ABSTRACT
About 19,000 playa basins are etched in the Southern High Plains of Texas. The playas collect water from small watersheds surrounding the circular depressions. Cultural associations of playas undoubtedly included some of the earliest inhabitants of North America. Plains Indians later hunted wildlife attracted to water-filled playas. First mention of the playas appears in the chronicles of Coronado's trek across the Llano Estacado in 1541. In 1842, an expedition of Texans hunted wildlife near a playa during a march toward the Mexican stronghold at Santa Fe. Troopers found shelter inside a shallow playa embankment during the Red River Indian War of 1874-75. Playas also offered hazards, particularly as maps drawn when the lakes were brimming might later guide trekkers to waterless traps in drier times, as experienced by Army troops in 1877. Playas may symbolize, in part, the ecological forces that once molded a new culture for settlers venturing westward from the humid east, perhaps akin to the settings so powerfully constructed by Walter Prescott Webb in The Great Plains. Playa wetlands remain as significant to modern land management on the Llano Estacado as when wagon ruts first cut the prairie sod.

INTRODUCTION
Etched on the vast panorama of the Southern High Plains of Texas are some 19,000 shallow basins known as playas. In wet years, the playas catch and hold runoff, thus forming a patchwork of small lakes dotting the landscape and virtually all of the surface water available in a large semi-arid region popularly known as the Llano Estacado (= Staked Plains).

1Another 6,000 playas occur in Oklahoma, New Mexico, Colorado, and Kansas. The most recent and best census of playas--county by county for Texas and the other states--was published in abbreviated form in Guthery and Bryant (1982). Playas in various forms occur elsewhere in North America (e.g., Arizona) as well as in Africa and Australia. But nowhere are these landforms so numerous or dense as in the Texas Panhandle. Playa, in Spanish, means "beach," a somewhat curious designation for small, freshwater ponds.

2In Spanish, "llano" is singular but, when translated, often lapses into the plural, plains. The original meaning of Llano Estacado remains obscure. Ideas include: (a) horses were staked on the plains because no trees were available to tether the animals; see following text, (b) the dried flower stalks of soapweed (Yucca spp.) emerging from the closely cropped grasslands appeared as stakes, (c) from a distance, the western edge of the High Plains escarpment appears stockaded, that is, as if fortified by a series of vertical stakes so as to resemble a palisade and (d) a corruption of destaco, roughly meaning detached, so that "llano destaco" perhaps was a description for the elevated and isolated nature of the region. See Carroll (1941) for further details.

Playas—wet or dry—have long been part of the rigorous life on the prairie landscape, therein offering a fold of blending the threads of history and ecology. As early as 1876, Lieutenant E. H. Ruffner, leader of an expedition exploring the headwater canyons of the Red River, speculated that the breakdown of playa basins along the eastern edge of the plain contributed to arroyo and canyon formation, and thus to the steady erosion of the Llano Estacado (Baker 1985). More recently, at least one cultural anthropologist argued that the ephemeral nature of water (including, by implication, catchment in playas) on the Llano was a critical ecological factor that limited Indian populations in historic times (Levy 1961). Thus, scholars have long recognized playa lakes as important elements in the environmental setting of the Llano Estacado.

HYDROLOGICAL FEATURES
Most playas originated as wind-deflated depressions. Some of the more romantic tales mention that herds of dusting bison (Bison bison) formed "buffalo wallers" but such notions are dispelled by less fanciful geological evidence (Reeves 1966; see also Judson 1950). Randall clays lining the basin floors remain the most important structural feature of the playa environment. These soils are nearly impermeable, thereby assuring retention of runoff collecting in the closed watersheds surrounding each basin. Lacking seepage into the underlying strata, water collecting in playas nonetheless evaporates rapidly from the shallow basins. Geological forces at work during the late Tertiary were a prelude to later history. The vast Ogallala Aquifer formed from a myriad of streams then crossing the region; much of the water seeped into a thick layer of calcareous sediments. During the Quaternary, this formation was covered by a rich mantle of fine aeolian sediments. More importantly, waters flowing in the many surface streams crossing the southern third of the plains were intercepted and diverted by the channels of the Pecos and Canadian rivers. These events thereby created an isolated and almost streamless tableland—the Llano—on which the playas formed. Moreover, that part of the Ogallala Aquifer underlying the Llano no longer received any recharge and the groundwater, when tapped for human uses later in history, would be consumed without replenishment. Indeed, in the 20th century, demands for water increased as the prairie steadily vanished beneath the plow, affecting not only a heavily mined aquifer but also ecological fortunes of the playas (Bolen and Guthery 1982).

