

THE RECREATION POTENTIAL OF THE
LAS LENGUAS AREA, TEXAS

by

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INTRODUCTION

The demand for additional outdoor recreation opportunities in the United States is paramount--and unquestioned. This need is also quite evident in the State of Texas. As more and more people congregate in metropolitan centers, the demand for recreational lands in natural areas increases correspondingly. The 1970 population of Texas was 11,196,730.¹ It has been estimated by the Bureau of Business Research, the University of Texas, that the figure should reach 19,900,000 by the year 2000, with a vast majority of these people being urban dwellers.²

The National Park Service has estimated that forty-five acres of state park land per 1,000 population in Texas would be adequate to meet future demands. Likewise, the White House Regional Conference on Outdoor Recreation suggested forty-five acres per 1,000 population as a goal for

¹U.S., Department of Commerce, Bureau of Census, 1970 Census of Population--Texas (Washington, D.C.: Government Printing Office, January, 1971), p. 3.

²Texas Parks and Wildlife Department, State of Texas Comprehensive Outdoor Recreation Plan (SCORP) (Austin, Texas: State of Texas, 1965), 1.6. Hereinafter referred to as Texas Parks and Wildlife Department, Outdoor Recreation Plan.

the year 2000.³ Analyzing these figures, it is observed that Texas needs 503,853 acres of state park land now and 895,500 acres by the year 2000. As of 1969 a meager 63,310 acres of Texas land, approximately .04 percent of the state, was in recreational use as state parks.⁴ This example is only one of several that could be cited to exhibit the magnitude of the deficit of recreational land in Texas.

The Comprehensive Planning Division of the Texas Parks and Wildlife Department has partitioned the state into seven planning regions. Region I consists of sixty-seven counties, most of which are a part of either the High Plains or the Rolling Plains of northwestern Texas. The region contains 64,119 square miles of land, which is twenty-four percent of the state, and sustains a population of 995,511 persons, which represents 8.9 percent of the Texas population. Yet it contains a mere 2.2 percent of the total Texas outdoor recreation acreage.⁵ In 1969 Region I included only five of the sixty-six State Parks and Sites.

³Texas State Parks, E.J. Urbanovsky, project director (Lubbock, Texas: Texas Technological College Press, 1963), p. 13.

⁴Texas Parks and Wildlife Department, Report of the Department, Annual Report 68-69 (Austin, Texas: State of Texas, 1969), p. 21.

⁵Texas Parks and Wildlife Department, Outdoor Recreation Plan, 2.1.2.

The citizens of Region I have most avidly voiced their desire for additional outdoor recreation opportunity through the publication, Goals for Texas--Phase Two. They specifically express an ambition to fulfill their needs through the acquisition of regional and state park sites, and through promotion of the public use of privately owned recreational land. They further wish to enhance public interest in the environment of the region by acquiring, and making available to the public, unique natural areas.⁶

Las Lenguas Canyon is located six miles west of Quitaque in Briscoe County near the center of Region I (see Fig. 1). The area exhibits characteristics which will make it an integral part of the future outdoor recreation program of the region. The canyon locality is quite scenic with its rugged terrain and panoramic vistas. A permanent stream flows along the floor of Las Lenguas Canyon, and three distinct vegetative zones may be encountered while descending from the rim of the canyon to the stream below.

Legends tell of Indians and Comancheros who once frequented the recesses of Las Lenguas Canyon. The canyon offered protection to renegade Comanches who raided neighboring ranches for cattle and captives to trade with the

⁶Office of the Governor, Goals for Texas--Phase Two (Austin, Texas: State of Texas, 1970), pp. 199-210.

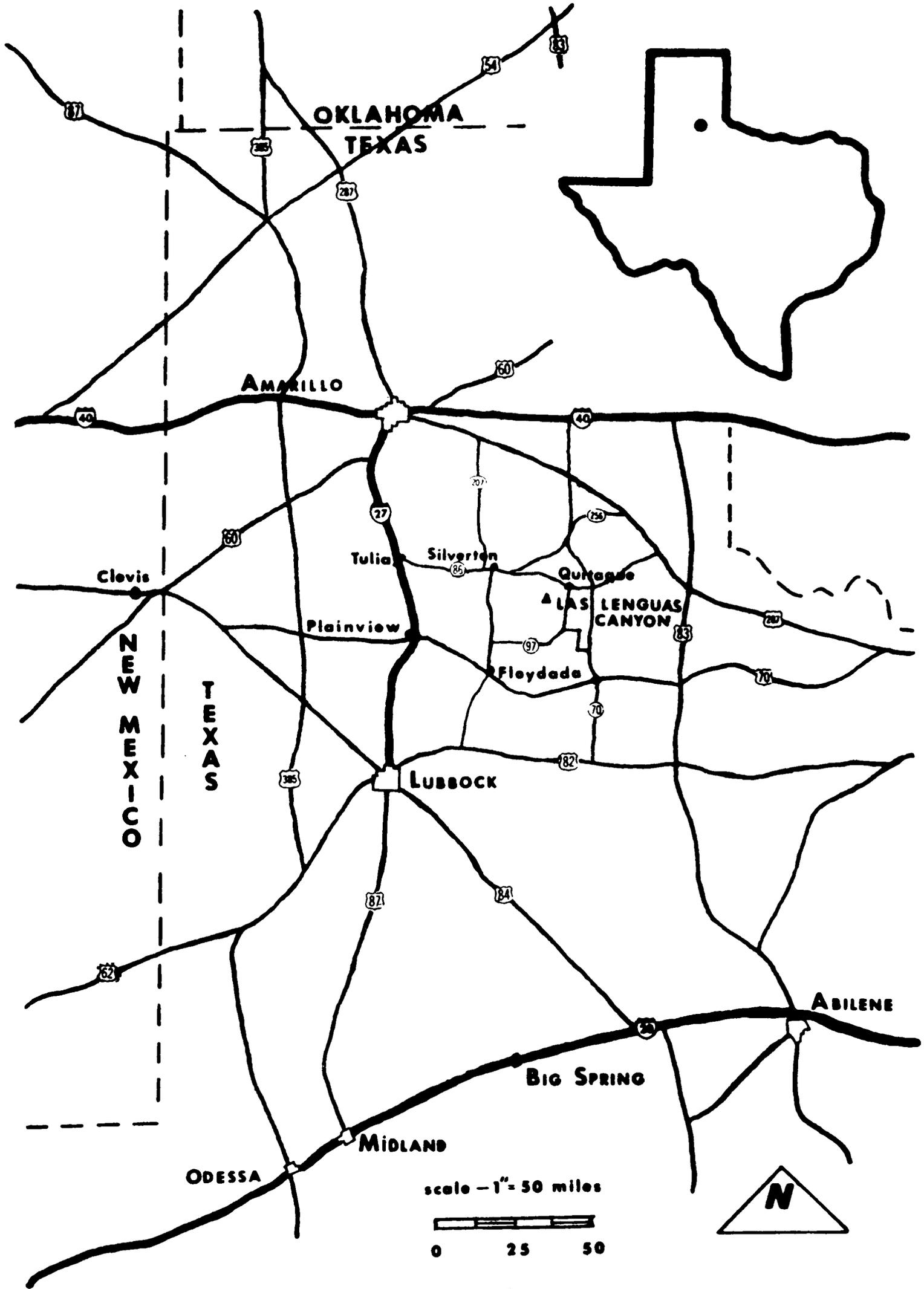


Figure 1

LOCATION MAP

Comancheros. It has even been said that Las Lenguas Canyon was the place at which Cynthia Ann Parker, mother of the famous Comanche chief Quannah Parker, grew to womanhood after she had been captured by the Indians.⁷

The attributes of the locale are worthy of further investigation. Moreover, an objective evaluation of the recreation potential of the Las Lenguas Canyon area should be of considerable value to recreation planners in the future. It is, therefore, the goal of the present research to determine the recreational potential of a 22,400 acre study area which includes Las Lenguas Canyon, Pole Canyon, and adjacent broken land (see Fig. 2).

Objectives

I. To inventory and evaluate the geological, paleontological, archaeological, historical, bioecological, and scenic attributes of the Las Lenguas Canyon area.

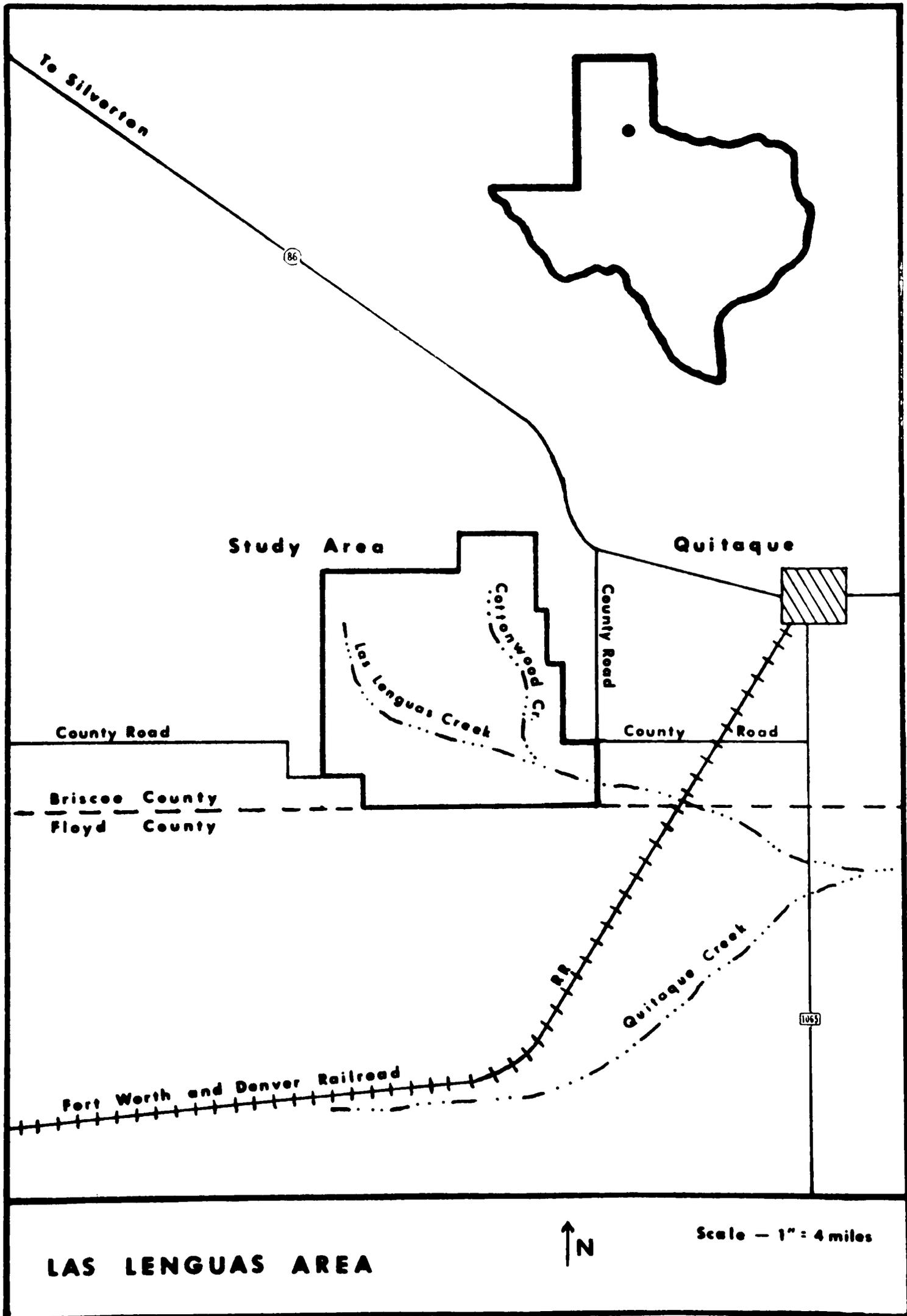
II. To formulate recommendations concerning future use and development of the locality for recreation.

Justification for Study

Several factors have been influential in determining that the recreation potential of Las Lenguas Canyon merits

⁷Donald C. Peattie, "The Ballad of Cynthia Ann," The Denver Post, November 26, 1961, pp. 16-17.

Figure 2



evaluation. First, the canyon has been suggested as a potential park of statewide significance in at least two park and recreation publications. In Parks for America, the "canyon area" which is classified as a potential 15,000 acre state park refers to Las Lenguas Canyon,⁸ while in Texas State Parks, the canyon is specifically mentioned as a unique area that could qualify as a future state scenic park.⁹ Secondly, the Director of Park Services for the Texas Parks and Wildlife Department indicated in 1971 that the Texas Parks and Wildlife Department was interested in further study of the canyon.¹⁰

Third, it has been ascertained by the Texas Parks and Wildlife Department that rather critical shortages of available outdoor recreation land are particularly manifest near metropolitan centers including Amarillo, Lubbock, Odessa-Midland, and Wichita Falls.¹¹ Included within a seventy-five mile radius of Las Lenguas Canyon are both Amarillo and Lubbock, while the urban areas of Wichita

⁸U.S., Department of the Interior, National Park Service, Parks for America (Washington, D.C.: Government Printing Office, 1964), p. 195.

⁹Texas State Parks, p. 17.

¹⁰Mark Gosdin, Director of Park Services, State of Texas, a telephone conversation with Fred W. Welden and Dr. J.W. Kitchen, Associate Professor, Texas Tech University, 1971.

¹¹Texas Parks and Wildlife Department, Outdoor Recreation Plan, 0.2, p. i.

Falls, Abilene, and Big Spring fall inside a 160 mile radius. The Odessa-Midland complex is only slightly farther at about 180 miles. All of these population centers are within reasonable driving distance of the canyon for a week-end excursion, while Amarillo and Lubbock could derive day-use recreation from the area.

Fourth, and finally, Las Lenguas Canyon may exhibit intrinsic values of such a quality as to merit preservation of the area simply in order to protect these desirable characteristics. In the composite, these reasons justify a study which proposes to evaluate the recreation potential of Las Lenguas Canyon and its environs.

Methodology

The method employed in the study of Las Lenguas Canyon has been one of inventory, evaluation, and recommendation. The inventory has been mostly descriptive, with emphasis being placed upon the bioecology, geology, scenery, archaeology, paleontology, and history of the area. Personal observation, interview, and literature review have constituted the most applicable methods of inventory. Sources such as professional organizations, non-professional societies, university educators, pioneers in the region, federal and state departmental officials, and various types of literature have been utilized in this phase of the study.

Having completed the inventory, evaluation of the canyon area's characteristics ensued. Many factors entered the evaluation. During this process, a major concern became delineation of the area's national, state, regional, or local level of significance. Criteria for determination of the degree of significance have been established by the National Park Service, Texas Parks and Wildlife Department, and the National Conference on State Parks. The existing conditions at the Las Lenguas Canyon locality have been evaluated according to these criteria in order to determine the canyon's level of significance.

From a detailed evaluation of the site, recommendations were formulated. All of the attributes which were delineated through the inventory have been considered in the preparation of recommendations. Other factors such as access, uniqueness, proximity to population, ownership, land use patterns, use-quality relationships, and carrying capacity were also considered. In the final analysis, recommendations were based upon the relative significance of these factors and the ability of the site to support recreational development. The recommendations which have been presented should function as guidelines for optimal development of the recreational potential of the Las Lenguas Canyon area.

PART I

INVENTORY

CHAPTER I

GEOLOGY

Permian Period

The 500 foot relief strikingly manifest in the Las Lenguas Canyon area had its beginning in the distant geologic past of the Permian Period. Rocks of Permian age underlie the entire study area, and where visible, are the oldest outcrops. From the mouth of Las Lenguas Canyon to the south and east, Permian rocks are mostly overlain by sands of a recent age.¹² This Permian rock-recent sands complex constitutes what is commonly called the "breaks" or rolling plains due to the consistently broken topography.

Permian rocks, known as red beds, consist of thin-bedded fine-grained arkosic sandstone, silt, and shale with some beds of gypsum and veins of satinspar. Most of the sediments exhibit a characteristic orange-red color. However, pale green reduction halos are also abundant.¹³

¹²Glen L. Evans and John P. Brand, eds., Guidebook, 1956 Spring Field Trip (Lubbock, Texas: West Texas Geological Society, 1956), p. 2.

¹³T.S. Jones, "Permian System," in Guidebook, 1956 Spring Field Trip, ed. by Glen L. Evans and John P. Brand (Lubbock, Texas: West Texas Geological Society and Lubbock Geological Society, 1956), p. 6.

Evidence suggests that during the Permian Period, which ended the Paleozoic Era, some 280 million years ago, a shallow sea occupied a wide area of Texas extending from Mexico northwestward into Oklahoma and Kansas. The red beds were deposited in a landlocked arm of the sea during the latter part of the Permian Period. As evaporation ensued and the sea water was reduced to approximately one-third of its original volume, gypsum was precipitated. Periodic influxes of silt- and mud-bearing waters must have entered the ancient Permian sea, for layers of shale and mudstone are interbedded with the gypsum.¹⁴

At the close of the Permian Period and the Paleozoic Era, the landmass of the Texas Panhandle Region was uplifted, and a period of widespread erosion followed. Permian rocks are the only remaining indications of seas in the Texas Panhandle.

Triassic Period

A sharp ascent of approximately 500 feet marks the northwestern limit of the visible rolling plains, or "breaks." It is along this escarpment, known locally as the "caprock," that gently dipping geologic formations

¹⁴William H. Matthews, III, Guidebook Eight: The Geologic Story of Palo Duro Canyon (Austin, Texas: The Bureau of Economic Geology, The University of Texas at Austin, 1969), p. 18.

ranging in age from Permian to Recent are best exposed. Lying unconformably above the Permian bed along the escarpment are Triassic beds which are believed to be of Keuper (Upper Triassic) age. The Middle and Lower Triassic are not represented.

The lithology of the Triassic beds in the Las Lenguas area is similar to that of the underlying Permian red beds. The nature of clay lenses of the two periods is identical; consequently, separation of the two rock systems is extremely difficult.

The Dockum Group encompasses all Triassic exposures in the Las Lenguas Canyon area. This group is subdivided into a lower unit named the Tecovas formation and an upper unit called the Trujillo formation.¹⁵

Tecovas Formation

The Tecovas formation consists predominantly of clay and shale. The sandy shales are often a maroon, lavender, yellow, or white color while the more solid shales exhibit a magenta or dark red color. Bedding features include banded clay and thin, evenly bedded shale in the thick sections and highly irregular bedding in the coarser grained

¹⁵Francis E. Green, "The Triassic Deposits of Northwestern Texas" (unpublished Ph.D. dissertation, Texas Technological College, 1954), pp. 13-15. Hereinafter referred to as Green, "Triassic Deposits."

parts of the Tecovas. Also typically interspersed throughout the formation are unconsolidated and poorly cemented sands which occur as massive deposits of fairly clean sand, or more commonly as thin, flaggy layers of carbonate-cemented sandstone separated by clay. Because of the lack of resistant beds in the Tecovas formation, undercutting and slumping are common where the clays and shales are cut by streams or gullies. Huge quantities of these materials are carried away during heavy rains. Many exposures of the Tecovas are unvegetated because of the rapidity of erosion of the clays preventing the accumulation of soils. After precipitation and upon drying, the clay surface cracks and becomes puffy, forming a powdery crust up to several inches in thickness. All of this loose material is available for transportation and may be removed by various erosional agents.¹⁶

Trujillo Formation

The contact between the Tecovas formation and the overlying massive sandstone of the Trujillo formation is seemingly conformable at most localities, but at others, such as the area adjacent to Las Lenguas Falls where the Trujillo rests directly on Permian beds, a distinct erosional unconformity exists. The sandstone of the Trujillo

¹⁶Green, "Triassic Deposits," pp. 16, 21-22.

formation ranges from fine- to medium-grained, locally conglomeratic beds which are mostly massive but may be cross-bedded. They are cemented by carbonate, carbonate-clay, and siliceous matrices. Although cement distribution may be irregular, it is sufficiently continuous so that the sandstone forms resistant ledges where it is exposed. This Trujillo sandstone contrasts the unconsolidated Tecovas sand which weathers and erodes with the same ease as does the clay and shale. Within Las Lenguas Canyon, well defined terraces have been developed on the resistant Trujillo unit.

In the Las Lenguas area the Trujillo formation exhibits only one massive sandstone horizon. The most common color of the sandstone is a light gray, but it may be greenish-gray if the clay content is high, or light tan to brownish-yellow where there is a large amount of iron oxide present. At Las Lenguas Falls the base of the sandstone, which rests on Permian clayey sand, is marked by large boulders of clay and shale which, together with the Permian sediments, weather away to leave overhanging ledges whose under surface is covered with large pits and cavities.¹⁷

Cenozoic Era

Following Triassic and Jurassic Periods, seas again covered the Texas Panhandle, but all remains of these seas

¹⁷Green, "Triassic Deposits," pp. 27, 29-32.

were eroded away during subsequent ages. This erosion in the Panhandle seems to have continued through the Paleocene, Eocene, Oligocene, and Miocene epochs of the Cenozoic Era (see Fig. 3). Later epochs brought new deposition to the Las Lenguas area.¹⁸

Ogallala Formation

The name "Ogallala" has been used in a general manner since 1898 to designate the Pliocene aged formation which unconformably overlies beds of the Dockum Group. Considerable controversy has arisen more recently over the exact geological nomenclature pertaining to this name. It is agreed that the oldest Cenozoic deposits in the Texas Panhandle are of early Pliocene age. These deposits were derived from the eastern ranges of the Rocky Mountains and laid down on an erosional surface of Triassic beds.¹⁹

Evans categorizes the Pliocene Ogallala at the level of a group and subdivides this group into the Couch and the Birdwell formations. The Couch formation, the lower of the two, is described as containing a basal member composed of

¹⁸West Texas State University Geological Society, Guidebook, Palo Duro Field Trip (Canyon, Texas: West Texas State University Geological Society), p. 23.

