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IV. ENVIRONMENTAL SETTING

Today the Hinojosa site is located on the banks of a dry stream that holds water only after periods of heavy rainfall. About half the site and most of the uncultivated land in the area is overgrown by dense thorn brush. The other half of the site lies in a plowed field where wheat and other crops are planted semiannually. Looking at the area today, the factors that influenced the Indians to camp at the Hinojosa site are certainly not obvious. Six hundred years ago, the creek held water year round, and the site lay in a narrow wooded band surrounded by grass covered prairies interspersed with mottes of brush and prickly pear. To understand what the environmental setting was like at the time that 41 JW 8 was an Indian campsite one must consider a variety of modern, historic, and prehistoric environmental data.

CLIMATE*

Jim Wells County has a fairly mild climate characterized by hot summers and comparatively warm winters. The annual growing season usually lasts over 280 days (continuous days without freezing temperatures). Annual rainfall averages between 26 and 28 inches a year but varies widely on a year to year basis from the annual mean. Late spring (May) and early fall (September) are usually the wettest times of the year. March is the driest month of the year. The heaviest rainfall usually occurs in the early fall when tropical storms and hurricanes strike the Coastal Bend area. Humidity is fairly high most of the year due to the nearby coast (Alice lies about 45 miles due west of Corpus Christi Bay). The prevailing winds blow moist Gulf air in from the southeast.

A considerable amount of the annual precipitation is lost due to evaporation. Annual evaporation rates far exceed the annual precipitation. The average annual temperature is 72°F. During July and August the average temperature is 85°F, and the average daily high is over 96°F. The extremely hot conditions in July and August cause most of the soil moisture which is built up in the late spring to evaporate. Dry conditions are also common in the winter when northers bring frequent bursts of cool dry air down. These northers disrupt the normal prevailing wind pattern and push the moist Gulf air off the coast. The total rainfall from December through March averages less than five inches.

Two periodic climatic phenomena create serious problems in the Jim Wells County area: tropical storms and droughts. Tropical storms and hurricanes periodically strike the Coastal Bend area of Texas causing hundreds of thousands of dollars worth of damage to homes, crops, and urban areas. The Texas Coastal Bend area near Corpus Christi averages four years between occurrences of major tropical storms or hurricanes, five years between occurrences of hurricanes, and 16 years between occurrences of extreme

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*The information in this section was compiled from a variety of sources in addition to those cited. These include: Minzenmayer (1979); **The Texas Almanac** (1983-1984); the U.S. Weather Bureau, San Antonio; and maps from publications cited elsewhere.

hurricanes (Henry, Driscoll, and McCormack 1975). The damages are caused by high winds, associated tornados, and extremely heavy rainfall rates. Alice received over 13 inches of rain from a tropical storm on September 13, 1951. Because the topography in the area is relatively low and flat, large areas of the county are inundated for days following a severe storm. One of the most unpleasant lingering effects of a major storm in the coastal plain area is the presence of hordes of vicious mosquitos for weeks or months following major flooding.

Droughts also periodically create extreme conditions in Jim Wells County. Major droughts lasting over a year occur about once every 20 years. Shorter droughts lasting up to a year occur about once every 10 years. Periods of several months with little rain occur almost every year. Drought conditions are usually created when stable high pressure cells remain centered just off the coast southeast of Corpus Christi (Carr 1967). These high pressure cells may dominate the weather pattern for many months, effectively blocking all sources of moist air. The recent (1984) drought conditions in southern and central Texas exemplify this problem.

Jim Wells County lies within a climatically sensitive area that is currently classified as having a dry subhumid or a humid semiarid climate. This area borders large semiarid to arid regions to the west and large subhumid to humid regions to the east. Comparatively minor climatic shifts can and apparently have caused significant changes in south Texas climatic conditions. Gunn **et al.** (1982) have defined a south Texas climatic threshold that is linked to the average temperatures of the Northern Hemisphere. When the average annual temperature of the Northern Hemisphere exceeds 15-16°C, south Texas has a more arid climate. Conversely, when the average annual temperature is below the threshold, south Texas has a more humid climate. The south Texas climatic threshold model is based on a statistical analysis of various climatic factors, including global temperatures, atmospheric shielding, solar activity, and precipitation (Gunn **et al.** 1982). Projecting the climatic threshold across the estimated temperatures of the Holocene produces a series of dry and wet intervals.