3The aquifer is named, albeit corrupted somewhat in translation, for the Ogala Sioux of western Nebraska where the huge aquifer—the largest in the world—reaches its northernmost extension. As related in the text, however, the southern third of the aquifer receives virtually no recharge, and there its waters are mined instead of cycled.
PALEOHISTORY

The setting at the dawn of human immigration and use of the Llano can be reconstructed only in a cursory fashion. We do know, however, that a diverse mammalian megafauna once thrived on the North American plains, including a huge bison (Bison antiquus), elephant (Mammuthus columbi), giant armadillo (Chlamytherium septentrionale), camel (Camelops hesternus), and short-faced bear (Arctodus simus) (Johnson 1983). These and other species of the early fauna are now extinct, perhaps because Paleoindian hunters had overexploited the larger species by the close of the Pleistocene (see Martin and Klein 1984). One outcome stemming from the extinction of the Pleistocene megafauna was an expansion of the niche available for the modern species of bison and, as the herds expanded, procurement of bison became the major economic system for native peoples (Johnson 1983). Other species, such as the muskrat (Ondatra zibethicus), were extirpated from the Llano, presumably when wetland habitat dried. Stratigraphic data suggest that at least two episodes of prolonged drought occurred on the Llano between 6500 and 4500 B.P.; an essentially modern climate has prevailed since then although there have been shifts toward aridity within the last 100 years (Holliday 1985). Muskrats have not recolonized the playas wetlands during the Holocene, no doubt because of the unavailability of water in the modern environment and perhaps because the region lacks a network of corridors suitable for the immigration of aquatic species. In any case, the modern playas fauna lacks aquatic mammals and the region never gained importance as a source of furs despite searches for beaver (Castor canadensis) (e.g., Pike 1968). Conversely, other regions on the plains—notably those crossed by permanent corridors of aquatic habitat—supported large populations of furbearers and the commerce they produced yielded an equally rich history.

The Paleoindian period on the Llano included cultures known as Clovis (11,500–11,000 yrs. B.P.), Folsom (10,900–10,000 yrs. B.P.), Plainsview (10,000–9,500 yrs. B.P.), and Firstview (10,000–8,000 yrs. B.P.). Each culture maintained associations with one or more types of wetlands, including playas. For example, an ancient playa in Roberts County, Texas, contained Folsom or Folsom-like spears and a顺序化association with a bed of elephant bones (Sellards 1938). Johnson (1983) noted that aquatic species-musksharks and surface-feeding ducks (Anas spp.)—supplemented the dietary staple of bison in the Folsom culture. Drew (1979) accordingly suggested that playas were ideally suited as sites where Paleoindian materials might be uncovered, including those of pre-Clovis or "Early Man" circa 12,000 or more B.P. (but see Holliday 1980-81). However, the surface hydrology of the late Holocene and Early Holocene also included flowing streams, and most of the Paleoindian sites known today are associated with the beds of those ancient streams rather than playa lakes (e.g., Sellards et al. 1947). Of especial note is a site in Yellow House Draw with an unusually complete sequence of Paleoindian culture, including a locale where now-extinct bison were killed and/or butchered (Johnson and Holliday 1980). At the time these activities took place, however, the site was a marshy pond rather than a playa, and it was no different in the same geological origin as true playas. By the end of the Firstview culture, the fossil beds reflected the modern fauna assemblage, thereby suggesting the onset of modern climatic conditions (Johnson and Holliday 1981).

