures. Several areas with abundant naturally fractured chert on the surface were observed that probably indicate adjacent outcrops near ground surface. Additionally, colluvial and alluvial movement has transported significant amounts of chert into areas of secondary deposits.

The southern potion of GCSNA is a flat pediment (McNatt et al. 2000a) that has some potential to contain knappable cherts. This area contains a thin mantle of Tarrant Series (Weston 2001:8–13) and Patrick Series soils overlying the Austin Chalk formation (Kau). This limestone has a lower chert-bearing potential. Many nodules are present in this area because of secondary deposition of eroded cobbles from Edwards Limestone formation deposits. The pediment area directly south of the Haby Crossing Fault contains several large archaeological sites (41BX1190, 41BX1191, 41BX1195, and 41BX1199). These sites form a continuous distribution of chert that is interrupted only by modern ephemeral drainages (see McNatt et al. 2000a). Just upslope of the fault zone, the northern boundaries of these previously identified sites contain large and dense sheet deposits of Edwards cherts, though most appear to be naturally fractured. This large deposit is at least partly a product of alluvial depositional forces.

Figure 5. *Exposed bedrock within the survey area.*

Hydrology

The current project area is dissected by a number of ephemeral streams, most of which are concentrated on the western side of the current project area (Figure 6). Primary among drainages is Government Canyon Creek. This stream, which begins to the north of the State Natural Area, is fed by surface runoff and exsurgence. The majority of the eastern and some of the northern drainage basin for Government Canyon Creek is within the current park boundaries. Much of the basin for tributaries that feed Government Canyon Creek from the west and northwest is outside of GCSNA. Government Canyon Creek empties into Culebra Creek to the south of the State Natural Area. The other primary drainage is Wildcat Canyon that joins Government Canyon Creek in the southwestern section of the project area. A variety of smaller, unnamed tributaries also drain into Government Canyon Creek. In addition, several unnamed drainages are present in the southern portion of the project area. These drain off the escarpment.

A single spring is recorded in the current project area. The unnamed spring, identified on the 1970 U.S.G.S. *San Geronimo* quadrangle, is within the bed of Government Canyon Creek.

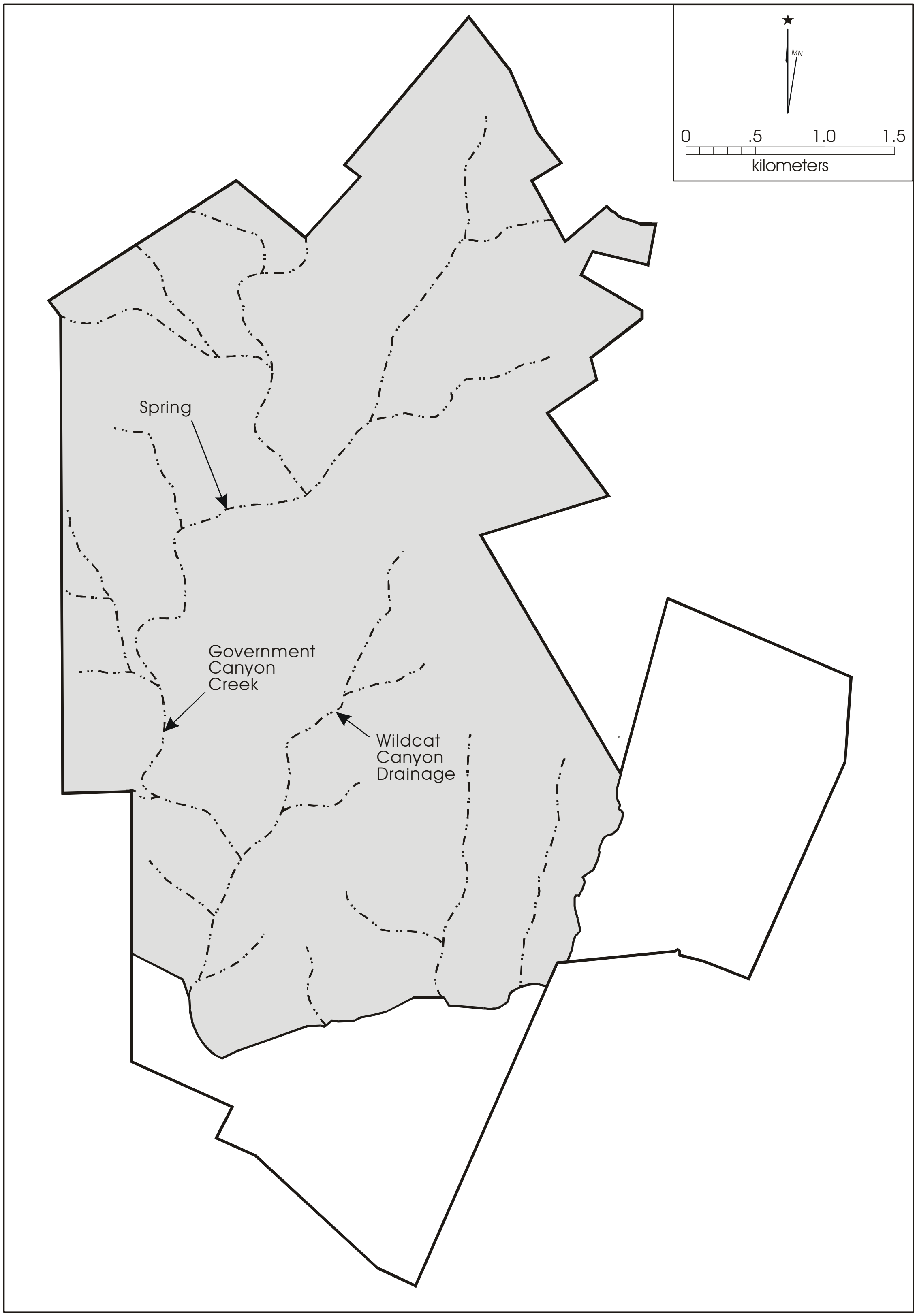

Figure 6. *Drainages and springs in the project area.*

Soils

Almost the entirety of the current project area contains thin Tarrant Association soils (Figure 7). Drainages contain Tarrant Association undulating soils (Taylor et al. 1962:Sheets 18–19, 25–26). Tarrant Association hilly soils are present on ridge tops and steep slopes (Taylor et al. 1962:31). In general, the Tarrant series are shallow, stony soils found on limestone. They are dark colored (black to very dark grayish-brown) calcareous and clayey. Tarrant soils have rapid surface runoff, good internal drainage, and are prone to erosion. Less than 15 percent of these soils are 25–60 cm deep, and only three percent may contain deeper soils extending 60–115 cm below the modern ground surface (Taylor et al. 1962:30).

Two general forms of contact with the underlying bedrock were noted within the upland area. Soils that are evidently *in situ* contain abundant weathered bedrock. The contact zone between *in situ* soils and the bedrock occurred as chalky calcic zones with relatively small stones, large individual stones, or minimally weathered rock still exhibiting bedding morphology (see Taylor et al. 1962:Figure 14). In other contexts, the soil was in contact with unweathered and obviously scoured bedrock. This distinction may be useful to differentiate intact and secondarily deposited soils. The minor variations in the Tarrant soils make identification of colluvial and alluvial deposition problematic. However, a scoured bedrock contact clearly indicates that soils have been removed to the bedrock, sediment has accumulated, and pedogenesis may have begun on that secondary deposition of Tarrant soil colluvium. It proved infeasible to obtain consistent observation of bedrock contact from all shovel tests conducted during the current project. Future systematic subsurface examination could potentially identify the potential for shallow buried archaeological remains with higher integrity by including systematic observation of soil and bedrock contact.

Patrick soils are relatively shallow and occur on generally level settings. The southernmost portion of GCSNA contains a small amount of these soils. Patrick soils are dark colored and often rest on gravel substrates (Taylor et al. 1962:26–27). A small expression of Lewisville series soils also is present in the southernmost part of GCSNA (Figure 7).

On the extreme northern end of GCSNA are soils of the Brackett-Tarrant group (Figure 7). This is a shallow soil common on limestone ridge tops (Taylor et al. 1962:12). These soils are clay loam or silty clay loams lighter in color than the Tarrant soils (light brownish-gray).

Flora

Government Canyon State Natural Area is located in a transitional zone between the South Texas Brush Country, the Blackland Prairies, and the Balcones Canyonlands. McNatt (2000:8–9) provides a good discussion of variable floral communities within GCSNA. McNatt (2000:8–10), citing work by James and Wiersema (1972), suggests that three primary habitat zones are reflected in the Government Canyon area. These are 1) the Upper Slopes and Hilltops Zone, dominated by Ashe juniper and a variety of oaks, 2) the Riparian Habitat Zone associated with the larger canyons, and 3) the Plateau Live Oak-Midgrass Zone. Zones 1 and 2 are associated with the upland section of the project area, while Zone 3 is confined to the southern section below the escarpment.

While a recent baseline survey of floral and faunal resources is not available for the project area, it is clear that the modern plant and animal communities have been significantly shaped by historic land use practices. Freeman (2000) provides a discussion of a variety of historic uses of the Government Canyon area, the most significant of which, in terms of land alteration, was grazing. Both cattle and horses were grazed in the area, and sections may have been bulldozed to increase grass production. In addition, limited agriculture appears to have been practiced in the southern section of the State Natural Area. These historic modifications have resulted in the destruction of native grasses, the removal of many trees and shrubs, and the alteration of habitat for native fauna.

Several genera of oaks (*Quercus*) are found throughout the GCSNA escarpment area (Kavanagh 2000). Most prevalent are live oak (*Q. fusiformis*), Texas oak (*Q. texana*), and shin oak (*Q. sinuata*). More widespread are the junipers, *Juniperus ashei* (Gould 1975:17; Vines 1960:32–33), that form dense stands in many parts of the uplands and dominate once park-like areas of larger trees with open understory. In these areas where the juniper cover is intermittent, a variety of smaller trees, bushes, and shrubs have invaded creating a dense understory cover. Much of this brushy undergrowth is characterized by whitebrush (*Aloysia gratissima*), mescal-bean (*Sophora secundiflora*), agarita (*Mahonia trifolia*), persimmon (*Diospyrios texana*), and prickly pear cactus (*Opuntia phaeacantha;* Elias and Dykeman 1990:140; Vines 1960:273, 568–569, 780). Prickly pear and other cacti are locally dominant and represented within GCSNA by cholla (*Opuntia* sp.) and barrel cactuses (*Echinocereus* sp.). Succulents include yuccas (*Yucca torreyi* and *Y. rupicola*) and sotol (*Dasylirion leiophyllum*). Mesquite (*Prosopis*

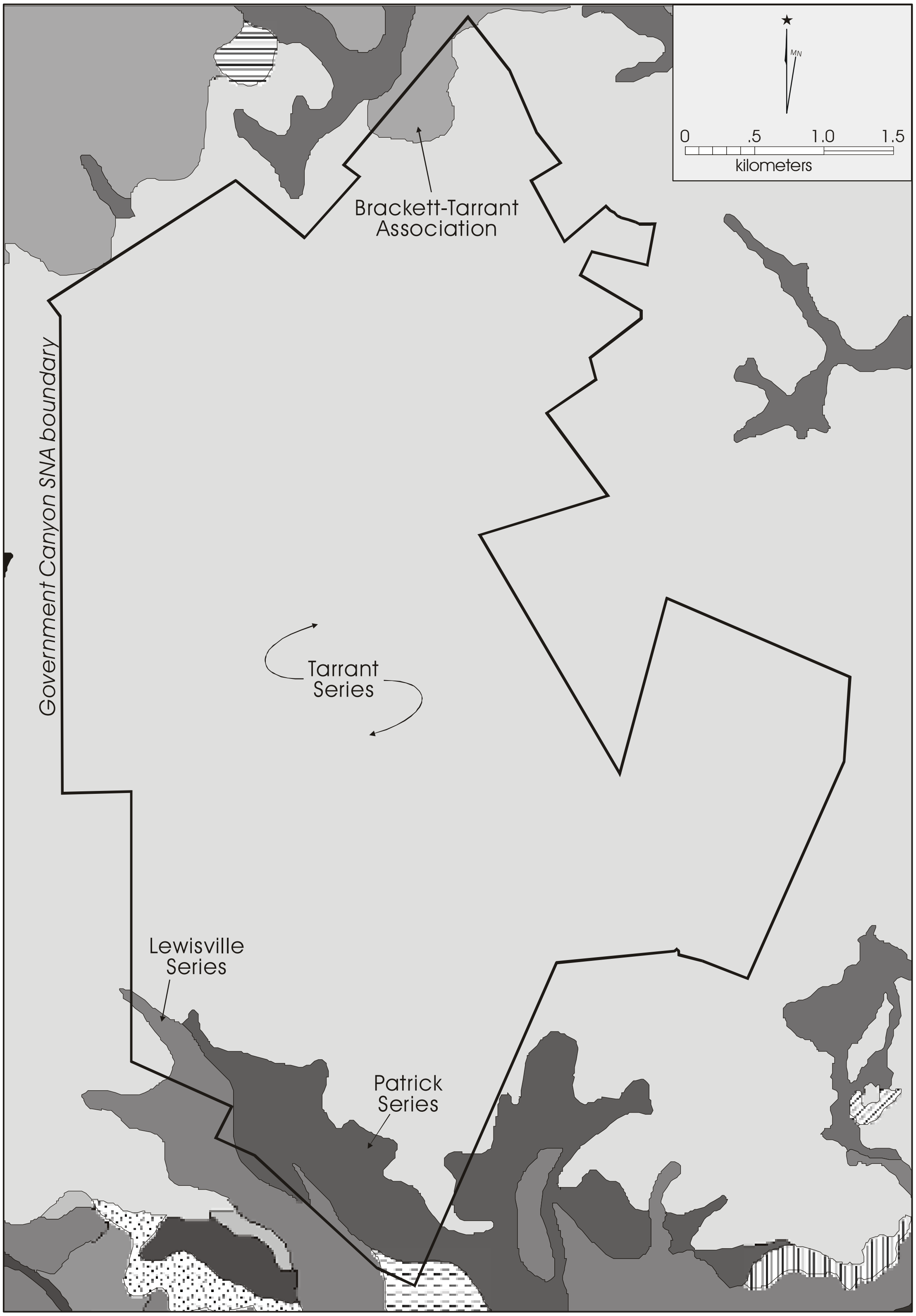

Figure 7. *Soils in GCSNA.*

glandulosa) is common only on the piedmont. Both juniper and mesquite are probably more common now than they were during the Late Prehistoric and early historic periods (Dick-Peddie 1993:132). Grass covers significant areas of the savannah-like uplands. The common grasses of GCSNA are little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), threeawn (*Aristida* spp.), and needlegrasses (*Stipa* spp.).

Currently, a vegetation restoration effort is underway that has the goal of restoring disturbance communities that have resulted from past agricultural practices on the lower, or southern, portion of GCSNA. By employing hand-clearing and prescribed fire, it is believed that a mesquite-oak-juniper savannah will reemerge in these old fields.

Fauna

The species and distribution of faunal resources have also probably been altered during the historic period. Currently, white-tailed deer (*Odocoileus virginianus*) is the most common large mammal, although both bison and antelope probably ranged in the State Natural Area prior to the 1900s. A variety of smaller mammals and an assortment of reptiles, amphibians, and birds are also present.

A variety of animal species were noted in GCSNA during the current survey. They included species of reptiles such as the Western Diamondback (*Crotalus atrox*) and the Texas Spiny Lizard (*Sceloporus olviaceus;* Conant 1975:102, 110, 236). A variety of avian species are present, but only the Roadrunner (*Geococcyx californianus*) was visually identified (Robbins et al. 1983:172). Mammals noted were the white-tailed deer and feral hogs (Davis and Schmidly 1994:268; Harper and Row 1981:382).

Paleoenvironmental Data

Recent research, particularly during the past decade, has contributed immensely toward understanding the paleoenvironment of the state (e.g., Bousman 1998; Brown 1998; Caran 1998; Frederick 1998; Fredlund et al. 1998; Ricklis and Cox 1998). These studies continue to refine and complicate the larger context of Late Quaternary climatic change. Unfortunately, the paleoclimate of Texas contains significant gaps primarily due to the scarcity of deep, finely stratified, and well-dated deposits (Stahle and Cleaveland 1995:51), as well as uneven history of work across the state. This section relies on information taken from a variety of studies located primarily to the north of the current project.

In the following discussion, we use a number of different data sets, including pollen, phytolith, geomorphic, oxygen-isotope, and faunal data, in an attempt to document aspects of the paleoenvironment from the close of the Pleistocene until the modern era. The relationship between the current project area and the various sources of paleoenvironmental data can be seen in Figure 8**.** Each of these data sets monitors climate and vegetation changes at varying spatial and temporal scales. In addition, each data set has specific problems associated with preservation, sampling, chronological control, and interpretation. A detailed review of the problems and prospects associated with each specific data set is beyond the scope of this section, and several excellent discussions are available (e.g., Bousman 1998; Collins 1995; Johnson and Goode 1994).

Late Pleistocene (ca. 18,000–10,000 BP)

In Central Texas, pollen spectra from Boriack Bog, located roughly 195 kilometers to the northeast of Government Canyon (Figure 8), suggest a shift from grasslands before 16,500 BP (BP, years before 1950) to woodlands before 12,500 BP in a moist and cool climate (Bousman 1994:79). The same spectra reveal a decline in spruce (probably cold-adapted) pollen by 15,000 BP, indicating a trend toward a warmer climate. Bousman's (1992) oxygen isotope evidence from South Texas complements the bog pollen data and suggests early warming by 15,000 BP.

Toomey et al. (1993) argue that faunal data from Hall's Cave on the Edwards Plateau, roughly 75 kilometers to the northwest of Government Canyon (Figure 8), suggest that summer temperatures in the Late Pleistocene were 6º C cooler than present averages, and that by 13,000 BP (or 12,500 BP [Toomey and Stafford 1994]), a warm and more arid interval was present.

Between 12,500 and 11,800 BP, the Boriack Bog data indicate that a dry episode stimulated a brief shift to grasslands, corroborated by oxygen-isotope ratios showing a relatively cool setting in South Texas (Bousman 1992, 1994:80). The Hall's Cave record indicates a wet interval around 11,000 BP (Toomey and Stafford 1994).

Recently, Camper (1991) has reanalyzed Patschke Bog, a Central Texas bog near Boriack (Bousman 1994, 1998) that was originally investigated by Potzger and Tharp (1943, 1947). The samples presented by Camper appear to represent a continuous, and relatively well-dated sequence stretching back to 17,000 BP. However, as Bousman (1998:207–208)

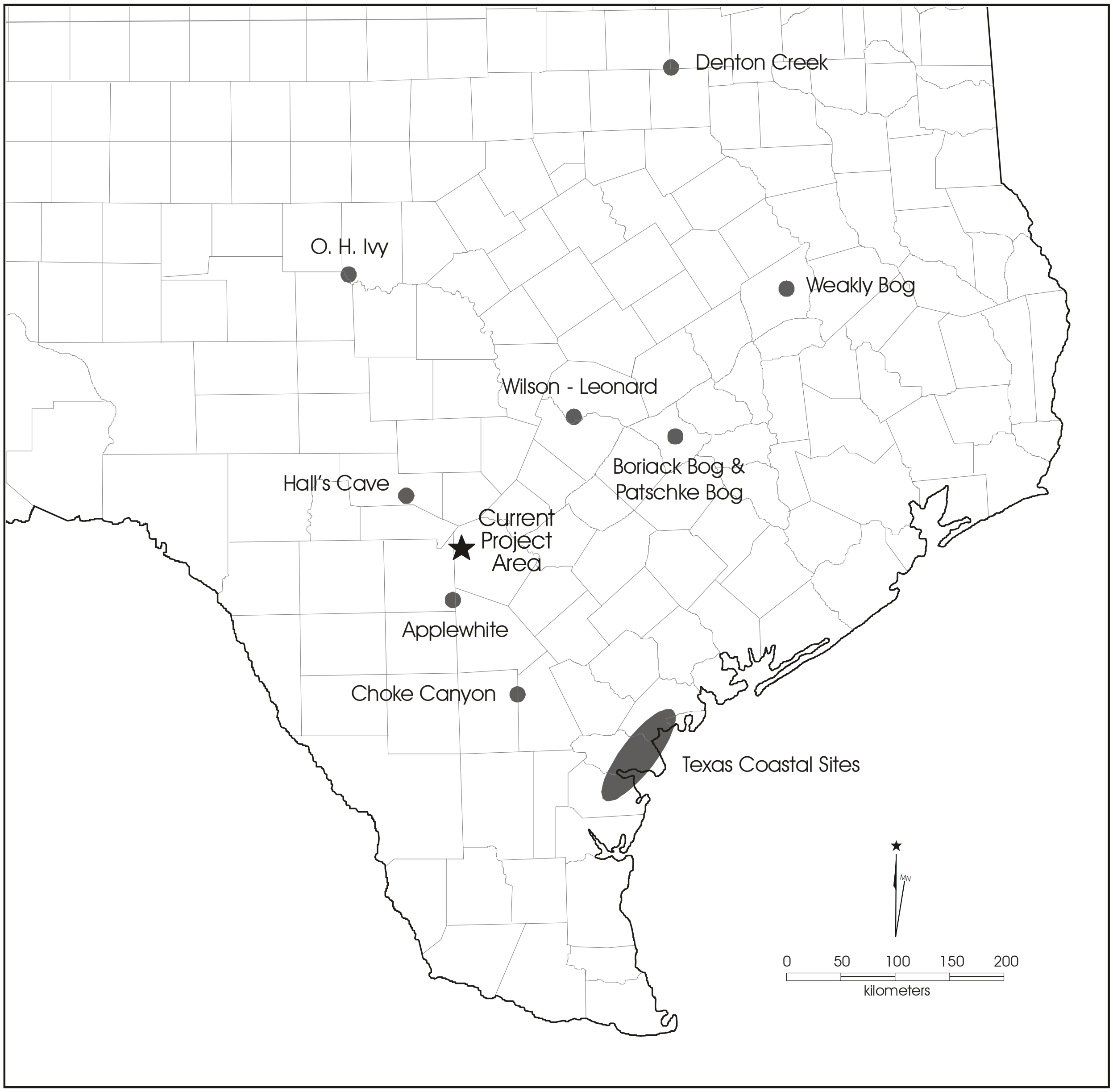

Figure 8. *Locations of regional paleoenvironmental data discussed in the text.*

notes, the Patschke data have significant frequencies of local marsh taxa, such as *Alnus* and *Cyperaceae*, which make the identification of regional changes difficult. In an attempt to clarify the pattern of regional change indicated at Patschke Bog, Nickels and Mauldin (2001) reviewed the raw pollen grain counts from Patschke Bog (Camper 1991). While Bousman (1998) is correct in noting the high level of marsh taxa throughout the deposits, Nickels and Mauldin (2001) note that Camper's grain counts, unavailable to Bousman in 1998, are extremely high, with an average of just over 370 grains per level, and a minimum count of 270 grains for any single level. They reworked the original data, eliminating the potential contaminants from the pollen data (Nickels and Mauldin 2001:34–35).

Figure 9 presents these revised percentages for grass (*Poaceae*) taxa for Patschke Bog (Nickels and Mauldin 2001), as well as the grass percentages for Boriack Bog with major contaminants removed (Bousman 1998). An examination of the figure shows good correlation with

Bousman's (1998) summary, especially in light of the fact that the dating of the sediment core analyzed from Boriack Bog (Core 1) is based on four radiocarbon dates from an adjacent core (Bousman, personal communication 1999). The Patschke Core 4 samples are supported by four radiocarbon dates from the core itself, as well as additional dates from Core 2 located less than two yards away from Core 4 (Camper 1991:31).

The Patschke pollen sequence (Figure 9) suggests that between roughly 17,000 BP and 15,500 BP, a cool grassland environment may have been present. After 15,500 BP, a rapid decline in grass pollen is indicated which reaches a low at roughly 14,000 BP. While there is a brief spike in grass percentages around 13,200 BP, low grass frequencies are present until roughly 10,500 BP. Though not shown in the figure, pollen from cold-adapted arboreal species such as spruce (*Picea*) are not present in the Patschke sequence after about 8000 BP, and are infrequent after the Late Pleistocene, again consistent with the suggested warming trend.