¹⁹Glen L. Evans, "Cenozoic Geology," in Guidebook, 1956 Spring Field Trip, ed. by Glen L. Evans and John P. Brand (Lubbock, Texas: West Texas Geological Society and Lubbock Geological Society, 1956), p. 16.

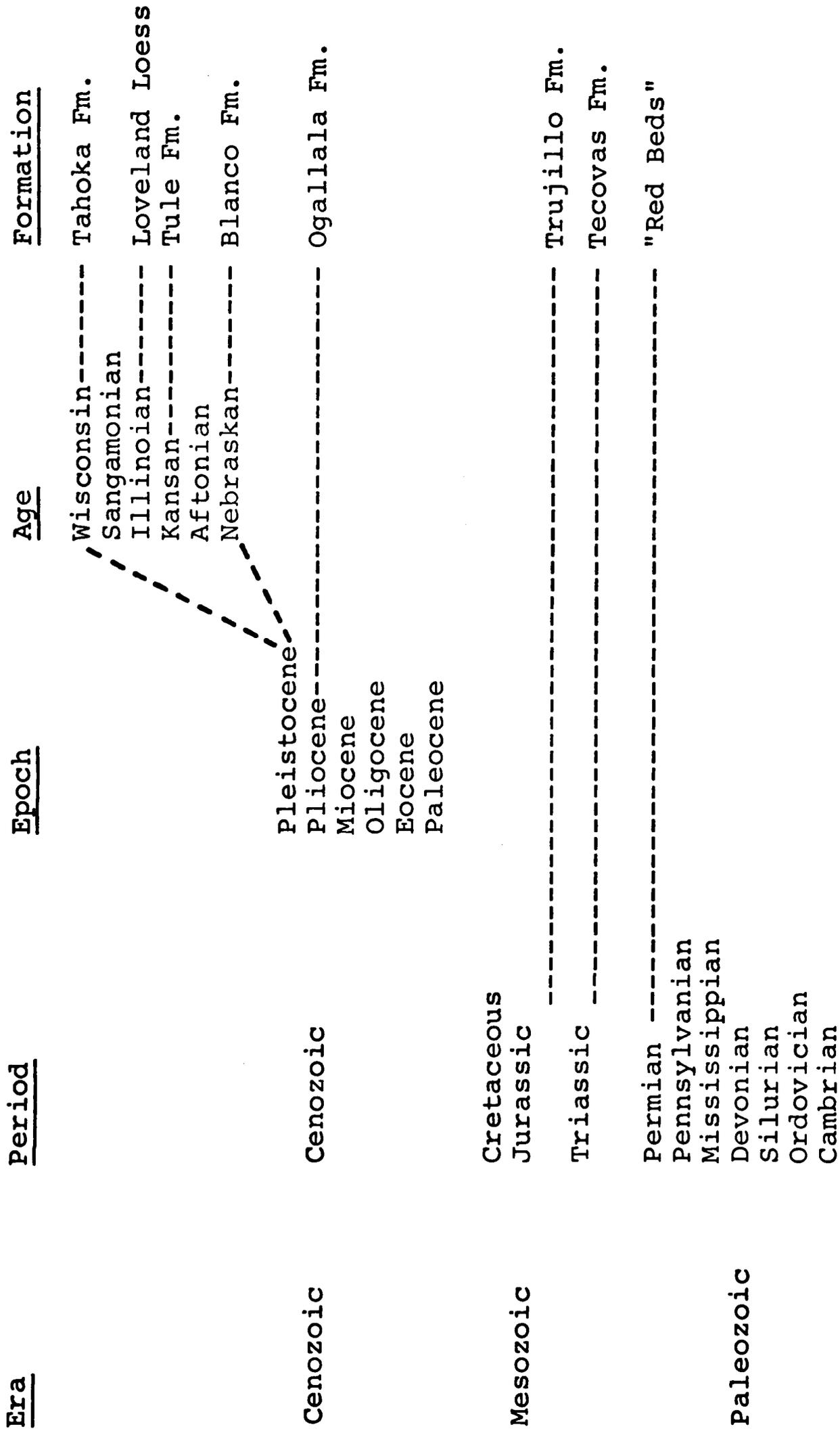


Figure 3
Geologic Sequence

cross-bedded sands and gravels and an upper member consisting of well-sorted semi-consolidated calcareous and clayey sands. The main body of the Birdwell formation is said to consist of bedded unconsolidated sands and clays. Large clay balls are usually present in the base, and colors range from a characteristic reddish-brown to light gray.²⁰

The Ogallala is described as predominantly consisting of fine to medium sand usually exhibiting reddish to pale pinkish-gray hues. The formation is marked by discontinuous and variable zones of weak cementation by calcium carbonate, except in the uppermost part where cementation is commonly dense and tough.

The stratigraphic top of the Ogallala formation consists of an impure, irregular, resistant limestone. This bed, known as the "caprock," is probably the most distinct lithologic entity within the formation and is the only widespread resistant bed of the Ogallala. It has been generally agreed that the caprock bed with its characteristic upper zone of "pisolitic limestone" marks the top of the late Pliocene depositional sequence and that this deposit formed

²⁰Evans, "Cenozoic Geology," pp. 17-21.

to approximately its present character before the beginning of Pleistocene time.²¹

Pleistocene Formation

A complete and distinctive sequence of Pleistocene deposits, resting unconformably on the Ogallala formation and underlying bedrock, is recognized in the Texas Panhandle region. The Pleistocene is generally characterized by episodes of progressively deeper erosional incision of the Pliocene alluvial plain along with cyclic episodes of alluviation. Although sediments of this age in the Texas Panhandle were deposited south of the glacial border, they have been correlated to the glacial sequence.²² (See Fig. 3.)

The Blanco formation (Nebraskan) is the oldest Pleistocene deposit and is characterized by stratified white to light-gray bentonitic clay, sands, fresh-water limestone, and local beds of distomaceous earth. The next oldest Pleistocene formation is the Tule formation (Kansan), which consists mainly of bentonitic clay with alternating

²¹John C. Frye and A. Byron Leonard, Studies of Cenozoic Geology Along Eastern Margin of Texas High Plains, Armstrong to Howard Counties, Report of Investigations--Number 32, Bureau of Economic Geology, The University of Texas (Austin, Texas: The University of Texas, 1957), pp. 11-13, 17-18. Hereinafter referred to as Frye and Leonard, Studies in Cenozoic Geology.

²²Frye and Leonard, Studies in Cenozoic Geology, p. 5.

sand beds. Fresh-water limestone, gravel, and unaltered volcanic ash are also found within the Tule formation.²³

During Illinoian time the continental ice sheet was smaller in the Great Plains region than were the earlier Pleistocene ice sheets. No lacustrine sediments of Illinoian age are known in the Texas Panhandle, but eolian deposits called Loveland Loess are widespread. These sands covered the Las Linguas Canyon area during the Illinoian period.²⁴

The next Pleistocene depositions took place during the Early Wisconsin Age and is evidenced by the Tahoka formation. The Tahoka, which is the most recently developed formation, is characterized by stratified calcareous clays and sands with thin beds of fresh-water limestone. Some gravels also exist as lenses in the Tahoka formation.²⁵

All of the Pleistocene formations are seldom found at one location in the Texas Panhandle. Usually only one or two examples are visible.

The Pleistocene Epoch is typified by episodes of progressively deeper incision of the Pliocene alluvial plain

²³Evans, "Cenozoic Geology," pp. 22-26.

²⁴C.C. Reeves, "Some Geomorphological, Structural, and Stratigraphic Aspects of the Pliocene and Pleistocene Sediments of the Southern High Plains" (unpublished Ph.D. dissertation, Texas Tech University, 1970), pp. 62-64.

²⁵Evans, "Cenozoic Geology," p. 26.

along with cyclic periods of alluviation. The formation and retreat of bounding escarpments (the "caprock") took place during this time, as did the establishment of the Canadian River and subsequent isolation of the Southern High Plains, or "Llano Estacado," of eastern New Mexico and western Texas. Deep reentrant canyons also formed along the caprock during the Pleistocene Epoch. Thus were born Las Lenguas and its neighboring canyons. These canyons' entire life histories are told in the geologic formations evident within the Las Lenguas study area.

CHAPTER II

PALEONTOLOGY

After obtaining a knowledge of geological nomenclature, it becomes much simpler to investigate the paleontological reconstruction of life and forces which were active in the Las Lenguas area during times past. The Permian and Triassic Periods are only understood in a general manner, but fairly detailed paleontological data is available for the Pliocene and Pleistocene Epochs. Ecological conditions can be reconstructed best from fossil remains found in the formations which correspond to the continental glacial sequence, but a generalized picture can also be drawn from earlier strata.

Permian Period

As previously stated, at the beginning of Permian time, the present area of the Southern High Plains was almost entirely covered by seas. This fact is evidenced by the predominance of marine fossils which have been found in Permian deposits. Thirty-two species of pelecypods, gastropods, bryzoa, serpulids, and brachiopods have been reported from Permian beds of the Texas Panhandle. It is

theorized that these animals lived in offshore bars where supersaline water was diluted by influent streams.²⁶

The diversity in lithology of the Permian sediments indicates varying conditions of deposition. Marine sediments became less prevalent later in the Permian. The deposition of evaporites and non-marine beds indicates an intermittent but progressive withdrawal of the sea, in general to the southwest. Uplift of the land probably accompanied or followed this withdrawal.²⁷

Triassic Period

As the landmass was lifted, a period of erosion and continental deposition was initiated. An age of unstable conditions followed. During the Triassic Period deposition was neither continuous nor generalized. Some areas may have been receiving sediments while others were being eroded, and these processes may have been reversed numerous times at any given locality.

The Triassic-aged Dockum sediments represent deposition in a continental environment. Probably the most obvious evidence of this fact is the extensive faunal and

²⁶Jones, "Permian System," p. 7.

²⁷J.G. Cronin, A Summary of the Occurrence and Development of Ground Water in the Southern High Plains of Texas, Texas Board of Water Engineers--Bulletin 6107 (Austin, Texas: Texas Board of Water Engineers, 1961), p. 12.

floral assemblages preserved in the sediments. The aquatic forms are limited to fresh water types, probably the most notable of which is the pelecypod Unio. Continental amphibians, most often represented by the genus Beuttneria, and reptiles, most frequently of the family Phytosauridia, are preserved throughout the Tecovas beds. Floral remains include well-preserved fossilized wood, leaf imprints, and small lignite beds.

Sedimentary characteristics of the Dockum beds appear to represent deposition in what is best described as a flat valley environment. The Tecovas formation consists essentially of floodplain stream, lake, and swamp sediments, while the overlying Trujillo beds exhibit all of the characteristics of stream channel deposits. These Triassic streams flowed generally to the west and probably derived their sediments from the Llano uplift region in central Texas, the Wichita-Arbuckle Mountains in southern Oklahoma, or the Bend Arch region of north central Texas.²⁸

The faunal and floral associations point toward an environment in which streams emptied into lakes or ponds in a habitat which was perhaps more suitable for aquatic or semi-aquatic forms than for terrestrial animals. During

²⁸Howard W. Kiatta, "A Provenance Study of the Triassic Deposits of Northwestern Texas" (unpublished M.S. thesis, Texas Technological College, 1960), pp. 45-52.

part of Dockum time, climatic conditions were unfavorable for abundant vegetation and correspondingly abundant animal life, but at other times, rainfall may have been sufficient for the development of widespread forests and habitats suitable for numerous aquatic and terrestrial forms of life. In all probability, the prevailing climate during deposition of the Triassic beds in the Las Lenguas area was one of semi-aridity, becoming at times more humid and at other times shifting in the opposite direction toward aridity.²⁹

Pliocene Epoch

After an extended erosional period which covered most of the early Cenozoic epochs, a depositional environment developed during the Pliocene, in which the Ogallala formation was produced. The mechanism of Ogallala deposition was one of valley alluviation. Reconstruction of the Texas Panhandle Pliocene topography indicates broad eastward-trending valleys arising in the mountainous areas of New Mexico. The streams of these valleys meandered back and forth creating a broad alluvial plain.³⁰

²⁹Green, "Triassic Deposits," pp. 92, 172.

³⁰John C. Frye and A. Byron Leonard, Correlation of the Ogallala Formation (Neogene) in Western Texas with Type Localities in Nebraska, Report of Investigations--Number 39, Bureau of Economic Geology, The University of Texas (Austin, Texas: The University of Texas, 1959), pp. 7-12. Hereinafter referred to as Frye and Leonard, Correlation of the Ogallala Formation.

The most useful paleontological materials for studies of the Ogallala are the remains of plants. Frye and Leonard distinguish three floral zones: the Kimball, the Ash Hollow, and the Valentine, in the Pliocene of Briscoe County and the Texas Panhandle. Prolithospermum johnstoni, Berrichloa maxima, and Berrichloa minuta are diagnostic of the Kimball floral zone, while the Ash Hollow zone is characterized by Biorbia papillosa, Berrichloa conica, Panicum eliasi, and Stipidium intermedium. Stipidium commune is a grass which is diagnostic of the Valentine floral zone. Celtis willistoni, the hackberry, was the only tree to be identified in the Ogallala floral zones by Frye and Leonard.³¹ These authors also list several mammal species which are said to be associated with the Pliocene floral zones. Plihippus pachyops, Neohipparion sp., Nannippus sp., Procamelus sp., and Metoredon sp. are found in deposits classed as being within the Valentine zone, while the Ash Hollow zone contributes a species of Astrohippus.³²

Research in the Texas and Oklahoma Panhandle by Chaney and Elias has enhanced understanding of paleontology

³¹Frye and Leonard, Studies of Cenozoic Geology, pp. 15-17.

³²Frye and Leonard, Correlation of the Ogallala Formation, p. 19.

of the Pliocene Epoch. They list Neohipparion and Nannippus as representing the horses, and the beaver, Eucaster, as characteristic of stream-side fauna during Pliocene time. Wood of Fraxinus, palm seeds, and a seed of Arctostaphylos have also been secured from the Ogallala of the Texas Panhandle. The authors further denote the presence of Acer (box-elder), Bumelia, Celtis, Diospuros, Gymnocladus, Populus (cottonwood), Salix, and Ulmus. This flora connotes a floodplain assemblage which was more mesic than that now found in the region. Chaney and Elias concluded that the flora and fauna of the Ogallala point toward climatic conditions which favored the development of broad grasslands, with forests restricted to valleys and stream borders. They estimated an average annual rainfall of approximately 35 inches during Pliocene times.³³

Frye and Leonard expanded somewhat upon the picture drawn by Chaney and Elias. They reconstructed a mild humid climate for the early Pliocene Epoch. However, this mild humid climate progressively gave way to a drier harsh climate by the end of the Pliocene. Evidence supporting this viewpoint is the disappearance of arboreal flora,

³³Ralph W. Chaney and Maxim K. Elias, "Late Tertiary Floras from the High Plains," in Contributions to Paleontology-Miocene and Pliocene Floras of Western North America (Washington, D.C.: Carnegie Institution of Washington, 1938), pp. 4-7, 12, 26-28.

deterioration of the lush prairie flora, and a gradual loss of branchiate and pulmonate gastropods as the epoch progressed. By the end of Pliocene times, it is judged that conditions were at least as dry and unfavorable to organic life as are those of the present. The latter stages of the Pliocene probably denote the most adverse conditions to plant and animal life of any times during the Cenozoic Era.³⁴

Pleistocene Epoch

A distinct climatic reversal characterizes the beginning of the Pleistocene. This fact is indicated by the reappearance of branchiate snails and a marked increase in the abundance and kinds of the total gastropod fauna.³⁵ Large collections of vertebrate fossils have also been collected from beds of the Nebraskan-aged Blanco formation. The fauna includes the characteristic early Pleistocene genera, Borophagus, Gigantocamelus, Plesippus, and Stegomastodon.³⁶

³⁴John C. Frye and A. Byron Leonard, "Ecological Interpretations of Pliocene and Pleistocene Stratigraphy in the Great Plains Region," American Journal of Science, Vol. 255 (January, 1957), 1-9. Hereinafter referred to as Frye and Leonard, "Ecological Interpretations."

³⁵Frye and Leonard, "Ecological Interpretations," p. 9.

³⁶Evans, "Cenozoic Geology," p. 23.

The reversed climatic trend toward moist and tolerant conditions continued and reached its climax during Kansan time. The terrestrial gastropods of this age are characteristic of prairies or forest borders and therefore point to a dominant prairie vegetation associated with belts of trees and shrubs along the valleys.³⁷ Vertebrate fossils also occur in the Kansan-aged Tule formation. The middle Pleistocene horse, Equus scotti, Camelops, and the mammoth are abundantly represented in Tule beds.³⁸

Following the Kansan, a strong, distinctive, but oscillating, trend toward increasing aridity in the Southern High Plains continued into recent time. Faunal changes support the strong physical evidence of pronounced climatic deterioration by Illinoian time. Ecologically speaking, the Illinoian assemblages of fossils known from the Texas Panhandle indicate a terrain of prairies with small amounts of timber and woody understory vegetation. Water supplies must have been rather meager and unstable. Local environments were obviously less humid than those which prevailed during Kansan time.³⁹

³⁷Frye and Leonard, "Ecological Interpretations," pp. 9-10.

³⁸Evans, "Cenozoic Geology," p. 26.

³⁹Frye and Leonard, Studies of Cenozoic Geology, pp. 29-31.

The Early Wisconsinan Age, which produced the Tahoka formation, signified a temporary halt in the trend toward an arid climate. From all indications the Early Wisconsinan time in the Texas Panhandle was characterized by a much more stable, more humid, and cooler climate than exists in the same region at present. From the nature of the faunal assemblages, the general picture to be derived is that of humid prairie on the plains, with tree- and shrub-bordered streams flowing across the prairie and from the escarpment. However, as the Wisconsinan Age continued, a return to the trend toward an arid climate was reestablished. Thus, with minor fluctuations, the present time was introduced.⁴⁰

A different approach than the one previously described for the paleontological study of the Pleistocene has been taken by Fred Wendorf of the Museum of New Mexico. By correlating the percentages of different types of pollen trapped within the lake sediments with the present-day pollen rain from various floral assemblages, a picture of the Pleistocene vegetative structure can be drawn. Vegetative character on the Southern High Plains has been shown to be directly dependent upon the glacial cycles for which the Pleistocene Epoch is well-known.

⁴⁰Frye and Leonard, Studies of Cenozoic Geology, pp. 31, 38-39.

From his study of the Texas Panhandle, Wendorf has named and characterized the major climatic-vegetative changes which occurred during the Pleistocene. A summary of his conclusions follows.

Terry Pluvial

Estimated dates.--More than 32,000 B.P.*

Characteristics.--Moderate percentages of pine and spruce was coupled with considerable grass. Pollen assemblages indicate that the climate was considerably cooler and wetter than today.

Rich Lake Interpluvial

Estimated dates.--22,500 to 32,000 B.P.

Characteristics.--More grass and sage elements were present than are found today. Pine pollen occurred in about the same percentages as today. A prairie is indicated.

Tahoka Pluvial

Estimated dates.--15,000 to 22,500 B.P.

Characteristics.--The pollen spectra was dominated by pine and spruce, with very minor representation from grass, composites, or artemisia. An open boreal woodlands

*Before Present.

or forest is indicated to have covered 50 to 60 percent, or more, of the area.

Monahans Interpluvial

Estimated dates.--13,000 to 15,000 B.P.

Characteristics.--During this period the regional water table dropped approximately to its present level. Numerous lakes which had existed during previous pluvial episodes became dry.

San Jon Pluvial

Estimated dates.--6,000 to 13,000 B.P.

Characteristics.--The extensive, open boreal woodlands or forests of the preceding Tahoka Pluvial had disappeared. Some pine and spruce survived in protected areas along the escarpment and in stream valleys. Major elements of the vegetation were grass, sage, and composites. This period marked the most recent interval during which greater moisture and colder temperature than today were manifest.⁴¹

The paleontological information presented by Wendorf is interesting, but it would be infinitely more valuable if it were correlated to the Panhandle geological sequence. The data is unquestionably relevant to the Las Lenguas area,

⁴¹Fred Wendorf, Paleoecology of the Llano Estacado (Santa Fe: The Museum of New Mexico Press, 1961), pp. 19-21, 129-132.

since much of the research was done near the canyon site. To a person observing the semi-arid conditions manifest in the major part of the Las Lenguas area today, paleontological indications of a boreal forest on the very same site should be extremely exciting.

CHAPTER III

ARCHAEOLOGY

The Tahoka Pluvial of the Pleistocene Epoch, during which time a pine-spruce forest covered much of the Southern High Plains, immediately preceded the first undoubted human records from the region.⁴² From this early date, the Texas Panhandle has been inhabited by men more or less continually until the present. These people left traces of their habitation at many sites which have been found and studied in more recent times. The archaeological sequences of the Texas Panhandle may be divided into the early game hunter stage, the archaic stage, and the neo-American stage.

Early Game Hunter Stage

The first people to inhabit the Texas Panhandle depended strictly upon hunting for their livelihood. These men hunted elephant, or mammoth, with spears which were tipped with a distinctively fashioned flint point. The name Clovis Fluted has been assigned to this spear point.

⁴²Frank Oldfield and James Schoenwetter, "Late Quarternary Environments and Early Man on the Southern High Plains," Antiquity, 1964, p. 228.

Clovis Fluted points vary somewhat in details, but all are leaf-shaped in outline, fairly heavy in cross section, with parallel or slightly convex edges and a concave base. On one or both sides they exhibit a broad, shallow channel, or flute, which runs from the base about half way to the tip. Sites containing Clovis Fluted points are widespread, especially in the southwestern United States. They have been found associated with mammoth bones at Clovis, New Mexico; Miami, Texas; and McLean, Texas; all of which are considered to be near Las Linguas Canyon.⁴³

With the disappearance of the mammoth from the Southern High Plains, the early hunting peoples of the region turned to bison. The species of bison which these men hunted were much smaller than the mammoths but appreciably larger than the modern bison. Remains of these early bison hunters are more plentiful and more widespread than those of the mammoth hunters.