The past climatic conditions in south Texas have not been studied enough to construct an accurate prehistoric climatic chronology. This is due to several factors, including a general lack of interest in the subject and very poor preservation. Paleoclimatic studies usually rely on the analysis of pollen, tree rings, fossil pack rat middens, and other environmental indicators. South Texas has notoriously poor preservation conditions due to alternating wet and dry conditions. Pollen analysis has been attempted with little success at a number of prehistoric sites (Hester 1977:28). One promising avenue for research has been suggested by Robinson's (1979, 1982) work with phytoliths. Unfortunately, Robinson has only published preliminary results to date, and these are not directly applicable to the 41 JW 8 site area. The preliminary results appear to document major shifts between cooler, more mesic periods and hotter, more xeric periods in the Holocene.

Holloway (1986) has recently reported the results of macrobotanical (charcoal) identification of samples collected at sites in the Choke Canyon Reservoir area dating back to 4000 B.C. Holloway summarized relevant macrobotanical, pollen, and faunal data and suggested that the region has had a relatively stable environment characterized by increasing aridity for 6000 years. He also criticized Gunn **et al.** (1982) and Robinson (1979, 1982) for relying on the identification of a definable Hypsithermal Interval in their climatic interpretations of south Texas. The Hypsithermal Interval is an inferred wetter/cooler interval around 4000-3000 B.C. that is linked to a glacial advance episode in the Northern Hemisphere. Holloway cites numerous studies that have failed to evidence this climatic interval in southern Texas and the surrounding region.

HYDROLOGY

In the current century the availability of reliable subsurface and surface water in south Texas has grown progressively worse. Large and small reservoirs provide adequate surface water supplies for localized areas during wet years but wells and springs continue to dry up. Most streams draining the eastern Reynosa Cuesta (Goliad Formation), including Chiltipin Creek, have not flowed regularly this century (Price and Gunter 1943:8). A number of lines of evidence suggests that at the time that the Hinojosa site was occupied, Chiltipin Creek was spring fed and held water year round.

A study of springs in Texas by Brune (1981) documents 10 now dry springs and seeps in Jim Wells County. Most of these were active reliable sources of water in the 19th century (Brune 1981:265-267). It is very interesting and informative to note the locations of many former small springs and seeps in the inland south Texas area that is today so dry. Of particular interest are the Amargosa Springs which are located very near the Hinojosa site. Brune gives the location of the Amargosa Springs as 16 km north-northwest of Alice near the junction of Chiltipin Creek and Amargosa Creek. This places the springs within a few hundred meters of 41 JW 8. In fact, Brune (1981:266) mentions a "way station for stagecoaches" near the springs. This is undoubtedly a reference to the Amargosa Stage Stop, the ruins of which lie some 200 m east of the Hinojosa site. Thus, 41 JW 8 is located at or just downstream from springs active less than a hundred years ago.

The water quality of the spring water that once kept Chiltipin Creek flowing may have left something to be desired. The name of the springs, Amargosa, is Spanish for "bitter." Brune (1982:265-266) notes that the springs flowing out of the Goliad and Lissie Formations, such as the Amargosa Springs, have very hard, alkaline, sometimes slightly saline, water. Thus, during dry periods in the prehistoric era, when the only water in Chiltipin Creek was provided by springs, the water may have tasted bad. After the mud settled out following heavy rains, Chiltipin Creek would have had much more drinkable water. In a land where surface water was hard to find, the taste of the water may not have been important.

Confirmation that the site was located near a spring-fed creek was provided by several of the project consultants. William Murray concluded that Chiltipin Creek had been a spring-fed creek at the time of the prehistoric occupation based on an examination of the freshwater mussel shells found in the site deposits (Section VII: Macrobotanical Analysis). Murray identified several clam specimens from the prehistoric occupation that evidenced seven to twelve years of growth and suggested that Chiltipin Creek "was a small (couple of meters wide) constantly running (possibly artesian source), shallow (1/2 meter deep) stream. The substrate bottom was probably mud or mud-sand base." Gentry Steele (Section VII: Vertebrate Faunal Remains) identified a number of water proximate faunal species from the site deposits, including aquatic birds, riparian mammals, soft shell turtles, and fish.