Early Holocene (ca. 10,000–8000 BP)

Pollen samples from the Llano Estacado and the dry caves of the Trans-Pecos region prompted Bryant and Shafer (1977:15–19) to suggest a gradual warming and drying trend throughout the Holocene (after about 10,000 BP). Others, including Aten (1979) and Gunn and Mahula (1977), use data from Oklahoma and eastern Texas to propose a more variable change from the colder, wetter Pleistocene to the modern climate.

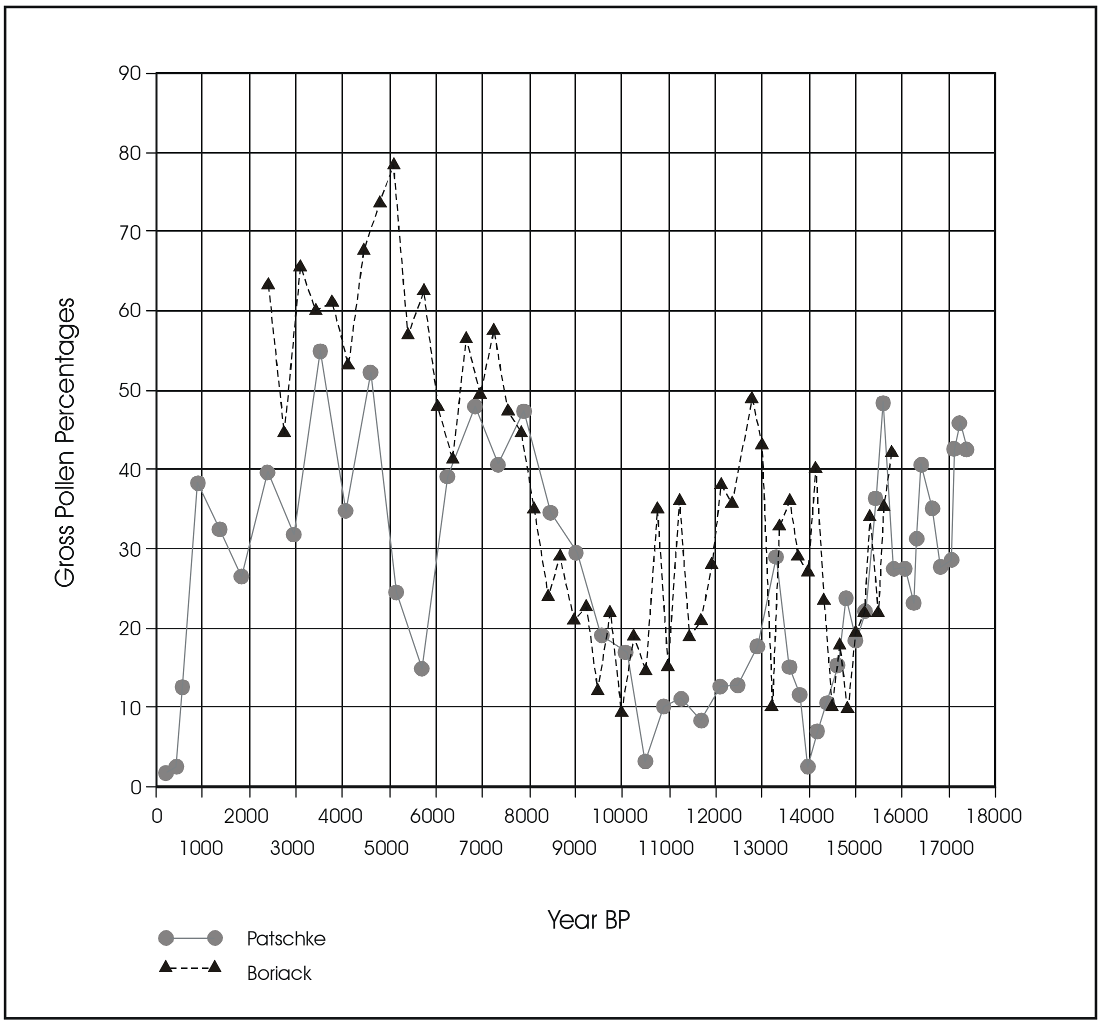

Figure 9. *Grass pollen percentages from Boriak and Patschke bogs.*

Innovative research in opal phytoliths reported by Robinson (1979) from archaeological sites on the Coastal Plain of South Texas (Figure 8) also showed that, at least since the Early Holocene, climatic change has been highly variable. Bousman (1998), again based on the Boriack and Weakly Bog data from Central Texas (Figure 8), suggested significant climatic fluctuations during this period. Toward the Pleistocene-Holocene boundary at about 10,000 BP, arboreal species in the Boriack Bog spectra show a return of woodlands up to 9500 BP, followed by their decline and a reestablished predominance of open vegetation communities. Grasslands again replaced woodlands that had been reestablished by 8750 BP (Bousman 1994:80). The gradual warming trend is supported by the consistent increase in grass pollen at Patschke (Figure 9). Robinson (1979:109) associated his oldest phytolith sample, although poorly dated, with the late Paleoindian period and suggested an age of about 8000 BP. The predominance of tall grass species, white oak phytoliths, a generally high frequency of other tree species (unidentifiable), and the generally small size of the grass phytoliths indicated a wet environment.

Middle Holocene (ca. 8000–4000 BP)

The continuous decline of the woodlands in the Early Holocene was briefly checked around 6000 BP, but resumed its slide until 5000 BP when arboreal pollen slowly increased with the appearance of a wetter climate (Bousman 1994:80). The Mid-Holocene arid period indicated at Boriack Bog agrees with data presented by Nordt et al. (1994) from the Applewhite project, located to the south of Government Canyon (Figure 8), where a dry period corresponding to roughly the same time frame (6000 to 4800 BP) is indicated. Humphrey and Ferring (1994) discovered the same arid episode in north-central Texas, but with greater duration (6500–4000 BP), agreeing with the revised interpretation from Hall's Cave for an arid episode between 7000 and 2500 BP (Toomey and Stafford 1994). Johnson and Goode (1994) report a later occurrence between 5000 and 2500 BP (calibrated). The opal phytolith records from the Wilson-Leonard site (Figure 8), roughly 140 kilometers to the northeast of Government Canyon (Fredlund 1994), and two sites on Colette Creek in South Texas (Robinson 1979:111), agree with increasing aridity in the Middle Holocene, indicated by spreading grasslands around 4500 BP. However, a sample from slightly higher in the Colette Creek strata with roughly the same age argues for a quickly appearing, yet brief, wet episode (Robinson's [1979:111] Sample 4), followed by a return to an arid climate up to ca. 2750 BP. Grass pollen data from Patschke (Figure 9) suggest a grassland setting for the Middle Holocene, but with a marked, brief decline between 6000 and 5000 BP, hinting at a wet interval.

Phytolith analysis of sediments from the Choke Canyon project (Figure 8), located to the south of Government Canyon, add to the claim of considerable climatic variability (Robinson 1982:597–610). Between 5300 and 4300 BP, Robinson (1982:598) infers a cool, mesic climatic regime that shifts to a more arid period. He then suggests a return to both cooler and wetter conditions by 3250 BP.

Late Holocene (4000–0 BP)

There are indicators that climate continued to fluctuate in the Late Holocene. Nordt et al. (1994) suggest a warm and dry episode between 3000 and 1500 BP based on stable carbon ratios from deposits at Applewhite Reservoir (Figure 8). Toomey and Stafford (1994) see a wet period appearing about 2500 BP at Hall's Cave. Their observations agree with those of Robinson (1979:112), suggesting a very wet episode. Ricklis and Cox's (1998) study of oyster growth patterns on the Texas Gulf Coast (Figure 8) tentatively implies a shift to a cooler climate at ca. 3000 BP, emerging out of a much warmer Middle Holocene. The Gulf Coast data tend to agree with the Choke Canyon analysis that points to mesic conditions (similar to today's) by 2450 BP (Robinson 1982:598–599). Afterward, a shift to more xeric conditions occurred by 1000 BP, but Robinson suggests that they may have been more mesic than modern conditions. The predominance of short grass species agrees with large quantities of bison remains documented in archaeological context at Choke Canyon (Robinson 1982:599). Grass pollen frequencies in the Boriack and Weakly Bog pollen spectra indicate drying episodes at 1600–1500 BP and 500–400 BP (Bousman 1994:80). Data from Patschke suggest a fluctuating but generally dry period early in the Late Holocene, with accelerated mesic conditions after about 1000 BP.

Brown (1998) suggests that the mean oxygen isotope values (^{18}O) for freshwater mussel shells from Denton Creek (41DL270) in north-central Texas (Figure 8) can be used to make general inferences about past air and water temperatures, rainfall, and evaporation. Isotope values occurring in a small sample of mussel shells from dated contexts suggests a cool and wet climate around 3500 BP, a warm, dry climate around 2850 BP, and then a more mesic interval between 2500 and 1500 BP. Brown (1998:164) suggests that a warming trend occurred after 1500 BP. The conclusions reached from Brown's study of freshwater mussels are generally comparable to those of Humphrey and Ferring's (1994) study of soil carbonate stable isotopes. The carbon isotope data from north-central Texas indicates that between 4500 and 2000 BP the climate was moist, but began drying by 2000 BP, and for the next 500 years the area was much drier. However, around 1500 BP another shift occurred, and after 1500 BP the climate again returned to wet conditions.

Summary

The previous discussion suggests that the paleoenvironment of Texas is quite varied. While, in part, this variability may reflect problems with comparing different proxy data sets that measure different aspects of climate at varying spatial and temporal scales, as well as problems with the temporal assignment of particular samples or sequences, the variability may be real, especially during certain periods. This point can be seen in Figure 10, a summary of climate patterns suggested by four different data sets. The figure includes two faunal data sets as relative indicators of xeric and mesic conditions. The first data set uses Dillehay's (1974) presence/absence data for bison in the Central Texas and southern plains area (see also Collins 1995). The second faunal data set is material from Hall's Cave reported by Collins (1995). In addition, two pollen data sets are used. These are the frequency of grass pollen taken from the revised counts at Patschke Bog (Nickels and Mauldin 2001) and the arboreal pollen frequencies taken from the second counts at Boriack Bog (Bousman 1998). While a variety of other data sets are available, these four were selected because they span much of the 12,000 years of primary interest and illustrate two different data types, pollen and fauna.

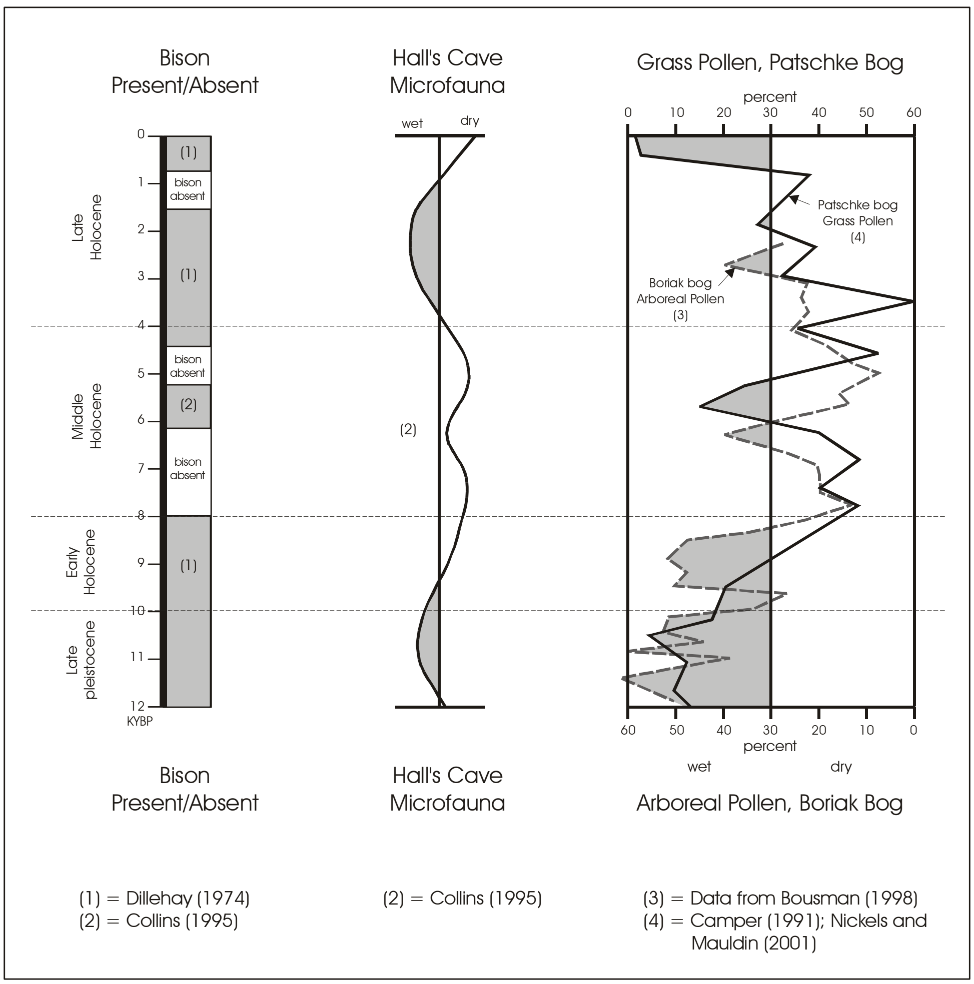

Figure 10. *Comparisons of several regional climatic sequences for Central and South Texas.*

At a general level, there is good agreement between these four data sets, especially for the period before 4000 BP. There are also periods throughout the sequence where differences are present. The waning of the Pleistocene clearly marked a transition from a cool, wet environment to one that steadily grew warmer and drier. All four data sets indicate that much of the Early Holocene was relatively mesic. The early portion of the Middle Holocene, between roughly 8000 BP and 6200 BP, was generally warm and/or dry. A brief mesic period is suggested in the data sets sometime between 6200 and 5200 BP, followed by a return to dry conditions. The faunal data sets seem to indicate the onset of a more mesic regime at roughly 4500 or 4000 BP, while the pollen data sets suggest that the xeric conditions continue, perhaps until as late as 3000 BP. Between about 1500 and 750 years ago, all the available data sets hint at a dryer period, while a more mesic interval is suggested by two of the three applicable data sets for the last 750 to 800 years (see Figure 10).

Chapter 3: Cultural Background

This chapter provides an overview of the cultural history of the project area, including a discussion of previous archaeological research conducted within Government Canyon. More detailed information on the cultural history of the region can be found in Collins (1995), Hester (1995), Black (1989b), and Prewitt (1981). Howard et al. (2000) provide a detailed discussion of the prehistoric patterns as well as research within GCSNA, while Freeman (2000) provides a similar review of the history of GCSNA.

Cultural Overview

Government Canyon falls within the Central Texas Archaeological Region (Black 1989b; Hester 1989:2–3; Prewitt 1981:71). Human use of the Government Canyon area began during Paleoindian times, appears to have been extensive during Archaic times, and continued through the Late Prehistoric. Historic occupations are also present.

Paleoindian

The Paleoindian period, from 11,500 to 8800 BP (Collins 1995:380, 381), represents the earliest human habitation in Central Texas. Clovis points and associated artifacts represent the earliest cultural manifestations during the Paleoindian period (11,500–8800 BP; Meltzer and Bever 1995:48–49). The Clovis "lifeway" is one of hunting and gathering (Collins 1995:381, 382). Folsom points, spurred end scrapers, and ultra-thin bifaces represent the next Paleoindian cultural manifestation. The livelihood of people during the Folsom period seems to have been more nomadic and more reliant on specialized hunting rather than the generalized hunting-gathering adaptations during Clovis times (Collins 1995:382). After Folsom, dart points begin to change and diversify, as do other tools, indicating an increased variation in the lifestyles of the inhabitants of all of North America as well as Central Texas (Collins 1995:382). Point styles recognized for late Paleoindian occupations in the region include Plainview, Golondrina, Dalton, and San Patrice.

Within the immediate area, several under-reported Paleoindian occupations have been identified. Clovis and Folsom points have been recovered from Bexar County (Meltzer and Bever 1995:48–49; Prewitt 1995:105) though the overall number appears to be minimal. The primary sites with Paleoindian remains in the immediate region are 41BX52 (Pavo Real) on Leon Creek, 41BX229 (St. Mary's Hall) on Salado Creek, and 41BX1 (Olmos Dam) on Olmos Creek. The Pavo Real site contained both Clovis and Folsom points and associated occupation debris (Henderson and Goode 1991). The site of St. Mary's Hall (Hester 1979, 1990) contained both Folsom and what have been classified as Plainview points (but see Hester 1995:435), while Olmos Dam produced only Plainview points (Orchard and Campbell 1954).

Archaic

A number of different schemes exist for subdividing the long Archaic period (8800–1200 BP). While the timing and termination dates for any given scheme differ slightly, most researchers distinguish three broad subperiods. For example, Collins (1995:383–385) divides the period into the Early Archaic (8800–6000 BP), the Middle Archaic (6000–4000 BP), and the Late Archaic (4000–1200 BP). Johnson and Goode (1994:20–29) follow a similar scheme, though using slightly different dates for the termination and onset of the various subperiods (see also Black 1989b, 1989c; Hester 1995). The various schemes seem to differ most in dividing the Late Archaic period, with Johnson and Goode (1994) further subdividing that time frame into a Late Archaic I (4250–2550 BP) and Late Archaic II (2550–1350 BP).

Regardless of how the distinctions are made, it appears that in Central Texas the lithic tool assemblages associated with this long period continue to reflect the diversification begun in the later part of the Paleoindian period. Shifting away from the specialized Folsom trend, food resources also diversify with plant gathering apparently taking on greater significance (Collins 1995:383, 384). Heated rock began to be used as cooking elements in burned rock middens (Collins 1995:383), like the one found in the northern end of GCSNA (Dillehay 1972:13).

It seems clear that the Archaic period cultures were affected by climatic fluctuations documented in the previous chapter. During mesic times people probably relied on plants like nuts, berries, and geophytes (bulbs), and animals such as bison, deer, turkey, and aquatic species. In xeric times they probably relied more on plants such as sotol (Collins 1995:383,384). Settlement shifts, resulting from the changing resource base, also can be anticipated.

Though more common than Paleoindian occupations, Early Archaic sites are typically small in size, and widely dispersed, suggesting both low overall population size and high mobility. A variety of sites with Early Archaic remains have been excavated within the region, including 41BX184 (the Higgins site) and the Panther Springs site (41BX228). Angostura, Gower, and Early Corner-notched projectile points are not uncommon at these locations (see Potter et al. 1995). Tennis (1996; see also Tennis and Hard 1995) notes that at 41BX47, located on Leon Creek, excavation recovered a variety of hearths that appear to date primarily to the Early Archaic period, along with associated debitage and a variety of projectile points. Tennis notes that 73 small hearths were associated with levels that potentially date to the Early Archaic. Based on a relatively small excavation sample, Tennis (1996:53) estimates that this large site may contain in excess of 4,000 such features. The features and associated remains from 41BX47 suggest a different focus for the Early Archaic relative to the Paleoindian occupations in the area.

The Middle Archaic period appears to be a time of increased population, based on the large number of sites reported from Central and South Texas (see Black 1989b, 1989c; Story 1985). Creel (1986; see also Weir 1976) suggests that the use of burned rock middens, first recognized in the Early Archaic and probably representing specialized features associated with plant processing, were increasingly common during the Middle Archaic. Several excavations within the region represent the relatively short Middle Archaic. These include components at Panther Springs Creek (Black and McGraw 1985; Potter et al. 1995), site 41BX300, the Elm Waterhole sites (Katz 1987), site 41BX272, the Granberg II site (Hester and Kohnitz 1975; Hester 1980), Olmos Dam (Lukowski 1988), and 41BX534 (McGraw and Hindes 1987). A variety of point types have been recovered from these locations, including Bell, Nolan, Early Triangular, and Travis dart points.

Several researchers suggest that population during the Late Archaic period continued to increase (e.g., Prewitt 1985), while others argue that population size was stable or fell during this period (e.g., Black 1989b, 1989c). A proliferation of human cemeteries seems to take place, especially in south and south-central Texas (e.g., Givens 1968; Hall 1981; Lukowski 1988; Taylor and Highley 1995), leading some to argue that populations were becoming more territorial with reduced mobility (Story 1985:44–45).

A variety of point styles are recognized for this period, including Pedernales, Marshall, Montell, Castroville, Frio, and Ensor. These point types are commonly recovered throughout the study area.

Late Prehistoric

The Late Prehistoric (1200 BP–European Contact), also termed Neoarchaic (Prewitt 1981:74) and Post-Archaic (Johnson and Goode 1994:5), sees the advent of the bow and arrow, followed by pottery (Collins 1995:385). These technological changes are reflective of subsistence changes, as it appears that later in this period bison once again play an important subsistence role (Johnson 1995; Prewitt 1981). While some researchers argue that this period saw a substantial decline in population relative to the Late Archaic (e.g., Black 1989b; Prewitt 1985), Collins (1995:386) suggests that the large encampments reported by Europeans at the time of contact in Central Texas may have developed during the Late Prehistoric (Collins 1995:386).

A variety of excavated Late Prehistoric occupations are reported around Bexar County, including components at Panther Springs Creek (Black and McGraw 1985) and Elm Waterhole (Katz 1987). With the technological shift to the bow and arrow, a variety of new point styles are recognized during this period. Within the current region, Edwards, Scallorn, and Perdiz points are common.

Historic

Europeans began affecting Central Texas before direct contact in the late seventeenth century. The Spanish entry into Mexico displaced indigenous groups and may have initiated migration northwards that affected Amerindian peoples within South and Central Texas.

The presence of Europeans certainly affected native populations by the time the Spanish had established five missions in San Antonio de Bexar by 1731. European colonization was limited by the effective territorial defense by Comanche and Apache groups until the mid 1830s. Following Mexican Independence, an influx of Anglo-Americans caused a demographic shift in control of lands formerly occupied by mobile equestrian foragers. This effectively destroyed the independent economies of Native Americans and dramatically altered the lifeways of remaining indigenous folk (Freeman 2000:28–29).

Relatively few historic features (aside from evidence of twentieth-century ranching) were identified during the current investigation. Peter and Hunt (1992:56) also noted a dearth of historic remains in their survey area within GCSNA. A single standing structure from the early 1880s remains within GCSNA. The Christian and Emilie Zizelmann house is located along the main Joseph E. Johnston Road. It was built at the location of a spring in Government Canyon Creek. This facility includes a house, excavated well, and stone perimeter wall. The Joe Johnston Road itself is an important historical feature. This roadway appears to have existed in the 1850s, and was a main route between San Antonio and civilian communities and military posts to the northwest and west (Freeman 2000:3–37, Figures 3–6).

Previous Archaeological Research

A review of archaeological literature in the Government Canyon area suggests that, prior to the initiation of the current project, 68 sites had been recorded within the park boundary. Much of the extant data from the area now encompassed by GCSNA was generated by three projects conducted between 1972 and 2000. Figure 11 (located in map pocket in Volume 2) presents the locations of these 68 sites. Table 1 provides information on 52 of these sites that are within the current survey area.

Archaeological investigations began in the region in 1972 when a pedestrian survey was conducted by the University of Texas in association with the San Antonio Ranch New Town Development (Dillehay 1972). This survey emphasized examination of areas adjacent existing drainages. Dillehay (1972:7–9) characterized the survey as preliminary, and urged more thorough examination of the area with systematic attention to areas located at higher elevations. Forty prehistoric sites were recorded, 30 of which are in the current project area (Table 1). Diagnostic artifacts suggested a predominantly Archaic period use of the San Antonio Ranch area. Shovel testing was not a component of the project. Four sites (41BX152, 41X153, 41BX158, and 41BX161) were subsequently tested (Filson and Prewitt 1978). None of these sites are within the current project area. All four were demonstrated to be primarily surface sites (Filson and Prewitt 1978; Peter and Hunt 1992). Dillehay (1972:5) notes that within the areas that were well-sampled, archaeological sites were common.