ENVIRONMENT CIRCA 1500

Much of the North American interior developed into a grassland that ecologists later would call the shortgrass prairie. The principal species were blue grama (Bouteloua gracilis) and buffalograss (Buchloe dactyloides) together with a colorful variety of forbs (Shefford 1963). The shortgrass formed thick sod that later became the building blocks for the dugout homes of early settlers. As with grasslands elsewhere, fire was a dominant environmental force shaping the shortgrass prairie; lightning started fires in similar grasslands with an average frequency of 6.0 to 24.7 fires per 3862 sq. mi. (10,000 sq. km) per year (Higgins 1984). Herds of modern-day bison (Bison bison) and other grazing animals maintained a closely cropped aspect on a plain where taller grasses otherwise might have brushed the horizon ( Larson 1940). And that aspect was indeed awesome, especially for travelers accustomed to the cloistered forests east of the 100th meridian. Consider the narrative of George Wilkins Kendall, editor of the New Orleans Times Picayune, when his party ascended onto "... the Tone and dreary prairie. Not a tree or bush, and hardly a weed could be seen in any direction. A green carpeting of short grass, which... was studded with innumerable strange flowers and plants, was spread over the vast expanse, which stretched to the horizon where nowhere else does one feel that sickly sensation of squalor, [when] nothing but a boundless prairie is around him" (Kendall 1847). Pike (1869) noted that the Llano Estacado "... lay before us like a boundless ocean" which even Indians regarded "... with a sort of terror, which showed that it was by them regarded as a place from which we could not escape alive."

The ceremonies of the Comanche included homage to Tabana Yuane—the sunrise wind. The rite featured a dance early on a March morning before a fire; the direction of the smoke foretold the year to come: east for good, north for average, west for bad, and south for a very bad year. Because the Comanches were hunters, the prediction of Tabana Yuane undoubtedly concerned the condition of the playsas; a good year, for example, would find plenty of water in the lakes, and thus good hunting. Nonetheless, residents of modern-day Panza County continued the ritual on a broader economic base (i.e., farming and oil industries) and resigned themselves to the 1986 forecast of a bad year; fully 94% of the predictions were fulfilled during the past 80 years (Burton 1986).

PLAYAS AND THE SPANIARDS

The first European (or documentary) mention of the playas appears in the chronicles of the trek of Francisco Vazquez across the plains in the late spring of 1541. One entry notes that "Occasionally there were found some ponds, round like plates, a stone's throw wider or larger. Some contained fresh water, others salt." Mention of salt water in the lakes may well be misleading, however, as saltwater lakes were encountered only during the retreat into New Mexico over a route lying well southwest of the troop's original route eastward (Bolton 1949). Indeed, the latter wetlands are large alkaline, shallow lakes of which there are about 25 on the Llano (e.g., Mound Lake); these are not typical of the thousands of wind-deflated playas. Although the conquistadors and their livestock drank opportunistically from playas, the basins were far too dependable as sources of water to have become established
milestones of travel or settlement. Bison (= "cattle") did command frequent mention, however, and the Spaniards, impressed with the vast herds, no doubt started the myth that the playas originated as walls.