PHYSIOGRAPHY, GEOLOGY, AND SOILS

The Hinojosa site lies within a vast physiographic province known variously as the West Gulf Coastal Plain, the Rio Grande Plain, and the South Texas Gulf Coastal Plain (cf. Fenneman 1938; Bogush 1952; Carr 1967). This vast area of comparatively flat topography stretches from northeastern Mexico north to the Balcones Escarpment and east across Texas into adjacent Gulf coast states.

Site 41 JW 8 lies at an elevation of about 250 feet above mean sea level on the edge of a northeast-southwest trending Pliocene age geological formation, known as the Goliad Formation (Barnes 1975). The Goliad Formation, or the Reynosa Cuesta as it is termed in early publications (Price and Gunter 1943), can be characterized as a dissected rolling upland area with eroded ridges and valleys (Minzenmayer 1979). The Goliad Formation is made up of calcareous sands with some gravels and calcium carbonate concretions. This formation forms a 15- to 25-mile-wide band that provides minor topographic relief and has significant vegetational and soil associations that contrast with the Beaumont Formation to the southeast. The Beaumont Formation is a massive Pleistocene clay accumulation that forms the flat coastal prairie. The Hinojosa site occurs within a narrow band of the Lissie Formation sandwiched between the Beaumont Formation and the Goliad Formation. The Lissie Formation is a Pleistocene accumulation of sand, silt, and clay that forms a transition in soils and relief between the Goliad and Beaumont Formations. Thus to the north and west from the site, the topography is rolling and eroded, while to the south and east the topography becomes progressively flatter as one nears the coast.

The site lies on a raised area adjacent to Chiltipin Creek. From the perspective of the creek, the site lies atop a steep bluff. From the opposite perspective, the topography gradually slopes downhill from a sandy ridge some 1.4 km west of the creek to a low point approximately 200 m west of the site and then gradually rises adjacent to the creek. The slight rise adjacent to the creek appears to be a natural levee of Chiltipin Creek to which has been added cultural debris. No evidence was observed of layered sedimentary deposits or erosional facies, however, the fine sandy clay loam that dominates the site deposits would appear to be primarily alluvial rather than aeolian in origin. Some wind borne sediment has definitely been added to the site deposits. The best evidence of this was seen along the fence row (Wagon Trail Area) were vegetation has trapped fine aeolian sediments that are no doubt derived from erosion of the adjacent plowed fields.

The sandy loam soil on the topographic rise drains much better than the clayey soils in the eastern site area and in the field. The farmer who has leased the property for a number of years commented, "that corner [the site area] has always disked up real fine but the crops never do well there." He went on to attribute this phenomena to the fact that clayey soils hold moisture better and have more nutrients. The correlation between archaeological sites and poor crop growth has been noted in many areas of south Texas. Vela (1982) has suggested that stunted grain sorghum in site areas may be due to mineral deficiencies caused by concentrated land snails. The 41 JW 8 situation suggests that localized variation in soil characteristics may be the determining factor responsible for the difference in crop growth and that the snail concentrations are an unrelated coincidence.

Immediately adjacent to the main site area Chiltipin Creek is rather deeply entrenched; the west creek bank is a steep bluff some 4 m high. Upstream and downstream the bluff is noticeably less abrupt. The creek bed adjacent to the site is partially filled with recent clay loam sediments and heavily overgrown with grass and weeds. Every 50 or 75 m along the creek bed are small depressions some 5 to 10 m long that hold water for extended periods of time. The depression adjacent to the site is one of the larger depressions observed for several hundred meters in either direction. Under wetter conditions the modern creek has a series of shallow muddy pools of water. It appears likely that the Late Prehistoric creek would have been less clogged by sediments and vegetation and would have had somewhat larger and deeper pools.