Peter and Hunt (1992) conducted a sample survey of 450 acres; most of the area surveyed lies within the current GCSNA. Sixteen new archaeological sites were recorded, and all 16 are within the current project boundary (see Table 1). Limited shovel tests were conducted on selected sites that were thought to have some depth. However, most of the sites are described as eroded and were not shovel tested. These sites primarily represented lithic scatters and were interpreted as lithic procurement areas (Peter and Hunt 1992:54). Diagnostic artifacts were uncommon. Peter and Hunt (1992:54) note that the majority of the sites reflect Archaic occupation. Only two sites had Late Prehistoric diagnostics and no evidence of Paleoindian components was identified.

In 1987, C. K. Chandler recorded two sites, 41BX713 and 41BX714 in the State Natural Area. Information on file at the Texas Archeological Research Laboratory (TARL) suggests that site 41BX713 has two burned rock middens, each roughly 10 meters in diameter. Site 41BX714 was recorded as a lithic quarry.

Between 1994 and 1996, TPW recorded several sites in Government Canyon in association with a cave inventory of the State Natural Area (TPW 1995, 1996, 1997). Sites 41BX1067 and 41BX1068 were recorded in 1994. Site 41BX1067, the Christian and Emilie Zizelmann House, a standing historic structure from the early 1880s, was recorded in 1995 (Freeman 2000:Figure 11; TPW 1995:164, 1996:210). Site 41BX1068, an apparent burial, consisted of several human bones found in a vertical shaft within the Lubbock Area Grotto (LAG) cave. This burial has been termed an ossuary, although only minimal information on the remains is available (TPW 1995:164, 1997:147). In 1995, three new archaeological sites were recorded (41BX163, 41BX1206, and 41BX1207). Two of these were erroneously identified as sites 41BX206 and 41BX207 (TPW 1996). TARL site records indicate their correct trinomials are 41BX1206 and 41BX1207. Site 41BX163 was recorded as a lithic scatter with a single burned rock midden (TPW 1996:211). Site 41BX1206 was described as a lithic scatter that was considered to represent quarrying activities (TPW 1996:211). Site 41BX1207 is a double sinkhole that was apparently uncovered before the karst survey (probably by looters) and contained a single human burial (TPW 1996:212). The human remains from 41BX1068 were reinterred. The burial from 41BX1207 is currently under curation at the archaeological laboratory of Texas Parks and Wildlife in Austin.

In 1996, archaeologists from TPW conducted a survey of 725 acres within GCSNA (McNatt et al. 2000a). That survey,

Table 1. Selected attributes of previously recorded sites in the survey area

Trinomial	Original Project Records	Estimated Site Area (sq. meters)	Site Type	General Age	Period 1	Period 2
41BX130	Dillehay, 1972	2240	Lithic Scatter	Prehistoric	Unknown	
41BX131	Dillehay, 1972	3171	Lithic Scatter	Prehistoric	Unknown	
41BX132	Dillehay, 1972	6866	Lithic Scatter	Prehistoric	Unknown	
41BX133	Dillehay, 1972	1916	Lithic Scatter	Prehistoric	M. archaic	
41BX134	Dillehay, 1972	10875	Midden	Prehistoric	L. Archaic	
41BX135	Dillehay, 1972	1881	Lithic Scatter	Prehistoric	Unknown	
41BX136	Dillehay, 1972	2773	Lithic Scatter	Prehistoric	Unknown	
41BX137	Dillehay, 1972	2295	Lithic Scatter	Prehistoric	L. Archaic	L. Prehistoric
41BX138	Dillehay, 1972	2561	Lithic Scatter	Prehistoric	Unknown	
41BX139	Dillehay, 1972	10805	Lithic Scatter	Prehistoric	L. Archaic	
41BX140	Dillehay, 1972	11812	Lithic Scatter	Prehistoric	Archiac	
41BX141	Dillehay, 1972	5877	Lithic Scatter	Prehistoric	L. Archaic	
41BX142	Dillehay, 1972	2584	Lithic Scatter	Prehistoric	Unknown	
41BX143	Dillehay, 1972	4647	Lithic Scatter	Prehistoric	Unknown	
41BX144	Dillehay, 1972	1094	Lithic Scatter	Prehistoric	E. Archaic	L. Archaic
41BX145	Dillehay, 1972	3421	Lithic Scatter	Prehistoric	Unknown	
41BX146	Dillehay, 1972	7593	Lithic Scatter	Prehistoric	Unknown	
41BX147	Dillehay, 1972	6156	Lithic Scatter	Prehistoric	Unknown	
41BX148	Dillehay, 1972	21371	Lithic Scatter	Prehistoric	Unknown	
41BX149	Dillehay, 1972	1832	Lithic Scatter	Prehistoric	Unknown	
41BX150	Dillehay, 1972	2871	Lithic Scatter	Prehistoric	Unknown	
41BX151	Dillehay, 1972	8490	Lithic Scatter	Prehistoric	Unknown	
41BX162	Dillehay, 1972	2065	Lithic Scatter	Prehistoric	Unknown	
41BX163	Dillehay, 1972	7824	Lithic Scatter	Prehistoric	Unknown	
41BX164	Dillehay, 1972	2830	Lithic Scatter	Prehistoric	Unknown	
41BX165	Dillehay, 1972	1157	Lithic Scatter	Prehistoric	L. Archaic	
41BX166	Dillehay, 1972	1796	Lithic Scatter	Prehistoric	L. Archaic	
41BX167	Dillehay, 1972	716	Lithic Scatter	Prehistoric	E. Archaic	
41BX168	Dillehay, 1972	5665	Lithic Scatter	Prehistoric	Unknown	
41BX169	Dillehay, 1972	1421	Lithic Scatter	Prehistoric	Unknown	
41BX713	C.K. Chandler	930	Midden	Prehistoric	Unknown	
41BX714	C. K. Chandler	29380	Lithic Scatter	Prehistoric	Unknown	
41BX963	Peter and Hunt, 1992	12801	Lithic Scatter	Prehistoric	E. Archaic	
41BX964	Peter and Hunt, 1992	1324	Lithic Scatter	Prehistoric	Unknown	
41BX965	Peter and Hunt, 1992	6290	Lithic Scatter	Prehistoric	Unknown	
41BX966	Peter and Hunt, 1992	107796	Quarry/ Procurement	Prehistoric	Unknown	
41BX967	Peter and Hunt, 1992	129394	Quarry/ Procurement	Prehistoric	E. Archaic	
41BX968	Peter and Hunt, 1992	27315	Lithic Scatter	Prehistoric	Unknown	
41BX969	Peter and Hunt, 1992	1883	Lithic Scatter	Prehistoric	E. Archaic	

Table 1. continued…

Trinomial	Original Project Records	Estimated Site Area (sq. meters)	Site Type	General Age	Period 1	Period 2
41BX970	Peter and Hunt, 1992	590	Lithic Scatter	Prehistoric	Unknown	
41BX971	Peter and Hunt, 1992	929	Lithic Scatter	Prehistoric	Archiac	
41BX972	Peter and Hunt, 1992	1409	Lithic Scatter	Prehistoric	Archiac	
41BX973	Peter and Hunt, 1992	736	Lithic Scatter	Prehistoric	Unknown	
41BX974	Peter and Hunt, 1992	1405	Lithic Scatter	Prehistoric	Unknown	
41BX975	Peter and Hunt, 1992	11125	Quarry/ Procurement	Prehistoric	Unknown	
41BX976	Peter and Hunt, 1992	4238	Lithic Scatter	Prehistoric	Unknown	
41BX977	Peter and Hunt, 1992	1704	Lithic Scatter	Prehistoric	E. Archaic	
41BX978	Peter and Hunt, 1992	6869	Lithic Scatter	Prehistoric	L. Prehistoric	
41BX1067	Ralph, 1995	1199	Homestead	Historic	n/a	
41BX1068	Ralph, 1995	122	Sinkhole burial	Prehistoric	Unknown	
41BX1206	Ralph, 1996	1226	Lithic Scatter	Prehistoric	Unknown	
41BX1207	Ralph, 1996	115	Sinkhole burial	Prehistoric	Unknown	

which was limited to the southern portion of the canyon, recorded 16 new archaeological sites and relocated and updated 41BX148. Sixteen of the 17 sites discussed by McNatt et al. (2000a, 2000b) contained prehistoric material, and the vast majority of these sites seem to date to the Archaic period. These sites, like those previously documented, were dominated by chipped stone debris. Analysis of lithics from 12 sites within GCSNA suggested early-middle stage reduction (Beceiro et al. 2000:105, Tables 4–5). However, a small sample size (n=200) and the occurrence of most of these on a single site (n=103 from 41BX1195) may not be representative of the range of reduction on sites within that survey. Site 41BX1195 is located at the base of the uplift landform, and at least some of the chert on this site appears to derive from secondary alluvial fan deposits. Of the 17 sites, three (41BX148, 41BX1195, and 41BX1199) were judged to have moderate to high research potential. McNatt et al. (2000a) recommended site 41BX1195 for official designation as a State Archeological Landmark (SAL), and all three sites were determined to be potentially eligible to the National Register of Historic Places (NRHP).

More recently, Weston (2001) conducted eligibility testing at site 41BX1199. A total of 49 shovel tests, and a single 1 x 1-m test unit, were placed within this site. Overall, recovery was low and deposits at this site were shallow. Weston (2001:13) concluded that the site has low research potential.

Summary

Several survey and two testing projects have been conducted within the confines of what is now Government Canyon State Natural Area. At a general level, these studies suggest that shallow sediments dominate the area, and that most sites are manifested on the surface or within the upper 20 to 30 cm of deposits.

The Geo-Marine survey of the northwestern portion of GCSNA, an area that is within the current project area (Peter and Hunt 1992), can serve as a baseline against which to refine the expectations for the current survey. That survey employed a judgment sample with variable inspection intensity using transect intervals of 30 m or greater (Peter and Hunt 1992:24). Areas were characterized as having "high" ground visibility. The results of Geo-Marine's survey were interpreted to suggest that a relatively low density of archaeological sites would be present in other adjacent areas (Peter and Hunt 1992:56).

A review of all data from all projects that fall within the current survey area shows that a total of 52 archaeological sites have been recorded within the northern and central portions of the State Natural Area (Table 1). Only one of these (41BX1067) is a historic site. Overall, these sites are variable in size, with site areas that range from just over 129,000 m^2 to under 1,000 m^2. The average site size is roughly 9,525 m^2, an occupation area corresponding to a circle roughly 110 m in diameter. While two burned rock midden sites, two burial locations, and a single historic site have been recorded in the State Natural Area, the vast majority of the sites consist of scatters of chipped stone. Three of these scatters are identified as quarry or lithic procurement areas, and the remaining locations (n=44) are lithic scatters. The interpretation of some of these sites as procurement locations is based on the presence of chert-bearing deposits in the survey area, rather than any analysis of the materials observed within a site.

Two-thirds of the 51 prehistoric sites lack any temporal designation. No Paleoindian components have been recorded. Most sites with temporal information are Archaic in age, with the Early Archaic (n=6) and Late Archaic (n=7) being the most commonly represented periods. Only a single Middle Archaic occupation was recorded. In addition, only two Late Prehistoric components are present in the survey area.

As noted in Chapter 6 of this report, several aspects of the above characterizations of the survey area proved, in practice, to be of little use. Many areas investigated by CAR exhibited much lower surface visibility than anticipated. In addition, compared to previous surveys, a much higher archaeological site density was discovered, and the recorded sites were, in general, significantly larger. Finally, our survey results suggest that the archaeological record within Government Canyon is complex, with a variety of processes interacting to create the archaeological patterns.

Chapter 4: Research Perspective and Analytical Issues

As noted in Chapter 1, the archaeological survey discussed in this document was conducted in response to a scope of work (SOW) issued by Texas Parks and Wildlife Department (TPW). The SOW called for a pedestrian survey of trail locations in the northern and central portions of Government Canyon, along with an examination of previously recorded sites within the project area. Archaeological sites in the project area were to be inventoried and the significance of the sites assessed for State Archeological Landmark status. These efforts were undertaken in anticipation of opening the State Natural Area to the general public. This chapter outlines the overall research perspective that guided the survey effort.

General Research Perspective

One of the primary cultural resource management tasks identified in the scope of work is assessment of whether archaeological sites identified during the current survey within Government Canyon State Natural Area (GCSNA) may be eligible for official designation as State Archeological Landmarks (SAL). Designation as an SAL depends on an archaeological site meeting at least one of the five SAL criteria for consideration (Rules of Practice and Procedure for the Antiquities Code of Texas, Section 26.8): 1) if a site has the potential to contribute to a better understanding of Texas prehistory or history by providing new information; 2) if a site contains deposits that are preserved and intact; 3) if a site possesses unique or rare attributes concerning Texas prehistory or history; 4) if a site offers unique opportunities to evaluate theories or methods of preservation; or 5) if there is a high likelihood that a site may be subject to relic collecting leading to the destruction of any research potential, it may qualify for SAL designation.

The likelihood of a site contributing new or unique information relevant to understanding local and/or regional prehistory, as well as the likelihood that a site will offer opportunities to evaluate new theories and/or methods, depends on the integrity of the deposits rather than on the questions being asked. In fact, integrity, as a proxy for research potential, is one of the five criteria for SAL status. If cultural or taphonomic processes significantly mix deposits within an archaeological site the research potential of that site can be diminished. Sites excluded from additional considerations often include surface sites as they are subjected to a variety of processes that are not active on buried, sealed deposits. It is this latter class, the sealed, single occupation site, frequently assumed to represent one or a small number of activities (e.g., lithic procurement, campsite) over a limited time frame that is given high integrity ratings and assumed to have high research value.

However, the value of archaeological deposits is dependent on the research questions being asked, not absolute qualities of sites as such. Because archaeological sites possess unique formation histories, they pose individual opportunities for improved knowledge of the past. For example, acidic soils may destroy most direct evidence for subsistence (bone, pollen, phytoliths) but this does not mean that other aspects of ancient behavior cannot be examined. Sites that lack datable materials or temporally distinctive artifacts are not inherently uninteresting, though the data may be applicable to a more narrow range of research issues. The archaeologists' tasks are to identify the research issues appropriate to the available sample. For some questions, sites with high integrity and good preservation may be critical. Other research questions may be able to effectively examine sites that traditionally are viewed as having low integrity. For example, a research goal that requires reconstruction of some class of behaviors during a particular time period would find sites that were repeatedly occupied over thousands of years to have low research value if these occupations cannot be clearly separated. Conversely, single component sites, traditionally viewed as having high integrity and high research potential, are of little use if research questions center on understanding processes of re-occupation or processes of long-term change in the use characteristics of a given location.

In part, the traditional perspective of archaeological research stems from the notion that the archaeological record consists of sites that result from past decisions concerning where to locate camps, where to gather lithic raw materials and food, where to bury the dead, and where to produce stone tools. The goal of the archaeological survey, then, is to discover those sites, describe the patterns, reconstruct the decision process at a general level to form synchronic pictures of adaptation, and, through comparing these synchronic pictures, document changes and investigate reasons for those changes in the decision processes. The view of the archaeological record produced by such a perspective is one of discrete packages of artifacts (sites) that, if they are to have high research potential and contribute to the goal of reconstruction must date to one or a few temporal periods and have a specific, limited role in past settlement systems. Sites that lack temporally diagnostic artifacts, have diagnostic artifacts that reflect more than one component, or have evidence of multiple behavioral themes (e.g., lithic procurement, habitation, etc.) are necessarily less useful in interpretation (e.g., Collins 1995).

Reality is likely to be much more complicated than the picture of the past produced by this traditional perspective. Even under conditions of limited seasonal variability, hunter-gatherer responses to changing resource conditions and availability can be extreme (Kelly 1995:111–160). It is unrealistic to expect simple characterizations of site use across time to capture salient prehistoric strategies of landscape use. It is likely that over the past 11,000 years, various places within Government Canyon were used for a variety of different activities during any particular temporal period. It is likely that the activities were organized differently during different time frames. Locations were potentially reused for a variety of activities at various points in time. The archaeological landscape created is likely to be a complex arrangement of artifacts. The record is formed over thousands of years by both culturally organized behavior and by processes of erosion, deposition, and turbation. It is our perspective that, with sufficient temporal resolution, it is probably the case that all assemblages, including so called "pristine" sites, are mixed by cultural and physical processes. The mere fact that a site is currently subsurface tells us little about the integrity, for all sites were, at one time, on the surface. Many sites considered to be pristine (e.g., Collins et al. 1990) may simply be locations where we are still ignorant of the processes that have altered the record. From our perspective, the goal of archaeology is to understand all those processes that both create the archaeological record and shape our interpretations of that record. These processes include culturally organized behavior, taphonomic processes, methodological decisions, and the conceptual schemes used by archaeologists to interpret the record. We are competent at understanding some of these processes, and there are certainly others that we have not even recognized.

Formation of the Archaeological Record

For a survey project such as this, we see the archaeological record as consisting of artifacts spread at varying densities across the landscape. The archaeological patterns observed and interpreted on any survey can be conceptualized as the result of the intersection of four different spheres, two of which create the record, and two of which sample and interpret the record. The baseline archaeological data are the result of a complex interaction between 1) the history of artifact deposition and feature construction at various places on the landscape and 2) the history of the taphonomic processes that affect those artifacts and features, as well as the landscape itself. That record is then observed by researchers using 3) a conceptual scheme, often implicit, that involves ways to sample that record (e.g., transect spacing) and group the data (site definitions). The resulting database is then 4) interpreted to present a picture of what happened in the past to produce that modern record.

The notion that the surface archaeological record is composed not of sites, but of artifacts, is not common among researchers in the state, or elsewhere. However, several researchers have convincingly argued that the survey record is in fact one of artifacts at varying densities, and that we create sites at a conceptual level (Binford 1992; Camilli 1988; Dunnell 1992; Dunnell and Dancey 1983; Ebert 1992; Larralde 1988). We do not observe sites directly in the record. Certainly, sites, as locations of specific sets of behaviors, did exist in the past. Groups of people did camp at various locations, procure raw materials, and produce artifacts and features. But the idea that the archaeological record is generated at an ethnographic time scale is not realistic. We often conceptualize archaeological sites as reflecting a small slice of time generated by a single group conducting some finite set of activities, analogous to an ethnographic description. However, there is no necessary connection between the sites we define in the present based on arbitrary criteria and those behaviors that existed at any given point in the past. Ethnoarchaeological research has clearly documented that even the best archaeological preservation can produce assemblages and spatial patterning that are ambiguously related to the behaviors responsible for that record (e.g., Yellen 1977:103). On a landscape, many different processes can produce high densities of artifacts. In most cases, archaeological sites are concentrations of artifacts that were deposited across a landscape at different times, at different rates, and in variable contexts.

Once deposited on the landscape, artifacts are subject to a variety of processes minimally including bioturbation, scavenging, erosion, and deposition (e.g., Butzer 1982; Schiffer 1987; Waters 1992; Wood and Johnson 1978). From a strict site behavioral position, all of these processes distort the archaeological record. From the current perspective, these processes form the record that we see, and, as such, they require investigation. The archaeological record is a current phenomenon, not a fossilized or distorted picture of the past. For this survey, we view sites as arbitrarily defined locations of higher density concentrations of artifacts. We wish to understand how they came to be in the position and configuration that we observed.

Observing and Interpreting the Record

Once formed, archaeologists observe the record using a number of conventions. These include defining what constitutes a site. The definition of a site used on the current survey is arbitrary, as are all such definitions. Changing these arbitrary definitions can change the number, distribution, size, and temporal affiliation of sites within a project (see Mauldin et al. 1999; O'Leary et al. 1997). The situation is analogous to the use of Minimum Number of Individuals (MNI) in faunal analysis (see Grayson 1984). That is, decisions that archaeologists make in terms of analytical units, in this case what constitutes a site, greatly impacts not only the number of sites but also the interpretation. Archaeologists, themselves, commonly structure the archaeological record simply by deciding what is, and is not, a site (O'Leary et al. 1997).

Once described, patterns must be interpreted. For cultural behavior, our own interpretive scheme comes, in part, from the theoretical background that can be most effectively classified as cultural ecology. We view cultural systems as adaptive and differentiated. By adaptive we mean that cultural systems are continually responding to changes in the natural and social realms, including changes that are a product of their own actions. Of particular concern in this regard are the strategies and tactics used to acquire food, fuel, and raw material resources from the environment. By differentiated, we mean that different activities are conducted at different times and places depending on specific circumstance. The activities conducted at a location may vary considerably depending on a variety of specific circumstances, and the material remains left by those activities at a location will also vary. Consequently, individuals operating within the same cultural system may generate radically different material cultural remains.

Under this position, changes in cultural systems are the result of changing parameters in the natural and social environments. Currently, our understanding of the mechanisms of social change are not as well developed as our understanding of the impact of changes in the natural realm. Especially critical in the latter arena are strategies and tactics of energy capture, including technology, mobility, and settlement strategies used in resource acquisition. It is where cultural systems interact with the natural environment that extant adaptive strategies are molded and modified. Our ability to see and understand cultural strategies is most productively initiated in examination of interactions at this cultural and natural interface.

The implications of this overall research conception of the archaeological record are important. The implications range from ways that survey is conducted through analytical and interpretive decisions. In an ideal world, an archaeological survey such as this would be conducted with transect spacing that insured 100 percent of the ground surface would be observed, perhaps on the order of two to five meters in certain ground cover. All artifacts would be described and point provenienced, allowing the grouping of artifacts at a variety of different spatial scales, and subsurface testing would be systematic and at a high density. The actual constraints of the project in terms of time and money make such a complete description of the record impossible. Consequently, we attempted to balance our overall research concerns with the needs of TPW for management data.

Given these considerations, there are several fundamental data needs that, in the context of the current survey, guided the data collection and analysis (see Chapter 5). These included providing information to TPW regarding traditional concerns such as the location of archaeological sites, the integrity of archaeological deposits, and their chronological placement. In addition, we wanted to document some aspects of the technologies represented, and consider how they implicate activities at different locations. In the course of accomplishing these goals, we are constantly concerned with learning not only how prehistoric populations used Government Canyon, but also how our conceptual schemes and analytic decisions influence the patterns that we observe.

Research Issues

This brief section outlines criteria for identifying sites in GCSNA that have the potential to contribute to our understanding of local and/or regional prehistory. The likelihood of a site to contribute knowledge in terms of either of these two areas depends on the integrity of the deposits as well as the questions being asked.

Because one goal of the archaeological survey of GCSNA is to determine the SAL eligibility of sites identified and revisited during this archaeological survey, three issues specifically related to eligibility determination are given priority. These issues concern, at a broad scale, site chronology, subsistence strategies, and technological organization. A more detailed discussion of the manner in which each of the GCSNA sites recommended for further work can contribute to each of these research domains is presented in Chapter 7.

Chronology

To identify the age and chronological range of the deposits contained at a site, datable materials and temporal diagnostic artifacts in consistent vertical and primary associational contexts will be necessary. However, temporally diagnostic artifacts in disturbed contexts or on deflated surfaces can provide at least an indication of the time periods represented at sites. While their utility in identifying associated artifact assemblages may be questioned, the assumption that a projectile point provides a date for associated artifacts is always open to question, whether one is dealing with buried or surface components. Nonetheless, knowing even broad information on periods of occupation is valuable for reconstructing long-term hunter-gatherer land-use strategies at a regional scale.

Features can provide an additional source of chronometric information that is certainly more reliable than projectile points. The presence of charcoal in a feature, allowing for the potential of radiocarbon dating, can provide chronological control for feature use.

Subsistence

The identification of features offers additional opportunities for archaeological analyses and interpretation. Relatively undisturbed features may provide a variety of remains critical to subsistence reconstruction, (e.g., charred nuts, seeds, bone). Features also provide evidence of past environments (e.g., wood species used for fuel, prehistoric faunal assemblages present in a region), and offer clues about feature use parameters (e.g., amount and kinds of fuels used). Even if other cultural deposits are disturbed, feature contexts can provide important information on subsistence and food processing practices through analyses of feature morphology, associated artifacts, macrobotanical remains, pollen, phytoliths, faunal remains, and spatial patterning of artifacts around features. Excavation of identifiable hearth features can provide reference points for understanding other more complex or partially disturbed archaeological remains.