The journals of later Spaniards also mention playas (Loomis and Nasatir 1967). On 18 April 1788, José Mares marched "toward a plain that had no landmarks other than a very large pond" in his journey to Santa Fe. Similarly, an entry for 3 July 1788 in the diary of Santiago Fernandez notes that his party encountered 13 ponds, and camped beside the last of these, on the first day's trek across the plains. Interpretation of an entry in the diary of Francisco Xavier Fragoso for 2 August 1789 suggests the hazards of crossing the flat dry plains; namely, that the travelers learned from a Comanche of a playa still filled with water in late summer and therefore directed their line of march to the lake. That theme was reflected again in the charge of Texas Governor Cordero to Capt. Francisco Amanguel, commandant at La Bahía. Amanguel was to blunt the claim of the United States that Louisiana extended to the Rio Grande by establishing a road between Santa Fe and San Antonio. An important part of that task, of course, was to find water sources along the roadway. The records of his travels, made in 1808, thus mention playas ("many small lakes", on 13 May and ". . . many pools of rain water" on 15 May) when his troop encountered the plains. In contrast to Fragoso's passage in August, Amanguel crossed in May, normally one of the two rainy periods for the region. The entry for 25 May relates the setting: ". . . we continued. . . over plains so extensive that the horizon was tiring to the eye. We traveled all day over this kind of land, and found some dry lakes that showed signs of accumulating much water in time of rain."

No official Spanish or Mexican trade routes developed across the Llano from Santa Fe to San Antonio because of trade developing instead between New Mexico and St. Louis. But New Mexican Comancheros (Indian traders), Ciboleros (buffalo hunters) and Pastores (sheep herders) utilized the Llano extensively until the 1870s, and established many trails, trade sites, and camping/watering stops using playa lakes. This activity ceased by 1878 with the removal of the Indians, the extirpation of bison, and the arrival of Anglo-American cattlemen (Kenner 1969).

PLAYAS AND 19TH CENTURY ADVENTURERS

Perhaps the first American adventurer into the Llano was an enterprising gunrunner and trader in contraband, Philip Nolan. The young Nolan made four forays into Spanish Texas, including the Llano Estacado, between 1790 and 1799, but a fifth trip in 1800-01 claimed his life when a troop of Spanish cavalry under the command of Lt. Miguel Musquiz surrounded Nolan's party and killed him, thereby thwarting his mission (Flores 1984). That mission was to gather information for President Thomas Jefferson whose overt interest, at least, was to initiate a study of mustangs ". . . in the only moment in the age of the world. . . ." when the horse could be examined in its wild state. Such an endeavor for a sensitive political mission, undoubtedly represented the first study of wildlife sponsored by the United States government. Our interest here, however, remains Nolan's report (received posthumously) to Jefferson that the Llano was ". . . so destitute of water, as to oblig[e] [Indians] to transport their drink in preserved entrails of beasts," the clear implication being that the local sources of water--playas--were too unreliable even for the prairie-wise Indians.

In 1820, a part of the Long expedition returned from the Rockies via the Llano but traveled along the Canadian River, the avenue of numerous U.S. explorations of the area between 1820 and 1853 (Goetzmann 1966). The journal of Lt. J. W. Abert of the U.S. Topographical Engineers provides yet another warning of travel on the fickle Llano. Abert, marching from Bent's Fort on the Arkansas River to St. Louis along the Canadian River in 1845, wrote "The only water [on the Llano] is contained in pools or lakes, often at great distances asunder, and with banks so low that the traveller. . . . often passes them unnoticed" (Carroll 1941). In that regard, the "Staked Plains Horror" stands foremost in the annals of adventurers on the dry plains. In July 1877, a company of Black cavalry ("Buffalo Soldiers") under command of Captain Nicholas Nolan set out on a 60-day mission from Fort Concho (now San Angelo) searching for renegade Indians on the Staked Plains (Cook 1907). The troops lacked experienced guides and, chancing on 24 encamped buffalo hunters, gained their services. However, when the band left camp on 27 July in pursuit of Indians, many did so with empty or partially filled canteens, thereby beginning two days or more of thirst in the torrid heat. One of the forlorn troopers described the ordeal but five of the troopers perished despite the sacrifice of 22 horses for blood. The same drought hindered an expedition of the Red River led by Lieutenant E. H. Ruffner, who found nearly every playa dry (Baker 1985).