A linear depression occurs in the plowed field some 250 to 300 m west of the site. This topographic feature appears to be a filled-in stream channel. The abandoned channel runs parallel to present-day Chiltipin Creek. Examination of topographic maps and aerial photographs reveals that the abandoned channel once joined present-day Chiltipin Creek at the modern junction of Amargosa Creek less than a kilometer upstream from the site. It is suggested that the abandoned channel is a relic channel of Chiltipin Creek. Dating the abandonment is difficult. It can be assumed that this event took place at least 500 years ago (prior to when the site was occupied). Given the fact that the abandoned channel is still quite distinct, topographically, it is suggested that the change in stream channels took place within the past several thousand years.

Across Chiltipin Creek from the site are a series of low ridges with thin calcareous soils. The Amargosa Stage Stop lies on the slope of one such ridge. Erosional gullies on the slopes of these ridges reveal caliche and calcium carbonate concretions only a few inches below the surface. The soils associated with the ridges are not very fertile and do not support mid and tall native grasses. The ridges do provide an overlook of the lower lying areas west of the site.

Site 41 JW 8 lies within an area mapped by the Soil Conservation Service as having Opelika fine sandy loam, depressional soils (Minzenmayer 1979). As is usually the case, more variation was observed in the field than is recorded on the soils maps. Opelika fine sandy loam, depressional soils are characterized as deep calcareous loamy soils that form on nearly level upland areas. (The SCS refers to all of Jim Wells County as an "upland" area except for a narrow stretch of "bottomland" adjacent to the Nueces River.) Excavation profiles seem to fit the general description of Opelika soils except in the eastern edge of the site where a much darker clay loam was encountered.

In the main site area, adjacent to Chiltipin Creek, the soil is a gray brown fine sandy loam that becomes more compact and more calcareous with depth. Opelika soil is described as having an eight-inch-thick surface layer that is "friable, neutral, gray fine sandy loam" (Minzenmayer 1979:25). Between 8 and 22 inches, the soil is "firm, moderately alkaline, dark gray sandy clay loam." From 22 to 33 inches, the soil is "firm, moderately alkaline, gray sandy loam that has brownish mottles." A mottled white sandy clay loam occurs below 30 inches. The SCS descriptions of Opelika soil are similar to that observed at the site, although the lower zone in several excavation units appeared to be caliche rather than white clay.

The general soil map of Jim Wells County shows some interesting soil distributions with respect to 41 JW 8. The soil distributions mirror the differences observed in surface geology and topography. The site occurs within a one- to two-mile-wide band of deep loamy and clayey soils. Surrounding this band to the northeast, north, and northwest is a large area of shallower loamy soils that extends across northwestern Jim Wells County. Southeast of the site the band of deeper soil broadens to encompass most of the eastern section of the county. Minzenmayer (1979) notes that the deeper clayey soils provide excellent native range plants. These soils support the highest yields of native mid and tall grasses of any soil in the county. The implication is that 41 JW 8 lies at the head of an area which would have originally been a mid and tall grass prairie.

The detailed soils photomaps of Jim Wells County demonstrate another very interesting fact about the site location; the soils in the general site vicinity are significantly more diverse than comparable areas north and south as well as most of the rest of the county. This statement is based on a study of the photomap sheets showing the distribution of the 52 mapped phases of the 27 named soils series defined by the SCS in Jim Wells County (**ibid.**). The detailed soils distributions across the county are shown by 45 aerial photograph sheets. Each sheet covers an area of about 21 square miles. The Hinojosa site occurs on Sheet 16. Sheet 16 has a total of 35 out of the 52 mapped phases (67%), representing 22 out of the 27 named series (81%) for the entire county. Adjoining Sheet 16 to the west and following Chiltipin Creek upstream is Sheet 15. Sheet 15 has a total of 27 out of the 52 mapped phases (52%), representing 16 out of the 27 named series (59%). The photomap sheet adjoining Sheet 16 to the south along Chiltipin Creek is Sheet 20. Sheet 20 is almost as diverse as Sheet 16. Sheet 20 has 33 out of the 52 mapped phases (63%), representing 20 out of the 27 named series (74%). Farther downstream, soils diversity drops rapidly after Chiltipin Creek flows into San Fernando Creek north of Alice. Sheet 24 covers the eastern half of Alice and San Fernando Creek to the east. Sheet 24 has only 18 out of 52 (37%) of the mapped phases, representing only 11 out of 27 (41%) of the named series.