Technological Organization

As will be discussed in Chapter 6, many of the sites in GCSNA lack conventional qualities of good preservation or buried deposits that are relatively intact. The Balcones uplands are a dynamic landscape subject to erosion and potentially significant movement of artifacts. Sites lacking fine-grained preservation or easily separable assemblages still can be investigated to advance archaeological understanding. Several aspects of the sites within the project area can provide significant information on technological organization, including the organization of lithic procurement and reduction at a regional scale, frequency and character of re-occupation, and lithic raw material exploitation.

Summary

Assessment of the information from the trail survey in GCSNA presents unique challenges. During the course of the fieldwork, it became apparent that both the density and size of the sites were much greater than anticipated. As demonstrated in Chapter 6, although the size of many of these sites indicates significant prehistoric use of this portion of Government Canyon, subsurface deposits are sparse on most of these sites. Several previous researchers have indicated that such sites possess little research potential because of the lack of buried artifacts (Peter and Hunt 1992:53–54, 57; McNatt et al. 2000b:67–73). The most important criteria used to infer that these sites lack research significance is that the majority of identified artifacts are found on the current ground surface, the dearth of buried archaeological deposits, and the inferred difficulty in assigning secure or discrete temporal assignments to these archaeological sites.

Although many archaeological investigations seek sites that possess buried deposits that are considered to be relatively undisturbed and possess clear temporal indicators, this hardly exhausts the kinds of sites that can produce significant archaeological information. If one goal of archaeological inquiry is to study significant aspects of cultural variability and processes in the past (Black 1989b:35), then identification of the potential to address creative issues from sites can be independent of prior notions of what information may be contained in sites. Only if archaeology already understood those processes could the identification of site research value be a facile exercise of recognition. Many sites that lacked qualities that standard expectations of integrity would have identified as high potential have produced critical research that significantly advanced archaeological knowledge. For example, the Paleoindian site of Stewart's Cattle Guard (Jodry and Stanford 1992) and the Garnsey Bison Site (Speth 1978, 1980, 1983) were both considered degraded assemblages lacking ideal integrity. Each provided a unique opportunity to take advantage of several aspects of that particular record to contribute significant research.

Chapter 5: Survey and Recording Methods

The purpose of the project was to conduct a systematic, 100 percent pedestrian survey of trail locations in the northern and central areas of Government Canyon State Natural Area. In addition, all previously recorded sites in the central and northern sections were to be relocated, and additional information was to be collected on these sites. The overall management goals of the project, were to provide TPW three types of information: 1) an inventory of sites intersected by trail locations; 2) additional information on known sites outside of the trails; and 3) data that could be used to either recommend, or not recommend, sites for State Archeological Landmark designation. In order to accomplish these goals, three separate phases of fieldwork were initiated and a series of laboratory and analytical procedures were used. This chapter outlines the field, laboratory, and analytical procedures used on this project.

Field Methods

The fieldwork consisted of three phases. The initial phase consisted of the survey of the trails. The second phase consisted of revisiting sites defined during the initial investigation. The final phase of the research focused on revisiting a number of previously recorded sites not encountered during the trail survey. Each of these phases is described below.

Phase 1: Pedestrian Survey of Trails

The survey was designed to sample areas within and adjacent proposed hiking and bicycling recreation trails. The survey covered a corridor approximately 60 m wide centered on each trail. Most of the survey trails had previously been marked, or were designated during the project, by TPW personnel. Several trails were unmarked but readily apparent. A few trails were very difficult to identify in the dense brush. Trail identification was a significant, unanticipated task in some areas of GCSNA. Three professional archaeologists from CAR formed the survey team. One individual walked the established or proposed trail, and two crew members were responsible for surveying both sides of those trails. Survey crew away from the trail maintained a distance of approximately 15 to 20 m from the trail. Because of the dense vegetation in most of GCSNA, transect intervals between individuals were maintained by verbal contact and compass orienteering.

Ground surface visibility in forested areas within GCSNA is often poor. Dense shrubs and short trees provide significant amounts of litter that is up to 3 cm thick in places. Nevertheless, there are many eroded surfaces within the survey corridor, and limestone bedrock is exposed in many areas of Government Canyon. Consequently, systematic shovel testing was a necessary component of this discovery phase of the project. Minimally, the trail almost always represented a corridor of excellent surface visibility approximately 30–50 cm wide.

Shovel test excavations were placed at intervals of approximately 100 m. Shovel tests were excavated on alternate sides of the trail at each interval. Some modifications to this method were necessary as conditions merited. If a sample location contained only exposed bedrock or very thin soil (5 cm or less) an alternate location was sought within approximately 5–10 m of that selected spot along the transect travel direction (either ahead or behind the designated interval location). If no appropriate soil was located on the side of the trail designated for sampling at that interval, a shovel test was selected on the opposite side of the trail. If both sides of the trail were on exposed bedrock or very thin soils (5 cm or less), the shovel test location was not sampled. A sequential shovel test number was assigned to unexcavated shovel tests. This strategy permits the identification of areas with exposed bedrock or soils that were considered too thin for testing. This information is in turn critical for identifying localities affected by erosion and potentially deflated archaeological contexts.

The survey consisted of pedestrian examination of the ground surface along transects and excavation of shovel tests at established intervals. A GPS reading was made on the location of most shovel tests using a hand-held Trimble Geo Explorer II GPS unit. However, GPS information could not be collected on all units, primarily as a result of limited satellite coverage in deeper canyons. A compass orientation and measuring tape distance was collected for these units from the trail 100-m interval position to the shovel test.

Shovel tests were 30 x 30-cm units excavated in 10-cm levels. All soil was screened through ¼-inch hardware cloth and all potential cultural artifacts were returned to the laboratory for analysis. Only lithics and possible fire-cracked rock (FCR) were collected. Some animal bone was encountered and it was returned to the laboratory. However, judging from the lack of weathering and leaching on their surfaces, most bone is probably quite recent.

A standard recording form was completed for each shovel test. These forms collected information on soil color, texture, consistence, bedrock depth, artifacts recovered, and other observations made by excavators. Some shovel test units, representative of specific settings or a given site, were profiled. The redundancy in the subsurface profile made drawings of each unit unnecessary. The depth to bedrock and whether bedrock was encountered as a scoured or weathered unit was the most critical variation in shovel tests.

Identification of sites was based on the presence of five or more artifacts within 30 m of each other. Artifact densities always exceeded this arbitrary minimal threshold. Shovel test results and surface artifacts were both considered in the evaluation of artifact distributions.

The trail survey covered a distance of approximately 41.52 km (25.8 miles). Table 2 presents CAR's trail designations, TPW's trail names, and the total length of each trail. A total of 290 shovel tests was excavated in the trail portion of the survey. At 104 locations along the trails, no sediments were present, and consequently no shovel tests were excavated. These locations, however, were recorded so that a total of 394 shovel test numbers was assigned during the survey.

Table 2. Trail designations and trail lengths

CAR Trail Numbers	TPW Trail Names	Trail Length (m)
Trail 1	Far Reaches Trail	3,557
Trail 3	Comanche Cut	3,008
Trail 5	Johnston Road	8,211
Trail 6	Wildcat Canyon Trail	2,530
Trail 5a	Not Named	207
Trail 7	Twin Oaks Trail	4,155
Trail 8	Little Windmill Trail	2,729
Trail 9	Not Named	1,896
Trail 10	211 Single Trail	3,850
Trail 11	Overlook Trail	1,569
Trail 12	Cave Creek Trail	4,699
Trail 13	Not Named	722
Trail 14	Not Named	2,078
Trail 14a	Not Named	252
Trail 14b	Not Named	395
Trail 15	Laurel Canyon Trail	1,658
TOTAL		**41,516**

Phase 2: Site Recording Methods

Site recording was performed after the survey and shovel testing along all existing and identified trails. Some trail locations remained unmarked by TPW at the conclusion of survey of all the specified trails. TPW and CAR personnel later marked these trails and completed the survey. Site recording involved returning to the locations of artifact distributions identified during survey. During an intensive ground examination, CAR used single-ply toilet paper to mark the apparent boundaries of sites. Following determination of site boundaries, the boundaries were walked by one crew member with a hand-held GPS unit. If additional shovel tests were considered necessary, they were excavated in areas of the site with sufficient soil for testing, within artifact clusters, or in areas that were thought to contain features. Shovel test excavations were performed identically to those during survey. A datum stake was placed on every site, out of sight of the trail. An aluminum tag was attached to each datum stake that identified the field site number, the date of visitation, and that CAR had performed this work. The datum position was recorded with a GPS unit.

Field site numbers were assigned sequentially during fieldwork. Subsequent examination of adjacent trails occasionally identified distributions that were part of nearby sites that had previously been identified by the survey crew. This difference in boundaries is attributable to several factors. Survey and site recording occurred across nine months of fieldwork. Seasonal and climate changes resulted in differential visibility of artifacts during the summer, fall, and winter. Many of the artifact distributions at GCSNA are very large. Seven sites are greater than 100,000 m^2 and two of those exceed 500,000 m^2. This clearly suggests that multiple occupational events are responsible for the very large artifact distributions encountered at GCSNA.

Additional information on each site was recorded on a standard site recording form that included a description of the site geomorphic setting, vegetation, percentage of ground surface visibility, amount of bedrock exposed on the site surface, and kinds and extent of disturbance. The presence or absence of lithic debitage, tools, FCR, and historic artifacts was recorded. Estimations of the total number of artifacts on the site and the presence of artifact clusters were noted. A quantified observation of the number of large flakes, cores, and total items was made along the trail segment contained within the site. If such segments were very long, a specified length of trail was examined for this transect inventory. The presence of any formal tools or features and additional pertinent information about the site also was recorded. A field map was drawn for many sites to complement the GPS map. Although the GPS map provides accurate data on site boundaries and artifact placement, some additional features of sites could be quickly identified in relation to topography or known components of each site that would have been too time consuming to record by the GPS units.

All formal tools were mapped using the GPS units and were collected. Some bifaces or cores also were collected. Such implements within the trails were always collected because it was anticipated that they would represent highly visible site indicators to future visitors. Some non-diagnostic tools away from trail areas were also collected. Almost all non-diagnostic artifacts not within the immediate vicinity of the trail were left *in situ*. Any artifact that could not have a GPS location recorded was referenced to a known point (datum, artifact, or shovel test) with a GPS location through compass and measuring tape, or compass and pace mapping.

During recording, the presence of possible flake tools was noted on several sites. These were recorded on the site description forms as utilized flakes, unifaces, or retouched flakes. Some of these possible implements were collected.

Seventy-one sites were recorded during the trail survey including 34 previously recorded sites. An additional 182 shovel tests were excavated within or near sites during the trail survey.

Phase 3: Revisitation of Previously Identified Archaeological Sites

There were 52 previously recorded sites within the central and northern sections of the GCSNA that CAR was requested to relocate and update. One historic nineteenth-century homestead, the Christian and Emilie Zizelmann house (41BX1067), had been previously recorded. Only minimal additional architectural mapping efforts were performed at the Zizelmann house during the current project. Thirty-four of the 52 previously recorded sites are within the trail boundaries and had been recorded during the trail survey. Consequently, twenty sites were slated for relocation. These sites are listed in Table 3.

Table 3. Disposition of revisited sites not associated with trails

Trinomial	Relocated	Comments
41BX136	yes	combined with 41BX976
41BX137	yes	
41BX139	yes	
41BX148	yes	
41BX149	yes	
41BX150	yes	
41BX151	yes	
41BX164	yes	
41BX165	yes	
41BX166	yes	
41BX167	yes	
41BX169	yes	nothing observed
41BX714	yes	
41BX973	yes	combined with 41BX978
41BX974	yes	
41BX976	yes	combined with 41BX136
41BX977	yes	
41BX978	yes	combined with 41BX973
41BX1068	yes	nothing observed
41BX1207	yes	nothing observed

Relocation of the twenty sites (Table 3) was accomplished through both the use of maps and the waypoint feature in the Geo-Explorer II. Seventeen of the 20 sites were relocated and additional information collected. Of the three sites that were not relocated (41BX169, 41BX1068, and 41BX1207), the locations of sites 41BX1068 and 41BX1207 were visited, however, the survey crew could not confirm the presence of archaeological sites at the locations. Both of these sites are sinkholes that held partial human burials. They have apparently been capped with concrete and camouflaged. Subsequent organic deposition has made their specific identification difficult. The location for 41BX169 was revisited, but no material was observed.

Relocation activities at a given site were comparable to the activities described for the site recording methods discussed above. In several cases, the revisits resulted in the combination of smaller, previously recorded sites into a single, larger site. These are identified in the "comments" field of Table 3. Forty-three shovel tests were excavated in association with the relocation efforts.

Laboratory Methods

On returning from the field, all artifacts recovered from the survey were washed and inventoried and cataloged. Many of the items collected during shovel testing were, once cleaned, deemed not to be artifacts and were discarded. This was especially the case with items originally recorded as fire-cracked rock. After this initial sort, all lithic artifacts were sorted into major categories (e.g., debitage, projectile points, fire-cracked rock). When possible, projectile points were assigned to types. The length, width, and maximum thickness, along with the presence/absence of cortex, was recorded on all bifaces. All other tools were counted and described. All debitage and fire-cracked rock were counted.

All artifacts for this project, along with all notes, site forms, shovel test forms, and photographs, were prepared for curation in accordance with federal regulation 36 CFR part 79. In addition, all GPS data files have been differentially corrected and imported into ArchView GIS, version 3.3. A copy of these files were furnished to TPW.

Chapter 6: Survey Results

This chapter presents general information on the survey results. The goal of this chapter is to provide an overview of the survey. Detailed site descriptions for each of the 86 sites, including individual site maps, are provided in Appendix A, Volume 2. The current chapter consists of six sections. The initial section presents information on site density and overall site size. Section two discusses the character of these sites, including information on site type and depth of deposits. The third section presents details of the chronology, while section four considers aspects of the overall occupation within the project area. The fifth section presents a short summary of isolated finds, and the sixth section provides a summary of the chapter.

As outlined in the previous chapter, the fieldwork conducted for the Government Canyon Survey consisted of both an investigation of just over 25 miles of trails and relocation of previously identified sites within the project area. Table 4 lists all 86 sites, along with summary information on each site, including site size, temporal placement, number of components, distance from the site boundary to the nearest drainage, an estimate of the proportion of each site that has some amount of identifiable disturbance from natural erosion or recent human activities, and an ordinal ranking of the estimated number of surface artifacts. In addition, presence/absence data for various types of artifacts are noted (0 or 1), along with the total number of artifact categories represented on a site. Finally, the number of shovel tests, the number of positive shovel tests, and the percentage of shovel tests that were positive are provided for each site. Note that only shovel tests that fall within the site boundaries are included in this total, and shovel test numbers assigned to those that were not excavated due to lack of soil also are not counted.

Site Density and Site Size

The total area systematically surveyed, identified in Figure 12, is approximately 6.47 km^2 (1,599 acres). This area includes both the 60-m corridor centered along all trails, as well as a 30-m buffer around all sites.

Within this 6.47 km^2 area, a total of 86 sites, covering an overall area of roughly 4.003 square kilometers, was identified. Site density is roughly 13.29 sites per square kilometer, or .054 sites per acre. Roughly 61.9 percent of the surveyed area is within the boundary of an archaeological site. While the latter figure is somewhat inflated by the inclusion of the relocation effort in the overall site area, the density of archaeological material is still high. For comparison, McNatt et al. (2000a) reported an overall density of 5.79 archaeological sites per square kilometer (.023 sites per acre) in the southern survey area, and roughly 32 percent of the survey area was within site boundaries. The survey of 450 acres of "high probability" within the current survey area produced 17 sites (Peter and Hunt 1992), a density of .038 sites per acre.

Clearly, the site density within the current project exceeded expectations derived from these earlier surveys. While definitions of what constitutes a site certainly impact these figures, comparisons with recent CAR projects, using the same basic site definitions, suggest that the Government Canyon density is indeed high. Mauldin and Nickels (2001) report a site density of .0187 sites per acre for a large survey near San Angelo, and Tomka et al. (2001) report a site density of .021 sites per acre for a moderately-sized survey in Lamar County.

Table 4 shows that sites in the current project area are large. The average site size is 46,543 m^2, an area equivalent to a circle with a diameter of roughly 243 meters. The median site size, however, is only 8,008 m^2, and reference to Table 4 will show that two sites, 41BX1491 and 41BX963, are inflating the average site size. 41BX1491 is roughly three-fourths of a square kilometer in size, and 41BX963 is over 1 km^2 in area. While removing these two cases does reduce the average site size to 25,453 m^2, that size is still substantial when compared to earlier survey results. Reference to Table 1 (Chapter 3) demonstrates that the average site size for the 52 previously recorded sites is 9,527 m^2, and only 3.8 percent of the 52 sites are larger than 100,000 m^2. In contrast, 11.6 percent of the current 86 sites are larger than 100,000 m^2.

Site Characteristics

It is a common practice within the state to assign sites to descriptive types based on some attribute of a site. These types can be either descriptive, for example "lithic scatter," or quasi-functional, such as "lithic procurement/quarry site." A quick review of the criteria used in the classification suggests that the presence of a burned rock midden is sufficient to classify the site as a "burned rock midden" site, while the presence of hearths or fire-cracked rock in

Table 4. Chronometric placement, site observations, and shovel testing information for recorded sites

		Chronometric Information							**Site Level Data**													**Shovel Test Data**		
Site Number (41BX___)	Area (m^2)	Late Prehistoric	Late Archaic 2	Late Archaic 1	Middle Archaic	Early Archaic	Paleoindian	Number of Components	Distance to Drainage (m)	Estimated Disturbance (%)	Number of Artifacts	Cores Present	Early Bifaces Present	Late Bifaces Present	Fire-cracked rock present	Utilized Flakes Present	Unifaces Present	Projectile Points Present	Other items	Total Number of Catagories	Shovel tests in site	Positive Shovel Tests	Percent Positive
130	30116	0	0	0	0	0	0	0	21	75	3	1	1	1	1	1	1	0	0	6	5	4	0.80
132	24958	0	0	0	1	0	0	1	4	95	3	1	0	1	1	1	0	1	0	5	5	4	0.80
133	82426	1	1	1	0	1	0	4	10	60	5	1	1	1	1	1	1	1	0	7	16	13	0.81
134	45997	0	1	0	1	1	0	3	4	60	5	1	1	1	1	1	1	1	1	8	16	13	0.81
135	2419	0	0	0	0	0	0	0	4	60	3	1	1	1	1	1	1	0	0	6	3	1	0.33
136	8281	0	0	0	0	0	0	0	0	70	2	1	1	1	1	1	0	1	0	6	3	1	0.33
137	1458	0	0	0	1	0	0	1	0	60	2	1	1	1	1	0	0	1	0	5	2	2	1.00
138	5060	0	1	0	0	0	0	1	53	10	4	1	1	1	1	1	1	1	0	7	4	3	0.75
139	34292	0	0	1	0	1	0	2	15	70	4	1	1	1	1	1	0	1	0	6	4	3	0.75
140	38837	1	1	1	0	1	0	4	25	50	6	1	1	1	1	1	1	1	0	7	9	6	0.67
141	173496	1	1	1	1	1	0	5	10	60	6	1	1	1	1	1	1	1	0	7	15	10	0.67
142	48966	0	1	1	0	0	0	2	15	50	6	1	1	1	1	1	1	1	0	7	8	8	1.00
145	7425	0	0	0	0	1	0	1	23	80	3	0	0	1	1	1	1	1	0	5	3	1	0.33
146	20766	0	0	0	0	0	0	0	15	60	3	1	1	1	1	1	1	1	0	7	7	5	0.71
147	6603	0	0	0	0	0	0	0	5	70	3	1	1	1	1	0	0	0	0	4	3	2	0.67
148	52708	0	0	0	0	0	0	0	0	100	1	0	0	0	0	0	0	0	0	0	11	10	0.91
149	5645	0	0	0	0	0	0	0	21	70	3	0	1	0	1	1	1	0	0	4	3	3	1.00
150	4223	0	0	0	0	0	0	0	15	80	2	1	1	1	1	0	0	0	0	4	2	2	1.00
151	17373	0	0	0	0	0	0	0	95	100	3	1	0	0	1	0	0	0	0	2	2	2	1.00
162	4616	0	0	0	0	0	0	0	7	70	4	1	1	1	1	0	0	0	0	4	2	1	0.50
163	114463	0	0	0	0	0	1	1	0	70	6	1	1	1	1	1	1	1	0	7	17	10	0.59
164	20560	0	0	0	0	0	0	0	0	75	3	1	1	1	1	1	1	1	0	7	7	4	0.57
165	5054	0	0	0	0	0	0	0	5	90	2	1	1	0	1	0	0	0	0	3	2	2	1.00
166	461	0	0	0	0	0	0	0	15	75	1	0	1	1	0	0	0	0	0	2	2	1	0.50
167	515	0	0	0	0	0	0	0	0	100	1	1	0	0	0	0	0	0	0	1	2	0	0.00
168	4552	0	0	0	0	0	0	0	0	50	4	1	1	1	1	1	1	0	1	7	4	3	0.75
713	37712	0	1	0	0	0	0	1	25	50	3	1	1	1	1	1	1	1	0	7	6	6	1.00
714	110635	0	0	0	0	0	0	0	151	70	6	1	1	0	1	0	1	0	0	4	5	4	0.80
963	1109127	0	0	1	0	0	0	1	0	30	6	1	1	1	1	1	1	1	0	7	36	15	0.42

Table 4. continued…

		Chronometric Information							**Site Level Data**													**Shovel Test Data**		
Site Number (41BX___)	Area (m^2)	Late Prehistoric	Late Archaic 2	Late Archaic 1	Middle Archaic	Early Archaic	Paleoindian	Number of Components	Distance to Drainage (m)	Estimated Disturbance (%)	Number of Artifacts	Cores Present	Early Bifaces Present	Late Bifaces Present	Fire-cracked rock present	Utilized Flakes Present	Unifaces Present	Projectile Points Present	Other items	Total Number of Catagories	Shovel tests in site	Positive Shovel Tests	Percent Positive
964	7558	0	0	0	0	0	0	0	47	90	3	1	1	0	1	0	0	0	0	3	1	1	1.00
973	24905	0	0	1	0	0	0	1	0	80	4	1	1	1	1	1	0	1	0	6	5	3	0.60
974	1054	0	0	0	0	0	0	0	0	80	2	1	0	0	0	1	0	1	0	3	2	2	1.00
977	2386	0	0	0	0	0	0	0	20	50	3	1	1	1	1	1	0	0	0	5	3	3	1.00
1190	11997	0	0	0	0	1	0	1	71	90	4	1	1	1	0	0	1	1	0	5	1	1	1.00
1482	3437	0	0	0	0	0	0	0	232	90	2	1	0	1	0	0	0	0	0	2	1	0	0.00
1483	5609	0	0	0	0	0	0	0	212	80	3	1	0	1	1	0	0	0	0	3	2	2	1.00
1484	12534	0	0	0	0	0	0	0	132	80	2	1	1	0	0	0	0	0	0	2	3	1	0.33
1485	93583	0	0	0	0	0	0	0	142	70	6	1	1	0	0	1	1	0	0	4	11	9	0.82
1486	5754	0	0	0	0	0	0	0	222	85	1	1	0	1	0	0	0	0	0	2	1	1	1.00
1487	23096	0	0	0	0	0	0	0	175	85	5	1	1	1	0	0	0	1	0	4	5	4	0.80
1488	37715	0	0	0	1	0	0	1	317	60	5	1	1	1	1	0	0	1	0	5	6	4	0.67
1489	1867	0	0	0	0	0	0	0	758	90	1	1	1	0	0	0	0	0	0	2	1	1	1.00
1490	8948	0	0	0	0	0	0	0	510	80	4	1	1	0	1	0	0	0	0	3	4	1	0.25
1491	755558	0	1	0	1	0	0	2	50	60	6	1	1	1	1	1	1	1	1	8	48	24	0.50
1492	8698	0	0	1	0	0	0	1	0	80	3	1	1	1	1	1	0	1	0	6	2	1	0.50
1493	8030	0	0	0	1	1	0	2	263	70	2	1	0	1	1	0	0	1	0	4	2	1	0.50
1494	16103	0	0	0	0	0	0	0	152	80	4	1	1	1	1	0	0	0	1	5	1	1	1.00
1495	5098	0	0	0	0	0	0	0	56	90	2	1	1	0	0	0	0	0	0	2	1	0	0.00
1496	12522	0	0	0	0	0	1	1	1	80	3	1	1	1	1	0	0	1	0	5	4	4	1.00
1497	1816	0	0	0	0	0	0	0	7	80	2	0	0	1	1	1	0	1	0	4	2	2	1.00
1498	784	0	0	0	0	0	0	0	0	80	2	1	1	0	1	0	0	0	0	3	1	0	0.00
1499	1432	0	0	0	0	0	0	0	0	70	2	1	1	1	1	0	0	1	0	5	2	2	1.00
1500	155696	0	1	1	0	0	0	2	23	60	6	1	1	1	1	1	1	1	0	7	24	13	0.54
1501	304	0	0	0	0	0	0	0	72	80	2	0	1	1	1	0	0	0	0	3	1	1	1.00
1502	162258	0	0	0	0	0	0	0	343	70	5	1	1	1	1	0	1	1	0	6	8	3	0.38
1503	3356	0	1	0	0	0	0	1	387	100	1	1	0	1	0	1	1	1	0	5	0	0	0.00
1504	1298	0	0	0	0	0	0	0	331	100	1	0	1	0	0	0	0	1	0	2	0	0	0.00
1505	18382	0	0	0	0	0	0	0	72	80	4	1	0	0	1	0	0	0	0	2	2	2	1.00