The drought of 1876-77 apparently was broken, at least locally, by the downpour from a waterspout and the formation of a huge playa that became what Mari Sandoz poetically called an "Eden of the animals" (Sandoz 1954). Her account seems somewhat fanciful but probably does illustrate how some kinds of wildlife, in this case, bison, respond to the sudden availability of water. The smell of water on the west wind drew the herd--first at a walk, then on the run--to the playa in a way remarkably like wildebeest (Connochaetes taurinus) responding to rainfall on African grasslands (Talbot and Talbot 1963). The account also claims that the bison died by the thousands when the thirst-crazed beasts tried to trample themselves in the "marshy lagoons of the Staked Plains," a clear reference to the playas.

Even in better times, playas might be overlooked by men searching for water on the level plains. The Gallagher-Howe account for 20 September 1841, recording a journey across the Llano, noted that "the water holes are round basins sunk from the level of the prairie & are not discernible at the distance of 400 yards" at a time and place where water was plentiful (Carroll 1951). Lest such oversights seem improbable, note another experience concerning visibility on the Llano. On emerging from the vastness of Palo Duro Canyon, a party of travelers found themselves ". . . upon the level prairie, and on looking back, after proceeding some hundred yards, not a sign of the immense chasm was visible" (Kendall 1847).

Views of the Llano and its playas sometimes were mixed and even contradictory. Josiah Gregg traveled along the Canadian River Valley on the northern border of the Llano in 1839 but rejected the advice of a Mexican comrade who wanted to venture southward ". . . into the fearful Llano Estacado, where we probably would have perished" (Moorhead 1954). Similarly, Thomas Falconer, an English adventurer accompanying the ill-starred Texas Santa Fe Expedition of 1841, wrote of the Llano as "too extensive to travel over . . . without water, and where many
of our horses would perish" (Hodge 1930). The playas, it seems, did little to assuage an ubiquitous fear of thirst. Despite his fears, Gregg also praised the innumerable playas that "... bespeckled the plain, and which kept us well supplied with water" (Moorhead 1954). In fact, both Gregg and Stephen H. Long remarked that the frequent detours around the playas impeded direct lines of travel across the plains. Yet, in large measure, it was Long's expedition (in 1820) that labeled the region as The Great American Desert (James 1905). See also Goetzmann (1966) and Smith (1950) for discussions of the desert image vis-a-vis available technology (e.g., the Llano could be viewed only as a desert early in the 19th century since deep-well irrigation technology did not exist at the time).

Just as hopes of gold once lured Coronado into the American Southwest so did a quest for furs often champion the travels of American explorers early in the 19th century. Such was among the aspirations of Albert Pike when he journeyed on the plains in 1831-1832. His mission, like those of the Spaniards, proved fruitless because of the treacherous promises of Indian guides. Pike was told by a Comanche chief that beaver awaited nine days' march to the east (the party was then on the western edge of the Texas Panhandle, probably in Bailey County). On 28 September 1832, however, as the explorers crossed what is now Lubbock County, they "... began to question the probability of finding the immense quantities of beaver that we had anticipated" (Pike 1968). Indeed, the party encountered water only rarely, noting the occurrence of playas as "solitary holes of water," "no water except in here and there a hole," and once (on 22 September) of being "... frequently tantalized by seeing at a distance ponds which appeared to be full of clear rippling water." That they were mirages became painfully apparent, however, as the thirsty travelers reached the dried, encrusted playa basins.