VEGETATION

South Texas lies within the Tamaulipan Biotic Province as defined by Dice (1943) and revised by Blair (1950). The Tamaulipan province is characterized as a thorny brush plain dominated by a relatively small number of species, including mesquite, **Acacia**, **Mimosa**, granjeno, **lignum vitae**, cenizo, whitebrush, prickly pear, and tasajillo (**ibid.**:103). Abundant evidence suggests that substantial changes have occurred in the vegetation patterns in south Texas during historic times (cf. Price and Gunter 1943; Bogush 1952; Inglis 1964; Weniger 1984). Today northern Jim Wells County is dominated by brush in uncleared and uncultivated areas. Evidence suggests that more of the area was covered with native grasses prior to the late 1800s.

In 1833, Benjamin Lundy crossed Jim Wells County from west to east just south of the site. He described the area as "delightful" and mentioned that the stream courses were wooded but that the uplands had "scarce a bush" (quoted in Inglis 1964:35). Lundy also pointed out that the country was "abounding in excellent grass." Other travelers such as Bonnell in 1840 and Michler in 1849 passed through sections of Jim Wells County and described prairie conditions with mesquite and oak concentrated near creeks and rivers (Inglis 1964:36). By 1885, the western area of Jim Wells County and adjacent Duval County were apparently covered in dense brush as indicated by Harvard's comments (**ibid.**). Harvard did note that eastern Jim Wells County was covered in a sparse scrubby chaparral that was absent in places "leaving the ground covered with thin sparse grass."

In examining the historic accounts of south Texas, the terms "prairie" and "grass prairie" are frequently used to describe much of the region particularly prior to the mid 1800s. This usually brings to mind a picture of an endless grassland. This picture may be misleading. Del Weniger (1984 and personal communication) has recently compiled hundreds of pre-1860 historic references to the landscape, water resources, vegetation, and fauna of Texas. Weniger emphasizes that the term "plain" refers to an endless level expanse of grass whereas "prairie" actually refers to a rolling topography covered with both grass and brush. Weniger argues that early travelers clearly indicate that the southern Texas prairie areas had dense stands of grass interspersed with mesquite, live oak, acacia, prickly pear, and other brush species. "Grass prairies" may have referred to areas of the prairie that had particularly dense stands of grass between the brush mottes. Early travelers often discussed vegetation from a practical perspective--from having had to cross through it. One can readily imagine that a reference to a prairie would emphasize the ease of passage after having to cross through or find a way around the extensive chaparral thickets bordering the major streams and rivers. Thus the terms "delightful" and "grass prairie" may have referred to areas of the praire that had ample grassy areas that allowed easy travel between the brush mottes.

In addition to the grass prairies, however, there are early historic accounts of unusually large concentrations of dense prickly pear (**Opuntia engelmannii**) west of the lower Nueces River in parts of Live Oak, Jim Wells, Duval, Nueces, and Kleberg Counties (Campbell and Campbell 1981:7). Campbell and Campbell (1981:14) make specific reference to a concentration of prickly pear located near 41 JW 8: "the greatest concentration of prickly pear plants nearest to the Mariames [group of Indians Cabeza de Vaca lived with] was in Duval and Jim Wells Counties, particularly between San Diego and Alice on the north and Falfurrias on the south." The Campbells' statement is based in part on data collected by Davenport and Wells (1918-1919) who interviewed long-time inhabitants of the area. The prickly pear fields were much reduced after the "great freeze of February 1899" (Davenport and Wells 1918-1919:209).