As did their earlier counterparts, the bison hunters provided themselves with weapon heads of somewhat distinctive types. The Folsom complex with its Folsom Fluted point is considered to be the oldest of the bison-hunting groups. Folsom Fluted points are generally smaller and lighter than

⁴³Waldo R. Wedel, Prehistoric Man on the Great Plains (Norman, Oklahoma: University of Oklahoma Press, 1961), pp. 54-58. Hereinafter referred to as Wedel, Prehistoric Man.

Clovis Fluted. Highly characteristic is a broad groove on one or both faces. This groove runs from the base for two-thirds or more of the distance toward the tip and gives the point a biconcave appearance. Folsom Fluted points have been found in intimate association with scrapers, knives, hammerstones, paint pots, and awls, as well as with the now extinct species of bison. Significant sites in the Las Lenguas Canyon region are the Lipscomb site near Canadian, Texas; the Lubbock, Texas locality; and the Clovis, New Mexico site.⁴⁴

In contrast to the localities from which have come the typically fluted Clovis and Folsom points, there exists another group of early bison hunter sites characterized instead by leaf-shaped, non-fluted points. This complex, which is of a later date than the Folsom complex, has been given the name Plainview after the location of the initial type site. The Plainview point is described as being lanceolate in outline with parallel or slightly convex edges and a concave base. These, like the previously described points, have been discovered at several sites, but

⁴⁴Wedel, Prehistoric Man, pp. 60-64.

the only notable one near the Las Linguas Canyon area is the Plainview locality.⁴⁵

Archaic Stage

Relatively little evidence has been reported concerning the nature of man's life in the Texas Panhandle during the vast time between the hunting of now extinct forms of big game and the much later activities of neo-American aboriginal populations. These pre-pottery people drew their sustenance from game animals of modern types supplemented by the gathering of plant foods. Evidence for this conclusion is exhibited by the abundance of dart points, scrapers, and milling stones which have been recovered from archaic sites.⁴⁶ Two very significant archaic localities near Las Linguas Canyon have been reported. These are the Twilla site, which is located five miles east of Turkey in Hall County, Texas,⁴⁷ and the Little Sunday

⁴⁵E.H. Sellards, Glen L. Evans, and Grayson E. Meade, "Fossil Bison and Associated Artifacts from Plainview, Texas," Bulletin of the Geological Society of America, October, 1947, pp. 927-954.

⁴⁶James M. Malone, Archeological Reconnaissance in the Mackenzie Reservoir Area of Tule Canyon (Austin, Texas: Texas Historical Survey and Texas Water Development Board, 1970), pp. 14-15. Hereinafter referred to as Malone, Archeological Reconnaissance.

⁴⁷Curtis D. Tunnell and Jack T. Hughes, "An Archaic Bison Kill in the Texas Panhandle," Panhandle-Plains Historical Review, 1955, pp. 63-70.

site in Randall County, Texas, near Palo Duro Canyon.⁴⁸

Both of these archaic sites have been discovered in terrain which is almost identical to the Las Lenguas Canyon study area.

Neo-American Stage

One of the more important and archaeologically better-known cultures to encroach upon the archaic peoples was the pottery-making, semi-horticultural village culture known as the Antelope Creek Focus of the Panhandle Aspect. These people seem to have entered the Texas Panhandle by the twelfth century and retained their cultural integrity for some two centuries. Their villages were concentrated along the Canadian River where, in sharp contrast to the previously mentioned cultures, they built permanent, multi-roomed, pueblo-styled homes with walls of stone or adobe. Subsistence of these people was based on maize agriculture, hunting, and gathering. Although exhibiting similarities in architecture to the more western Pueblo civilization, the Antelope Creek Focus is believed to have developed separately from the Pueblo with only influential trade contact between the two.⁴⁹

⁴⁸ Jack T. Hughes, "Little Sunday: An Archaic Site in the Texas Panhandle," Bulletin of the Texas Archeological Society, 1955, pp. 63-70.

⁴⁹ Wedel, Prehistoric Man, pp. 139-144.

Remains of the Antelope Creek Focus are almost entirely restricted to the Canadian River and its tributaries. However, sites with similar traits are known along the caprock escarpment to the east and south, although masonry structures of the north have yet to be reported. The only possible exception is a site in Tule Canyon, twenty-five miles northwest of Las Linguas Canyon, in which stone structures appear to have once existed.⁵⁰ Alex D. Krieger suggested that another focus of the Panhandle Aspect may develop in the southeastern Texas Panhandle where the major contrasting feature to the Antelope Creek Focus is a lack of masonry.⁵¹ It seems that archaeological research in the Las Linguas area, none of which has been undertaken to date, should be critical in determining the actual archaeological relationships which have existed in the Texas Panhandle.

In very late prehistoric times three new groups of people entered the Texas Panhandle region. The first were the Apaches, or as they were called by the early Spaniards, Querchos, who entered the area shortly after 1500, probably

⁵⁰Malone, Archeological Reconnaissance, pp. 15, 25.

⁵¹Alex D. Krieger, Culture Complexes and Chronology in Northern Texas, The University of Texas Publication No. 4640 (Austin, Texas: The University of Texas, Oct. 22, 1946), pp. 74-75.

from the plains north of the Arkansas River.⁵² Shortly after 1700 the Comanches came upon the Texas Panhandle scene from the Dismal River region and Nebraska, as did also the Kiowas from their mountainous home along the Yellowstone River in western Montana. The Comanches forced the Apaches out of the Panhandle region, and after several years of conflict the Comanches and Kiowas declared a lasting peace covenant in the year 1790. The Kiowas and especially the Comanches were truly "Lords of the South Plains" until their strength was finally broken by the advance of the White Man.⁵³

⁵²Wedel, Prehistoric Man, p. 289.

⁵³Ernest Wallace and E. Adamson Hoebel, The Comanches: Lords of the South Plains (Norman, Oklahoma: University of Oklahoma Press, 1958), pp. 279-285. Hereinafter referred to as Wallace and Hoebel, The Comanches.

CHAPTER IV

HISTORY

The Indian Period

Much of the early history of the Las Linguas Canyon area is tied directly to the Indian inhabitants of the region. The Comanches, who dominated the Southern High Plains, were a short, heavy-set people with bright, copper-colored complexions. Before Europeans arrived these Indians best could be described as being dog nomads. Using their dogs as beasts of burden, they travelled about on foot in search of the bison which composed their total sustenance.⁵⁴

Because these pre-white Indians lacked the technological advantages of the later European and American invaders, their ways of life represented a closer response to the opportunities and limitations of the land on which they lived. In a region of limited precipitation and scanty surface water, the Indians placed great importance upon rivers, creeks, and springs. Besides supplying the elemental need for water, the valleys also provided fuel and

⁵⁴Wallace and Hoebel, The Comanches, pp. 17, 34-35.

building materials, shelter from vigorous winters, and a fairly sure food supply.⁵⁵

The Comanches of the Texas Panhandle preferred to camp near a running stream in open country. Their villages most often were found along meandering creek valleys toward the headwaters of larger streams where adequate canyons for protection, wood for campfires, and sweet water for drinking were available. A large camp sometimes extended several miles along a stream or forest edge. The Las Lenguas Canyon area was one of the Comanches' most popular campgrounds. In fact, it may be stated that the very favorite retreat and stronghold for the group of Comanche bands called the Middle Comanches was the breaks of the Pease River country, of which the Las Lenguas Canyon area is a most desirable locality.⁵⁶

After its introduction by early Spaniards, the horse was quickly adopted by the Comanches as a beast of burden. By many who saw them, these Indians were thought to be among the greatest horsemen in the world. The artist George Catlin wrote concerning the Comanches,

In their movements they are heavy and ungraceful; and on their feet one of the most unattractive and slovenly-looking races of Indians I have ever seen; but the moment they mount their horses, they seem at once

⁵⁵Wedel, Prehistoric Man, pp. 25-29.

⁵⁶Wallace and Hoebel, The Comanches, pp. 14-15, 26.

metamorphosed, and surprise the spectator with the ease and grace of their movements.⁵⁷

Many such glowing accounts of Comanche horsemanship have followed the tribe through history.

The Comanche always had been a nomad, but it is difficult to overestimate the value of the horse to his way of life. With the horse he achieved incomparably greater mobility; he mastered the buffalo; he had a new and valuable trade asset; and most significant of all, he was changed from an impotent infantryman into a fierce cavalryman--a dangerous warrior and insatiable raider. When measured by the number of horses, the Comanches were the richest of all tribes. In warfare no one surpassed them. Due to the great mobility of the horse, Las Lenguas and adjacent streams which led southeastward became highways for Comanche parties raiding the scattered and undefended Anglo-American settlements of Texas.⁵⁸

The Comanchero Period

Probably the most interesting and colorful history of the Las Lenguas area is based upon the friendly relationship which sprang up between the Comanches and their Mexican neighbors in New Mexico. Before the coming of the cowboy,

⁵⁷George Catlin, North American Indians (Philadelphia: Hubbard Brothers, 1891), pp. 74-75.

⁵⁸Wallace and Hoebel, The Comanches, pp. 14, 34-36.

before the buffalo hunters arrived on the scene, and even before the earliest Anglo-American explorers came, the Panhandle of Texas was known to the Spaniard and the Mexican. To the plains came the Spanish buffalo hunters called Ciboleros from their little New Mexican villages. They took their prey not with high-powered rifles, but with tasseled lances.⁵⁹ These colorful individuals were no doubt the first of the European descendants to become familiar with Las Linguas Canyon. They were so impressed with the area that they named the stream which headed in this canyon Rio Cibolo, or Buffalo River.⁶⁰ Thus the Spaniard was added to the already intimate relationship which the Comanche and the Las Linguas area shared.

The Ciboleros hunted beside their Comanche friends. Both were excellent horsemen and proud hunter-sportsmen. The Ciboleros often carried hard-baked loaves of bread and other small articles to trade with their Comanche companions. As word of the trade opportunities was carried back to the villages of New Mexico, a new group of Spaniards began to travel to the Texas Panhandle. These were the Indian traders, or Comancheros.

⁵⁹J. Evetts Haley, The XIT Ranch of Texas (Norman, Oklahoma: University of Oklahoma Press, 1953), p. 18.

⁶⁰Edna Kahlbau, "The Comanchero Barter on the High Plains, III," Amarillo Sunday News and Globe, November 2, 1941, p. 2.

The first Comancheros were poor but honest traders, simply trying to secure a living from their meager business. They carried to the plains by burro a small store of goods which they traded to the Comanches mostly for buffalo robes. The trade grew, but even as late as 1839 Josiah Gregg, a noted frontier traveler, stated that:

These parties of Comancheros are usually composed of the indigent and rude classes of the frontier villages, who collect together, several times a year, and launch upon the plains with a few trinkets and trumperies of all kinds, and perhaps a bag of bread and maybe another of pinole, which they barter away to the savages for horses and mules. The entire stock of an individual trader very seldom exceeds the value of twenty dollars, with which he is content to wander about for several months, and glad to return home with a mule or two, as the proceeds of his traffic.⁶¹

However, as time passed the Comanchero trade grew considerably in scope and developed into a contraband operation. Wagons, or carretas, were employed to haul many more goods, especially guns and whiskey, causing the term "Comanchero" to take on the connotations of a "dirty word."⁶²

Soon the Indians learned that, not only for personal use but also for purposes of barter, the stealing of horses was a profitable business. Thus they began to plunder the ranches of Texas and the haciendas of northern Mexico. As

⁶¹Josiah Gregg, Commerce of the Prairies, ed. by Max L. Moorhead (Norman, Oklahoma: University of Oklahoma Press, 1954), p. 257.

⁶²H.H. Moncus, Prairie Schooner Pirates (Fort Worth, Texas: Western Heritage Press, 1963), pp. 44-47.

cattle were brought into the Texas Panhandle, they too became a prime target for Indian raiders. As the trade in stolen cattle and horses assumed greater proportions, definite meeting places were established. When Colonel Charles Goodnight, the first rancher to enter the Panhandle, arrived in 1876, "the roads of the Mexican traders were almost as big and plain as the roads of today" [1926].⁶³

Goodnight described these roads in detail. The most southerly trail left the Pecos River near Bosque Redondo, pointed east and south to the Yellow Houses and terminated in the Canon del Rescate. Both of the latter locations lie near the present city of Lubbock, Texas. The upper trail left Las Vegas, New Mexico, and led northeast to the Canadian River which it then followed east of Tucumcari Mountain. The trail forked near the Texas line with the northern section following the Canadian to Las Tecovas trading grounds.

The southern fork branched in a southeasterly direction from the Canadian River. It proceeded into the head of Palo Duro Canyon and then to Tule Canyon. From there the trail passed the head of Rock Creek and continued to the foot of the High Plains in the Quitaque country. This branch of the trail finally terminated at the Rio de las Lenguas.

⁶³Haley, The XIT Ranch of Texas, pp. 24-26.

Between these two roads was another which also led to Las Lenguas. Its travelers went by way of the government road between Santa Fe and Fort Sumner to La Laguna, approximately eight miles north of the fort. From there they proceeded to the head of Tule Canyon, where they intersected the northern trail and followed its course to the Quitaque country or to Las Lenguas.⁶⁴ Even today the old trail leading off the caprock into Las Lenguas and the Quitaque country can be distinguished from the surrounding countryside. A jeep road has been established over the old Mexican-Indian trail, but there is no doubt that the road marks the old Comanchero trail.⁶⁵

Contrary to popular belief, related Goodnight, few Indians spoke Spanish. And yet Indians of various tribes and dialects, renegade Anglo-Americans, and Mexican traders all gathered in a common barter. Negotiations called for the use of many languages, or lenguas--tongues. Hence the name of the stream at which they most often met became Rio de las Lenguas, or Las Lenguas.⁶⁶ In the Texas Panhandle

⁶⁴J. Evetts Haley, "The Comanchero Trade," The Southwestern Historical Quarterly, XXXVIII (January, 1935), 161-162.

⁶⁵Jim Stroup, lifelong Quitaque rancher whose birth was the second recorded in Briscoe County, private interview at his home within the Las Lenguas study area, August, 1971.

⁶⁶Haley, "The Comanchero Trade," p. 164.

today, only the Americanized version, Los Lingos, is commonly used. However, the origin and authenticity of the Spanish term, Las Lenguas, is unquestionable.

Just west of the Stroup ranch house and within the Las Lenguas study area, is located another valley where trading was often done. Scattered bands of raiding Indians concentrated here and separated their captives to lessen the danger of escape and to insure more rapid assimilation. Here mothers and children, torn from their homes in Texas and Mexico, were scattered with the splitting of tribal bands. Even in such a wild region, this valley came to be known as a spot of heartache, grief, and tragedy. The Comancheros appropriately referred to it as Valle de las Lágrimas--the Valley of Tears.⁶⁷ It becomes obvious that the Comanchero trading grounds at Las Lenguas, the Quitaque country, and the Valley of Tears compose a single unit and that this unit is contained within the boundaries of the Las Lenguas study area.

During the years from 1850 to 1870 the Comanchero trade reached and maintained its highest level. Las Tecovas became a prominent market place, but it was a distant second in importance to that at Quitaque and Las Lenguas.⁶⁸

⁶⁷Haley, "The Comanchero Trade," p. 164.

⁶⁸Haley, "The Comanchero Trade," p. 161, 164.

The magnitude of the Comanchero trade during these two decades was astounding. The Daily New Mexican reported that the commerce engaged more than one thousand New Mexicans in 1871 and was "immensely profitable" to the successful trader. It further stated that:

. . . The people on the Pecos have almost entirely neglected their ranches for this more profitable traffic, and the consequences will be a scarcity of bread stuffs this year.

Additional awesome figures were released by the newspaper. It reported one instance in 1868 in which 4,100 head of cattle had been stolen by Indians--3,000 head within two days and the other 1,000 having come from the same location only a few days previously.⁶⁹ Truly the Comancheros were engaged in a major undertaking.

Direct evidence of the magnitude of Indian depredations, as well as the prominence of the Quitaque-Las Lenguas trading grounds, was obtained by Charles Goodnight in 1893. In an effort to receive repayment for earlier cattle losses, he went to court and secured sworn testimony from three Comancheros and a trader who dealt with them concerning their previous activities. All of the men made repeated references to the Las Lenguas Canyon area. One trader, when asked why he nearly always went to the Las Lenguas-Quitaque area to trade, replied that,

⁶⁹The Daily New Mexican, July 20, 1868; July 18, 1870; May 24, 1871.

It was a kind of headquarters for the Indians. There was plenty of water there, it was a hiding place, good shelter and plenty of grass.⁷⁰

When asked how many cattle he had seen at Las Lenguas bearing Goodnight brands, another trader stated that he had observed in the possession of Comancheros and Indians together about 8,000 head. It must be emphasized that this approximation, and another estimate of 5,000 head by a different trader, were covering only a three year period and only one rancher's brand.⁷¹ At least one authority, who knew Goodnight well, estimates the total of this rancher's losses at 300,000 head of cattle and 100,000 horses.⁷²

There were numerous attempts to eliminate this lucrative Comanchero trade and its adjoining Indian depredations. When the Superintendent of Indian Affairs, A.B. Norton, reached New Mexico for the assumption of duty in 1886, he found the Territory "filled with Texas cattle." He made an unsuccessful effort to control the trade through a restricted permit system. Likewise in 1870, the governor of the Territory of New Mexico issued a proclamation against the trade and directed the judges to bring the guilty

⁷⁰Lowell H. Harrison, ed., "Three Comancheros and a Trader," Panhandle-Plains Historical Review, XXXVIII (1965), 82.

⁷¹Harrison, "Three Comancheros and a Trader." pp. 88-93.

⁷²Haley, "The Comanchero Trade," p. 169.

parties to justice. The Texas ranchers themselves even entered New Mexico on one occasion in an attempt to recover stolen stock by force. In 1872, it was decided that the time for concerted military action had arrived. Colonel Ronald S. Mackenzie was sent to the Texas Panhandle to eliminate the Comanchero trade and Indian depredations.⁷³

Colonel Mackenzie was a brilliant soldier, but no white man had any appreciable knowledge of the Texas Panhandle. The caprock and plains were the home of the Comanches, while the Anglo army was an ill-informed, often lost, intruder. With his vastly superior force, Mackenzie found and followed the Comanchero trails which have since been inappropriately labeled the Mackenzie Trail. His force passed directly through the Las Lenguas area several times. Finally in 1875, after several years of fighting, the strength of the Comanches was broken.⁷⁴ Notwithstanding all of the earlier attempts, only the final pressing of the Indians onto reservations brought an end to the infamous but highly colorful Comanchero trade.⁷⁵

⁷³Haley, "The Comanchero Trade," pp. 166, 170-174.

⁷⁴Ernest Wallace, Ronald S. Mackenzie on the Texas Frontier (Lubbock, Texas: West Texas Museum Association, 1964), pp. 178, 133-134, 146, 170.

⁷⁵Haley, "The Comanchero Trade," p. 161.

Quanah Parker

The last Comanche chief to lay down his arms was the notorious Quanah Parker. The story of Quanah Parker and his white mother Cynthia Ann is both interesting and pertinent to a study of the Las Lenguas area.

On a spring day in 1836, a band of raiding Comanches attacked Fort Parker in East Texas. Among the captives to be abducted from the site was a nine year old white girl named Cynthia Ann Parker. At least one report states that Cynthia Ann was taken directly to "the lost and inaccessible valley where a stream comes down between war-paint canyon walls through the break in the cap rock--the Rio de las Lenguas."⁷⁶ Although this report is highly speculative, the great number of captives to enter the Las Lenguas area and the Valley of Tears has already been documented. In any event, she was taken to the Panhandle wildlands where she became assimilated into the Comanche culture.

About four years after her capture, Cynthia Ann was observed by a pair of Anglo traders to be with a Comanche band along the Canadian River. Then again several years later she was noticed by a group of white hunters. When asked if they should try to free her, she replied,

⁷⁶Peattie, "The Ballad of Cynthia Ann," pp. 16-17.

I am happily wed. I love my husband who is good and kind and my little ones who, too, are his, and I cannot forsake them.⁷⁷

What the traders did not realize was that the husband to whom Cynthia Ann referred was the famous Peta Nocona, chief of the Nocona (Wanderers) band.

On a May morning in 1845, a half-breed boy was born to Cynthia Ann and Peta Nocona. The baby was named Quanah which means "sweet-smelling" or "bed of flowers." Quanah, later to be called Quanah Parker, was destined to become one of the most outstanding Comanche chiefs of all time.⁷⁸

In the early autumn of 1860, Peta Nocona led his band to their favorite retreat in the breaks of the Pease River of which the Rio de las Lenguas forms the northern headwaters. At a site in present Foard County, Texas, Captain L. Sul Ross with a ranger and cavalry force was successful in attacking and scattering the Comanches. Cynthia Ann was recaptured in this battle, and there are conflicting reports as to whether or not Peta Nocona was killed. Cynthia Ann was returned to her East Texas home. She tried to escape in order to return to her Comanche

⁷⁷James T. DeShields, Cynthia Ann Parker (St. Louis: By the Author, 1886), pp. 28-32.

⁷⁸Clyde L. Jackson and Grace Jackson, Quanah Parker: Last Chief of the Comanches (New York: Exposition Press, 1963), p. 18. Hereinafter referred to as Jackson and Jackson, Quanah Parker.

loved ones but was unsuccessful and died four years after returning to the foreign East Texas environment.⁷⁹

Quanah rose to a position of authority quickly. At a young age he became chief of the Kwahadi (Antelope) Comanches, the most fierce of the Comanche bands. The Kwahadies were reported at the Quitaque-Las Lenguas locality several times. In fact, it seems from all available information that this was a major center for their activities.

The Kwahadi warriors under Quanah Parker's command fought all invaders. During the first years of Mackenzie's campaigns, the colonel was repeatedly outmaneuvered by the crafty chief. The Kwahadies persisted in their insatiable raiding and probably more importantly formed a nucleus about which renegade Comanches from the reservation continued to gather.⁸⁰

In 1875 with all hope of victory gone, the first of the Kwahadies surrendered to Colonel Mackenzie at Fort Sill. Quanah and his warriors, however, remained free. At this time the colonel sent two of his men to the High Plains for the purpose of threatening and persuading the Kwahadies

⁷⁹J. Evetts Haley, Charles Goodnight: Cowman and Plainsman (Norman, Oklahoma: University of Oklahoma Press, 1949), pp. 55-59.