As Rathjen (1973) noted, the rush of buffalo hunters into the Texas Panhandle could scarcely have done less than to infuriate the Indians. The result was the Red River Indian War of 1874-75, in which a playa provided the setting for a famous skirmish. Early in September, 1874, scouts William "Billy" Dixon and Amos Chapman, together with four troopers of the U.S. 6th Cavalry, were surrounded on the open Llano by a force of more than 100 Kiowa and Comanche warriors (Haley 1976). Soon all but Dixon were wounded and, in obvious need of cover, the party gathered in the dry confines of a nearby "buffalo wallow." Thirst became another enemy in the heat of the long day, but after nine hours of fighting, rainwater from a sudden storm collected in the playa and provided much-needed relief. Luckily, the Indians began losing interest, and Dixon slipped away the next morning to find a column of troopers, whose arrival finished the episode. Each of the party (including a private who died from his wounds and was buried in the playa) was awarded a Congressional Medal of Honor for heroism, of which there is more than we relate here (see Rathjen 1973 and Haley 1976), although the medals awarded to Dixon and Chapman later were revoked because neither had been officially enlisted in the Army. The ordeal of Dixon and his comrades almost certainly inspired the painting "Fight for the Water Hole" by noted western artist Frederic Remington, but more importantly, had it not been for the protection of the rim of the playa, the entire party surely would have been martyred at what history records as the "Buffalo Wallow Fight" (Green 1970).

Bison, of course, are a subject of immense importance in any discussion of the ecology and history of the North American grasslands. However, our more limited focus here necessarily curtails further comment except to note that several sources agree that bison in the Texas Panhandle generally preferred the range lying below the elevation of the Llano (e.g., the rougher terrain below the Caprock, often known as the "breaks," lying to the east of the Llano). That preference clearly seems associated with the regular availability of water in the several tributaries of the Red and Canadian rivers. According to one source, cited in Rathjen (1973), in the early days the buffalo stayed mainly under the Plains as they would have to come to the streams for water. But in summer they did graze out on the plains... when the lakes were full of water" (emphasis added). As with human history on the Llano, the lack of dependable, year-round water in the playas similarly influenced the natural history of the bison, the mightiest symbol of the plains ecosystem.

PLAYAS AND SETTLEMENT

Unlike most of Texas, the Llano and its playas lingered in a natural state as elsewhere the American frontier slipped forever into history. The region was settled slowly, no doubt because of the discouraging reports of those who crossed the plains earlier in the 19th century. Although no farming technology was yet capable of creating an agricultural empire, descriptions of the Llano such as those made by Mercy in 1849 were reason enough to dissuade settlement:... the great Sahara of North America... must continue uninhabited forever..." (Foreman 1939). Indeed, as late as 1876, the Handbook of Texas stated that the Llano was the only uninhabitable part of Texas. These were persistent characterizations, including those of Capt. John Pope who, in 1854, explored the southwest for a railroad route between the Rio Grande and the Red River. For the most part, Pope skirted the Llano and surveyed only the southern fringe, reporting that the reputed horrors of the dreadful plains were by no means exaggerated (Pope 1854). His fears, apparently, were heeded; the Santa Fe's tracks reached Lubbock only in 1909.

Nonetheless, stockmen and, in turn, farmers followed with the passing of the buffalo, Indian, and blue-
coated cavalry. The earliest settlers necessarily relied on local materials for their homes and, because there was neither rock or timber on the Llano, pioneers built shelters known as dugouts. These and later homes were often placed near playas where, besides providing for utilitarian needs, the water captured the playful attention of children far removed from other diversions. One such playa thus became the setting for the adventures described in The Buffalo Wallow: A Prairie Boyhood (Jackson 1952).

The Randall clays of the playas were no less immune to the bite of the plow than other soils of the Llano. Farmers simply cast their furrows straight across the basins in dry years, although crops planted in the depressions—then as now—often flooded in the wake of autumn rains. Yet, because the clay basins held some moisture even in the driest of times, the playas often were important sources of forage, and tons of hay were sold to cattlemen who generally considered playa hay as the best feed in the country (Hammer 1943; Sheffey 1963). As might be obvious, farmers of the time often lacked the means of drilling wells and so necessarily watered their stock in playas, but, even at the turn of the century, Johnson (1901) still considered playas as more important for hay production than for water storage.