The nature and extent of the recent changes in the vegetation of south Texas are the subjects of considerable debate. Some have argued that thorny brush has "invaded" a pristine grassland aided by overgrazing, bovine digestive tract seed dispersal, and the cessation of natural range fires (cf. Bogusch 1952). Others seem to agree that the cited factors have caused a marked increase in density of thorny brush but contend that the brush was already present (cf. Inglis 1964). Del Weniger (1984) has recently created some controversy over his contention that dense stands of brush have long been present in the area. Weniger rejects the "natural" range fire argument by noting that of all the many pre-1860 range fires that he has found references to, none were attributed to natural causes. Weniger also attempts to demonstrate that range burning only became prevalent after the arrival of European settlers.

The role played by fire in maintaining grassland in southern Texas has long been discussed (Cook 1908; Johnson 1963). Weniger's contention that historic prairie fires were caused by man does not rule out the possibility that man has been setting prairie fires for many thousands of years (cf. Sauer 1950). Cabeza de Vaca noted that the Mariame sometimes controlled the movement of deer by burning large areas of the open prairie, thus concentrating the deer in the smaller unburned areas (Campbell and Campbell 1981:17). The Campbells point out that the burning could have only been done during times when the grasses were dry and combustible (fall or winter?). Weniger does not cite the Cabeza de Vaca evidence due to controversy over the exact route of de Vaca's travels. In doing so, Weniger chooses to ignore the earliest and most detailed account of purposeful burning of the prairies by the aboriginal inhabitants of the region. This calls into question Weniger's contention that the Indians did not burn the prairies prior to being taught how to do it by the white settlers.

A recent review of the "historic role of fire on the Rio Grande Plains" by Charles Scifres (1980) emphasizes both the drastic nature of the recent change from grassland to brushland predominance in south Texas and the role fire and man have played in this change. Scifres argues that the ability to control fire is one of the principal reasons that prehistoric man adapted to grasslands and by extension to south Texas. Scifres believes that the historical vegetation changes can be attributed to the cessation of man-caused fires, elimination of the original grazing species (bison and pronghorn), and climatic change to an increasingly xeric climate. Scifres advocates the use of prescribed (controlled) burning to improve range pasture by increasing the grass and forage species.

The effect of fire in controlling south Texas brush has been studied by several groups of range management specialists (Box, Powell, and Drawe 1967; Scifres and Kelly 1979; White 1980). Experimental burnings at the Welder Wildlife Refuge have demonstrated that fire helps maintain grass density and diversity and reduces brush species density in the areas between brush mottes or thickets. The actual brush mottes themselves were little affected by fire as they lacked adequate fuel (dry biomass) to burn quickly. This suggests that prehistoric range fires could have helped maintain corridors and pockets of grass but would not have eliminated the larger brush mottes. In the era before extensive overgrazing by sheep and cattle the grasses were a much more dominant aspect of the vegetation as numerous travelers attest. Prehistoric fires would have had more fuel (dry biomass) during wet climatic intervals when grass stands reached maximum densities. Therefore, prehistoric fires, whether started by man or natural causes, may have been more effective in controlling brush spread than modern experiments in grazed areas suggest.

One factor which is not often emphasized in discussions of vegetation changes is the effect of short-term climatic cycles. An excellent example of how drastically the vegetation of a particular locality can change over a 20-year period is illustrated in Drawe, Chamrod, and Box (1978). The Welder Wildlife Refuge in Sinton County (about 80 km east of 41 JW 8) has been carefully monitored and studied since the mid-1950s. Drawe, Chamrod, and Box (1978) illustrate a series of photographs of one area of the refuge over a 22-year period. In 1956, just after the terrible drought of the early fifties, the area had a prickly pear and short grass vegetation community. The photograph (ibid.:frontispiece) shows a dense field of cactus with very sparse native short grasses. Later photographs, taken in 1965 and 1977 (Drawe, Chamrod, and Box 1978:Figs. 5 and 6), show the area changing to a mid grass and mesquite community. The 1977 photograph shows dense thick grasses, low mesquite, and almost no prickly pear. Drawe, Chamrod, and Box attribute the change primarily to increased moisture, although reduced grazing pressure was certainly a factor in the improved grass. Prickly pear is thought to have decreased because of disease and insect problems created by a decade of higher rainfall.