Table 4. continued…

		Chronometric Information							Site Level Data												Shovel Test Data		
Site Number (41BX___)	Area (m^2)	Late Prehistoric	Late Archaic 2	Late Archaic 1	Middle Archaic	Early Archaic	Paleoindian	Number of Components	Distance to Drainage (m)	Estimated Disturbance (%)	Number of Artifacts	Cores Present	Early Bifaces Present	Late Bifaces Present	Fire-cracked rock present	Utilized Flakes Present	Unifaces Present	Projectile Points Present	Other items	Total Number of Catagories	Shovel tests in site	Positive Shovel Tests	Percent Positive
1506	599	0	1	0	1	0	0	2	0	100	1	0	0	1	1	0	0	1	0	3	0	0	0.00
1507	17253	0	0	1	0	0	0	1	492	90	2	1	0	1	0	0	0	1	0	3	1	0	0.00
1508	2313	0	0	0	0	0	0	0	231	90	1	1	1	0	0	0	0	0	0	2	1	0	0.00
1509	50443	0	0	0	1	0	0	1	140	80	5	1	1	1	1	1	0	1	0	6	5	1	0.20
1510	1962	0	0	0	0	0	0	0	14	10	1	0	0	0	0	0	0	1	0	1	2	1	0.50
1511	7988	0	0	0	0	0	0	0	45	100	2	1	0	1	1	0	0	0	0	3	3	1	0.33
1512	2638	0	0	0	0	0	0	0	228	100	2	1	0	0	0	0	0	0	0	1	0	0	0.00
1513	27030	0	0	0	0	1	0	1	360	80	3	1	1	1	1	1	1	1	0	7	5	3	0.60
1514	1232	0	0	0	0	0	0	0	394	100	1	1	0	0	0	0	0	0	0	1	0	0	0.00
1515	4312	0	0	0	0	0	0	0	9	70	2	1	1	0	1	0	0	0	0	3	4	2	0.50
1516	2077	0	0	0	0	0	0	0	125	100	2	1	1	0	0	0	0	0	0	2	0	0	0.00
1517	6799	0	0	0	0	0	0	0	23	100	3	0	0	1	1	0	0	1	0	3	1	0	0.00
1518	1266	0	0	0	0	0	0	0	27	100	2	1	1	0	0	0	0	0	0	2	0	0	0.00
1519	7105	0	0	0	0	0	0	0	120	90	5	1	1	0	1	0	0	0	0	3	1	1	1.00
1520	146510	0	0	0	0	1	0	1	68	70	6	1	1	1	1	1	1	1	0	7	6	6	1.00
1521	4207	0	0	0	0	0	0	0	274	80	3	1	0	0	0	0	0	0	0	1	2	1	0.50
1522	1688	0	1	0	0	0	0	1	151	100	2	1	0	0	1	0	0	1	0	3	0	0	0.00
1523	15627	0	0	0	0	0	0	0	137	95	2	1	1	1	1	1	1	0	0	6	1	1	1.00
1524	8029	0	0	0	0	0	0	0	145	90	3	1	1	0	1	0	0	0	0	3	0	0	0.00
1525	7325	0	0	0	0	0	0	0	197	95	3	1	1	1	0	1	1	0	0	5	0	0	0.00
1526	2591	0	0	0	0	0	0	0	384	90	1	0	1	0	1	0	0	0	0	2	1	1	1.00
1527	101037	0	0	0	0	1	0	1	42	70	6	1	1	1	1	1	1	1	0	7	5	3	0.60
1528	114096	0	0	0	0	0	0	0	146	70	6	1	1	0	1	1	1	0	0	5	6	5	0.83
1529	9473	0	0	0	0	0	0	0	145	80	3	1	1	1	1	1	1	0	0	6	1	1	1.00
1530	19448	0	0	0	0	0	0	0	332	80	2	1	1	1	1	1	1	0	0	6	4	3	0.75
1531	13742	0	0	0	0	0	0	0	371	60	3	1	1	1	1	1	1	1	0	7	4	4	1.00
1532	6871	0	0	0	0	0	0	0	95	95	1	1	0	0	1	0	0	0	0	2	3	2	0.67
1533	8522	0	0	1	0	0	0	1	23	75	3	1	1	1	1	1	1	1	0	7	3	2	0.67

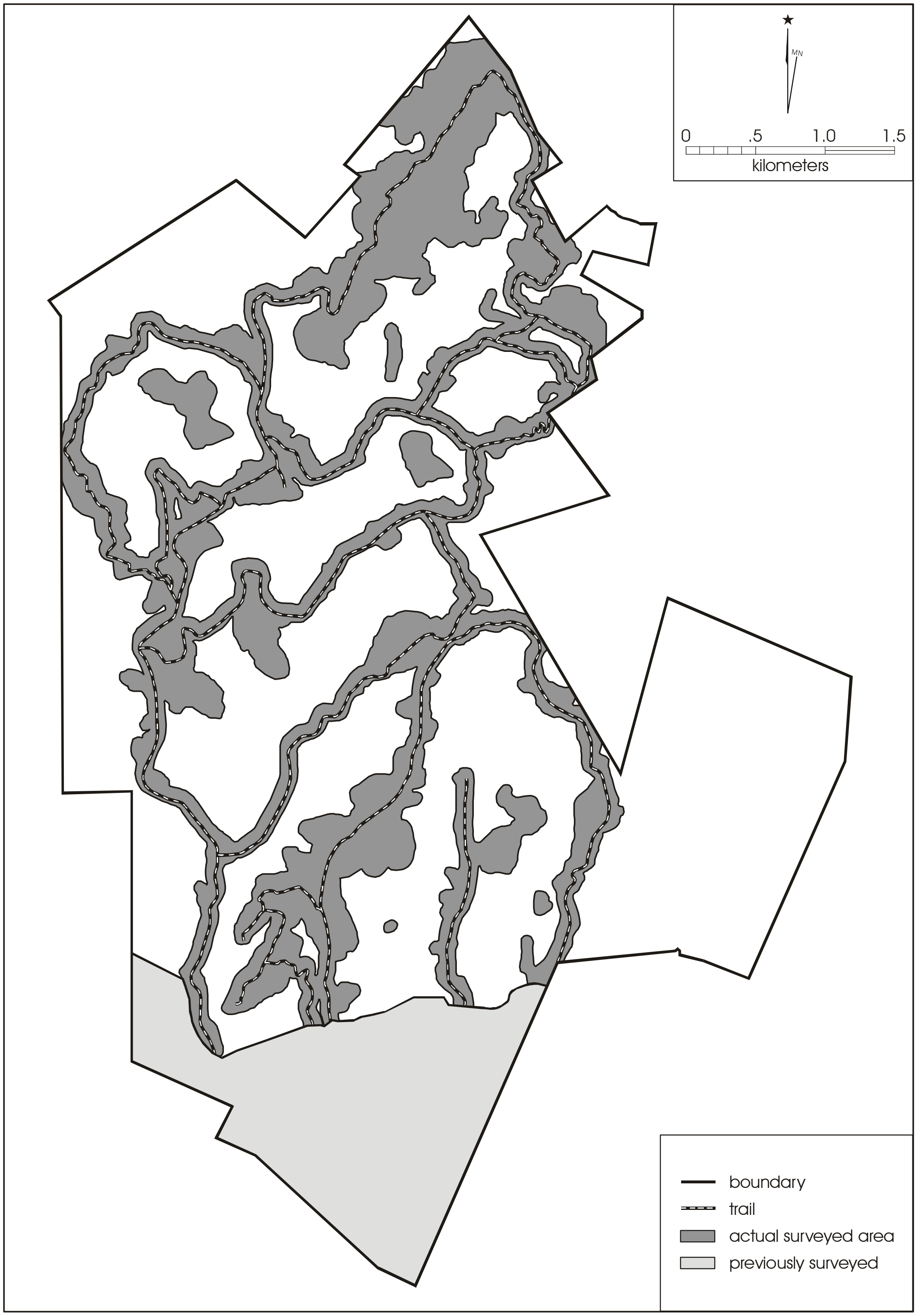

Figure 12. *Approximate survey area.*

association with chipped stone qualifies the location as a "campsite." The absence of features in the presence of lithic debris seems to define the "lithic scatter" category, while cores and early stage bifaces in situations where lithic raw materials are plentiful and features are not present document "lithic procurement" or "quarry sites."

As noted in Chapter 3, previous surveys within the current project area have characterized many of the sites identified as lithic procurement/quarry locations, burned rock midden sites, or simply as lithic scatters. A review of the criteria used to make these assignments is consistent with the general definitions above. Thus, Peter and Hunt (1992:30–35) define both site 41BX966 and 41BX967 as "quarry/lithic reduction area[s]" based on the presence of "primary flakes and cores." Table 4 provides our observations on these two sites, which have been incorporated into our site 41BX963. Artifacts recorded include both cores and early stage bifaces. We also noted late stage bifaces, fire-cracked rock, utilized flakes, unifaces, and projectile points. In addition, a variety of debitage is present, with both secondary and tertiary flakes noted. Finally, 42 percent of the 36 shovel tests excavated at this site were positive, and artifacts were present to a maximum depth of 48 cm below surface. The variety of artifact types and the shovel test data suggests that while lithic procurement may have been an activity at this location, a variety of other activities were also present.

Table 5 presents observations on burned rock middens in sites recorded during the current survey. The table lists six sites with middens varying in size from relatively small scatters to dense scatters of burned rock over 500 m x 45 m in size. In a standard typology, these sites could be classified as burned rock midden sites. However, reference to Table 4 demonstrates that these sites contain a variety of other attributes. For example, 41BX141, a location with a single midden spread over roughly 20 m x 12 m, had all major artifact types present. In addition, we collected 23 projectile points, nine bifaces, and a uniface from this location. As will be discussed subsequently, the 23 points suggest some level of occupation from the Early Archaic through the Late Prehistoric. To characterize such sites as reflecting a single type, be it a "burned rock midden," a "campsite," or a "quarry" location, is a taxonomic exercise that has little descriptive or analytical value.

Artifact data presented in Table 4 suggests that a simplistic classification of most sites in the project area is not warranted. The data indicate that 87 percent of all sites have cores and that 73 percent have early stage bifaces noted on the surface, an assemblage that may support some notion of lithic procurement and/or reduction. However, 65 percent of the sites have late stage bifaces, 73 percent have fire-cracked rock, 45 percent have utilized flakes, 38 percent have unifaces, and 49 percent have projectile points. Given that prior to the acquisition of the property by TPW, the area was probably subject to extensive collection, and that such activities would have focused on formal tools, it can be assumed that the number of projectile points once present was actually higher. We conclude that a wide variety of behaviors were certainly conducted at the sites within Government Canyon.

A total of 105 bifaces and six unifaces were collected during the current project. Figures 13 and 14 present examples of these tool types. An examination of Figure 13 shows that many of these artifacts would probably be classified as reflecting late reduction, a characteristic not usually associated with quarry or procurement activities. While there may have been a collection bias towards more "finished" specimens, the sample contradicts initial expectations about lithic procurement at some of these sites. Figure 15 presents

Table 5. Thermal features observed on sites in the survey area

Site Number	Feature Type	Observed Maximum Feature Size	Observations on features
41BX146	Burned Rock Midden	2m x 2m x 30cm	Appears to be an intact midden
41BX168	Burned Rock Midden	40m x 30m x50cm	Midden has been extensively looted
41BX142	Burned Rock Midden	15m x 15m	Midden has been extensively looted
41BX142	Burned Rock Midden	10m x 10m x 63 cm	Appears to be an intact midden
41BX142	Burned Rock Midden	?	Not looted; May be natural, unburned rock cluster
41BX141	Burned Rock Midden	20m x 12m x 30cm	Midden has been extensively looted
41BX134	Burned Rock Midden	50m x 25m x 80cm	Midden has been extensively looted
41BX133	Burned Rock Midden	517m x 45m	Midden has been looted; May be palimpsest of several middens

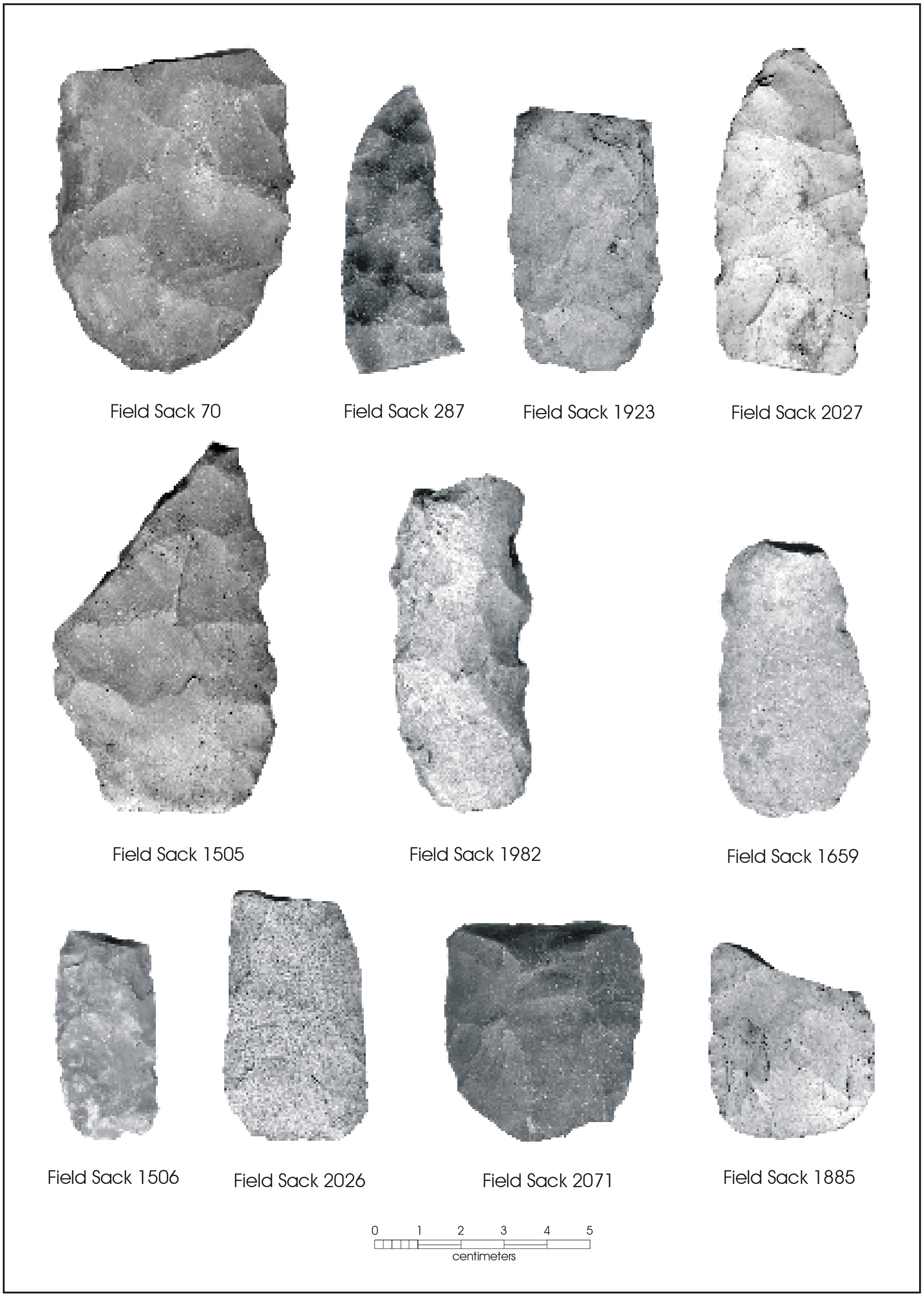

Figure 13. *Selected bifaces collected from surveyed areas.*

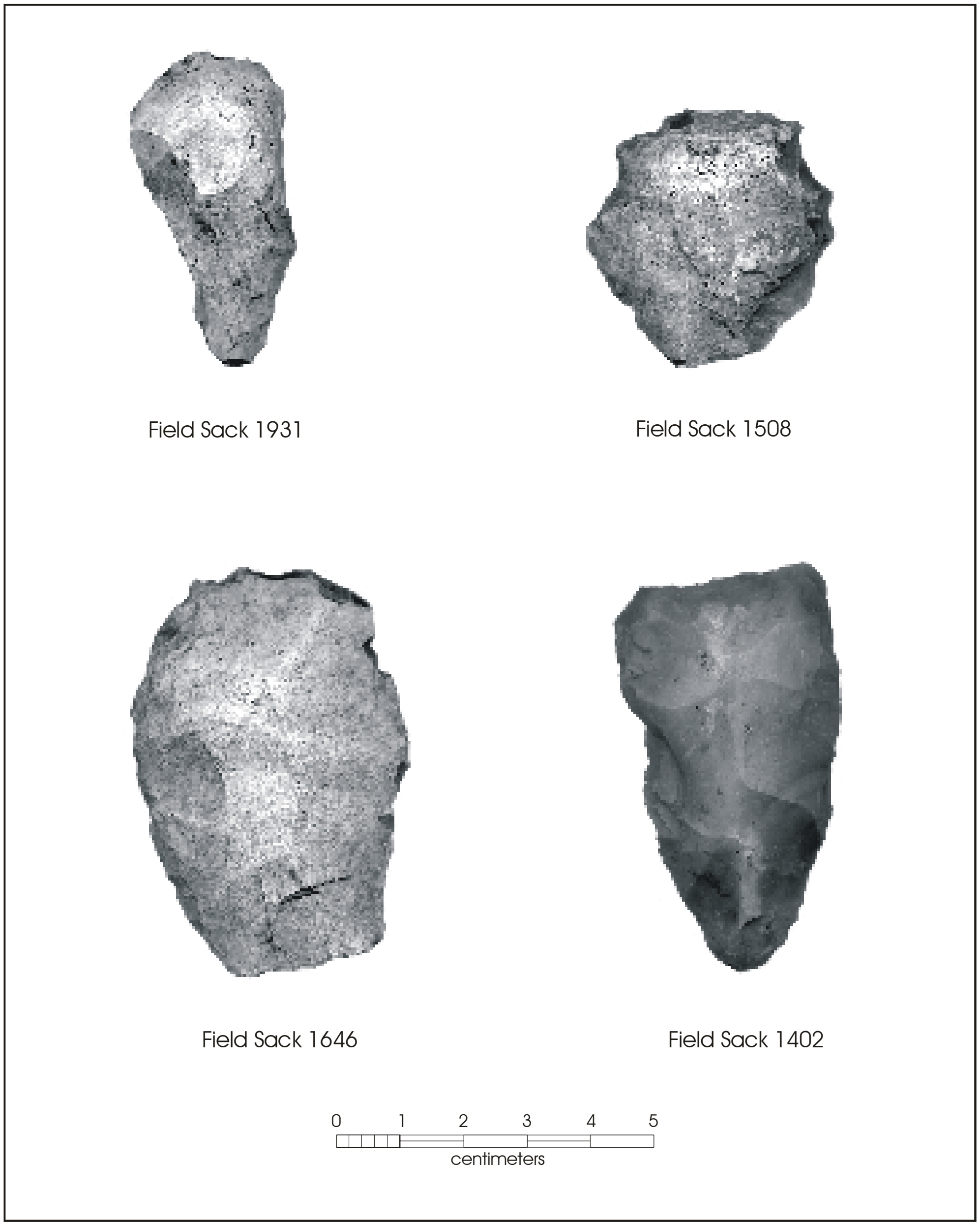

Figure 14. *Selected unifaces collected from surveyed areas.*

a histogram of complete biface width divided by complete biface thickness for all 85 cases with available data. Bifaces that are later in the reduction sequence should have higher values as their thickness is differentially reduced relative to their width. Small percentages of these bifaces should retain cortex. Conversely, bifaces in the early stages of reduction should be thicker relative to their overall width. A higher proportion of these bifaces may retain cortex.

Data in Figure 15 suggests that only a single mode is present in the distribution, with most samples falling between 2.5 and 3.5 on the index. Thirty-six bifaces are above 3.5 on the index, and only 18 are below a value of 2.5. Though not shown in the figure, 90.6 percent of the 85 bifaces lack any cortex. While comparable data from a known quarry location is lacking, the low frequency of bifaces with an index of less than 2.5, coupled with both the high number of bifaces with scores above 3.5 and the overall low occurrence of cortex on all collected bifaces are patterns not consistent with a dominant presence of lithic procurement activities in the project area.

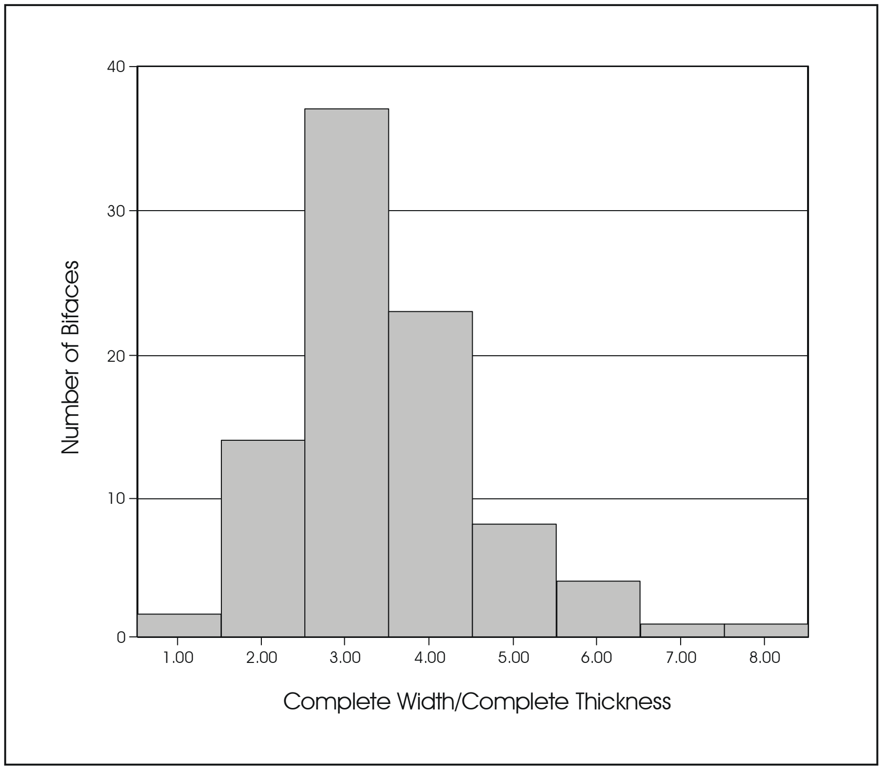

Figure 15. *Complete width/complete thickness for collected bifaces.*

The presence of natural chert in this area is the main criterion to suggest that raw material acquisition was likely an important reason for prehistoric use of the GCSNA vicinity (Howard et al. 2000:20, 66; Peter and Hunt 1992:54–56). The presence of an exploitable raw material is insufficient by itself to suggest procurement as a significant explanation of past use of this area. Good quality cherts are available in many portions of the Edwards Plateau. It has been noted (Binford 1980; Kelly 1995) that particularly abundant material resources may form a background of additional opportunities for people using areas for more limited or seasonal activities. Food resource availability and quality change throughout the year and across different years. Subsistence exploitation is demonstrated to be the most significant reason for residential mobility among foraging peoples (Kelly 1995:57, 116–120). The fixed location of chert resources may provide some re-occupation of magnet locations, but it is unclear under what conditions lithic exploitation would be critical to determining visitation.