⁸⁰Rupert N. Richardson, The Comanche Barrier to South Plains Settlement (Glendale, California: The Arthur H. Clark Company, 1933), pp. 21, 346-347.

to come in peaceably. The white men located the Kwahadies near Quitaque and delivered their message. Quannah took charge of the negotiations and, knowing that the defeat of his people was imminent, surprisingly promised to be responsible for the surrender of the entire Kwahadi band. This was the greatest victory that Mackenzie had ever won. A man whom he had been chasing for three years simply walked in and surrendered. Mackenzie stood face to face with the greatest of the Comanche chiefs, a half-breed who had combined the attributes of both white man and Indian.⁸¹

The Pastores Period

At some time preceding the final removal of the Indians and simultaneous elimination of their contraband trade, several of the old-time Comancheros began to revert to their original pursuit of sheep raising. These men had seen the fertile valleys of the Texas Panhandle and were quick to bring their great sheep herds into the region. Several of the pastores, as the shepherds were then called, built permanent homes and settled down in the more choice Panhandle localities. It is unknown when the earliest sheep grazed the grassy valleys, but buffalo hunter and trail driver Frank Collinson found old houses on the Canadian

⁸¹Jackson and Jackson, Quannah Parker, pp. 110-111.

River and at Las Lenguas in 1873. Likewise, Henry Kimball found the Canadian River valley fairly well populated when he entered the region in 1874. As far as can be ascertained, nothing remains today of the old houses at Las Lenguas. The houses, as did the pastores of this region, passed into history when the great cattle kings arrived upon the scene in the late 1870's.⁸²

The Cattle Kingdom Period

Despite the popular impression, there was little animosity between pastores and cowmen in the Texas Panhandle. Trouble might have developed were it not for the fact that when the cattle came, the sheepmen simply drifted back into New Mexico. There was no open conflict.⁸³

It seems evident that the hostile Comanches represented a more powerful force than did the pastores in preventing cattlemen from entering the High Plains. But by 1876 the Indians were removed, and cattlemen began moving into the country. In this year Charles Goodnight brought from Colorado the first cattle herd to enter the Texas Panhandle. He settled in Palo Duro Canyon and with his English

⁸²John L. McCarty, Maverick Town--The Story of Old Tascosa (Norman, Oklahoma: University of Oklahoma Press, 1968), pp. 15-16, 21.

⁸³Haley, The XIT Ranch of Texas, p. 34.

financier-partner, James Adair, began to build the vast JA Ranch.⁸⁴ Charles Goodnight soon became the acknowledged leader and monarch of the cattle ranchers in the Texas Panhandle. More importantly, he introduced cattle raising, which was to become the first great commercial industry in Texas,⁸⁵ to the West Texas plains.

Shortly after Goodnight settled in Palo Duro Canyon, several other ranchers advanced into the Texas Panhandle. The most significant of these ranchers for the present report were the Baker brothers, who brought 2,000 head of cattle under the management of J. Wiren into the Quitaque area in 1877; and Colonel McCoy, who likewise settled in the Quitaque country. Wiren used the Lazy F brand, while McCoy initiated the Hat brand.⁸⁶

In 1882 Colonel Goodnight purchased the Quitaque (F) Ranch from the Bakers for Mrs. Cornelia Adair. Twenty-two cents per acre was paid for approximately 140,000 acres, but the actual range was much larger than this figure due to the grazing of leased land and alternating sections which were in railroad ownership. The F Ranch was managed by

⁸⁴T.C. Israel, "The History of Oldham County, Texas" (unpublished M.S. thesis, The University of New Mexico, 1934), pp. 33-34.

⁸⁵Holland Thompson, The Book of Texas (Dallas: The Colonial Press, 1929), p. 91.

⁸⁶Haley, The XIT Ranch of Texas, pp. 43-44.

Goodnight as a part of the JA holdings until 1887 when the Adair-Goodnight partnership was dissolved. At that time Mrs. Adair traded Goodnight the F Ranch and its cattle for his one-third interest in the JA enterprise. In 1888 Goodnight sold half of his ranch to L.R. Moore of Kansas City, and the next year he sold the remainder to the same individual. In 1895 Mr. Moore in turn sold the F Ranch to Frank Howard of New Orleans, who dispensed of the land section by section as buyers could be found.⁸⁷

Colonel Goodnight's original F Ranch covered most of the Las Linguas Canyon area. The ranch headquarters burned several years ago, and as far as can be ascertained, the only remaining vestiges of the old F Ranch are hand-split cedar posts which were used by Goodnight to fence corrals. These planks are presently incorporated into a corral on the Stroup Ranch in the southeastern corner of the study area. But even today almost all the land within the Las Linguas study area has retained the ranching tradition initiated by Charles Goodnight and the F Ranch.⁸⁸

⁸⁷ Harley T. Burton, A History of the JA Ranch (New York: Argonaut Press, 1966), pp. 46-47, 56-57.

⁸⁸ Jim Stroup, private interview, August, 1971.

CHAPTER V

BIOECOLOGY

Because of the location of the Texas Panhandle and South Plains in the rain shadow of the Rocky Mountains, the climate is continental. The whole region, which exhibits a markedly uniform climate, is semi-arid with low and irregularly distributed precipitation, high evaporation, and pronounced daily and seasonal ranges in temperature. During fifty years of weather records, there has existed a great year to year variation in precipitation, the average being approximately 20 inches annually.

Seasonal distribution of precipitation is also highly variable with April-May and September-October being the highest rainfall months. Normally there is a summer dry period with high temperatures and high evaporation rates. Throughout the year daily temperature ranges of 30 degrees are not uncommon. These marked daily variations are due in large part to the high degree of radiational cooling characteristic of the region.

Dry winds prevail during most of the year, and under their influence the potential evaporation is much greater than the total average precipitation. Prevailing winds are

from the south-southwest with an annual average velocity of 12-15 miles per hour. Winds of 30-50 miles per hour are not uncommon. The severity of climate is further augmented by not infrequent tornados, blizzards, and long periods of drouth.⁸⁹

Although climate contributes significantly to determination of the gross biotic community types in the Las Lenguas area, topography and soil water are much more important factors in the explanation of local variation. The elevation of the Las Lenguas area ranges from 2,700 feet to 3,100 feet above sea level. The broken topography provides protected niches and a well defined drainage system. Springs in the area have furnished a permanent water supply to Las Lenguas Creek. Although the creek becomes intermittent farther downstream, within Las Lenguas Canyon it exhibits a sustained flow.

The entire Las Lenguas study area is basically a grassland type, even though brush cover is evident to some degree over most of the area. As one enters Las Lenguas Canyon from the top and progresses out past the mouth, he is impressed by four distinct vegetative zones through which he passes. In most places the changes of vegetative types

⁸⁹Chester M. Rowell, Jr., "Vascular Plants of the Texas Panhandle and South Plains" (unpublished Ph.D. dissertation, Oklahoma State University, 1967), pp. 7-8. Hereinafter referred to as Rowell, "Vascular Plants."

are abrupt and evident even to a biological novice. Above the caprock a grassland exists which has been invaded by mesquite. Immediately upon entering the canyon, he observes a change to predominantly juniper cover clinging to the steep walls and a juniper-grassland savannah upon the open canyon floor. Mesquite is totally absent in this community. Proceeding across the canyon floor, he arrives at a small canyon-within-the-canyon. This well protected lower terrace follows the approximate center of Las Lenguas Canyon and contains Las Lenguas Creek. A mesic community dominated by deciduous trees, taller grasses, and reeds is strikingly evident along the stream. The fourth vegetative zone to be encountered is entered as the observer nears the mouth of the canyon. At this point, and as he leaves the stream side, he becomes emersed in a broken, rolling, fairly densely covered mesquite-grassland.

The North American central grasslands, of which the Las Lenguas area is a part, stand as a major barrier to the east-west dispersal of forest species which occur to the east and to the west of them. They also provide a northward avenue for dispersal of groups that are primarily adapted to southern desert and semi-desert conditions.⁹⁰

⁹⁰W. Frank Blair, "Mammals of the Mesquite Plains Biotic District in Texas and Oklahoma, and Speciation in the Central Grasslands," Texas Journal of Science, VI, No. 3 (September, 1954), 256. Hereinafter referred to as Blair, "Mammals of the Mesquite Plains."

Likewise, the rock outcroppings of the escarpment furnish a means of dispersal for southern saxicolous species. It is also notable that various trees which are common in more eastern provinces entered along the stream floodplains that drain to the east from the caprock canyons. These forests provide avenues for the westward extension of eastern forest species of vertebrates.⁹¹ It is evident that the Las Lenguas area is part of a major biological crossroads within Texas and North America.

No less than twelve different schemes for the biological classification of the Texas Panhandle have been proposed by various authorities. Blair describes all of the designated Las Lenguas area as a part of the Kansan biotic province,⁹² while his predecessor, Lee Dice, splits the region into the Kansan province above the escarpment and the Comanchian below the caprock.⁹³ Bray states that the "red beds" below the escarpment are within the Lower Sonoran zone as regards temperature correlation, but bear a more common floristic relationship to the Upper Sonoran

⁹¹W. Frank Blair, "The Biotic Provinces of Texas," Texas Journal of Science, II, No. 1 (March 31, 1950), 95, 111.

⁹²Blair, "The Biotic Provinces of Texas," p. 98.

⁹³Lee R. Dice, The Biotic Provinces of North America (Ann Arbor, Michigan: University of Michigan Press, 1953), pp. 26-29. Hereinafter referred to as Dice, Biotic Provinces.

zone above the caprock.⁹⁴ Tharp⁹⁵ and Gould,⁹⁶ likewise, split the region into two biotic zones.

Within a smaller locality, such as the Las Lenguas study area, a slightly more detailed classification framework is advantageous. Such a scheme should logically be based upon the vegetative zones which one encounters as he traverses the area. Therefore, a framework which adheres to these community types has been composed. The remainder of this chapter shall be arranged so as to describe the High Plains area above the escarpment, the caprock and canyon proper, the riparian zone, and the Rolling Plains below the escarpment (see Fig. 4). Most of the published data pertaining to the Las Lenguas area can be adapted to this scheme of classification.

High Plains Zone

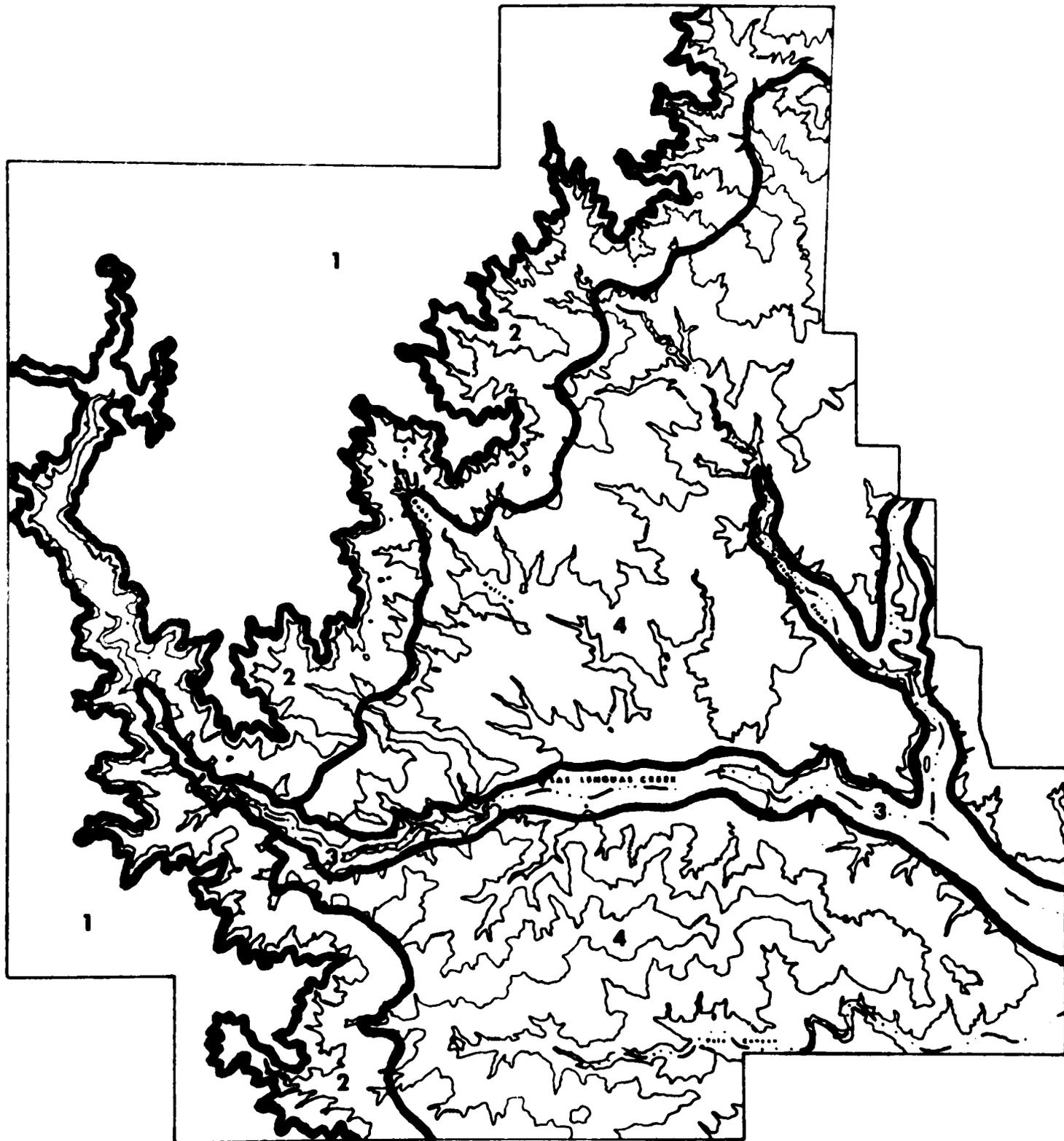
The Panhandle High Plains, which is represented in the Las Lenguas study area by the land above the caprock,

⁹⁴W.L. Bray, "Ecological Relationship of the Vegetation of West Texas," Botanical Gazette, XXXII (1901), 199-204.

⁹⁵Benjamin C. Tharp, The Vegetation of Texas (Houston, Texas: The Anson Jones Press, 1939), pp. 27-30.

⁹⁶F. Gould, Texas Plants--A Checklist and Ecological Summary (College Station, Texas: The A & M College of Texas, 1969), pp. 12-13. Hereinafter referred to as Gould, Texas Plants.

Figure 4



Scale - 1" = 6000 Ft.

KEY

- 1- High Plains Zone
- 2- Caprock and Canyon Zone
- 3- Riparian Zone
- 4- Rolling Plains Zone

BIOECOLOGICAL ZONES

was most aptly described by Ernest Palmer: "Far as the eye can see extend the unbroken, grassy stretches of level surface, conveying an impression of boundless space comparable only to the great sandy deserts or to the ocean."⁹⁷

Since that time, the High Plains landscape has changed considerably, but a few localities have retained their natural character.

Flora

The expression "Short Grass Country," which has become widely employed to specify the High Plains grasslands, is an apt description of the major vegetative type. Grasses of this semi-arid region are xerophytic with leaves that are narrow and inclined to curl with excessive transpiration. Whereas in their native state the coarser prairie grasses might have almost concealed grazing cattle, the High Plains grasses scarcely ever exceeded two feet in height.⁹⁸ Grass dominants under virgin conditions were probably blue and hairy grama (Bouteloua), with buffalo

⁹⁷ Ernest J. Palmer, "The Ligneous Flora of the Staked Plains of Texas," Journal of the Arnold Arboretum, II (1920), 92. Hereinafter referred to as Palmer, "Ligneous Flora."

⁹⁸ William L. Bray, Distribution and Adaptation of the Vegetation of Texas, Bulletin of the University of Texas--No. 82, Scientific Series No. 10 (Austin, Texas: The University of Texas, 1906), p. 91.

grass (Buchloe dactyloides) of secondary importance, but great herds of buffalo had already so overgrazed the country when the white man arrived as to have caused buffalo grass to become the chief dominant, with the grammas reduced to secondary rank. A dense stand of western wheat grass (Agropyron smithii), which later succumbed to intensive cattle grazing, also once stood waist high around High Plains playa lakes.⁹⁹ Additional plains grasses presently of importance are sideoats grama (Bouteloua curtispindula), black grama (Bouteloua eriopoda), little bluestem, (Andropogon scoparius), Indiangrass (Sorghastrum nutans), and switchgrass (Panicum virgatum).¹⁰⁰

Under native conditions the High Plains was free from all trees and brush. Mesquite (Prosopis) has been the most common woody invader of the grassland. This invasion has taken place since the introduction of domestic livestock and is a result of the decline in range condition. As the taller grasses disappeared under heavy grazing, they were replaced by short grasses and weeds which were unable to prevent mesquite invasion.¹⁰¹ The High Plains zone within

⁹⁹ Benjamin C. Tharp, Texas Range Grasses (Austin, Texas: University of Texas Press, 1952), pp. 60-62.

¹⁰⁰ Gould, Texas Plants, p. 13.

¹⁰¹ B.W. Allred, "Mixed Prairie in Texas," in Grasslands of the Great Plains, by J.E. Weaver and F.W. Albertson (Lincoln, Nebraska: Johnson Publishing Company, 1956), p. 274.

the Las Linguas study area is currently characterized by a mesquite-covered grassland.

Fauna

In general, only animals that can tolerate dry air may survive in open grasslands. Especially large numbers of reptiles and insects, most noticeably those exhibiting incomplete metamorphosis such as termites and grasshoppers, are well adapted to the rigorous environment. Among mammals, those forms relatively independent of water either because of slight development of the cutaneous gland (rodents), concentrated urine (pronghorn antelope), or dry feces, are most likely to survive. Other adaptive mechanisms which are very pronounced in grassland species include a burrowing habit and great speed, and endurance in movements.¹⁰²

Among High Plains mammals, the bison (Bison bison) and the pronghorn antelope (Antilocapra americana) were at one time the most visibly dominant species. The pronghorn remains, but the bison has been exterminated except for small, protected herds. The most significant mammals of the High Plains currently include the kit fox (Vulpes velox), pocket mouse (Perognathus flavescens), Kangaroo mouse

¹⁰²Richard Hesse, Ecological Animal Geography, prepared by W.C. Allee and Karl P. Schmidt (New York: John Wiley and Sons, Inc., 1937), pp. 444-448.

(Dipodomys ordii), deer mouse (Peromyscus maniculetus), skunk (Spilogale sp. and Mephitis sp.), badger (Taxidea taxus), coyote (Canis latrans), ground squirrel (Citellus spilosoma), prairie dog (Cynomys ludovicianus), plains wood-rat (Neotoma micropus), jackrabbit (Lepus californicus), and cottontail rabbit (Sylvilagus audubonii).¹⁰³

Referring especially to mammals, Dice notes that the caprock escarpment marks a distinct divisional boundary between related species of the High Plains and of the Rolling Plains. He states that the ground squirrels Citellus tridecemlineatus and C. spilosoma are found on the High Plains but are replaced by Citellus mexicanus in the lower Rolling Plains. Likewise the kit fox (Vulpes velox) is reported for the High Plains only while the gray fox (Urocyon cinereargenteus) inhabits the Rolling Plains.¹⁰⁴

Blair adds the pocket gopher Cratogeomys castanops of the High Plains whose counterpart from the Rolling Plains is the pocket gopher Geomys to this list.¹⁰⁵ It is evident that the escarpment separating the High Plains and the Rolling Plains also divides several closely related mammal species

¹⁰³Wendorf, Paleoecology of the Llano Estacado, p. 17.

¹⁰⁴Dice, Biotic Provinces, pp. 28-29.

¹⁰⁵Blair, "Mammals of the Mesquite Plains," p. 246.

and has probably functioned as an important device in the speciation process.

The avifauna of the High Plains is more abundant and diversified than one might expect for a grassland. The most conspicuous birds are the lark bunting, horned lark, McCowan's longspur, chestnut collared longspur, lark sparrow, Sprague's pipit, Brewer's sparrow, grasshopper sparrow, and the western meadowlark. The lesser prairie chicken was also at one time locally abundant but is presently being hunted for only one weekend per year. In general hawks and owls are not numerous, but the burrowing owl and the red-shouldered hawk are usually present. Among insects which are frequently eaten by these birds, the most notable is the High Plains grasshopper Dissosteira longipennis.¹⁰⁶

The reptiles which constitute principal elements of the High Plains community include the plains garter snake, the western rattlesnake, and the bullsnake, all of which take a heavy toll of ground squirrels and mice. Also included are horned toads (Phrynosoma cornutum), collared lizards, fence lizards, and utas.¹⁰⁷ Probably lesser known reptiles from this habitat are Coluber constrictor, Elaphe guttata, Heterodon platyrhinos, Kinosternon flavescens,

¹⁰⁶Victor E. Shelford, The Ecology of North America (Urbana, Illinois: University of Illinois Press, 1964), p. 346.

¹⁰⁷Shelford, The Ecology of North America, p. 346.

Lampropeltis getulus, Pseudemys scripta, and Sceloporus undulatus.¹⁰⁸ Still another study reports that reptile species which are more common in the High Plains association than in any other include Phrynosoma cornutum, Phrynosoma modestum, Cnemidophorus sacki, and Arizona elegans.¹⁰⁹

Caprock and Canyon Zone

The biotic community which occurs upon the caprock canyon walls and floor is considered to represent an ecotonal type with species characteristic of the High Plains and the Rolling Plains. Several mammals for which the escarpment forms a distributional boundary have already been discussed. It is also true that vegetational species from both adjacent areas are found within the caprock and canyon zone. The ecotonal plants growing in this habitat are often depauperate in comparison with those of the same species found in adjacent communities. However, it is to be noted in addition that several species have been found to exist

¹⁰⁸Don Hunsaker, II, "The Distribution, Annotated Checklist and Keys for the Reptiles of Northwest Texas" (unpublished M.S. thesis, Texas Technological College, 1957), p. 5. Hereinafter referred to as Hunsaker, "Distribution, Checklist and Keys."