Jim Wells County is often included in the Coastal Bend region of Texas for purposes of vegetation and wildlife studies. Several studies sponsored by the Welder Wildlife Foundation in Sinton, Texas, provide detailed identification lists of native vegetation. Jones (1975) provides an identification key to roughly 1150 species and varieties of Coastal Bend flora exclusive of the grasses. Gould and Box (1965) provide very detailed identification of the grasses of the Coastal Bend. The study by Drawe, Chamrod, and Box (1978) discusses plant communities similar to those that might have been present in the Jim Wells County area prior to intensive grazing and agriculture.

SITE SETTING CIRCA A.D. 1350

To construct an environmental model at the time that the Hinojosa site was occupied, a number of lines of evidence were considered, and a number of assumptions were made. It is assumed that the local climatic conditions at that time (circa A.D. 1300-1400) were wetter than today. The average annual rainfall was probably similar to that of today; however, it is assumed that absence of clearing, plowing, overgrazing, and historic erosion would yield more effective rainfall. It is also assumed that the area had relatively uneroded soils that were generally deeper than today in the upland areas. Nonetheless, present-day soil trends are considered reliable indicators of trends present 600 years ago. In other words, it is assumed that thin soils today would have also been comparatively thin then. Chiltipin Creek would have been spring fed year round, although during dry periods the creek would have only held water in the deeper holes.

It is assumed that with increased effective moisture and without modern impact (overgrazing and cessation of the prairie fires) the general region would have had less brush and more grasses than today. The same species that are present today were undoubtedly present 600 years ago. Brush mottes contained the same thorny species that today are so widespread. It is assumed that periodic fires did occur, whether natural or man-made. The fires would have kept brush-free corridors open in most areas. It is assumed that the prickly pear fields noted the following century by Cabeza de Vaca were not as extensive during the occupation of the Hinojosa site. These assumptions are made based on the published evidence cited previously and on archaeological evidence that will be presented later in this report.

The environmental model is shown in Figure 2. The model recognizes four general vegetation patterns: mid to tall grass prairies, riparian woods, short grass and thorny brush uplands, and short to mid grass and scrub brush uplands. These general vegetation patterns reflect the major native plant communities that would have been present in the area. The complex array of soil type distributions noted around the site suggests that a number of smaller microenvironments with associated plant communities would have been present in addition to the major plant communities. The model presented here is a schematic interpretation that will be used in later sections of this report to discuss the environmental exploitation patterns evidenced by the archaeological data. It is recognized that any such model is a simplification of the complex array of plant communities that would have existed.

The model shows that the mid to tall grass prairie covered the areas that today have deep clayey and loamy soils. The mid to tall grass prairie would have extended south and east of the site area. Small mottes of mesquite, live oak, and prickly pear would have been interspersed throughout the prairie, particularly in depressional areas with increased soil moisture. The site lies on the edge of a linear band of riparian woods or galeria forest (Weniger 1984:36) paralleling Chiltipin Creek. This wooded area would have included mesquite, anaqua, elm, live oak, and hackberry trees, and a variety of vines and bushes. Larger trees would have been clustered around the shaded water holes along the creek. East of the site, the ridges with shallow soil would have been covered with short grasses, thorny brush, and plants suited for shallow calcareous soils such as ceniza. Short to mid grasses and taller thorny brush would have occupied the lower slopes of the ridges east of the site where soil depth increases. Prickly pear thickets (not shown in the model) would have occurred west and southwest of the site in the lower lying areas with deeper sandy soils between the upland ridges.

Thus, we see that 41 JW 8 was situated in an broad ecotone situation with a variety of habitats nearby. It should be emphasized that the boundaries between the posited habitats would not have been as sharp as shown in the model. Most topographic, soil, and moisture gradients are gradual rather than abrupt. One good reason for the variety of habitats that are postulated for the aboriginal site area is the soils diversity as noted earlier. Diverse soils support diverse flora which in turn support diverse fauna. The faunal assemblage recovered from the site supports the hypothesized broad