This is not to argue that lithic procurement was not one of a variety of activities conducted in the area. For example, Figure 16 presents a section of 41BX1491, a large site (ca. 755,558 m^2) with a variety of different tools. Identified in the figure is a small area of approximately 48,460 m^2, which may represent quarrying activity. A high density of cores and associated debris characterizes the area, and both late and early stage bifaces were recorded. However, the area lacks fire-cracked rock, utilized flakes, and unifaces. Bedrock is exposed, and this is one of the few areas with abundant naturally occurring chert at high density on the surface. While samples of debitage and cores, which could be used to support the character of this portion of 41BX1491 as a procurement area, are not available, this is one of the few locations that may be indicative of lithic procurement. Nevertheless, to characterize 41BX1491 as a quarry site is certainly unproductive (see Table 4). These data, along with those discussed previously, demonstrate that a variety of different activities are occurring both at this particular site and on other sites within the current survey area.

A second characterization of the sites in the project area by previous investigators was that the sites were primarily surface sites. Reference to Table 6, which presents the recovery for the 2,007 levels excavated at 515 shovel test locations, generally supports that characterization. Sixty-four percent of the 5,421 artifacts recovered are within 20 cm of the surface, and only 29.5 percent of all shovel tests could be excavated below 30 cm in depth. In fact, the average shovel test depth was only 27.9 cm below surface. In addition, recall that in 104 survey shovel tests, sediment was too shallow to allow for any excavation.

Figure 17 considers the depth of sediment for all 515 shovel tests and the 104 shovel tests that could not be dug because of lack of sediment. These data are compared with the distance to drainages. Whenever possible, shovel tests were excavated to bedrock. Clearly, there is a strong relationship

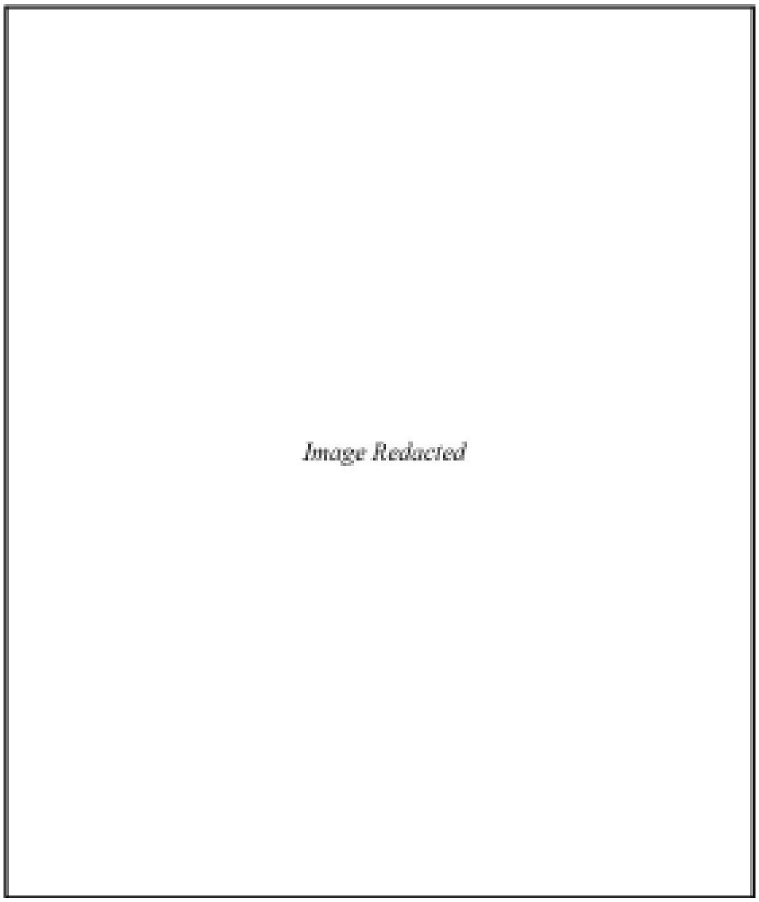

Figure 16. *Site 41BX1491 with possible lithic procurement area identified.*

between the proximity to drainages and the depth to bedrock in a shovel test. While shallow shovel tests can occur anywhere, shovel tests excavated to below 60 cm only occur near drainages. This pattern shows that deposition is occurring primarily in the drainages. Not surprisingly, the alluvial environments in GCSNA are the locations with the highest potential for significant amounts of subsurface archaeology. The areas away from drainages represent either eroding or stable surfaces. While it is the case that the archaeological record reflected in Government Canyon is primarily confined to the upper 30 cm, drainages provide the opportunity to uncover deeper deposits.

Chronology

The chronological framework used here primarily follows that outlined by Johnson (1995; see also Johnson and Goode 1994). The chronological placement of sites is based solely on the recovery of projectile point types that were probably manufactured during certain limited time periods. A total of 104 points was collected during the survey. All were from sites, including a specimen from 41BX1195 located outside of the current project area. Of the 103 points within the current project, 66 could be placed into recognized types with a reasonable level of

Table 6. Government Canyon shovel test data

Level	Levels Excavated	Cores	Debitage	FCR	Tools	Other	Total Recovery
0	515	1	128	72	2	1	204
1	515	10	1433	451	6	15	1915
2	411	4	1074	265	4	2	1349
3	253	0	520	154	2	3	679
4	152	4	394	138	2	0	538
5	92	1	250	67	1	0	319
6	48	1	130	32	1	0	164
7	14	0	164	29	0	0	193
8	7	0	30	29	1	0	60
Totals	**2007**	**21**	**4123**	**1237**	**19**	**21**	**5421**

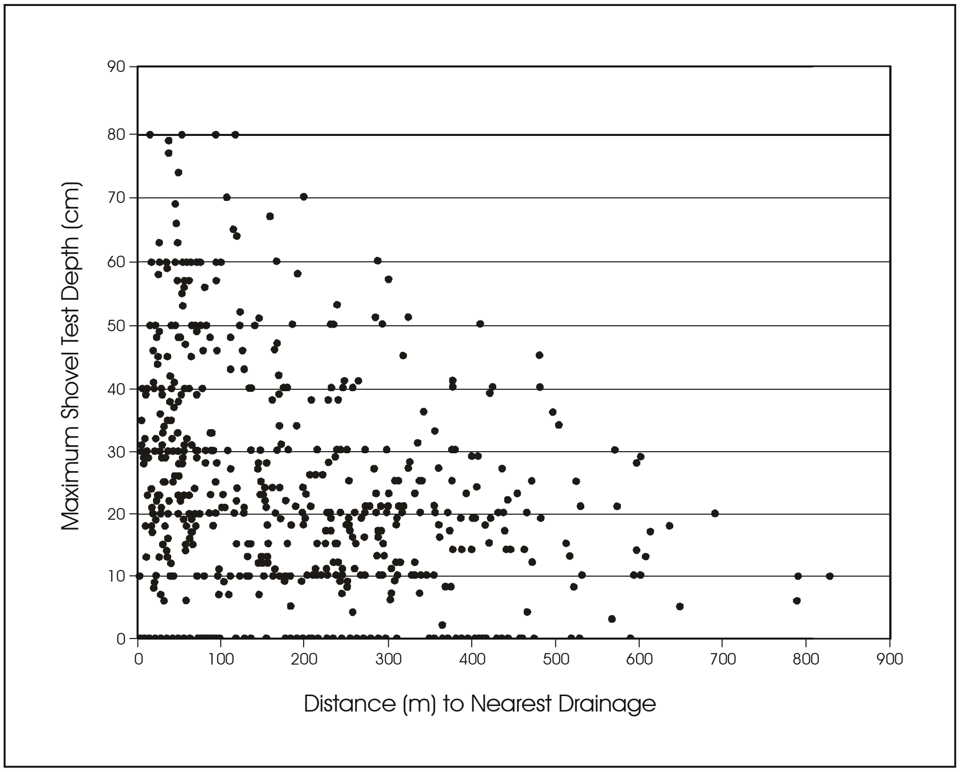

Figure 17. *Maximum shovel test depth (cm) by distance (m) to nearest drainage.*

confidence. Dr. Steve A. Tomka made the typological assignments. Table 7 presents these types, and Figure 18 presents a sample of these points.

A variety of types are present. The most common types are Langtry (n=9), Gower (n=8), Frio (n=7), and Marcos (n=5). Most of the types listed in Table 7 are common in central and south-central Texas. Point types from outside the region, however, are present, such as the Caracara type, from extreme south Texas and northern Mexico (Turner and Hester 1999:205).

These types span the period from Paleoindian through the Late Prehistoric. Figure 19 presents a histogram of the 66 points grouped into the chronological scheme suggested by Johnson (1995). Note that overall, occupation of the area appears to be principally from the Early Archaic through the Late Archaic. Though the low number of Paleoindian point forms is not unexpected given the rarity of these types in the region, as well as the potential that these older surfaces may be buried, there is a surprisingly low occurrence of Late Prehistoric points.

Fifty-six of the 86 sites (65.1%) lacked any temporally diagnostic projectile point types (see Table 4). The remaining 30 sites had a total of 48 datable components represented (e.g., projectile points). These included three Late Prehistoric components, 12 Late Archaic II components, 11 Late Archaic I components, nine Middle Archaic components, 11 Early Archaic components, and two Paleoindian components. Twenty of the 30 sites with components were assigned only to a single period, with the remaining 10 sites having two or more components recorded. Of these single component sites, four date to the Late Archaic II period, five date to the Late Archaic I, four date to the Middle Archaic, five date to the Early Archaic, and two sites date to the Paleoindian period.

While these temporal assignments may prove to be accurate for some portion of the site, it is probable that with additional examination of any given location, additional points, reflecting other periods, would be uncovered. The 48 temporal assignments are made on the basis of only 66 assignable points. It is unlikely that such small samples of points with a limited spatial distribution can accurately assign all material on a site into a temporal period. This is especially

Table 7. Typed projectile points recovered from sites

Site Number	Field Sack Number	Point Type	Period
41BX140	152	ellis	Late Archaic 2
41BX1496	210	golandrina	Paleoindian
41BX133	1043	perdiz	Late Prehistoric
41BX132	1046	langtry	Middle Archaic
41BX132	1049	langtry	Middle Archaic
41BX133	1051	gower	Early Archiac
41BX141	1066	perdiz	Late Prehistoric
41BX141	1067	martindale	Early Archiac
41BX141	1070	uvalde	Early Archiac
41BX963	1113	montell	Late Archaic 1
41BX1190	1115	gower	Early Archiac
41BX1488	1174	tortugas	Middle Archaic
41BX1491	1176	langtry	Middle Archaic
41BX1491	1177	frio	Late Archaic 2
41BX1493	1180	langtry	Middle Archaic
41BX1493	1182	uvalde	Early Archiac
41BX1496	1338	orchard	Paleoindian
41BX1500	1341	bulverde	Late Archaic 1
41BX145	1343	martindale	Early Archiac
41BX142	1482	pedernales	Late Archaic 1
41BX142	1483	frio	Late Archaic 2
41BX141	1484	marcos	Late Archaic 2
41BX141	1486	langtry	Middle Archaic
41BX141	1489	langtry	Middle Archaic
41BX141	1491	frio	Late Archaic 2
41BX141	1493	pedernales	Late Archaic 1
41BX141	1496	langtry	Middle Archaic
41BX141	1497	angostura	Early Archiac
41BX141	1498	montell	Late Archaic 1
41BX141	1499	castorvile	Late Archaic 1
41BX141	1502	shulma	Late Archaic 1
41BX141	1507	tortugas	Middle Archaic
41BX141	1513	bulverde	Late Archaic 1
41BX141	1514	frio	Late Archaic 2
41BX1503	1517	frio	Late Archaic 2
41BX1509	1519	nolan	Middle Archaic
41BX1507	1521	pedernales	Late Archaic 1
41BX1500	1523	marcos	Late Archaic 2
41BX140	1525	gower	Early Archiac
41BX140	1528	gower	Early Archiac
41BX140	1529	caracara	Late Prehistoric
41BX140	1531	gower	Early Archiac
41BX140	1532	shulma	Late Archaic 1
41BX1506	1533	frio	Late Archaic 2
41BX1506	1534	langtry	Middle Archaic
41BX134	1637	marcos	Late Archaic 2
41BX134	1638	nolan	Middle Archaic
41BX133	1645	darl	Late Archaic 2
41BX133	1648	bulverde	Late Archaic 1
41BX713	1658	marcos	Late Archaic 2
41BX713	1660	fairland	Late Archaic 2
41BX138	1683	frio	Late Archaic 2
41BX1513	1722	martindale	Early Archiac
41BX142	1752	ensor	Late Archaic 2
41BX1520	1781	gower	Early Archiac
41BX1522	1791	marcos	Late Archaic 2
41BX1527	1844	gower	Early Archiac
41BX1533	1924	williams	Late Archaic 1
41BX163	1943	orchard	Paleoindian
41BX139	2004	early c-notch	Early Archiac
41BX134	2008	gower	Early Archiac
41BX134	2009	angostura	Early Archiac
41BX973	2037	pedernales	Late Archaic 1
41BX137	2059	langtry	Middle Archaic
41BX1492	2088	montell	Late Archaic 1
41BX139	2125	williams	Late Archaic 1

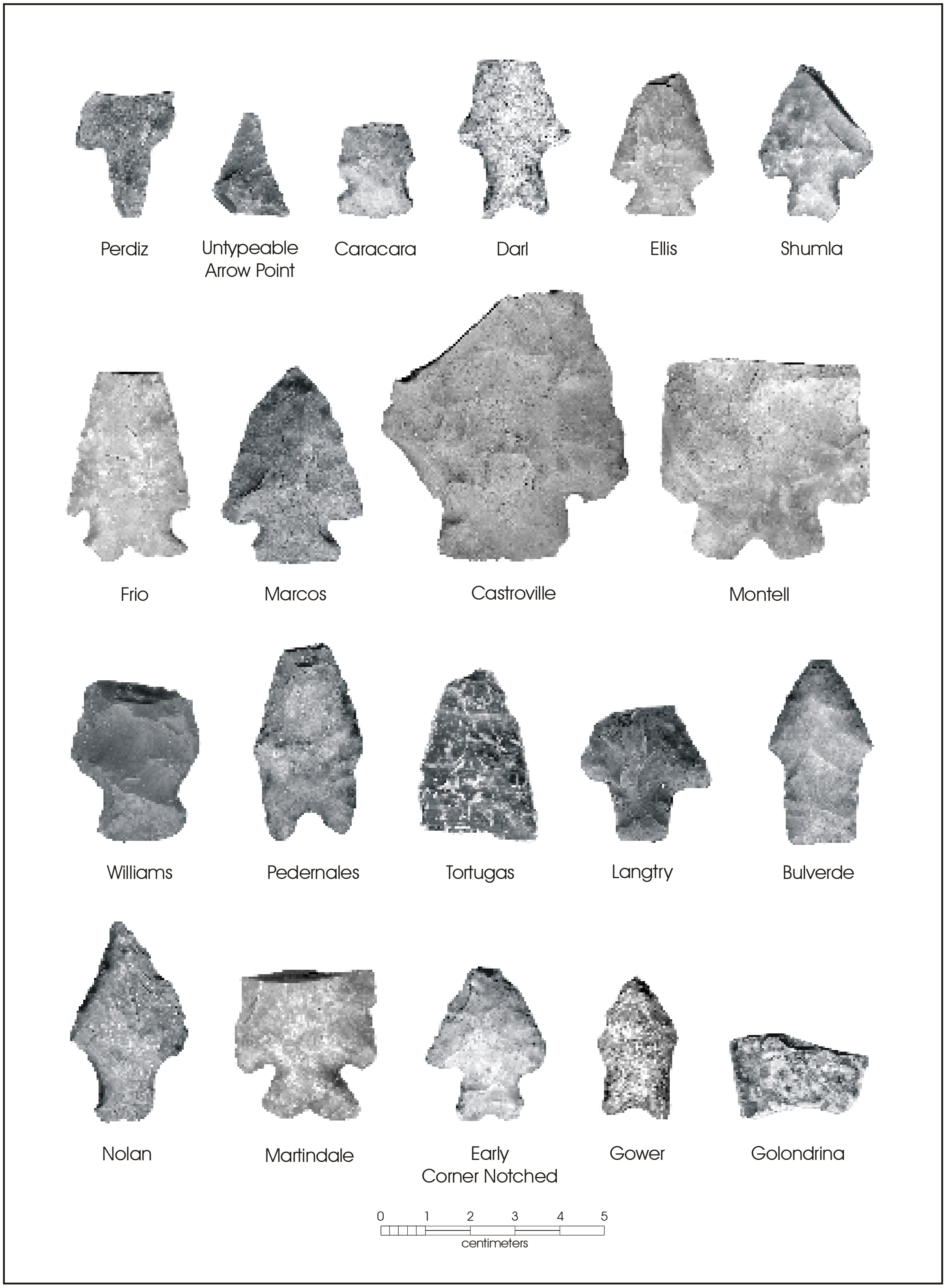

Figure 18. *Selected projectile points collected from surveyed sites.*

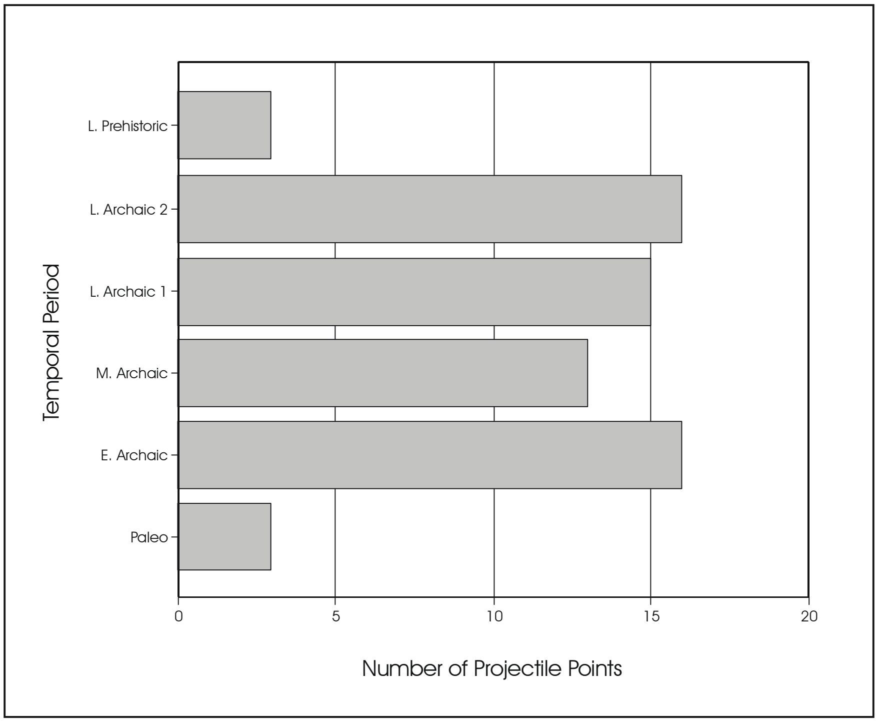

Figure 19. *Number of projectile points for major temporal periods.*

the case with extremely large sites such as 41BX963, a site that is over 1 km^2 in size, which is currently classified by reference to a single Late Archaic point.

Both the temporal distribution of the individual point types (Figure 19; Table 7) and the site level patterns discussed above suggest that, at least with regard to the occurrence of known point types, most occupation of the study area was between the Early Archaic and the close of the Late Archaic, a period of roughly 7,500 years. To the degree that these data reflect actual use, we can conclude that occupation was relatively constant during this time, with no one time period being represented by more than 25 percent of the available points. The presence of a relatively large number of Early Archaic point types is surprising, but is consistent with the previously recorded pattern for the current study area summarized in Chapter 3.

Occupation Patterns

The previous section indicates that occupation within the study area was concentrated between the Early Archaic and the close of the Late Archaic. This section considers the nature of the occupation. Specifically, we focus on the spatial aspects of the distribution.

Figure 20 (located in map pocket in Volume 2) presents the number of components within the project area at the site level (Table 4). This figure indicates that 1) sites that lack dated components appear to be located away from drainages, while sites with multiple components appear to be located near drainages, and 2) sites with more than two components appear to be clustered into a relatively small area along Government Canyon Creek. A calculation considering the distance from a site boundary to the nearest drainage confirms the initial impression. As a group, the 50 sites that lack dated components average 130 meters away from drainages. In addition, 50 percent of these sites are more than 75 meters away. The 20 single-component sites average 107.9 meters away, with only 30 percent of the sites being greater than 75 meters from any drainage. Those 10 cases with more than one component average only 41.5 meters from drainages, and only a single case (10%) is beyond 75 meters.

Figure 21 (located in map pocket in Volume 2) presents the distribution of the 103 projectile points, including the 66 diagnostic projectile points from which the component information in Figure 20 was derived. Note that the items cluster along drainages, and that the highest frequency of points appears to be associated with a roughly two-kilometer stretch along Government Canyon Creek. In fact, approximately 57 percent (n=59) of all projectile points collected on this project come from this 0.6 km^2 area. This area represents less than 10 percent of the total surveyed area of 6.47 km^2. This is, of course, roughly the same area that many of the sites with multiple occupations are located (Figure 20). These data suggest that this area was probably repeatedly occupied over a significant time span. Interestingly, this stretch of Government Canyon Creek is likely to be the area with the most reliable water source. This creek is the major drainage in the area and the only recorded spring is located along this section of the creek.

To explore the potential impact of water availability on occupation patterns, we consider a variety of data sets relative to extant drainages. Figure 22 is a box plot of the number of artifact classes on a site, taken from Table 4, relative to the distance to the nearest drainage. Note that while there is considerable variability, those sites with a wide variety of artifact types present are consistently located close to drainages. Those sites with only one or two artifact types tend to be located at greater distances from drainages. This pattern is consistent with an interpretation that a greater range of activities occurred along drainages.

Note also that all eight features identified as burned rock middens occur in settings adjacent drainages. The average distance from drainages for the eight features is 50.6 meters, with seven of the eight located within 100 meters of drainages. In addition, all eight features occur in the same area as the cluster of points outlined in Figure 21.

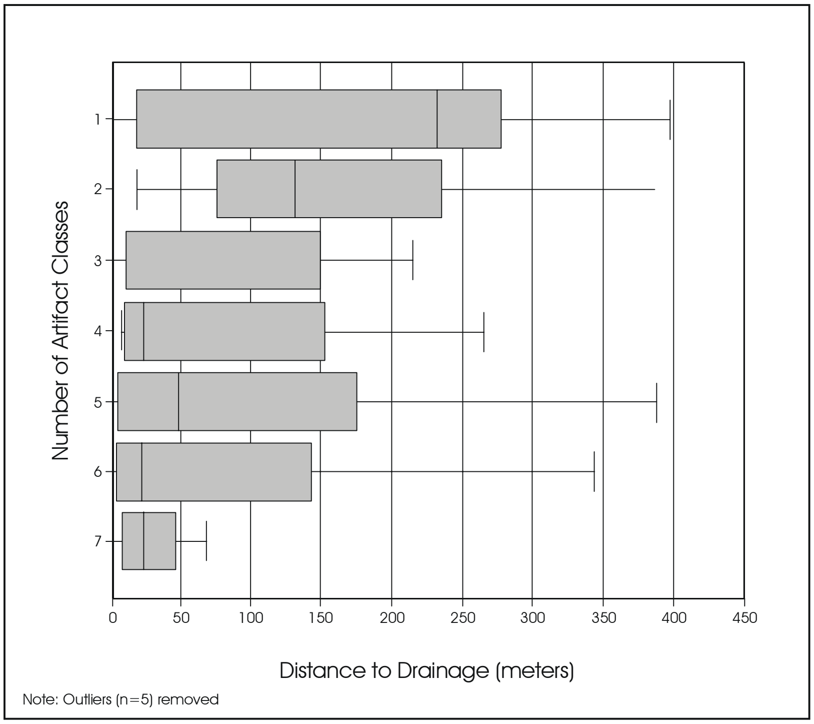

Figure 22. *Box plot of the distance to drainages (m) for artifact variety groups.*

Figure 23 is a line graph of the mean number of debitage and fire-cracked rock recovered from the 407 positive shovel tests excavated on the project. These are plotted against distance to drainage at 50-meter intervals. As both the fire-cracked rock and debitage data have a few cases with extremely high counts, we use a five percent trimmed mean as a plotting point. The five percent trimmed mean simply eliminates five percent of the cases from the upper and lower portion of the distribution, and is an effective method for considering the central tendencies of skewed data. Note that for both data sets, shovel test recovery is highest within 100 meters of drainages, and drops off rapidly beyond that point.