¹⁰⁹M.J. Fouquette and H.L. Lindsay, Jr., "An Ecological Survey of Reptiles in Part of Northwestern Texas," The Texas Journal of Science, VII, No. 4 (December, 1955), 405. Hereinafter referred to as Fouquette and Lindsay, "Ecological Survey of Reptiles."

only in the caprock and canyon community. Examples of these are the plants, Hymenoxys acaulis and Eriogonum jamesii.¹¹⁰

Flora

The vegetative complex of the caprock and canyon zone is more closely allied to that of the Rolling Plains than to the High Plains flora. This fact is due to the more similar topographic features and soil water patterns. In general the protection afforded in the canyons from the almost constant force of dry winds in the summer and the cold "northers" of winter that prevail upon the open plains, together with the more abundant water supply and the diversity of surface and soil, are favorable to the development of a richer and more varied flora than is possible in the High Plains zone. It is in these protected, broken habitats that most of the ligneous plants are to be found. To be sure, many of the woody species are restricted to this type of habitat.¹¹¹

The flora of the caprock and canyon zone is characterized by a variety of brush species on the canyon walls and an almost open juniper-grassland upon the canyon floor. Principal grasses include buffalo grass, hairy tridens (Erioneuron pilosum), and fingergrass (Chloris cucullata).

¹¹⁰Rowell, "Vascular Plants," p. 26.

¹¹¹Palmer, "Ligneous Flora," pp. 91-101.

Among the major forbs are Aplopappus spinulosus, Gutierrezia sarothrae, Dolea enneandra, Verbena bipinnatifida, Oxytropis lamberti, and Krameria secundiflora. Scattered cacti, mostly Opuntia arborescens, and Echinocereus reichenbachii, are also found within the community.¹¹² It is interesting to notice the climbing species which cling to the canyon walls. Among these the grape (Vitis spp.), stretchberry (Smilox bona-nox), Clematis, and Ampelopsis are fairly common.¹¹³

The most heterogeneous and remarkable vegetation of the caprock and canyon zone is unmistakably the ligneous or woody species. The junipers (Juniperus pinchotii and Juniperus monosperma) are the dominant and most striking woody species to be found. They form part of the savannah upon the canyon floor and range to the tops of the escarpment. Other woody species which are mostly found upon the canyon floor, although they often also range into the riparian community and the lower canyon walls, include Rhus microphylla, Zizyphus obtusifolius, and Atriplex canescens. Just above these species on the lower canyon walls are found Mahonia trifoliata, Mimosa borealis (cat's claw), Rhus trilobata, and Forestiera neo-mexicana. Ribes aureum and Barberis trifoliolata (algerita) may be observed upon either

¹¹²Blair, "Mammals of the Mesquite Plains," p. 240.

¹¹³Tharp, Texas Range Grasses, p. 60.

the lower or upper canyon wall, while Ephedra torreyana, Quercus mohriana, and Cercocarpus argenteus are the most prominent woody species on the upper portion of the escarpment.¹¹⁴ Mesquite, (Prosopis glandulosa) which is listed as a member of most caprock escarpment and canyon communities is conspicuous for its absence from this community in Las Lenguas Canyon.

It appears that the woody species which are peculiar to the caprock and canyon zone of the Texas Panhandle are emigrants from various other sources. Most have doubtlessly advanced gradually or been transported in from the Edwards Plateau region to the south. Some, most notable of which is the ephedra, have apparently come in from extreme southwestern Texas by way of the Pecos Valley, and another group seems to have worked its way from the east along streams such as Las Lenguas. Still others may have been introduced from the west via the Canadian River Valley. Palmer emphasizes the lack of completeness and balance of this caprock and canyon flora. He suggests that the flora is geologically and evolutionarily newly established and in a state of constant transition.¹¹⁵ This proposition is complementary to the ecotonal theory. Both phenomena illustrate the great biological significance of the Las Lenguas Canyon area.

¹¹⁴Palmer, "Ligneous Flora," pp. 96-100.

¹¹⁵Palmer, "Ligneous Flora," pp. 102-104.

Fauna

Probably the two principal agents in introducing new plant species into the caprock canyons are wind and birds. Many birds breed in the Las Lenguas area, and others doubtlessly rest and feed in the canyon's protection during their migratory flights. Among birds which are persistent seed eaters are the mockingbird, quail, jay, and species of woodpecker. Other birds reported for the caprock and canyon zone are the canyon wren, horned lark, poor will, cliff swallow, and western chipping sparrow.¹¹⁶ Residents also state that a pair of golden eagles has also been nesting in Las Lenguas Canyon for the past several years.

The caprock and canyon zone in the Las Lenguas area also supports various species of saxicolous mammals. The most characteristic and definitive mammals of this zone are the brush mouse (Peromyscus boylii rowleyi), which is restricted to the rocky cliff habitats of the escarpment edge,¹¹⁷ the Palo Duro mouse (Peromyscus comanche), which is endemic to the Texas Panhandle caprock canyons, and the white-throated packrat (Neotoma albigula), which is also

¹¹⁶Palmer, "Ligneous Flora," p. 104.

¹¹⁷Herschel W. Garner, "An Ecological Study of the Brush Mouse, Peromyscus boylii, in West Texas," The Texas Journal of Science, XIX (1967), 290. Hereinafter referred to as Garner, "Ecological Study of the Brush Mouse."

limited to the rocky habitats.¹¹⁸ In one study of the caprock and canyon community, the dominant mammalian fauna in order of abundance were the silky pocket mouse (Perognothus flavus), deer mouse (Peromyscus maniculatus), Zacatecan deer mouse (Peromyscus difficilis), wood mouse (Peromyscus leucopus), coyote (Canis latrans), striped skunk (Mephitis mephitis), gray fox (Urocyon cinereoargenteus), pronghorn antelope (Antilocapra americana), and the white-tailed deer (Odocoileus virginianus). Tracks of raccoon (Procyon lotor) and bobcat (Lynx rufus) were also observed.¹¹⁹ The mule deer (Odocoileus hemionus crooki) is another important mammal of the Las Lenguas Canyon area.

Several mammalian species have been extirpated from the caprock and canyon zone of the Las Lenguas area, and at least one has been introduced. The black bear (Ursus americanus) and the mountain lion (Felis concolor) were reported in the area as late as 1905. The timber wolf (Canis lupus nubilus) joins the black bear in having been eliminated from the Las Lenguas area and the Texas Panhandle. The mountain lion and the black-footed ferret (Mustela nigripes) are both exceedingly rare or extirpated from the region.¹²⁰

¹¹⁸ Blair, "Mammals of the Mesquite Plains," pp. 240, 251-252, 261-262.

¹¹⁹ Garner, "Ecological Study of the Brush Mouse," p. 286.

¹²⁰ Blair, "Mammals of the Mesquite Plains," pp. 254-256.

The aoudad sheep (Ammotragus lervia), a native of the Atlas Mountains in North Africa, has been introduced into the Las Lenguas Canyon area. This species has adapted well to the environment which became so inhospitable to the four species mentioned above. Forty-two aoudads were released in Palo Duro Canyon in 1957. As of 1967 the herd multiplied to number approximately 600 and had spread south along the escarpment at least as far as Las Lenguas Canyon. The buff colored, 180 pound aoudads inhabit the most rugged canyon cliffs and therefore pose no threat to deer which usually browse upon gentler slopes of the caprock and canyon zone.¹²¹ The secretive aoudad is rarely seen and makes an excellent game animal. In 1971 only forty-four sheep were killed from the 147 permits that were issued.

Reptiles complete the faunal list for the caprock and canyon zone. Several species are reported for the sandier soils of the canyon floor nearest the riparian zone. The racerunner Cnemidophorus sexlineatus is abundant in the deep sand and rare in all other habitats. Additional species which are common in sand include Holbrookia maculata, Phrynosoma cornutum, Heterodon nasicus, Arizona elegans, Terrapene ornata, Sceloporus undulatus, Coluber constrictor, and Masticophis flagellum.

¹²¹Phil Evans, "Pursue the Aoudads," Texas Parks and Wildlife, February, 1967, pp. 20-23.

The canyon walls exhibit their own reptilian assemblage. The species which were almost entirely restricted to the rocky slopes include Leptotyphlops myopica, Sonora episcopa, and Hypsiglena torquata, while Crotaphytus collaris and Tantilla nigriceps are more abundant here than in other associations. Additional reptiles common to the rocky habitats are Eumeces obsoletus, Diadophis punctatus, Holbrookia texana, and Cnemidophorus sacki.¹²² The rattlesnake Crotalus atrox is also abundant upon the rocky ledges of the caprock and canyon zone.

Riparian Zone

The riparian zone, which closely follows Las Lenguas and Cottonwood Creeks, supports a mesic community which is strikingly different from any other within the Las Lenguas study area. The vegetation is extremely lush in comparison to that of the surrounding semi-arid habitats.

Flora

A combination of water, sandy soils, and adequate protection makes the riparian zone a good habitat for grasses and woody shrubs. Here tall grasses similar to those of the true prairie occur. Natively significant

¹²²Fouquette and Lindsay, "Ecological Survey of Reptiles," pp. 404-405.

species include Indiangrass, little bluestem, switchgrass, sand bluestem (Andropogon hallii), sand lovegrass (Eragrostis trichodes), big sand reed (Calamovilfa gigantea), side-oats grama, and Canada wildrye (Elymus canadensis). These species also cover the more favorable habitats of the Rolling Plains zone.¹²³

Where permanent springs afford a considerable and consistent water supply, herbaceous growth becomes quite luxuriant. Dripping banks and undercuts are covered with Venus' Hair fern (Adiantum capillus venensis). Also exhibiting an intimate relationship with the water are mossy ledges and boggy beds of Equisetums, rushes, and the tall, plummy grass, Phragmites communis.

In the riparian zone, deciduous woody plants replace the evergreen junipers of the caprock and canyon zone. Upon the banks of the creeks and in the most highly protected canyon areas, cottonwoods (Populus texana) and (Populus deltoides) are dominant species. They are joined by the willow (Salix), hackberry (Celtis laevigata texana), plum (Prunus spp.), Amorpha fruticosa, Cephalanthus occidentalis, and the wild Chinaberry (Sapindus drummondii).¹²⁴ The variety and lushness of the riparian zone flora make it the most interesting portion of the Las Lenguas study area.

¹²³Allred, "Mixed Prairie in Texas," p. 275.

¹²⁴Palmer, "Ligneous Flora," pp. 97-100.

Fauna

As previously stated, the forests of the riparian zone constitute a major dispersal avenue for westward distribution of forest-adapted mammals in the plains. The most characteristic mammals of the cottonwood association are the wood mouse (Peromyscus leucopus) and the fox squirrel (Sciurus niger). The most important floodplain pond species are the muskrat (Ondatra zibethica) and cotton rat (Sigmodon hispidus). Among very small mammals, the desert shrew (Notiosorex crawfordi crawfordi) is most often found among cottonwood logs, while the eastern mole (Scalopus aquaticus intermedius) is sharply limited to sandy soils. The opossum (Didelphis marsupialis) and two bats, the big brown bat (Eptesicus fuscus pallidus) and the red bat (Lasiurus borealis borealis), are also reported for the riparian zone.

From a center of distribution in the eastern deciduous forest, the eastern cottontail (Sylvilagus floridanus) ranges across much of the Texas Panhandle, apparently following the stream valleys. Its range geographically overlaps that of a western desert species, Sylvilagus auduboni. There is a general ecological separation of the two species in the Las Lenguas area, with auduboni occupying the uplands

and floridanus generally restricted to the riparian zone. However, the two species do occur together in some places.¹²⁵

Several reptilian species are also common to the riparian zone. Reptiles which are the most characteristic of this zone include Kinosternon flavescens, Chelydra serpentina, Pseudemys scripta, Natrix erythrogaster, and Thamnophis sauritus. Species that are more common in this association than in others are Heterodon platyrhinos, Coluber constrictor, Masticophis flagellum, Pituophis catenifer, Thamnophis marcianus, and Thamnophis sirtalis. Terrapene ornata, Sceloporus undulatus, Phsynosoma cornutum, Eumeces obsoletus, Diadophis punctatus, Crotalus atrox, Holbrookia texana, and Cnemidophorus sacki are also fairly common within the riparian zone.¹²⁶

Rolling Plains Zone

That part of the Las Lenguas study area which is below the caprock, outside of the canyons proper, and away from the direct influence of the water is called the Rolling Plains. The Rolling Plains zone corresponds closely to the geologically defined Permian "red beds."

¹²⁵Blair, "Mammals of the Mesquite Plains," pp. 241-243.

¹²⁶Fouquette and Lindsay, "Ecological Survey of Reptiles," pp. 403-405.

Flora

In general the Rolling Plains may be said to consist of a mixed-grass prairie-plains plant community. It receives its biotic composition and much of its ecological structure from the two adjacent associations: the tall grass prairie to the east and the short grass plains above the caprock escarpment to the west. As the caprock and canyon zone constitutes a sharp ecotone between the High Plains and the Rolling Plains zones, so the Rolling Plains is a broader, more generalized ecotone between the tall grass prairie and the short grass plains. However, the mixed-grass community is an emergent type and as such attains a certain degree of individuality and stability.¹²⁷

The original prairie-plains vegetation of the Rolling Plains included tall and mid-grasses, such as little bluestem, big bluestem (Andropogon gerardi), sand bluestem, sideoats grama, Indiangrass, switchgrass, hairy grama, blue grama, Canada wildrye, and western wheatgrass. Buffalo grass, curly mesquite (Hilaria belangeri), tobosa (Hilaria mutica), several species of three-awn (Aristida), sand dropseed, and hooded windmillgrass have tended to increase under grazing. Shinnery oak and sand sage (Artemisia filifolia) increase or invade on the sandy lands, while mesquite

¹²⁷J. Richard Carpenter, "The Grassland Biome," Ecological Monographs, X, No. 4 (October, 1940), 645.

(Prosopis glandulosa) is a common invader on all soils. Other brushy invaders include croton (Croton spp.) western ragweed (Ambrosia psilostachya), and yucca.¹²⁸

Some authorities state that mesquite is a part of the native flora of the Rolling Plains. The majority, however, list this plant as an invader. Lifelong residents of the Las Linguas area concur with the view of the majority and tell of the early days when mesquite was not prominent upon the Rolling Plains. In either case, mesquite is definitely the dominant woody species of the zone at the present time.

The most extensive community of the Rolling Plains today is a mesquite-grass association in which an open stand of mesquite and a few other shrubs alternate with a good grass cover. The grasses principally consist of various species of grama (Bouteloua) and three-awn (Aristida). The broomweed (Gutierrezia texana) and gaillardia (Gaillardia puchella) are the most abundant and characteristic forbs of this community.¹²⁹

Another association of lesser extent is that of stabilized sand dunes which most often exhibit a cover of sand sage (Artemisia) and the grasses Panicum, Chloris, and Andropogon. A sage-mesquite-cedar association is also

¹²⁸Gould, Texas Plants, p. 12.

¹²⁹Blair, "The Biotic Provinces of Texas," p. 111.

found within the Rolling Plains zone. This community is characterized by a dense cover of juniper, sand sage, and mesquite. The most conspicuous forb of the community is Gaillardia pulchella, while the most common grass is Aristida.¹³⁰

Fauna

The fauna of the Rolling Plains is similar in type to that of the High Plains above the caprock. The same grassland habitats are retained by a majority of the animals, but various specific changes are notable. Several of these distributional differences have already been discussed in the presentation of the fauna of the High Plains zone and will not be repeated here.

The broken, mesquite-grasslands of the Rolling Plains zone is difficult to classify as to faunal relationships. The fauna is a mixture of eastern and western species with the latter predominating. The zone, therefore, constitutes a transition area in which no endemic vertebrate fauna of any consequence has evolved. One exception to this statement is found in the kangaroo rat, Dipodomys elator, which is endemic to the Rolling Plains zone of the Texas Panhandle. However, the center of distribution for this

¹³⁰Blair, "Mammals of the Mesquite Plains," p. 240.

mammal species is to the east of the Las Lenguas study area.¹³¹

Three species comprise the bulk of the small mammal population of the mesquite-grassland association within the Rolling Plains zone. They are the plains pocket mouse (Perognathus hispidus), Merriam's pocket mouse (Perognathus merriami), and the jackrabbit (Lepus californicus). The prairie dog (Cynomys ludovicianus) probably once had a similar distribution, but it, like the once dominant bison, has been extirpated from most of the area. Among carnivores, the coyote (Canis latrans) and the striped skunk (Mephitis mephitis) occur extensively throughout the Rolling Plains. Characteristic mammals of the stabilized sand dune areas include Dipodomys ordi, Perognathus flavescens, Onychomys leucogaster, Geomys bursarius, and Scalopus aquaticus, while the sage-mesquite-cedar association supports mostly Geomys bursarius, Dipodomys ordi, Perognathus merriami, Scalopus aquaticus, and Perognathus hispidus. In addition, several species of ground squirrel (Citellus) and the badger (Taxidea taxus) range through the Rolling Plains.¹³²

¹³¹Blair, "The Biotic Provinces of Texas," pp. 110-111.

¹³²Blair, "Mammals of the Mesquite Plains," pp. 239-255.

Like the mammals, the avian population of the Rolling Plains is a combination of both eastern and western species. Commonly encountered are the prairie and desert horned lark, the eastern savannah sparrow, eastern red-tailed hawk, Krider's hawk, and the western vesper sparrow. Also reported are the Howell's nighthawk, longbilled curlew, Sprague's pipit, western burrowing owl, and western lark sparrow.¹³³

Probably least segregated of the Las Lenguas area fauna is the reptiles. It is reported that very little variation exists between the reptilian faunas of the High Plains and those of the Rolling Plains. The reptiles most common to the Rolling Plains include Arizona elegans, Masticophis flagellum, Phrynosoma cornutum, and Pituophis catenifer, none of which are restricted to the zone.¹³⁴ The only reptile species which is restricted to the Rolling Plains zone is the snake Natrix barteri.¹³⁵

Conclusion

The climate and topography of the Las Lenguas area have coupled to produce quite a varied and interesting

¹³³Carpenter, "The Grassland Biome," p. 670.

¹³⁴Hunsaker, "Distribution, Checklist and Keys," pp. 7-8.

¹³⁵Blair, "The Biotic Provinces of Texas," p. 112.

biological community. The area is a crossroads at which species from several other regions intersect. The grasslands and the caprock escarpment form avenues for north-south dispersal, while the streams contribute significantly to east-west lines of distribution. The caprock and canyon zone constitutes an ecotone between the High Plains and the Rolling Plains, and the Rolling Plains itself functions as a transition zone between the eastern short grass plains and the western tall grass prairie. For these reasons, the principles of speciation are constantly operating within the Las Lenguas area. The possibilities for meaningful biological research in this area are almost unlimited.

CHAPTER VI

SCENERY

The geology and bioecology of the Las Lenguas area function together to make it one of the most scenic localities in West Texas. The early Anglo explorers were impressed with the caprock escarpment which, when first seen from the southeast, appeared to be a chain of low mountains. Upon negotiating the ledge along the old Comanchero trail, they were even more awed that the mountains were in reality a step up onto an almost limitlessly level plains grassland. Not a single tree blocked their vision. Forward was a sea of grass, and behind them lay the broken, inhospitable badlands. The Anglos were exceedingly lucky if they stumbled into the lush sanctuary which the Indians had frequented for so long--Las Lenguas Canyon.

The Las Lenguas area remains today much the same as it was when seen by the early explorers. Whatever qualities constitute a wilderness atmosphere abound in the area. As one enters the broken lands and canyons, he immediately feels a communion with nature which is rarely found in today's man-dominated environment. Las Lenguas and the surrounding breaks still function as a sanctuary, even

though for different people with different problems than those of old.

Upon approaching the canyon area from above the caprock or from the rolling land below, the explorer receives the distinct feeling of entering into and becoming a part of the landscape of the area. From the Stroup ranch house which sits upon a small rise beside Las Lenguas Creek in the southeastern corner of the study area, the observer can look into Las Lenguas Canyon. In the late evening a haze often hovers over the canyon and produces an engulfing calm. The old Comanchero trail can still be seen in the distance winding up the face of the caprock escarpment.

Another treat awaits the visitor who enters Las Lenguas Canyon from the High Plains above the caprock. As he descends the rugged canyon walls, he passes through several plant communities which ~~previously have been described~~ in detail. He arrives at a side canyon which leads into the major canyon, but as he continues forward, he finds himself approaching a narrow gully which has been cut into the sandstone by runoff water from above. This gully deepens sharply into what is locally called "the narrows." The walls of "the narrows" swirl as did the water which formed them. The crevice is about five feet wide and reaches a depth of approximately 40 feet in the deepest section.

At the mouth of "the narrows" stands a tall cotton-wood tree. This tree introduces the lush, mesic vegetation which is located just outside "the narrows" along Las Lenguas Creek. Following the creek past several quiet springs, the explorer next comes upon a fifteen foot waterfall which tumbles into a natural pond. The pond is large enough for limited swimming. The old-timers of the region call this locality Linguish Falls.

Just below Linguish Falls, the footpath splits. ~~One~~ ~~branch~~ follows the creek toward Stroup's ranch house, while the other ascends the canyon wall. If the visitor climbs ^{the} the latter trail, he finds himself standing upon a point which overlooks the entire Las Lenguas area. He can see into the upper reaches of the canyon as well as onto the vast Rolling Plains. The sensation is very much like sitting on top of a mountain surveying the countryside below. A vast natural expanse is spread before the explorer.

PART II

EVALUATION AND RECOMMENDATIONS

CHAPTER VII

ANALYSIS OF SIGNIFICANCE

Criteria for determining the level of significance for potential park sites have been established at the national and state levels.

National Level

The National Park System is composed of areas which are categorized as National Recreation Areas, National Historic Areas, National Parks, and National Monuments.