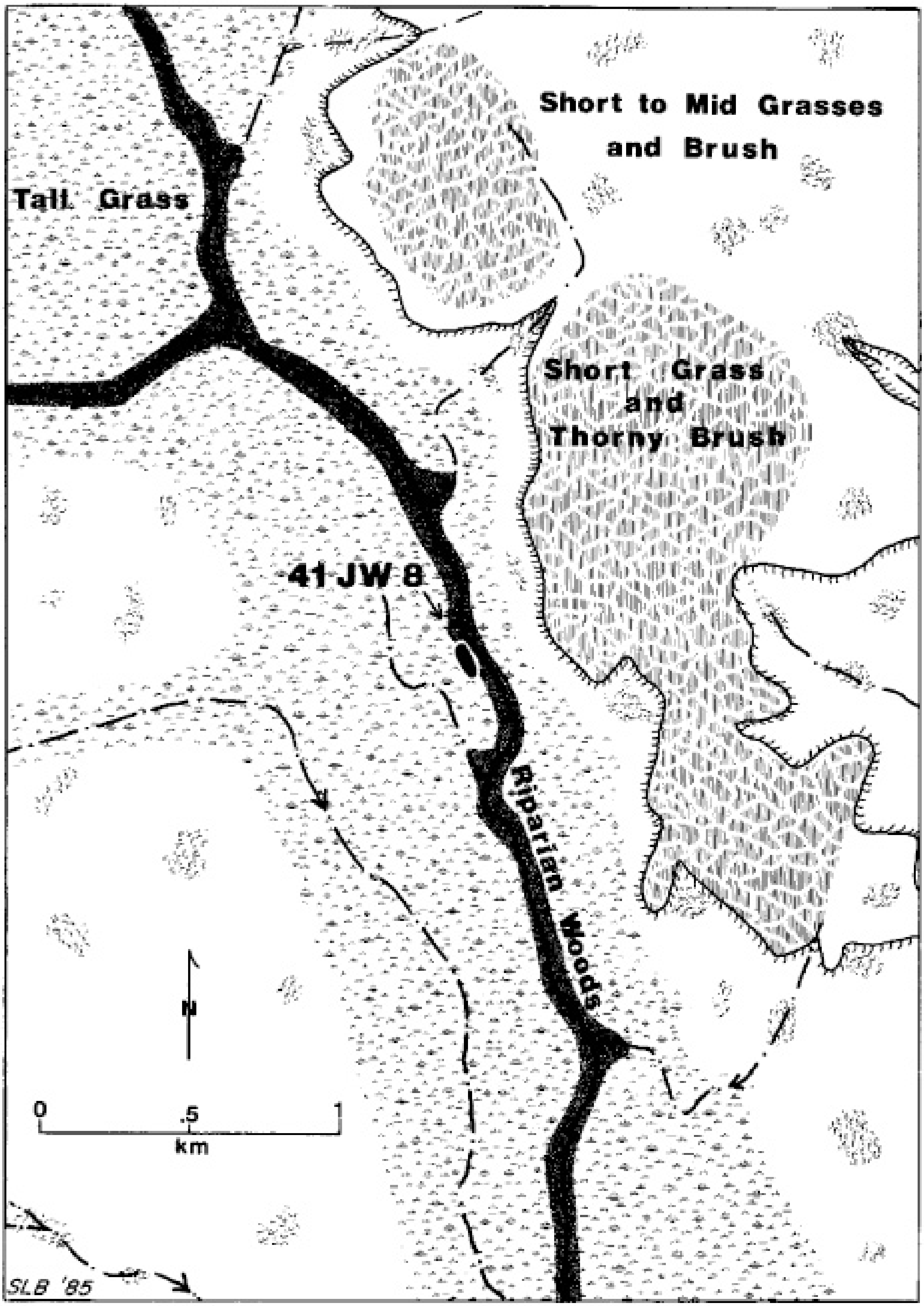

Figure 2. Environmental Model of Site Vicinity.

range of habitats rather well. Bison and antelope would be associated with the mid to tall grass prairies. The fish, mussels, soft-shelled turtles, and aquatic birds attest to the presence of a well-watered riparian zone. The javelina, **Rabdotus** land snails, and rats would have been associated with thorny brush and prickly pear thickets.