Figure 24 is a bivariate plot of the biface width/thickness index, discussed in the previous chapter, against distance to drainage. A total of 85 cases are present. It is expected that early in the reduction process, bifaces should have a low value on this index, whereas more finished bifaces should have higher values. Interestingly, while low values appear to occur at all distances, bifaces that are more finished tend to occur close to drainages. For the 25 samples with index values of 4.0 or greater, distance to drainages averages 69.2 meters, with only four cases (16%) being beyond 100 meters from drainages. For the 32 cases with index values below 3.0, the average distance is 132.7 meters, and 15 samples (46.9%) are beyond 100 meters. Although the sample size is small, finished bifaces appear to be associated with drainages, while, as a group, bifaces with attributes that suggest earlier reduction tend to be deposited away from drainages.

Overall, it appears that greater occupational intensity is associated with drainages. Patterning in diversity of artifacts relative to distance to drainages, as well as shovel test data that show higher recovery of debitage and fire-cracked rock along drainages, support this suggestion. It is likely that availability of water was a major element in structuring occupation within the study area. These patterns are consistent with an increased frequency of re-occupation of areas close to drainages, resulting in the deposition of more artifacts and a greater variety of artifact types. This suggests that many different activities are occurring along drainages, activities that are manifested both by the construction of features and different patterns of reduction evidenced in bifaces.

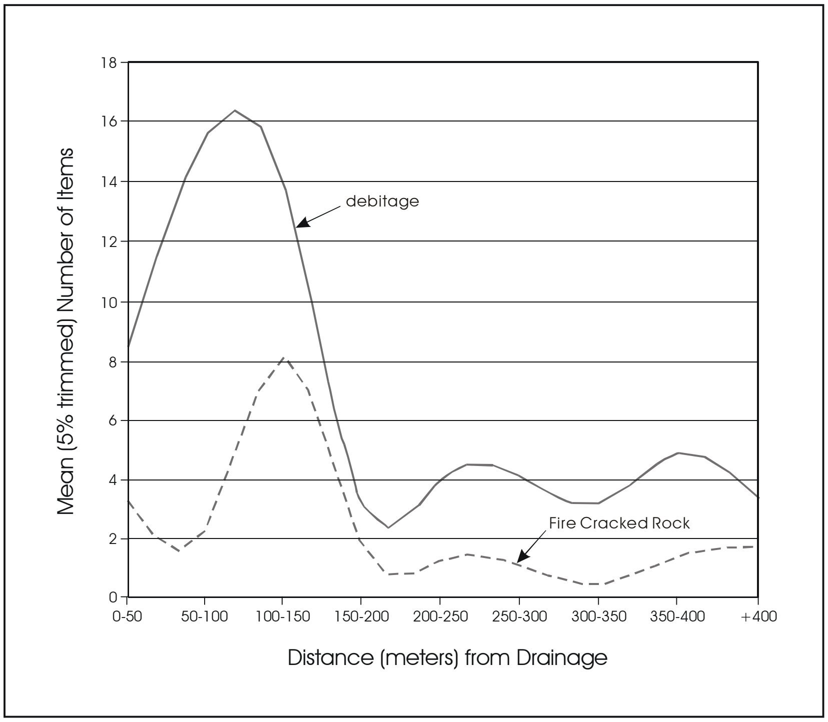

Figure 23. *Mean number of debitage and fire-cracked rock in shovel tests by distance from drainage.*

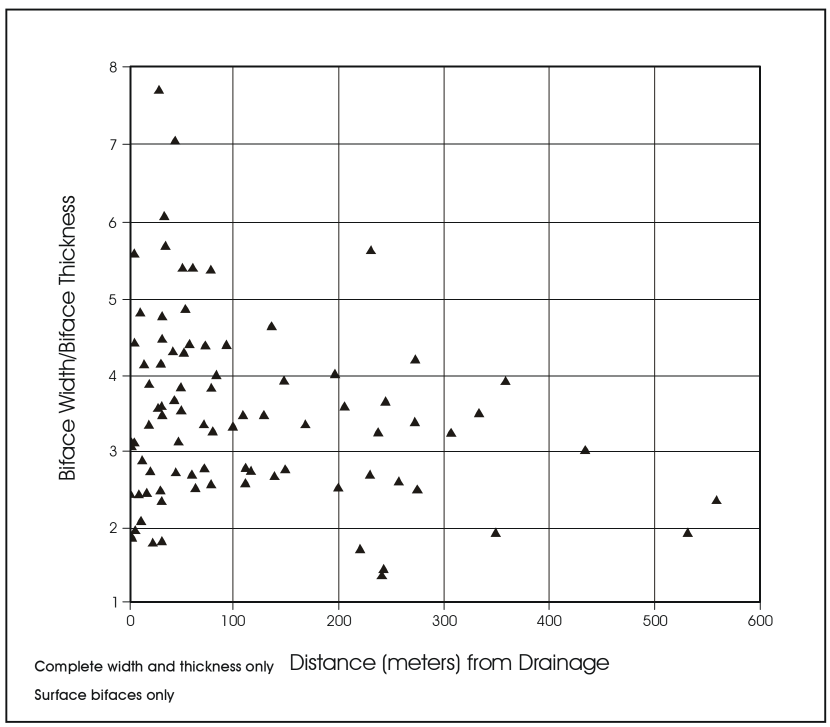

Figure 24. *Biface width/thickness ratio by distance to drainage.*

Isolated Finds

The vast majority of material observed on this survey was incorporated into sites, including 209 of the 211 isolated find collections. However, while 264 of the 279 positive shovel tests fell within site boundaries, there were 15 positive tests that were outside of sites. Table 8 summarizes the results from these shovel tests. Note that fewer than five recovered items characterize most positive shovel tests, and many of these items are fire-cracked rock. As noted previously, it is difficult to clearly characterize many of the collected materials as fire-cracked, and we were generally liberal in our assessment. Consequently, some of the fire-cracked rock may not reflect human activity. Nevertheless, there are two cases where either moderate debitage counts or debitage associated with moderate fire-cracked rock counts suggest that additional investigation and, possibly, site designation is warranted. These include shovel test numbers 328 and 408.

Table 8. Occurrence of material in non-site shovel tests

Shovel Test #	Maximum Depth	Maximum Artifact Depth	Debitage	Fire-Cracked Rock
5	50	10	1	0
7	29	10	0	1
9	30	20	1	0
24	20	10	1	0
100	60	30	0	3
156	40	40	1	3
164	40	40	0	3
173	39	30	0	2
181	50	50	0	3
201	40	40	2	1
328	30	30	12	24
408	40	40	4	11
410	21	20	0	2
429	47	20	0	2
449	20	10	0	1

Summary

Pedestrian survey of over 25 miles of trails within Government Canyon State Natural Area, along with examination of previously recorded sites, resulted in the documentation of 86 archaeological sites within roughly 6.47 km^2 (1,599 acres). Comparisons to previous surveys, as well as surveys using the same basic site definition, suggests that the area has a high density of sites, and that the sites are extremely large in size. The results of 515 shovel tests indicate that the archaeological record within the project area is also extremely shallow, generally being confined to the upper 30 cm of sediment, reflecting the thin soils present in this environment.

The materials observed on the sites clearly suggest that a variety of activities were conducted both within the project area and at individual sites. While evidence of quarrying activity is present, and burned rock middens were observed on several sites, to classify the occupation of a site by reference to a single activity or set of related activities seems unwarranted given the range of documented material.

The collection and classification of a variety of projectile points suggests that the survey area was used, as some level, for portions of the last 11,000 years. To the degree that the number of projectile points monitors intensity of use, the principal occupation was roughly 7,500 years, reflecting the period from the Early Archaic through the Late Archaic.

At a site level, 65 percent of the 86 sites lacked any temporally diagnostic projectile point types. The remaining 30 sites had a total of 48 datable components represented, with twenty of these being single-component sites. The overall temporal breakdown at a site level followed that for individual points, suggesting a primary period of use from the Early Archaic through the Late Archaic.

A consideration of occupational patterns within the study area shows that areas close to drainages are characterized by more frequent re-occupation. Multicomponent sites are clearly associated with drainages. The highest intensity of occupation, measured both by higher debitage and fire-cracked rock recovery in shovel tests and the number of different types of artifacts on the surface of sites, are associated with drainages. Additionally, all burned rock features are located close to drainages.

It is unclear if these patterns simply reflect greater, repeated intensity of use of the drainage areas, or if these areas were used, at least to some degree, for different sets of behaviors. Clearly, the presence of features suggests the latter, as no burned rock features were discovered away from drainages. Patterning in bifaces also suggests a somewhat different focus, with finished bifaces generally being close to drainages. Both the greater intensity of drainage occupation and unique opportunities offered by these environments are reflected in these survey data.

Chapter 7: Recommendations

Introduction

As summarized in the previous chapter, archaeological sites within GCSNA are large and cover significant portions of the modern ground surface. Ground visibility and exposure of artifacts through natural and anthropogenic erosion correlate with the ability to identify archaeological sites. The shallow nature of the Tarrant soils on the hilly topography of these limestone uplands indicates that most archaeological sites in this area are probably experiencing significant erosion and some amount of naturally occurring degradation. Within the survey sample examined, the size and extensive landscape distribution of archaeological material presents a difficult cultural resources management problem. Many of these archaeological sites do not appear to represent discrete prehistoric occupations. They probably formed as accretional cultural deposits from visitation of particularly attractive locations over the last 11,000 years, with the principal use occurring between the Early and Late Archaic periods. The materials observed on the sites demonstrate that a variety of activities were conducted at these locations. The resulting archaeological record in Government Canyon is a complex superposition of human occupations resulting in sites of various sizes, occupied and re-occupied for varying durations, and forming massive landscape deposits of artifact debris.

The current chapter considers these sites for possible designation as State Archeological Landmarks (SAL). As summarized previously, the designation of SAL status depends on an archaeological site meeting one of the five criteria (Rules of Practice and Procedure for the Antiquities Code of Texas, Section 26.8). Within the current context, two of these five are of primary importance. These concern a site's potential to contribute to a better understanding of Texas prehistory and the potential for SAL designation if there is a high likelihood that a site may be subject to relic collecting leading to the destruction of any research potential. We suggest that 24 of the 86 sites meet these criteria for designation. We propose, at a general scale, mitigation efforts that would be necessary for 19 of these 24 sites that would be impacted by opening this portion of the State Natural Area to public use.

We have argued, at various points in this volume, that traditional concerns with buried deposits in "pristine" condition are misguided, and have suggested that even in the absence of ideal integrity, sites can provide unique information important to regional and Texas prehistory. In Chapter 4, we suggested that sites lacking fine-grained preservation or easily separable assemblages could be productively used to examine aspects of chronology, subsistence, and technological organization.

The other principal element of our SAL consideration involves protecting sites from vandalism. Reference to Appendix A in Volume 2 of this report will demonstrate that archaeological sites within the Government Canyon area have been subject to ongoing destruction through looting (see also Peter and Hunt 1992:20). Local avocational archaeologists have apparently been well aware that extensive looting and collecting has occurred within the vicinity of Government Canyon for decades (D. Thorn, personal communication June 2001; T. Tomesal, personal communication August 2001). The acquisition of the property by TPW, beginning in 1993, brought a significant measure of protection to the area, and no instances of looting have been reported to GCSNA staff since that time. TPW personnel did not note any vandalism within the southern portion of GCSNA during their work (Howard and McNatt 2000:177). However, the current investigations noted five sites that had evidence of extensive excavations by artifact collectors at some time in the past. These are primarily sites with burned rock middens. 41BX168 on the Wildcat Canyon Trail (Trail 6) had extensive looting of a large burned rock midden. One of the burned rock middens on 41BX142 on Joseph E. Johnston Road (Trail 5) had a looters' pit in the center that caused extensive destruction of this feature. The eastern portion of a burned rock midden on 41BX141 appeared to have been removed mechanically. Site 41BX134, a large burned rock midden on the western margin of Johnston Road (Trail 5), shows extensive excavation (see Howard and McNatt 2000:117). The amount of material moved and the morphology of the excavation indicate that the destruction has been performed mechanically. The southwestern portion of 41BX133 contains multiple burned rock middens that have been extensively disturbed by mechanical excavation. Trenches and pits were placed in and around all of these thermal features. Shallow pits had been dug at the periphery of the obvious burned rock middens to try and identify any potentially buried features.

While this vandalism has severely damaged many of the more robust features encountered on the current survey, it is certainly the case that extensive surface collection has also occurred. When the facility is opened to the general public, close monitoring of hikers, bikers, and campers within the State Natural Area will be impossible. While the extensive vandalism of sites involving heavy machinery will certainly no longer occur, smaller scale impacts, including the potential for artifact collection and excavation at a smaller scale, can be expected.

SAL Criteria for Sites in Government Canyon

This section develops criteria for identifying sites that have the potential to contribute to our understanding of local, regional, or Texas prehistory. Given the research interests outlined in Chapter 4, several variables were selected for monitoring on sites. In order to be considered as eligible for SAL status, sites had to meet four criteria. First, all sites recommended must have some subsurface deposits present. Second, no site with an estimated surface disturbance greater than 80 percent was included in the selection. Recall that the disturbance estimate is a spatial estimate. That is, a value of 80 percent is an estimate of the percentage of the site that has suffered some level of disturbance, even if that disturbance is minimal. Third, a site had to have an identified temporal component or have an intact feature present that had a high probability of yielding chronometric information. Finally, a site had to have a high variety of artifact types present, relative to our estimate of the number of items on the surface. Table 9 lists all 86 sites, along with the criteria used to make the recommendations.

As we have argued previously, for some questions, sites with subsurface material are not necessarily superior to locations where artifacts are only on the surface. However, the presence of subsurface deposits increases the potential range of questions that can be addressed concerning an assemblage. As such, we considered the presence of subsurface deposits as a component in our determination. Reference to Table 9 shows that 17 sites lack any subsurface deposits. In 10 cases, no shovel tests were excavated within site boundaries, and in six of the remaining seven cases, only a single shovel test was excavated. However, reference to the site descriptions in Volume 2 demonstrates that in many cases, shovel tests were placed around sites, and in several cases, there was simply a lack of soil for excavation.

The focus on disturbance was the second criterion for SAL recommendation. While the level of disturbance was not quantified, the amount of the site that had some level of disturbance was estimated. The percentage of disturbance of the surface was generally high, with an average estimate of approximately 77 percent for all 86 sites (Table 9). This suggests that, on average, 77 percent of the surface of sites had some level of disturbance, with erosion, at various intensities, being the most frequently cited cause of disturbance. As with the requirement for subsurface deposits, sites that have a higher percentage of their surfaces impacted by erosion are less likely to produce data applicable to a wide range of questions. As noted above, for the current determination, an arbitrary cut-off of 80 percent was chosen. Considering the overall distribution, 13 sites were classified as having 100 percent of the surface disturbed, and an additional 17 sites had estimates of between 85 and 95 percent surface disturbance (Table 9). These 30 sites were eliminated from consideration.

The third criterion stated that a site had to have an identified temporal component or have an intact feature present that had a high probability of yielding chronometric information. While it is certainly the case that with more intensive work additional projectile points would be recovered, and therefore a higher number of sites could be placed in this sequence, 30 sites have known temporal affiliations. In addition, a single site, 41BX146, has a potentially intact burned rock midden. The presence of a temporal affiliation increases the range of potential questions that can be asked of these sites. The remaining 55 sites contained no intact features and no diagnostic artifacts were recovered. They were eliminated from further consideration.

Finally, a site had to have a high variety of artifact types present, relative to our estimate of the number of items on the surface. This final criterion was designed to identify sites that, potentially, had a high variety of activities present. While this criterion increases the possibility that multiple behaviors are represented, and thus increases the possibility that these behaviors cannot be separated, it also increases the possibility that a significant range of behaviors reflected in the canyon will be included in the sample. However, we did not simply want to focus on sites with high artifact variety for artifact variety is correlated with sample size. A focus only on artifact variety would simply select those sites with large assemblages. Consequently, sites were sorted by reference to the overall sample size, and the average number of types was calculated for that sample size. For example, there are 23 sites with an estimated sample size of between 101 to 500 items on the surface. The average number of different types of artifacts present was 4.96 for these 23 sites. All cases that exceeded that average were selected. Within this particular group, then, all cases with five or more artifact types noted as present were selected for inclusion in the sample. A total of 49 sites exceeded the average for their

Table 9. SAL status and data used to make that determination for sites in the project area

SAL Recommendation	Site Number (41BX__)	Late Prehistoric	Late Archic 2	Late Archic 1	Middle Archaic	Early Archaic	Paleoindian	Number of components	Estimated proportion of site disturbed	Ordinal category of number of artifacts	Cores present	Early Bifaces present	Late Bifaces present	Fire-cracked rock present	Utilized Flakes present	Unifaces Present	Projectile Points present	Other items	Total Number of catagories	Shovel tests in site	Number of positive shovel tests	Percent of positive tests.	clusters (1=single; 2=multiple)	Number of intact features	max art depth (cm.)
no	130	0	0	0	0	0	0	0	75	3	1	1	1	1	1	1	0	0	6	5	4	0.80	2	0	20
no	132	0	0	0	1	0	0	1	95	3	1	0	1	1	1	0	1	0	5	5	4	0.80	0	0	20
yes	133	1	1	1	0	1	0	4	60	5	1	1	1	1	1	1	1	0	7	16	13	0.81	2	0	56
yes	134	0	1	0	1	1	0	3	60	5	1	1	1	1	1	1	1	1	8	16	13	0.81	2	0	74
no	135	0	0	0	0	0	0	0	60	3	1	1	1	1	1	1	0	0	6	3	1	0.33	1	0	50
no	136	0	0	0	0	0	0	0	70	2	1	1	1	1	1	0	1	0	6	3	1	0.33	1	0	10
yes	137	0	0	0	1	0	0	1	60	2	1	1	1	1	0	0	1	0	5	2	2	1.00	0	0	40
yes	138	0	1	0	0	0	0	1	10	4	1	1	1	1	1	1	1	0	7	4	3	0.75	2	0	50
yes	139	0	0	1	0	1	0	2	70	4	1	1	1	1	1	0	1	0	6	4	3	0.75	2	0	50
yes	140	1	1	1	0	1	0	4	50	6	1	1	1	1	1	1	1	0	7	9	6	0.67	2	0	30
yes	141	1	1	1	1	1	0	5	60	6	1	1	1	1	1	1	1	0	7	15	10	0.67	2	0	50
yes	142	0	1	1	0	0	0	2	50	6	1	1	1	1	1	1	1	0	7	8	8	1.00	2	0	80
yes	145	0	0	0	0	1	0	1	80	3	0	0	1	1	1	1	1	0	5	3	1	0.33	0	0	6
yes	146	0	0	0	0	0	0	0	60	3	1	1	1	1	1	1	1	0	7	7	5	0.71	1	1	79
no	147	0	0	0	0	0	0	0	70	3	1	1	1	1	0	0	0	0	4	3	2	0.67	1	0	30
no	148	0	0	0	0	0	0	0	100	1	0	0	0	0	0	0	0	0	0	11	10	0.91	0	0	80
no	149	0	0	0	0	0	0	0	70	3	0	1	0	1	1	1	0	0	4	3	3	1.00	1	0	20
no	150	0	0	0	0	0	0	0	80	2	1	1	1	1	0	0	0	0	4	2	2	1.00	1	0	30
no	151	0	0	0	0	0	0	0	100	3	1	0	0	1	0	0	0	0	2	2	2	1.00	0	0	13
no	162	0	0	0	0	0	0	0	70	4	1	1	1	1	0	0	0	0	4	2	1	0.50	1	0	10
yes	163	0	0	0	0	0	1	1	70	6	1	1	1	1	1	1	1	0	7	17	10	0.59	2	0	20
no	164	0	0	0	0	0	0	0	75	3	1	1	1	1	1	1	1	0	7	7	4	0.57	2	0	24
no	165	0	0	0	0	0	0	0	90	2	1	1	0	1	0	0	0	0	3	2	2	1.00	1	0	50
no	166	0	0	0	0	0	0	0	75	1	0	1	1	0	0	0	0	0	2	2	1	0.50	0	0	13
no	167	0	0	0	0	0	0	0	100	1	1	0	0	0	0	0	0	0	1	2	0	0.00	0	0	0
no	168	0	0	0	0	0	0	0	50	4	1	1	1	1	1	1	0	1	7	4	3	0.75	1	0	80
yes	713	0	1	0	0	0	0	1	50	3	1	1	1	1	1	1	1	0	7	6	6	1.00	1	0	50
no	714	0	0	0	0	0	0	0	70	6	1	1	0	1	0	1	0	0	4	5	4	0.80	2	0	30
yes	963	0	0	1	0	0	0	1	30	6	1	1	1	1	1	1	1	0	7	36	15	0.42	2	0	48

Table 9. continued…

SAL Recommendation	Site Number (41BX__)	Late Prehistoric	Late Archic 2	Late Archic 1	Middle Archaic	Early Archaic	Paleoindian	Number of components	Estimated proportion of site disturbed	Ordinal category of number of artifacts	Cores present	Early Bifaces present	Late Bifaces present	Fire-cracked rock present	Utilized Flakes present	Unifaces Present	Projectile Points present	Other items	Total Number of catagories	Shovel tests in site	Number of positive shovel tests	Percent of positive tests.	clusters (1=single; 2=multiple)	Number of intact features	max art depth (cm.)
no	964	0	0	0	0	0	0	0	90	3	1	1	0	1	0	0	0	0	3	1	1	1.00	1	0	10
yes	973	0	0	1	0	0	0	1	80	4	1	1	1	1	1	0	1	0	6	5	3	0.60	0	0	18
no	974	0	0	0	0	0	0	0	80	2	1	0	0	0	1	0	1	0	3	2	2	1.00	0	0	30
no	977	0	0	0	0	0	0	0	50	3	1	1	1	1	1	0	0	0	5	3	3	1.00	1	0	30
no	1190	0	0	0	0	1	0	1	90	4	1	1	1	0	0	1	1	0	5	1	1	1.00	1	0	20
no	1482	0	0	0	0	0	0	0	90	2	1	0	1	0	0	0	0	0	2	1	0	0.00	0	0	0
no	1483	0	0	0	0	0	0	0	80	3	1	0	1	1	0	0	0	0	3	2	2	1.00	0	0	17
no	1484	0	0	0	0	0	0	0	80	2	1	1	0	0	0	0	0	0	2	3	1	0.33	0	0	10
no	1485	0	0	0	0	0	0	0	70	6	1	1	0	0	1	1	0	0	4	11	9	0.82	0	0	20
no	1486	0	0	0	0	0	0	0	85	1	1	0	1	0	0	0	0	0	2	1	1	1.00	0	0	6
no	1487	0	0	0	0	0	0	0	85	5	1	1	1	0	0	0	1	0	4	5	4	0.80	1	0	19
no	1488	0	0	0	1	0	0	1	60	5	1	1	1	1	0	0	1	0	5	6	4	0.67	1	0	27
no	1489	0	0	0	0	0	0	0	90	1	1	1	0	0	0	0	0	0	2	1	1	1.00	0	0	6
no	1490	0	0	0	0	0	0	0	80	4	1	1	0	1	0	0	0	0	3	4	1	0.25	0	0	10
yes	1491	0	1	0	1	0	0	2	60	6	1	1	1	1	1	1	1	1	8	48	24	0.50	1	0	60
yes	1492	0	0	1	0	0	0	1	80	3	1	1	1	1	1	0	1	0	6	2	1	0.50	0	0	10
yes	1493	0	0	0	1	1	0	2	70	2	1	0	1	1	0	0	1	0	4	2	1	0.50	1	0	36
no	1494	0	0	0	0	0	0	0	80	4	1	1	1	1	0	0	0	1	5	1	1	1.00	1	0	10
no	1495	0	0	0	0	0	0	0	90	2	1	1	0	0	0	0	0	0	2	1	0	0.00	0	0	0
yes	1496	0	0	0	0	0	1	1	80	3	1	1	1	1	0	0	1	0	5	4	4	1.00	0	0	50
no	1497	0	0	0	0	0	0	0	80	2	0	0	1	1	1	0	1	0	4	2	2	1.00	1	0	40
no	1498	0	0	0	0	0	0	0	80	2	1	1	0	1	0	0	0	0	3	1	0	0.00	0	0	0
no	1499	0	0	0	0	0	0	0	70	2	1	1	1	1	0	0	1	0	5	2	2	1.00	1	0	10
yes	1500	0	1	1	0	0	0	2	60	6	1	1	1	1	1	1	1	0	7	24	13	0.54	2	0	40
no	1501	0	0	0	0	0	0	0	80	2	0	1	1	1	0	0	0	0	3	1	1	1.00	0	0	40
no	1502	0	0	0	0	0	0	0	70	5	1	1	1	1	0	1	1	0	6	8	3	0.38	1	0	30
no	1503	0	1	0	0	0	0	1	100	1	1	0	1	0	1	1	1	0	5	0	0	0.00	0	0	0
no	1504	0	0	0	0	0	0	0	100	1	0	1	0	0	0	0	1	0	2	0	0	0.00	0	0	0
no	1505	0	0	0	0	0	0	0	80	4	1	0	0	1	0	0	0	0	2	2	2	1.00	2	0	30