National Recreation Areas

One of the primary criteria for a National Recreation Area is that the site should exhibit a high recreation carrying capacity.¹³⁶ The Las Lenguas area definitely does not fulfill this requirement.

National Historic Areas

National Historic Areas must exhibit national significance. They must be places which "outstandingly

¹³⁶U.S., Department of the Interior, National Park Service, NPS Criteria for Parklands (Washington, D.C.: Government Printing Office, 1966), p. 17.

represent the broad cultural, political, economic, military, or social history of the Nation, and from which an understanding and appreciation of the larger patterns of the American heritage may be gained." A National Historic Area must possess integrity. Integrity requires original location and the intangible elements of feeling and association. Structures are not essential, but they add appreciably to the interpretive possibilities of a site.¹³⁷ The Comanche barrier to white civilization and the Comanchero trade in the Las Linguas area are of national significance.

National Parks and National Monuments

Natural areas within the National Parks System are classified as National Parks or National Monuments. National Monuments usually encompass less acreage than do National Parks and generally preserve resources exhibiting primary scientific significance. Usually they are not of sufficient size to support as broad a range of visitor-use programs as National Parks, but National Monuments should embrace a sufficiently comprehensive unit to permit public use and enjoyment of the scientific area consistent with its preservation.¹³⁸ The crossroads character of the biological

¹³⁷U.S., Department of the Interior, National Park Service, NPS Criteria for Parklands, pp. 13-14.

¹³⁸U.S., Department of the Interior, National Park Service, NPS Criteria for Parklands, p. 11.

communities of the Las Linguas area, as well as the opportunity for isolation and speciation, is scientifically significant. However, this significance is not considered to be of a national character.

In conclusion, it may be stated that the Las Linguas area does not qualify as a National Recreation Area, National Park, or National Monument. The area does possess historical significance at the National level. The area also exhibits bountiful wilderness attributes. It is judged that these two qualities are compatible. The historic and wilderness values can be preserved and interpreted adequately within a single unit, whether it be at the National or the State level.

State Level

Within the State of Texas the State Parks are classified as either historical, scenic, or recreational. State Historical Parks are established to preserve sites of events which are of state-wide significance. Portrayal of important historical sites, events, or persons from representative eras of Texas history is the goal of the State Historical Park System. Likewise, State Scenic Parks are to be developed to protect and preserve outstanding or unique natural scenic values, provide public access, protect public health, and provide adequate interpretive programs.

The Las Lenguas area fulfills the criteria for State Historical and State Scenic Parks.¹³⁹

There is no classification within the Texas State Parks System for scientific or wilderness areas. The character of the Las Lenguas area is such that it more appropriately would fit into this latter category than any other. Both the scientific and wilderness significance of the locality have been emphasized throughout this study.

The precedent for designating wilderness areas and preserves is well established. In 1924, the first official wilderness at the National level was designated within the Forest Service by administrative decree. Additional wilderness areas were instituted in the same manner until the Wilderness Act of 1964 established a new set of procedures for designating and managing units of the National Wilderness Preservation System. Presently, only Congress has authority to expand or modify the System.

Preservation of wilderness areas at the State level is exemplified by areas such as the Porcupine Mountains State Wilderness Park in Michigan. At this park, activities and developments within appointed zones are governed by guidelines which are specific for each zone.

¹³⁹Texas State Parks Board, "Texas State Park Criteria," in Park Practice Guideline, a publication of the National Conference on State Parks, National Recreation and Park Association, and the National Park Service (Washington, D.C.: Government Printing Office, 1961), pp. 107-108.

An excellent example of wilderness preservation at the local level is the Cook County Forest Preserve District in Illinois. In 1913, the Illinois General Assembly authorized creation of the District and granted its commissioners power to acquire and hold forest lands. Thus, with the precedent for wilderness preserves being established at the national, state, and local levels of government, the concept of State Wilderness Parks in the State of Texas is deemed to be practical.

Improper development would definitely destroy the attributes for which the Las Lenguas area is significant. Without the restraints which would be imposed by a wilderness classification, the excellence of the Las Lenguas area, upon its development as a State Park, would rapidly deteriorate. The quality of the visitor's wilderness experience would decline proportionally.

The Texas Parks and Wildlife Department should incorporate into the State Park System a State Wilderness Park category. If this action is not feasible, stringent guidelines for development of certain fragile localities as State Scenic Parks should be formulated and implemented. It is evident that various aspects of the Las Lenguas Canyon area are significant at the State and National levels.

CHAPTER VIII

ANALYSIS OF DEVELOPMENTAL CHARACTERISTICS

Several characteristics of the Las Lenguas Canyon area should be analyzed to ascertain factors associated with development of the park. Among these are proximity and access, competing and complementing facilities, land ownership, utilities, soils, and carrying capacity.

Proximity and Access

The Las Lenguas area is strategically located near the center of the Texas Panhandle. Included within a seventy-five mile radius of the locality are Amarillo and Lubbock, while the urban centers of Wichita Falls, Abilene, and Big Spring fall inside a 160 mile radius. The Odessa-Midland complex is only slightly farther at approximately 180 miles.

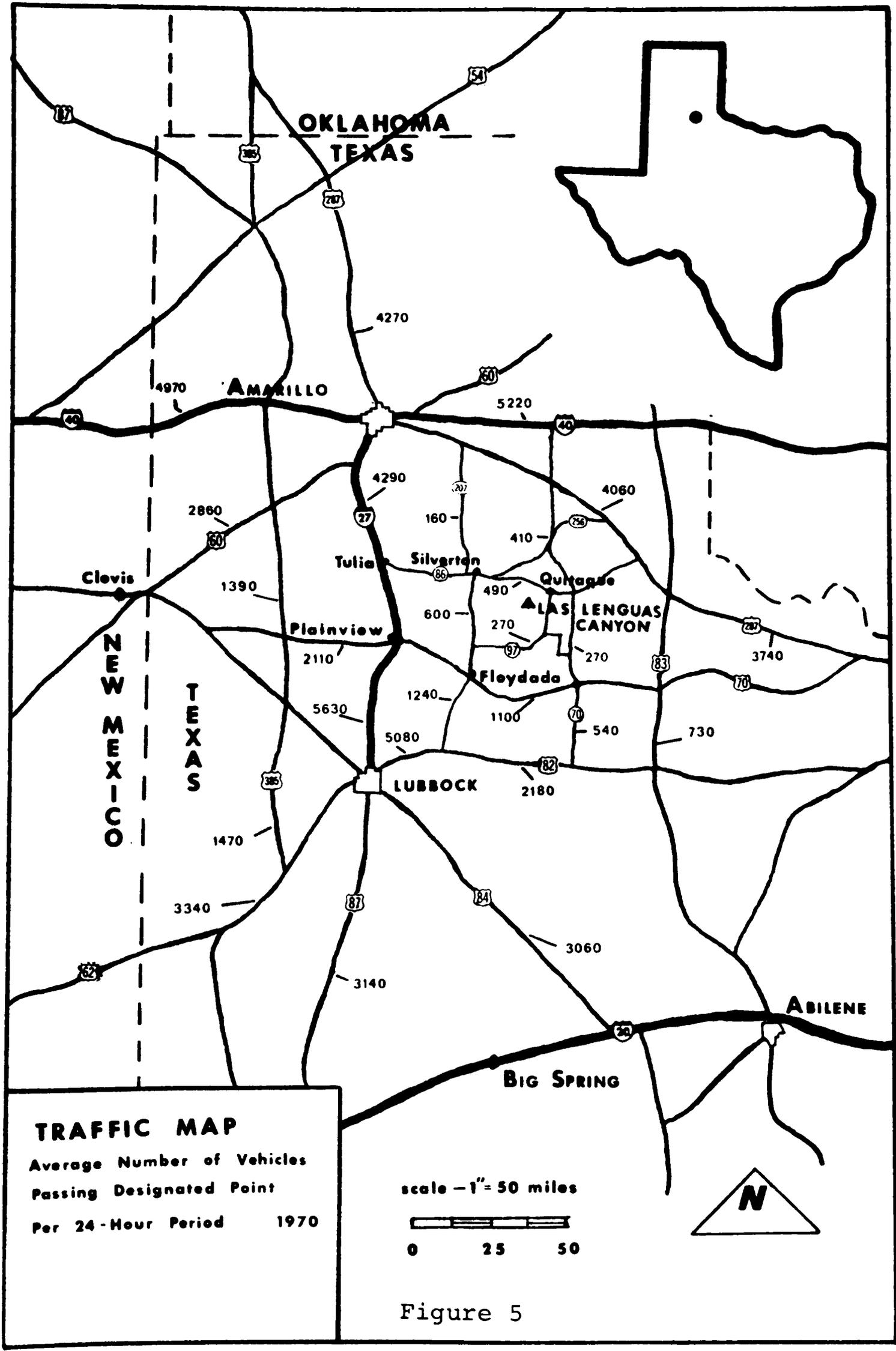
The Las Lenguas study area is accessible by county roads from State Highway 86 and 207 and from Farm Road 1065. These county roads are unimproved dirt roads but are kept in good condition. Two of the county roads intersect at the southeastern corner of the study area (see Fig. 2). Their intersection marks the location of the Stroup ranch house

and the most logical position for a park entrance. It is also interesting to note that State Highways 70, ten miles east of Las Lenguas, and 256, ten miles north of the Canyon, are part of the Texas Plains Trail System.

An analysis of the traffic map of the Texas Panhandle (see Fig. 5) reveals that the Las Lenguas Canyon area is located near the center of a high-traffic triangle formed by Interstate Highway 27 and U.S. Highways 287 and 82. These highways connect Lubbock, Amarillo, and Wichita Falls. Interstate Highway 40 which passes directly across the Texas Panhandle is also heavily traveled. In contrast, the highways closely surrounding the Las Lenguas area are only moderately used. If a park were developed at Las Lenguas Canyon, the major regional traffic arteries for the area would be Interstate Highways 27 and 40, and U.S. Highways 287 and 82.

Competing and Complementing Facilities

Several recreation facilities and attractions exist within the Texas Panhandle and South Plains region (see Fig. 6). There are vast national grasslands, several wildlife refuges, and scattered lakes. The only localities which could possibly be in competition with the Las Lenguas area are Palo Duro State Park and Tule Canyon. Mackenzie Reservoir is planned for inclusion in the upper portion of



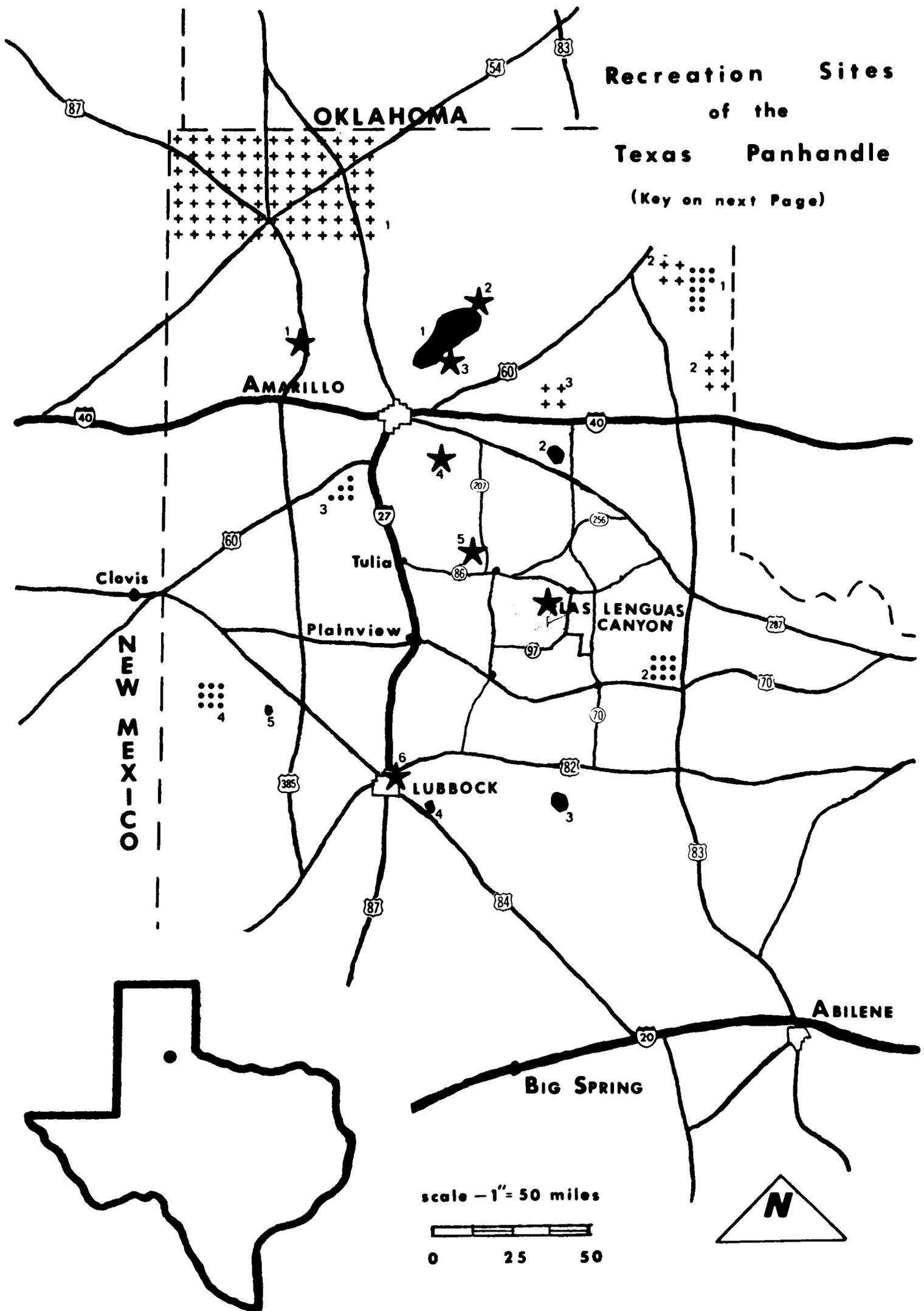


Figure 6

KEY TO "RECREATION SITES OF THE TEXAS PANHANDLE"

++ National Grasslands

1. Rita Blanca National Grassland
2. Black Kettle National Grassland
3. McClellan Creek National Grassland

⋮ Wildlife Areas

1. Gene Howe Wildlife Management Area
2. Matador Wildlife Management Area
3. Buffalo Lake National Wildlife Refuge
4. Muleshoe National Wildlife Refuge

● Lakes

1. Lake Meredith
2. Green Belt Dam Lake
3. White River Lake
4. Buffalo Lake
5. Bull Lake

★ Recreation Areas

1. Saddle-Back Mesa
2. Sanford National Recreation Area
3. Alibates Flint Quarries National Monument
4. Palo Duro State Park
5. Tule Canyon and Mackenzie Reservoir (proposed)
6. Mackenzie State Park

Tule Canyon. This development should make the canyon-reservoir complex a potential recreation park of the highest quality.

Likewise, Palo Duro Canyon State Scenic Park has become increasingly popular as a recreational attraction. Between September 1, 1970 and August 3, 1971, Palo Duro visitors numbered 156,161, and the park ranked fifteenth among 71 Texas State Parks in attendance.¹⁴⁰ The carrying capacity of Palo Duro Canyon is greater than that of Las Lenguas. The Las Lenguas area has retained much more of a wilderness atmosphere than has Palo Duro Canyon, which has been extensively developed. Development of the Las Lenguas Canyon locality with an emphasis upon protection of its wilderness character would assure a completely different clientele for the two recreation attractions.

In effect, all three sites, Palo Duro Canyon, the Las Lenguas area, and the Mackenzie-Tule complex, would complement one another. Each facility would be able to offer the visitor something different. Therefore, the emphasis of their recreational attractiveness would be unique. All types of interests would be accommodated, and each individual could participate in a variety of activities. It is suggested that these three sites could function as a

¹⁴⁰Texas Parks and Wildlife Department, "State Park Visitation" (unpublished departmental manuscript).

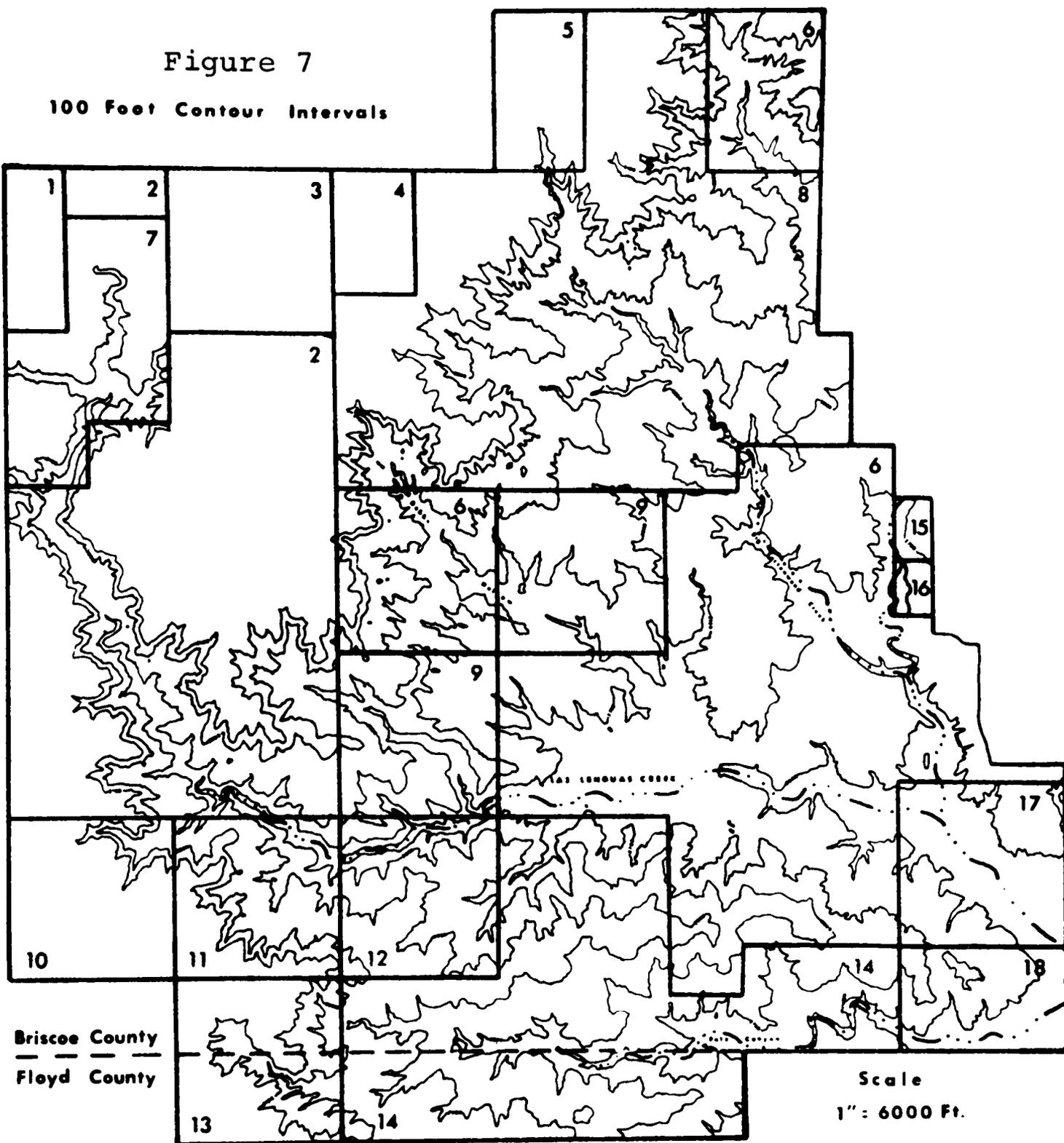
recreational unit of the finest quality. It is further suggested that a Caprock Trail which could connect the three components of this recreational unit would serve to solidify the unit.

Land Ownership

Eighteen land owners possess parcels of land within the Las Lenguas study area (see Fig. 7). Almost all of the area is ranchland which is presently being used for the grazing of cattle. Mr. Jim Stroup owns the only home located within the study area. He has expressed his desire that a State Park someday be developed at Las Lenguas.¹⁴¹

Several of the other land owners do not share Mr. Stroup's desire that the Las Lenguas area become a State Park. They are ranchers who have worked hard to build their ranches. A part of them is in the land, and they would be reluctant to sell their property. These ranchers attempt to regulate the people who enter the area, but vandals and litter-bugs are slowly and persistently leaving their mark upon the land. At some point the wilderness character and quality will be diminished beyond an acceptable level. However, it would unquestionably be better to leave the Las Lenguas area in private ownership than to create a park on

¹⁴¹Jim Stroup, private interview, August, 1971.



LAND OWNERSHIP MAP

KEY

- | | | | |
|-------------|------------|------------|-----------------|
| 1 Cornelius | 4 Brooks | 9 Howard | 14 Taylor |
| 2 Lemons | 5 Scott | 10 Wallace | 15 Rogers |
| 3 Brannon | 6 Birdwell | 11 Cruse | 16 Smith |
| | 7 Biffle | 12 Skaggs | 17 Stroup |
| | 8 Saul | 13 Welch | 18 Blair-Hughes |

the site without adequate enforcement of strict quality guidelines for its planning, development, and subsequent use.