Table 9. continued…

SAL Recommendation	Site Number (41BX__)	Late Prehistoric	Late Archic 2	Late Archic 1	Middle Archaic	Early Archaic	Paleoindian	Number of components	Estimated proportion of site disturbed	Ordinal category of number of artifacts	Cores present	Early Bifaces present	Late Bifaces present	Fire-cracked rock present	Utilized Flakes present	Unifaces Present	Projectile Points present	Other items	Total Number of catagories	Shovel tests in site	Number of positive shovel tests	Percent of positive tests.	clusters (1=single; 2=multiple)	Number of intact features	max art depth (cm.)
no	1506	0	1	0	1	0	0	2	100	1	0	0	1	1	0	0	1	0	3	0	0	0.00	0	0	0
no	1507	0	0	1	0	0	0	1	90	2	1	0	1	0	0	0	1	0	3	1	0	0.00	1	0	0
no	1508	0	0	0	0	0	0	0	90	1	1	1	0	0	0	0	0	0	2	1	0	0.00	0	0	0
yes	1509	0	0	0	1	0	0	1	80	5	1	1	1	1	1	0	1	0	6	5	1	0.20	1	0	20
no	1510	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	1	0	1	2	1	0.50	0	0	10
no	1511	0	0	0	0	0	0	0	100	2	1	0	1	1	0	0	0	0	3	3	1	0.33	0	0	30
no	1512	0	0	0	0	0	0	0	100	2	1	0	0	0	0	0	0	0	1	0	0	0.00	1	0	0
yes	1513	0	0	0	0	1	0	1	80	3	1	1	1	1	1	1	1	0	7	5	3	0.60	1	0	14
no	1514	0	0	0	0	0	0	0	100	1	1	0	0	0	0	0	0	0	1	0	0	0.00	1	0	0
no	1515	0	0	0	0	0	0	0	70	2	1	1	0	1	0	0	0	0	3	4	2	0.50	0	0	20
no	1516	0	0	0	0	0	0	0	100	2	1	1	0	0	0	0	0	0	2	0	0	0.00	0	0	0
no	1517	0	0	0	0	0	0	0	100	3	0	0	1	1	0	0	1	0	3	1	0	0.00	0	0	0
no	1518	0	0	0	0	0	0	0	100	2	1	1	0	0	0	0	0	0	2	0	0	0.00	0	0	0
no	1519	0	0	0	0	0	0	0	90	5	1	1	0	1	0	0	0	0	3	1	1	1.00	1	0	10
yes	1520	0	0	0	0	1	0	1	70	6	1	1	1	1	1	1	1	0	7	6	6	1.00	2	0	40
no	1521	0	0	0	0	0	0	0	80	3	1	0	0	0	0	0	0	0	1	2	1	0.50	1	0	17
no	1522	0	1	0	0	0	0	1	100	2	1	0	0	1	0	0	1	0	3	0	0	0.00	0	0	0
no	1523	0	0	0	0	0	0	0	95	2	1	1	1	1	1	1	0	0	6	1	1	1.00	1	0	10
no	1524	0	0	0	0	0	0	0	90	3	1	1	0	1	0	0	0	0	3	0	0	0.00	0	0	0
no	1525	0	0	0	0	0	0	0	95	3	1	1	1	0	1	1	0	0	5	0	0	0.00	0	0	0
no	1526	0	0	0	0	0	0	0	90	1	0	1	0	1	0	0	0	0	2	1	1	1.00	1	0	10
yes	1527	0	0	0	0	1	0	1	70	6	1	1	1	1	1	1	1	0	7	5	3	0.60	2	0	22
no	1528	0	0	0	0	0	0	0	70	6	1	1	0	1	1	1	0	0	5	6	5	0.83	1	0	31
no	1529	0	0	0	0	0	0	0	80	3	1	1	1	1	1	1	0	0	6	1	1	1.00	1	0	30
no	1530	0	0	0	0	0	0	0	80	2	1	1	1	1	1	1	0	0	6	4	3	0.75	2	0	20
no	1531	0	0	0	0	0	0	0	60	3	1	1	1	1	1	1	1	0	7	4	4	1.00	1	0	29
no	1532	0	0	0	0	0	0	0	95	1	1	0	0	1	0	0	0	0	2	3	2	0.67	0	0	40
yes	1533	0	0	1	0	0	0	1	75	3	1	1	1	1	1	1	1	0	7	3	2	0.67	1	0	20

respective sample size groups. The remaining 37 sites were eliminated from the sample.

Table 9 identifies the 24 sites that met all four of the criteria discussed. Figure 25 (located in map pocket in Volume 2) shows the distribution of all the sites, with their SAL recommendations noted. As a group, the 24 sites recommended for SAL status have temporal diagnostics, lower surface disturbance, deeper deposits, a wider variety of artifact types, a higher frequency of artifact clusters noted as present, and a higher average percentage of positive shovel tests. Twenty-three of the 24 sites have dated components identified, and 14 of these are single-component sites. All temporal periods recorded on the project are represented in this sample. In contrast, only seven of the 62 sites not selected (11.3%) have temporal components identified. In addition, the amount of the surface disturbance on the selected sites averages 63.1 percent, while the average for the remaining 62 sites is 82.2 percent. The average, maximum depth of subsurface artifacts is 40.1 cm for the selected cases, and only 17.8 cm for the 62 sites not selected. Finally, the 24 sites have an average of 6.5 different artifact types present, compared to an average of 3.5 for the 62 sites outside the sample. Only five of the 24 sites (21%) do not have artifact clusters noted on the surface, and 12 of the sites (50%) have more than a single cluster noted. In contrast, 48 percent of the 62 sites outside of the sample have no artifact clustering noted, and only five (8%) have multiple clusters. Finally, the 24 sites recommended for SAL designation have an average positive shovel test frequency of 67.6 percent. In contrast, the 62 sites not selected have an average positive shovel test frequency of 56.9 percent.

Specific Research Issues

This section develops criteria for identifying sites in GCSNA that have the potential to contribute to our understanding of local and/or regional prehistory. The likelihood of a site to contribute knowledge in terms of either of these two areas depends not only on the inferred integrity of the deposits, but also the questions asked.

Because one goal of the archaeological survey of GCSNA is to determine the SAL eligibility of sites identified and revisited during this archaeological survey, three issues specifically related to eligibility determination are given priority. These issues concern, at a broad scale, site chronology, subsistence strategies, and technological organization.

Chronology

To identify the age and chronological range of the deposits contained at a site, datable materials and temporal diagnostic artifacts in consistent vertical and primary associational contexts are most desirable. However, temporally diagnostic artifacts in disturbed contexts or on deflated surfaces can provide at least an indication of the time periods represented at sites. Although their utility in identifying associated artifact assemblages may be problematic, the assumption that a projectile point provides a date for associated artifacts is always open to question, either in buried or surface contexts. Nonetheless, knowing even broad information on periods of occupation is valuable for reconstructing long-term hunter-gatherer land-use strategies at a regional scale.

Features can provide an additional source of chronometric information that is certainly more reliable than projectile points. The presence of charcoal in a feature, allowing for the potential of radiocarbon dating, can provide chronological control for feature use.

Subsistence

The identification of features offers additional opportunities for archaeological analyses and interpretation. Relatively undisturbed features may provide a variety of remains critical to subsistence reconstruction, (e.g., charred nuts, seeds, animal bone). Features also provide evidence of past environments (e.g., wood species used for fuel, prehistoric faunal assemblages present in a region), and offer clues about feature use parameters (e.g., amount and kinds of fuels used). Even if other cultural deposits are disturbed, feature contexts can provide important information on subsistence and food processing practices through analyses of feature morphology, associated artifacts, macrobotanical remains, pollen, phytoliths, faunal remains, and spatial patterning of artifacts around features. Excavation of identifiable hearth features can provide reference points for understanding other more complex or partially disturbed archaeological remains.

Technological Organization

As was discussed in Chapter 6, many of the sites in the GCSNA lack conventional qualities of good preservation or buried deposits that are relatively intact. The Balcones uplands are a dynamic landscape subject to erosion and potentially significant movement of artifacts. Sites lacking fine-grained preservation or easily separable assemblages still can be investigated to advance archaeological understanding. Several aspects of the sites within the project area can provide significant information on technological organization, including the organization of lithic procurement and reduction at a regional scale, frequency and character of re-occupation, and lithic raw material exploitation.

The large amount of lithics present on several sites within GCSNA offers good sample sizes for the study of technology and its implications for examining more significant aspects of past human behaviors. Examination of lithic reduction strategies in the Government Canyon area provides an exciting opportunity to define technological production in an area with abundant raw material. Conventional expectations that sites in areas with readily available lithics will contain abundant evidence of early stage reduction debris can be tested. If significant amounts of middle stage reduction and finished implements are recovered, this may suggest several alternative models of land use in Government Canyon. Occupation history may be highly variable and both specialized lithic procurement and a variety of other activities may have occurred. If significant amounts of procurement and other activities are represented, then sites with predominantly early stage reduction should still be present. The prehistoric inhabitants of Government Canyon may have taken advantage of good availability of lithic raw material as an embedded resource. If this was common, then sites that contain only early stage reduction should be rare. Ambiguous results would suggest that occupational history is poorly explained by appeals to arguments regarding technological production. GCSNA offers an excellent opportunity to examine the unqualified expectations about the importance of lithic procurement in areas with abundant knappable stone.

Several of the GCSNA archaeological sites contain abundant and clustered lithic debitage. Although the majority of these sites are shallow, some have large quantities of debitage and numerous formal tools. Although these site surfaces are subject to erosion, some clustering does suggest patterning referent to cultural discard (i.e., lack of size sorting, dense lithics on flat surfaces, areas with no apparent sources of colluvial or alluvial deposition, and clusters not subject to slopewash). Large surface assemblages from such extensive sites can be excellent samples of the technological debris from past activities at these sites.

Several of the sites within GCSNA contain areas that have been extensively eroded or are likely secondary deposits. Many of these sites may not have significant research potential beyond their spatial location and the limited characterization possible within the current survey of trail impact right-of-way areas. The ubiquity of large sites within GCSNA strongly suggests that the State Natural Area does contain a significant regional record of prehistoric use. Re-occupation formed large artifact distributions visible on the modern surface, additional evaluation of a sample of sites is necessary to improve understanding of the dynamics of past use of GCSNA. The lack of subsurface deposits is not a handicap to additional investigations. Obtaining surface samples for useful analyses is both logistically and economically efficient. The visibility of surface materials on large sites permits evaluation of artifact type/sample size relationships at a scale and level of precision impossible for most excavation projects. Surface distributions are not inherently less useful than buried deposits. All archaeological sites were surface sites at one time. In the absence of detailed archaeological and geoarchaeological investigations, the taphonomic history of any site is not always clear.

Surface sites can also be used to examine lithic reduction strategies in the raw material abundant contexts of GCSNA in comparison with raw material poor regions of the Edwards Plateau and other portions of the state. This is possible even if chronologically sensitive artifacts are absent. Such broad, temporal or technological research questions can provide a better understanding of whether and how raw material availability conditions reduction strategies, tool morphologies (e.g., bifacial vs. core reduction, informal vs. formal tool use) and landscape occupational history.

Possible Mitigation Procedures for SAL Sites

This section outlines two distinct but related plans to mitigate the anticipated impacts resulting from collecting of artifacts from trails and erosion associated with trail use and maintenance. Both plans involve 100 percent surface collection of selected units from either trails or clusters within selected sites. Both plans are preliminary and are offered here primarily for discussion purposes. Details of either plan are available on request. Which of the alternative plans is chosen depends on the perspective of TPW staff and THC officials regarding the nature and scale of impact to the sites resulting from public access and erosion to GCSNA. In addition, a plan for fencing and monitoring the single intact burned rock midden, located on site 41BX146, is provided.

Of the 86 sites investigated during survey and relocation, a total of 24 sites met all four of the criteria discussed previously. Reference to Figure 25 shows that 19 of these 24 sites are intersected by trails. The five sites that are not crossed by trails are 41BX137, 41BX139, 41BX973, 41BX1492, and 41BX1505. If the perspective of TPW staff and THC officials is that the primary impact on these sites will be limited to the portions that are crossed by trails, the scope of impact mitigation can be more limited. If, on the other hand, it is expected that public access to these sites may also impact off-trail portions of sites, a more encompassing mitigation strategy may be necessary.

Both plans focus on the recovery of samples of chipped lithic artifacts. The inclusion of systematically collected samples of debitage, cores, and all tools would allow the investigation of a number of research issues. Specifically, by considering different chert types, the percentage of cortex on the debitage within these types, and the overall size of debitage, information on reduction strategies within a surface collection unit can be monitored. These data can then be compared to other collection units, both within a given site as well as across the project area, to identify different reduction strategies. For instance, it is possible that chert reduction strategies (i.e., core reduction or bifacial reduction) may vary depending on the distance of raw material outcrops from residential sites. It is possible that artifact manufacture is staged, depending on the regional lithic landscape or distinct land-use strategies practiced by hunter-gatherers. Raw material reduction strategies, as well as the nature of prehistoric tool kits, may also vary dependent on the quality (knappability) of raw materials. Coupled with more detailed information on chert outcrops observed during the present survey, raw material quality, and consideration of different patterns of debitage, projectile points, utilized flakes, cores, and retouched items, these data would help to clarify the nature and locations of different activities within the canyon. For example, little is known at present regarding the character of raw material procurement in raw material rich environments as opposed to poor areas. Answers to questions such as how raw material quantity and quality affects assemblage content, how it affects the spatial distribution of procurement relative to other activities, and how raw material quality and quantity impacts artifact replacement strategies, are currently unavailable. The 24 sites identified as having the best research potential within the GCSNA have significant information that will allow archaeologists to begin to understand a variety of factors that conditioned prehistoric behaviors, and minimally investigate how these processes varied across space. In addition, when chronometric items are recovered from these selected units, these data can be used to consider temporal changes in technological and subsistence strategies through time.

Trail Impact Strategy

If the anticipated impact to the 19 sites crossed by trails is viewed as being primarily limited to the trails, we propose that a 100 percent collection of all artifacts, with the exception of fire-cracked rock, be performed. These samples would be taken from specific locations along each trail within selected site to gather critical data and mitigate the impacts of future collection. The surface collection sample would consist of individual 1 x 4-meter units centered on the trail(s). The actual number of collection units would depend on the length of trail(s) crossing the site. The minimum size of the artifacts collected would be 10 mm in maximum dimension. This size closely approximates the smallest sized artifacts consistently recovered in a ¼-inch hardware cloth screen.

This strategy has three advantages. First, the strategy is focused on portions of the sites that have the highest probability of being directly impacted by visitors to the State Natural Area. Second, it will be the most cost-effective strategy to mitigate future impacts. The disadvantages are that this strategy mitigates impacts on only a very narrow segment of the site and, as such, samples may not be representative of the range of activities found at the site level. It is also unlikely that samples will consistently recover diagnostics that would allow temporal placement of the collected assemblages. Finally, the samples will be systematically selected. As such, they may not reflect concentrations of artifacts that have the potential for behavioral interpretations.

Cluster/Site Level Impact Strategy

This second strategy would focus at the site level and attempt to identify and sample units that represent artifact concentrations within each site. In this case, collection units would be placed in such a manner as to facilitate the collection of surface concentrations (e.g., flake concentrations potentially derived from knapping episodes). The advantages of this strategy are twofold: 1) it has a greater likelihood of recovering temporal diagnostics and therefore more solidly anchoring occupations in time; and 2) the strategy may yield data with greater analytical value (i.e., concentrations of artifacts derived from intensive and localized activities with temporal diagnostics) since they may be behaviorally more meaningful than the trail segments. However, because of the increase in the number of sites from 19 to 24, there is a significant increase in costs associated with identifying clusters. It is recommended that mitigation occur on only a small sample of the 24 sites, and that only a few clusters be targeted within this smaller site sample. As before, we suggest that all artifacts larger than or equal to roughly 10 mm in maximum dimension should be collected from units of a consistent size.

Fencing and Monitoring of 41BX146

41BX146 contains a potentially intact burned rock midden within easy view of a trail. Given the history of vandalism on these types of features within the current boundaries of GCSNA, we would suggest two different options for mitigating any potential damage to this feature. First, we would suggest the erection of a fence around the feature. While this will certainly draw attention to the location, it would likely keep all but the most determined individuals off the feature. Second, the feature should be monitored periodically for any evidence of damage. If damage is observed, we would then suggest that testing of the feature would be necessary prior to further loss of research value.

Developing Management Tools: Monitoring Collection and Erosional Impacts with Experimental Data at GCSNA

The selection of one of the two alternative surface collection strategies proposed above, designed to mitigate the impact of normal visitation effects, artifact collecting, and erosion on specific sites hinges on 1) research considerations, 2) financial considerations, and 3) the perceived nature of the impacts. It is the third component of this triad, the nature of the impacts to sites caused by both collection and erosion, for which we lack any quantifiable data. For example, it is commonly assumed that formal tools are more likely to be collected than debitage, that larger items are more likely to be collected than smaller items, that the rate and intensity of surface collection is a function of the number of individuals using a specific area, and that slopes dramatically impact artifact movement. However, little or no actual quantitative data exist on most of these topics. In this section, we propose a strategy to begin to develop quantitative data on the actual impacts associated with opening facilities such as GCSNA for public use. While Government Canyon will be open long before these data are available, and therefore they cannot be used in the decision process regarding which of the surface collection strategies should be implemented, the information can be used to assess both the effectiveness of the mitigation strategy chosen, and provide guidance for other TPW properties.

To obtain these data, we propose to create a series of experimentally produced assemblages. We propose to position a series of these assemblages in two or three different zones within Government Canyon that lack archaeological material, and monitor the assemblages over several years. The experimentally produced artifacts, created using GCSNA raw materials, should consist of a sample of common artifact types including unmodified flakes, bifaces, cores, and projectile points. A variety of size ranges should also be present. We suggest that within each of these zones, experimental plots be centered both on the trails, as well as at some distance (e.g., 5, 15, and 25 meters) from the trails. In addition, a variety of different slopes should be selected. We propose that each artifact within each specific control unit be weighed and either photographed or copied. The artifacts would then be placed on the ground and their precise location recorded with an EDM. While the control units should not be marked, a nearby datum should be set up to allow the precise mapping of all artifacts. This information will provide a baseline for monitoring the impacts of collection on both the content of artifacts at increasing distances from the trails, as well as the impact of slopes and trail use on artifact movement.

Personnel should relocate and inventory these control areas at some consistent temporal interval (e.g., every six months). These semi-annual inventories will provide information on the rates of artifact movement and collection and identify the types of artifacts most likely to be collected from GCSNA sites. Information from the different control units located at increasing distances from the trails and in off-trail artifact concentrations will, in combination with data on the number of park visitors, provide information on the distances away from the trails that visitor impact may be expected. In conjunction with this information, the point-plotted artifact locations will provide data on the degree and scale of artifact displacement due to erosion and foot traffic. These data may be useful in estimating the scale of artifact displacement and associational integrity of material. At a larger scale, the data generated from this monitoring strategy would allow managers to begin to quantify both the impact of public access on assemblages as well as aspects of erosion on archaeological resources. Aspects of these data should be applicable to other TPW properties, as well as other properties throughout the state.

Summary

In May of 2001, Texas Parks and Wildlife (TPW) contracted with the Center for Archaeological Research (CAR) at The University of Texas at San Antonio to conduct an archaeological survey of trails and revisit previously recorded archaeological sites in the northern and central areas of Government Canyon State Natural Area. The trail survey covered a distance of approximately 41.52 kilometers (25.8 miles). The total area systematically surveyed was approximately 6.47 km^2 (1,599 acres). Fieldwork, conducted between May of 2001 and early February of 2002, resulted in the identification of 86 sites. Fifty-two of these 86 sites represent new recordings. Projectile points from sites suggest that the survey area was used, at some level, for portions of the last 11,000 years, with the principal occupation primarily reflecting the period from the Early Archaic through the Late Archaic. A consideration of occupational patterns within the study area suggests that areas close to drainages are characterized by more frequent re-occupation

Twenty-four of the 86 sites are recommended for State Archeological Landmark status. These sites all have subsurface deposits, lower levels of disturbance, and a high number of artifact types relative to sample size. In addition, these sites either have an identifiable component or, in one case, have a feature that is thought to be intact and would therefore provide chronometric information. This combination of attributes makes these sites ideal for considering a variety of current as well as future research questions. The remaining 62 sites are not recommended for SAL consideration. While aspects of some of these sites can potentially provide useful information, the overall quality and quantity of data available at these locations may be limited.

Because Government Canyon State Natural Area will be open to the public, and it will be impossible to effectively monitor the entire 7,000 acres that are currently within the facility, we recommend two alternative surface collection strategies that could mitigate potential impacts to these SAL sites. Both strategies would focus on the surface collection of all non-burned rock artifacts greater than 10 mm from a series of sample units. The first strategy would center on trails, and thus involve only 19 of the 24 SAL sites. Assuming that public impact would extend off the trails, a second strategy would focus on the collection of sample units within artifact clusters at a site level. The implementation and effectiveness of either of these strategies depends on the scale of impact that will result from the opening of the facility to public access. In a single case with a potentially intact burned rock midden, we suggest that fencing and monitoring may be the least costly solution, though testing may ultimately be necessary should the initial options prove not to be effective. The mitigative strategies proposed for these sites would produce valuable data that could help provide answers to significant theoretical issues relevant to hunter-gatherer studies.

In order to monitor the potential and actual impact of public access to the State Natural Area, we also propose the delineation of control units with well-documented, experimentally produced, point-plotted artifacts. The repeated systematic re-inventory and mapping of the artifacts within these control units positioned at increasing distances from trails and on a variety of slopes should provide valuable data on the long-term impact of collecting related to public access, as well as data on rates of horizontal displacement due to trail use and natural factors. These data will be extremely valuable in shaping park management practices.

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Image Redacted

Figure 11. *Previously recorded sites in GCSNA.*

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Figure 20. *Number of temporal components on sites and drainages in the survey area.*

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Figure 21. *Distribution of projectile points in the survey area.*

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Figure 25. *Distribution of SAL recommended sites (black) and not recommended sites (gray) in the survey area.*