Utilities

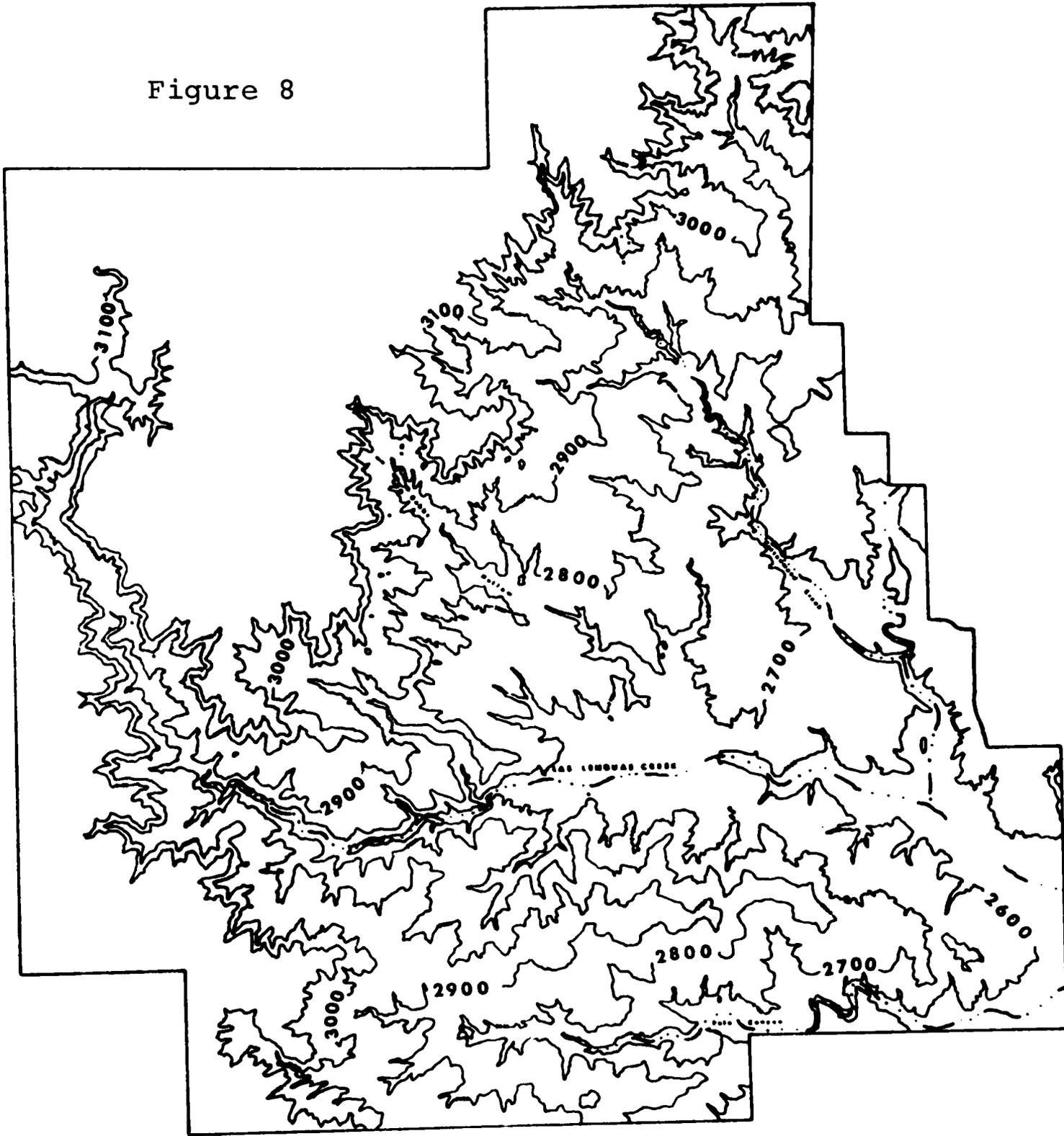
Almost all of the necessary utilities for park development are available within the Las Lenguas study area. The Stroup ranch house is built on the site of one of the finest views in the region. Electricity, gas, and well water are present at the ranch house. Windmills provide additional water and are located throughout the area. Sewage is treated by means of a septic tank and solid waste is burned. These procedures would not be desirable for State Park usage. The nearest locality offering more sophisticated utilities is Quitaque, six miles to the east.

Soils

Field research has been completed, but a soil survey for Briscoe County has not been published. Pertinent data are available from the Soil Conservation Service.

The topography and soils of the Las Lenguas area are very closely related (see Figs. 8 and 9). Recreational limitations which include various hazards for campsites, paths, trails, picnic areas, and ponds on these soils range from slight to severe. The most significant limiting

Figure 8

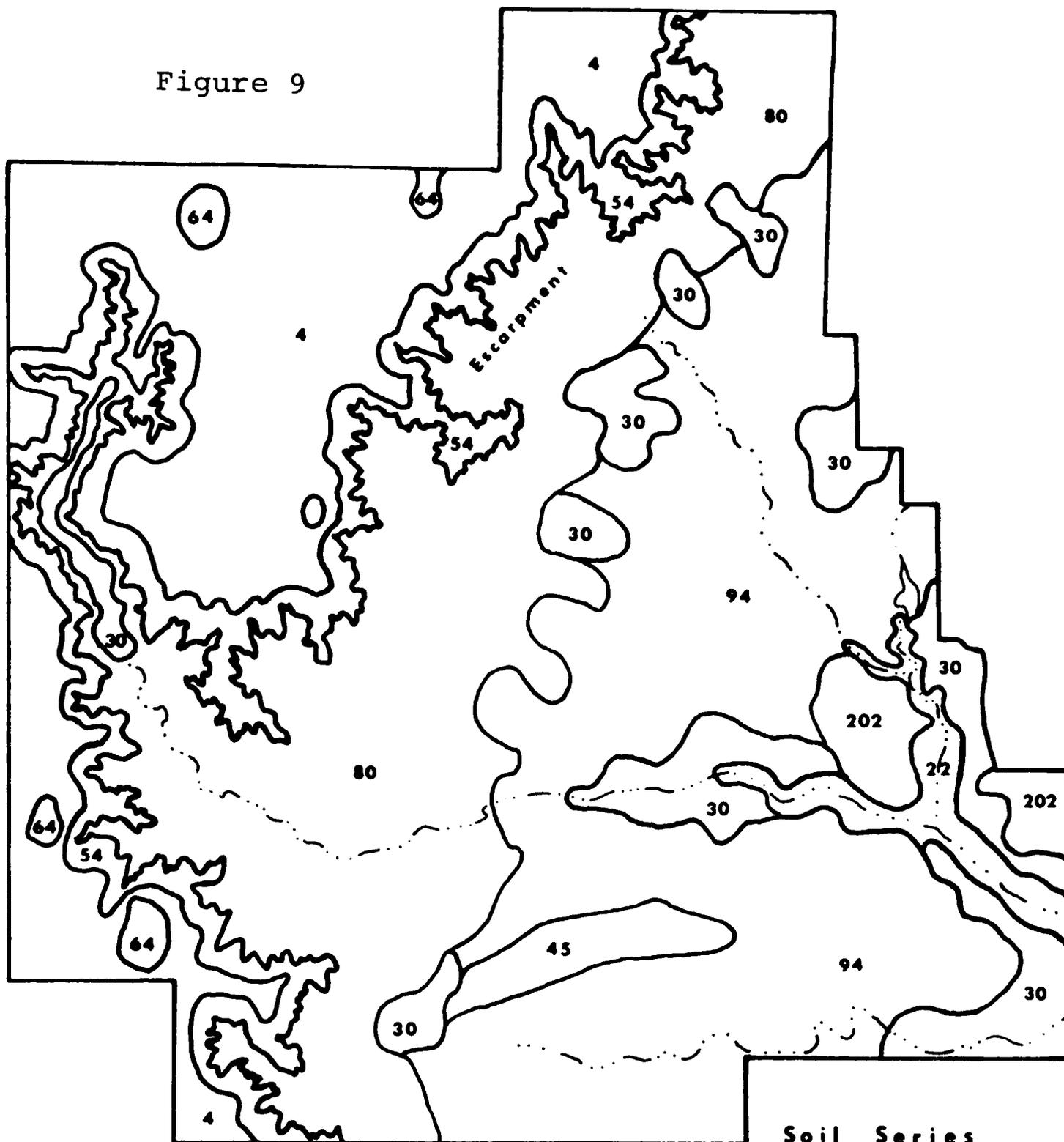


Scale - 1" = 6000 Ft.

Contour Interval : 100 Ft.

TOPOGRAPHIC MAP

Figure 9



Scale - 1" = 6000 Ft.



Soil Series

- 4 - Pullman
- 64 - Randall
- 54 - Tulia-Estacado
- 30 - Berda
- 94 - Quinlan
- 80 - Rough Broken
- 45 - Springer-Miles
- 22 - Yahola
- 202 - Bukreek

GENERALIZED SOIL MAP

Soil Survey Interpretations

4 Pullman c.l. , 0-1% slopes

Well drained, very slowly permeable upland soils. Dark clay loam surface over a clayey subsurface. Calcium carbonate at 30 to 60 inch depths.

64 Randall c.

Deep clayey soils of the playa lakes. Poorly drained and deeply cracked when dry.

54 Tulia-Estacado complex

Well drained, moderately permeable soils that are calcareous throughout. Brownish loam grading down into thick zone of calcium carbonate. Moderately severe water erosion hazards.

30 Berda l. , 1-8% slopes

Calcareous, well drained, moderately permeable upland soils. Grayish brown loam surface layer with pale brown loam subsoil. Moderate to severe erosion hazards.

202 Bukreek l. , 1-3% slopes

Well drained, moderately permeable upland soils. Dark loam surface over a reddish brown clay loam subsoil. Calcium carbonate accumulation at 48 to 66 inch depth.

94 Quinlan complex

Shallow reddish loam soil exhibiting a mildly or moderately alkaline reaction. Severe water erosion hazards.

80 Rough broken land

Extremely broken, very shallow to deep, rolling to extremely steep soils. Severe water erosion hazards.

45 Springer-Miles l.f.s.

Deep, sandy soils with moderately rapid permeability. Severe wind erosion hazard.

22 Yahota f.s.l.

Deep, well drained, fine sandy loam floodplain soils. Moderately rapid to rapid permeability with moderately alkaline reaction. Calcareous throughout.

Abbreviations:

c.l.--clay loam
c.--clay
l.--loam
f.s.l.--fine sandy loam
l.f.s.--loamy fine sand

factors are slope and texture. Also locally important are permeability, flooding, wetness, and depth of bed rock. Almost all of the soils exhibit some type of erosion hazard, with those in the canyon proper and closest to the caprock escarpment presenting the most extreme problem.¹⁴²

Carrying Capacity

Recreational carrying capacity may be defined as the character of use that can be supported over a specified time by an area developed at a certain level without causing excessive damage to either the physical environment or the experience for the visitor.¹⁴³ Thus, soil characteristics are very important in the determination of carrying capacity of land. There is no question that soil, as well as topographic and ecological, factors severely limit the recreational capacity of the Las Lenguas area. However, another facet of recreational carrying capacity is the quality of the mental response experienced by the person who is participating in an activity.

¹⁴²U.S., Department of Agriculture, Soil Conservation Service, Silverton, Texas (unpublished Briscoe County soil survey materials, December, 1971).

¹⁴³David W. Lime and George H. Stankey, "Carrying Capacity: Maintaining Outdoor Recreation Quality," in Recreation Symposium Proceedings, ed. by E. Larson, U.S.D.A., Forest Service (Upper Darby, Wisconsin, 1971), p. 175.

Henry Hubbard and Theodora Kimball pursued the same point when they spoke of the landscape effect of the prairie. They state that the vegetation of the prairie will be preserved at least in small patches. But inevitably man will break the openness of the prairie landscape, and its essential character, its boundless extent, will no longer exist. These authors pose the question as to whether the owners will ever go so far as to sacrifice large tracts of prairie land merely for the preservation of the landscape effect. They conclude, "One thing is certain, at any rate, not by preserving its flora alone, but only by preserving its expanse can the spirit of the prairie be preserved."¹⁴⁴ The spirit and expanse of the prairie are in the mind of the beholder as well as in the structure of the landscape. Thus, the human mind and the natural landscape are united to sense a single spirit, or effect.

At one time Americans were almost totally production oriented. After the production boom created by World War II the American public began to seek new outlets and objectives. A drive for more and better parks resulted. The trend has continued, and today a significant portion of the public is

¹⁴⁴H.V. Hubbard and Theodora Kimball, An Introduction to the Study of Landscape Design (Boston: Cuneo Press of New England, 1959), p. 65.

seeking a wilderness experience in their recreation.¹⁴⁵

Today in Texas, more total days are spent in hiking, horse-back riding, and bicycling than in all types of hunting combined. For these and other reasons, the Texas Parks and Wildlife Department is examining the possibility of limiting the use of areas which it administers to the physical carrying capacity of the land and the psychological carrying capacity of the visitors.¹⁴⁶

The Las Lenguas area exhibits a dominant and forceful wilderness effect. Las Lenguas and its environs should be developed as a State Wilderness Park if, and only if, very stringent ecologically based guidelines for development and operation are formulated, implemented, and rigidly enforced. Some skepticism has been voiced concerning the ability of the Las Lenguas area to retain its integrity and wilderness character under average State Park usage. Several authorities, such as Dr. Robert L. Packard, professor of biology and director of research at the West Texas Museum, Texas Tech University; Dr. B.L. Allen, professor of agronomy at Texas Tech University; and Dr. Eric G. Bolen, associate professor of range and wildlife management at Texas Tech University, have stated that the Las Lenguas

¹⁴⁵ Ron Jones, speech presented to the Sierra Club, Lubbock, Texas, January, 1972.

¹⁴⁶ Ron Jones, speech, January, 1972.

Canyon area would lose its scientific and wilderness attributes if it were developed as a conventional State Park.¹⁴⁷

The Las Lenguas area should be developed with the goal of preserving and enhancing its scientific and wilderness attributes. All other uses should be secondary and entertained only when they do not detract from the primary management objective. The park, assuming that this goal is accepted and a wilderness status is conferred, should serve the growing segment of the public which is seeking a wilderness experience.

For this reason, the area should be left in as nearly natural condition as possible. Entrance should be restricted to the southeastern corner of the area in the Rolling Plains zone. This locality exhibits the greatest carrying capacity to be found in the area. All necessary control and operational facilities should be developed in this same general locality. Trails and wilderness camp sites should be the only developments within the interior of the park.

It definitely would be in the public's best interest to preserve the wilderness character of the Las Lenguas Canyon area. But it must be emphasized that preservation of the separate characteristics of the area would be much less

¹⁴⁷ Dr. Robert L. Packard, Dr. B.L. Allen, and Dr. Eric G. Bolen, separate private interviews at Texas Tech University, 1971.

than preservation of its wilderness spirit. Development of the area in such a manner as to preserve its wilderness effect must be the primary goal of the future planning of Las Linguas Canyon and its environs.

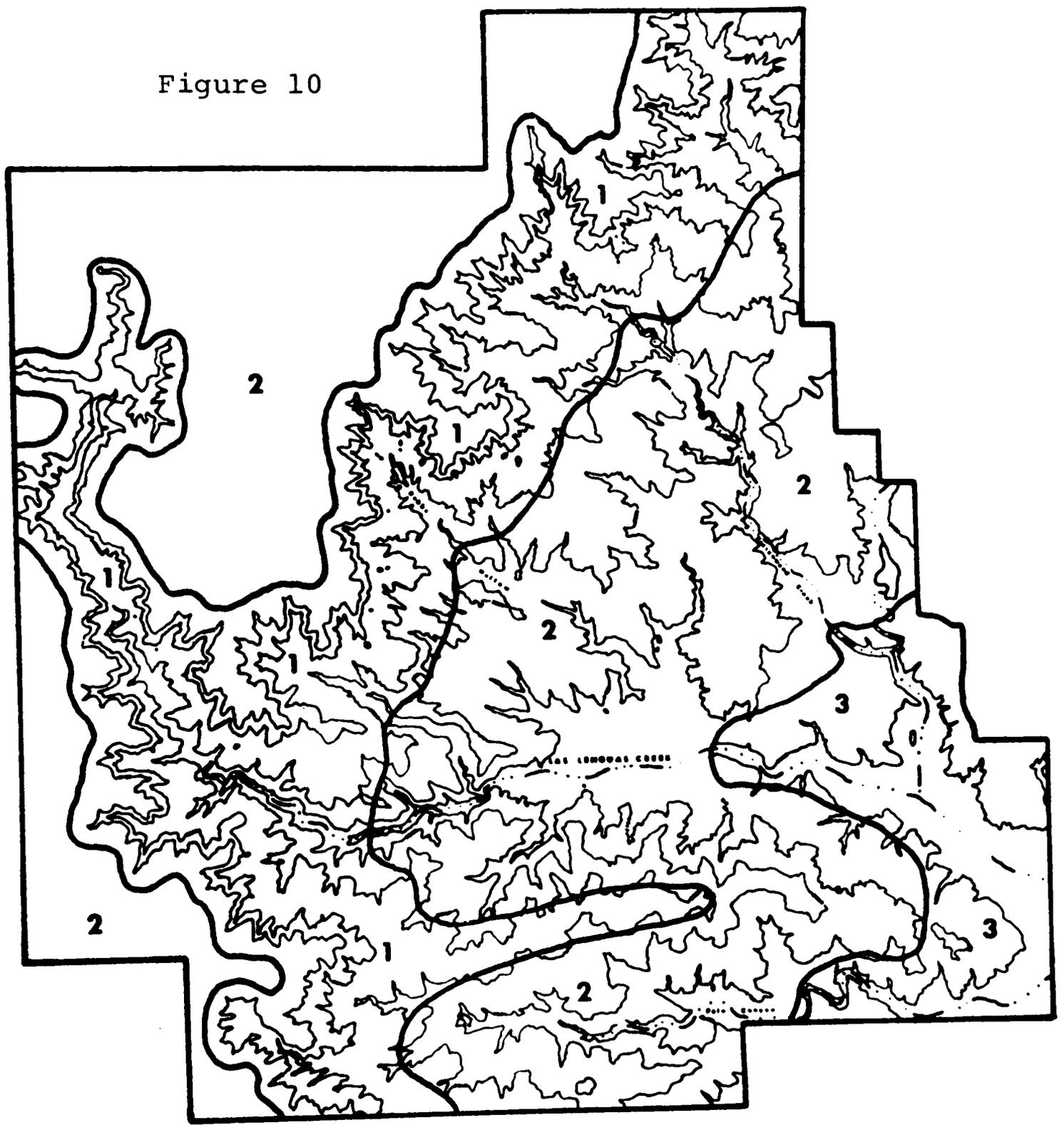
CHAPTER IX

RECOMMENDATIONS AND CONCEPTUAL PLAN

Recommendations

- I. The Las Lenguas Canyon area should be acquired and developed by the Texas Parks and Wildlife Department as a Texas State Park. Developmental guidelines should include the following:
 - A. The goal of planning in the Las Lenguas area should be to preserve and enhance the area's wilderness and scientific attributes.
 - B. Las Lenguas should be developed as a wilderness park, with major emphasis being placed upon preserving the wilderness spirit and effect of the area.
 - C. Acquisition of 22,400 acres of land would be necessary for preservation of the area's wilderness attributes and maintenance of its environmental integrity.
 - D. Use of the Las Lenguas area should be limited to that which the carrying capacity of the land will support and to the psychological carrying capacity of the visitors (see Fig. 10).

Figure 10



KEY

- 1- Severely Limited
- 2- Moderately Limited
- 3- Slightly Limited

100 Foot Contours
Scale - 1" = 6000 Ft.

RECREATIONAL CARRYING CAPACITY

- E. Management policies should include utilization of permits or reservations as the situation dictates.
- F. The Las Lenguas area should be divided into a wilderness zone and an intensive use zone.

- 1. Wilderness zone

Within the wilderness zone the following developments, uses, and activities should be prohibited:

- a. Removal, cutting, or other alteration of vegetation except as necessary for appropriate public access.
- b. Development of permanent facilities or any type of roads.
- c. Use of any motorized vehicle except in the case of emergencies.
- d. Granting of leases or easements of any type.

Within the wilderness zone the following management policies should be implemented:

- a. Travel should be limited to hiking or horseback riding.
- b. Development should be restricted to trails and wilderness camp sites. Camping should be limited to designated camp sites.

II. The Las Lenguas area should be designed so as to complement existing recreational attractions in the Texas Panhandle. Palo Duro Canyon, the Mackenzie Reservoir-Tule Canyon complex, and the Las Lenguas area should be developed as a regional recreation-tourism unit. Palo Duro Canyon currently provides a scenic and recreational attraction, while the Mackenzie Reservoir-Tule Canyon complex could supply water-based recreation, and the Las Lenguas area could provide a unique wilderness experience.

The Texas Parks and Wildlife Department should investigate the possibility of instituting a Caprock Trail which would connect the three components of this Panhandle recreational unit. Such a trail would serve to solidify the unit and offer additional recreation opportunities.

III. Alternative methods for preservation of the Las Lenguas area in descending order of preference are purchase of the entire area by one of the nation's conservation organizations and incorporation of the area into a university system as a scientific research station. The paramount priority should be preservation and enhancement of the wilderness spirit and scientific attributes of Las Lenguas Canyon and its environs.

IV. The Texas Parks and Wildlife Department should incorporate a State Wilderness Park category into the present State Park classification scheme. The Las Lenguas area should be included within this category. Recommendations presented in Section I above should function as guidelines for an official policy statement concerning development and management of Texas State Wilderness Parks.

The Conceptual Plan

The Las Lenguas Canyon area should be developed in strict accordance with the guidelines previously presented. Acquisition of 22,400 acres and limitation of the number of visitors within the area would insure preservation of its wilderness attributes.

The Stroup ranch house is strategically located upon one of the most scenic viewpoints within the area. For this reason, it is appropriate that the ranch house should be redesigned to function as an interpretive center. Building a new residence and remodeling the Stroup ranch house would be more costly than constructing a new interpretive center, but the value of the strategic viewpoint would be lost.

Imaginative interpretation could enhance significantly the visitor experience at Las Lenguas. Virtually all of the interpretation should be restricted to the

immediate vicinity of the interpretive center in order to preserve the wilderness character of the area. Displays within the center and a short interpretive trail system could function effectively to bring the visitor to an understanding of the park.

Most of the geologic outcroppings are located within Las Lenguas Canyon and along the escarpment. These formations are too far from the visitor center to allow their inclusion in an interpretive trail. They would have to be interpreted by display in and around the center. A scale model of the park could be effective in presenting the geologic formations of the area. A sequence of models could depict the park as it is thought to have existed during successive geologic periods. The changes of flora and fauna should be emphasized.

The wilderness character of the area would do much to aid in its historical interpretation. When the visitor learns the archeological and historical background of the park, the wilderness effect of the landscape brings him into a union with the area's historical heritage. Effective interpretation is related closely to the production of a mood or atmosphere. At Las Lenguas the atmosphere of the wild, nomadic Indian and Comanchero existence is present in abundance.

The bioecology of the Las Lenguas area could be interpreted in several ways. The crossroads nature of the biotic community could be depicted in model and display form. Nature trails would show living examples of the phenomena presented in the displays. Pictorial presentation of the flora and fauna of the area would also be effective. If tastefully developed, a small zoo containing native animals could be a great visitor attraction. All of the interpretive devices should lead the visitor to desire a more intimate understanding of the park. This he could acquire by actually entering and experiencing the natural qualities of the Las Lenguas area.

A stable complex is important to the design of the Las Lenguas locality as a wilderness area. This facility should provide the necessary horses and equipment to accommodate all interested visitors. If possible, the stables should be built by the State of Texas and leased to a concessionaire for a specified percentage of his net income from the enterprise. This procedure would insure the quality of the stable complex and also protect the concessionaire from major losses during the initial relatively slow years.

A trail system is proposed to accommodate horseback riders and hikers. The trails interlock and incorporate wilderness camp sites and scenic attractions into the

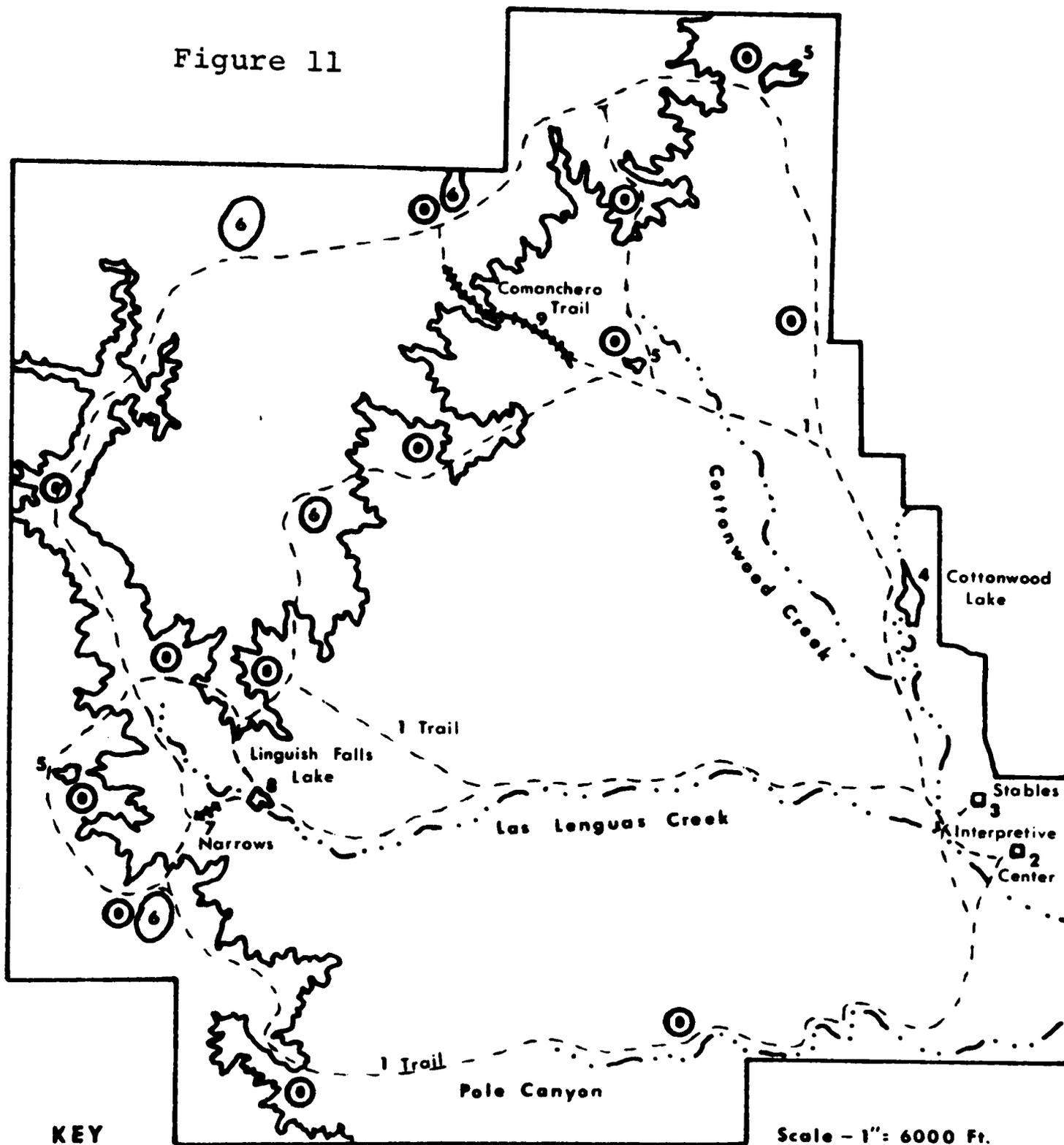
system. Camp sites were selected on the basis of factors such as proximity of water, protection from weather, topography, and wilderness atmosphere. It probably would be necessary to periodically rotate the selected camp sites in order to prevent degradation.

The maintenance building for the area need not be extravagant. Limited upkeep would be necessary in this type of park. The building should be located near the stables because of the necessity of storage and transport of wood to the wilderness camp sites. It would be essential for overnight visitors to camp at the designated wilderness camp sites. Cutting of firewood should be prohibited.

Another important group of people who could be expected to visit the Las Lenguas area in fairly large numbers would be the camper-trailer travelers. It is proposed that spaces be developed for parking campers and trailers around Cottonwood Lake. Some of the necessary utilities are present at the site, and two trailers now are located at the lake. A small charge for the use of these facilities is recommended.

For clarification of the preceding developmental proposals consult Figures 11 and 12.

Figure 11



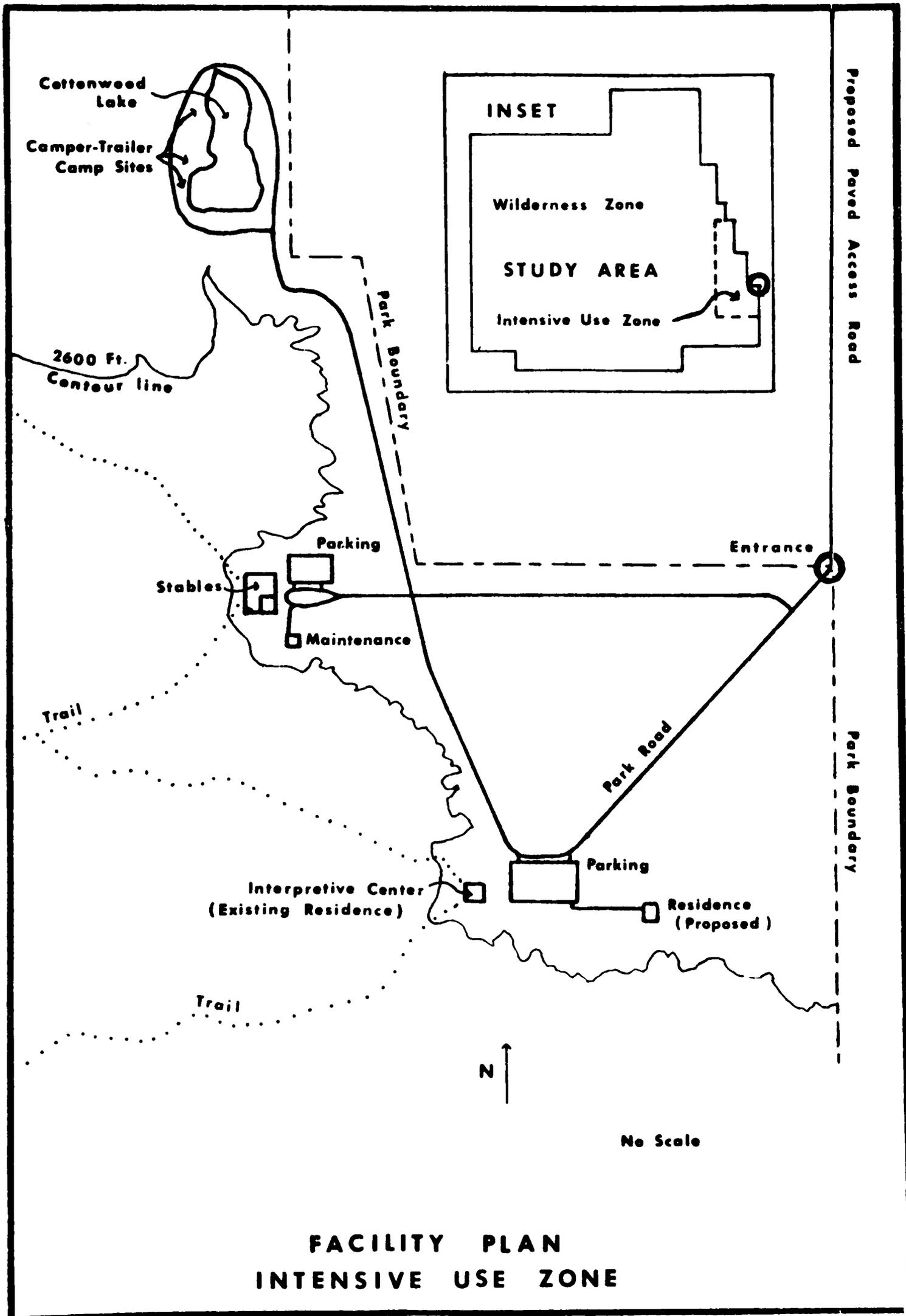
KEY

- 1 - Trails
- 2 - Interpretive Center
- 3 - Stables
- 4 - Cottonwood Lake
- 5 - Check-Dam Lakes

- 6 - Playa Lakes
- 7 - Narrows
- 8 - Linguish Falls Lake
- 9 - Comanchero Trail
- ⊙ Wilderness Camp Sites



CONCEPTUAL PLAN



**FACILITY PLAN
INTENSIVE USE ZONE**

BIBLIOGRAPHY

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Public Documents

- Cronin, J.G. A Summary of the Occurrence and Development of Ground Water in the Southern High Plains of Texas. Texas Board of Water Engineers--Bulletin 6107. Austin, Texas: Texas Board of Water Engineers, 1961.
- Lime, David W., and Stankey, George H. "Carrying Capacity: Maintaining Outdoor Recreation Quality." Recreation Symposium Proceedings. Edited by E. Larson, U.S.D.A., Forest Service. Upper Darby, Wisconsin, 1971.
- Malone, James M. Archeological Reconnaissance in the Mackenzie Reservoir Area of Tule Canyon. Austin, Texas: Texas Historical Survey and Texas Water Development Board, 1970.
- Office of the Governor. Goals for Texas--Phase Two. Austin, Texas: State of Texas, 1970.
- Texas Parks and Wildlife Department. Report of the Department, Annual Report 68-69. Austin, Texas: State of Texas, 1969.
- Texas Parks and Wildlife Department. State of Texas Comprehensive Outdoor Recreation Plan (SCORP). Austin, Texas: State of Texas, 1965.
- Texas State Parks Board. "Texas State Park Criteria." Park Practice Guideline. A publication of the National Conference on State Parks, National Recreation and Park Association, and the National Park Service. Washington, D.C.: Government Printing Office, 1961, pp. 107-108.
- U.S. Department of Commerce. Bureau of Census. 1970 Census of Population--Texas. Washington, D.C.: Government Printing Office, January, 1971.

U.S. Department of the Interior. National Park Service.
NPS Criteria for Parklands. Washington, D.C.:
 Government Printing Office, 1966.

_____. Parks for America. Washington, D.C.: Government
 Printing Office, 1964.

Books

Allred, B.W. "Mixed Prairie in Texas." Grasslands of the
 Great Plains. By J.E. Weever and F.W. Albertson.
 Lincoln, Nebraska: Johnsen Publishing Company,
 1956.

Bray, William L. Distribution and Adaptation of the Vegeta-
 tion of Texas. Bulletin of The University of
 Texas--No. 82, Scientific Series No. 10. Austin,
 Texas: The University of Texas, 1906.

Burton, Harley T. A History of the JA Ranch. New York:
 Argonaut Press, 1966.

Catlin, George. North American Indians. Philadelphia:
 Hubbard Brothers, 1891.

Chaney, Ralph W., and Elias, Maxim K. "Late Tertiary
 Floras from the High Plains." Contributions to
 Paleontology-Miocene and Pliocene Floras of Western
 North America. Washington, D.C.: Carnegie Insti-
 tution of Washington, 1938.

DeShields, James T. Cynthia Ann Parker. St. Louis: By
 the Author, 1886.

Dice, Lee R. The Biotic Provinces of North America. Ann
 Arbor, Michigan: University of Michigan Press,
 1953.

Evans, Glen L. "Cenozoic Geology." Guidebook, 1956 Spring
 Field Trip. Edited by Glen L. Evans and John P.
 Brand. Lubbock, Texas: West Texas Geological
 Society and Lubbock Geological Society, 1956.

- Frye, John C., and Leonard, A. Byron. Correlation of the Ogallala Formation (Neogene) in Western Texas with Type Localities in Nebraska. Report of Investigations--Number 39, Bureau of Economic Geology, The University of Texas. Austin, Texas: The University of Texas, 1959.
- . Studies of Cenozoic along Eastern Margin of Texas High Plains, Armstrong to Howard Counties. Report of Investigations--Number 32, Bureau of Economic Geology, The University of Texas. Austin, Texas: The University of Texas, 1957.
- Gould, F. Texas Plants--A Checklist and Ecological Summary. College Station, Texas: The A & M College of Texas, 1969.
- Gregg, Josiah. Commerce of the Prairies. Edited by Max L. Moorhead. Norman, Oklahoma: University of Oklahoma Press, 1954.
- Haley, J. Evetts. Charles Goodnight: Cowman and Plainsman. Norman, Oklahoma: University of Oklahoma Press, 1949.
- . The XIT Ranch of Texas. Norman, Oklahoma: University of Oklahoma Press, 1953.
- Hesse, Richard. Ecological Animal Geography. Prepared by W.C. Allee and Karl P. Schmidt. New York: John Wiley and Sons, Inc., 1937.
- Hubbard, H.V., and Kimball, Theodora. An Introduction to the Study of Landscape Design. Boston: Cuneo Press of New England, 1959.
- Jackson, Clyde L., and Jackson, Grace. Quanah Parker: Last Chief of the Comanches. New York: Exposition Press, 1963.
- Jones, T.S. "Permian System." Guidebook, 1956 Spring Field Trip. Edited by Glen L. Evans and John P. Brand. Lubbock, Texas: West Texas Geological Society and Lubbock Geological Society, 1956.
- Krieger, Alex D. Culture Complexes and Chronology in Northern Texas. The University of Texas Publication No. 4640. Austin, Texas: The University of Texas, October 22, 1946.

- Kuckler, A.W. Potential Natural Vegetation of the Conterminous United States. New York: American Geographical Society, 1964.
- McCarty, John L. Maverick Town--The Story of Old Tascosa. Norman, Oklahoma: University of Oklahoma Press, 1968.
- Matthews, William H., III. Guidebook Eight: The Geologic Story of Palo Duro Canyon. Austin, Texas: The Bureau of Economic Geology, The University of Texas at Austin, 1969.
- Moncus, H.H. Prairie Schooner Pirates. Fort Worth, Texas: Western Heritage Press, 1963.
- Richardson, Rupert N. The Comanche Barrier to South Plains Settlement. Glendale, California: The Arthur H. Clark Company, 1933.
- Sellards, E.H. Early Man in America. Austin, Texas: The University of Texas Press, 1952.
- Shelford, Victor E. The Ecology of North America. Urbana, Illinois: University of Illinois Press, 1964.
- Texas State Parks, E.J. Urbanovsky, project director. Lubbock, Texas: Texas Technological College Press, 1963.
- Tharp, Benjamin C. Texas Range Grasses. Austin, Texas: University of Texas Press, 1952.
- _____. The Vegetation of Texas. Houston, Texas: The Anson Jones Press, 1939.
- Thompson, Holland. The Book of Texas. Dallas, Texas: The Colonial Press, 1929.
- Wallace, Ernest. Ronald S. Mackenzie on the Texas Frontier. Lubbock, Texas: West Texas Museum Association, 1964.
- _____, and Hoebel, E. Adamson. The Comanches--Lords of the South Plains. Norman, Oklahoma: University of Oklahoma Press, 1958.
- Wedel, Waldo R. Prehistoric Man on the Great Plains. Norman, Oklahoma: University of Oklahoma Press, 1961.

Wendorf, Fred. Paleoecology of the Llano Estacado. Santa Fe, New Mexico: The Museum of New Mexico Press, 1961.

West Texas State University Geological Society. Guidebook: Palo Duro Field Trip. Canyon, Texas: West Texas State University Geological Society.

Periodicals

Blair, W. Frank. "The Biotic Provinces of Texas." Texas Journal of Science, II, No. 1 (March 31, 1950), 93-117.

_____. "Mammals of the Mesquite Plains Biotic District in Texas and Oklahoma, and Speciation in the Central Grasslands." Texas Journal of Science, VI, No. 3 (September, 1954), 235-264.

Bray, W.L. "Ecological Relationship of the Vegetation of West Texas." Botanical Gazette, XXXII (1901), 195-217, 262-291.

Carpenter, J. Richard. "The Grassland Biome." Ecological Monographs, X, No. 4 (October, 1940), 619-671.

Evans, Phil. "Pursue the Aoudads." Texas Parks and Wildlife, February, 1967, pp. 20-23.

Fouquette, M.J., and Lindsay, H.L., Jr. "An Ecological Survey of Reptiles in Part of Northwestern Texas." Texas Journal of Science, VII, No. 4 (December, 1955), 402-421.

Frye, John C., and Leonard, A. Byron. "Ecological Interpretations of Pliocene and Pleistocene Stratigraphy in the Great Plains Region." American Journal of Science, Vol. 255 (January, 1957), 1-9.

Garner, Herschel W. "An Ecological Study of the Brush Mouse, Peromyscus boylii, in West Texas." Texas Journal of Science, XIX (1967), 285-291.

Haley, J. Evetts. "The Comanchero Trade." The Southwestern Historical Quarterly, XXXVIII (January, 1935), 158-176.

- Harrison, Lowell H., ed. "Three Comancheros and a Trader." Panhandle-Plains Historical Review, XXXVIII (1965), 73-93.
- Hughes, Jack T. "Little Sunday: An Archaic Site in the Texas Panhandle." Bulletin of the Texas Archeological Society, 1955, pp. 63-70.
- Oldfield, Frank, and Schoenwetter, James. "Late Quarternary Environments and Early Man on the Southern High Plains." Antiquity, 1964, pp. 226-229.
- Palmer, Ernest J. "The Ligneous Flora of the Staked Plains of Texas." Journal of the Arnold Arboretum, II (1920), 90-105.
- Sellards, E.H.; Evans, Glen L.; and Meade, Grayson E. "Fossil Bison and Associated Artifacts from Plainview, Texas." Bulletin of the Geological Society of America, October, 1947, pp. 927-954.
- Tunnell, Curtis D., and Hughes, Jack T. "An Archaic Bison Kill in the Texas Panhandle." Panhandle-Plains Historical Review, 1955, pp. 63-70.

Newspapers

- Brown, Luron. "Historic Valley of Tears Jogs Memory of Rancher." Lubbock Avalanche-Journal. Saturday Morning, July 24, 1971, sec. B, pp. 1, 10.
- Daily New Mexican. July 20, 1868; July 18, 1870; May 24, 1871.
- Kahlbau, Edna. "The Comanchero: Barter on the High Plains III." Amarillo Sunday News and Globe. November 2, 1941, p. 2.
- Peattie, Donald Culross. "The Ballad of Cynthia Ann." Denver Post. November 26, 1961, pp. 16-17.

Unpublished Material and Other Sources

- Allen, Dr. B.L. Professor of Agronomy at Texas Tech University. Private interview at Texas Tech University, 1971.

- Bolen, Dr. Eric G. Associate Professor of Range and Wildlife Management at Texas Tech University. Private interview at Texas Tech University, 1971.
- Green, Francis E. "The Triassic Deposits of Northwestern Texas." Unpublished Ph.D. dissertation, Texas Technological College, 1954.
- Hunsaker, Don, III. "The Distribution, Annotated Checklist and Keys for the Reptiles of Northwest Texas." Unpublished M.S. thesis, Texas Technological College, 1957.
- Israel, T.C. "The History of Oldham County, Texas." Unpublished M.S. thesis, The University of New Mexico, 1934.
- Jones, Ron. Speech presented to the Sierra Club, Lubbock, Texas, January, 1972.
- Kiatta, Howard W. "A Provenance Study of the Triassic Deposits of Northwestern Texas." Unpublished M.S. thesis, Texas Technological College, 1960.
- Packard, Dr. Robert L. Professor of Biology at Texas Tech University and Director of Research at the West Texas Museum. Private interview at Texas Tech University, 1971.
- Reeves, C.C. "Some Geomorphological, Structural, and Stratigraphic Aspects of the Pliocene and Pleistocene Sediments of the Southern High Plains." Unpublished Ph.D. dissertation, Texas Tech University, 1970.
- Rowell, Chester M., Jr. "Vascular Plants of the Texas Panhandle and South Plains." Unpublished Ph.D. dissertation, Oklahoma State University, 1967.
- Stroup, Jim. Lifelong Quitaque rancher whose birth was the second recorded in Briscoe County. Private interview at his home within the Las Lenguas study area, August, 1971.
- Texas Parks and Wildlife Department. "State Park Visitation." Unpublished departmental manuscript.
- U.S. Department of Agriculture. Soil Conservation Service, Silverton, Texas. Unpublished Briscoe County soil survey materials, December, 1971.