Any regard for the playas as sources of hay has long since passed (although, at times, some playas are grazed heavily as pastures). Instead, farmers today often consider playa vegetation as little more than a "weed bed," and thus something of a threat to the integrity of their crops. Whereas herbicides are too expensive to use in the playas, plowing (when the basins are dry) and fire are not. The results of either practice, of course, are ruinous for wildlife, particularly during the nesting season. Ironically, plowing and burning each set back the native vegetation to a successional stage where annual forbs and grasses ("weeds") flourish, so that either practice actually increases opportunities for spreading undesirable plants into the surrounding croplands (Rollo and Bolen 1969).

The vast Llano did not escape the attention of land speculators who sometimes did much to promote settlement. Thus, in 1913, the Texas Land and Development Company drilled a well opposite the train station in Plainview so that a luxuriant plume of water greeted visitors. The water drained into a nearby playa, which became "Lake Plainview" and the recreation area for a fun-filled Sunday afternoon of boating and fishing (Brunson 1970). Playas also were a barometer gauging the borrowing power of farmers. According to Johnson (1947), bankers early in the current century used the water level of local playas as a means of assessing rainfall, thereby adjusting their loans to farmers for the next year's crops.

PLAYAS AND BIRDS

Playa lakes are "islands" of wetland habitat for many kinds of wildlife. Today, the playa basins, along with draws and canyons, support the only native vegetation remaining on most of the Llano; an intensively cultivated regime of croplands has replaced virtually all of the original shortgrass prairie. An addition to regional avifauna occurred when ring-necked pheasants (Phasianus colchicus) were established about 1940 (Jones and Felts 1950). Concentrations of 75-100 pheasants per playa are common (see Bolen and Guthery 1982). Playas also are the winter quarters for a million or more of waterfowl. Mallards (Anas platyrhynchos), pintails (A. acuta), wigeon (A. americana), and green-winged teal (A. crecca) form the nucleus of the winter population. The playas in fact are second in importance only to the Texas Gulf Coast as winter habitat for waterfowl in the Central Flyway (see Bolen 1982). Regrettably, avian cholera (Pasteurella multocida) has killed millions of birds since the first known case of the disease in wild, North American waterfowl occurred on playas in Castro County in 1944 (Quortrup et al. 1946).

In contrast to the abundance of pheasants and waterfowl, the observations of at least one early traveler testify to the threads by which other birds were later to hang. Kendall (1847), enroute across the Llano to Santa Fe in 1841, rested his horses near a small playa where "...large white cranes were standing about..." seemingly a clear reference to whooping crane (Grus americana). By 1941, scarcely more than 20 whooping cranes still survived in all of their then much-shrunken range (Greenway 1967). On another playa, "...of some 20 acres, but shallow," Kendall noted "flocks of large curlews, one of the finest birds that fly, were hovering and lighting about on all sides. Had I [possessed] a double-barrelled gun with small shot I would have had at least one good meal." In this case, the birds were likely long-billed curlews (Numenius americanus) or perhaps Eskimo curlews (N. borealis), now extinct or nearly so.

An entry in the journal of Lieutenant J. W. Abert for 28 August 1845 describes the birdlife during the late summer on playas on the western edge of the Llano. "The country was growing dry and sterile. We, however, found a few large shallow pools, covered with flocks of ducks, among them were green-winged teal, 'Anas crecca. We also saw the killdeer plover, 'Charadrius vociferus, the curlew, 'Numenius longirostris' [now N. americana], and a specimen of the American avocet, 'Recurvirostra americana'...our people...were on all sides of the pond endeavoring to kill some of the ducks which were quietly gliding on its surface. We afterwards passed several of these ponds in the open prairie. There have evidently been heavy rains here lately'" (Carroll 1941). Abert thus encountered several species at the beginning of the autumn migration period and, in doing so, his "people" undoubtedly became the first Anglo duck hunters on the Llano.

Fuller characterization of the playa avifauna prior to 1900 is difficult since many of the early naturalists accompanied expeditions that barely touched the Llano, usually at its northern edge (e.g., Edwin James and Thomas Say in the Long Expedition of 1820 traveled along the Canadian River). Moreover, the Llano often was avoided because of its reputation as the "Great American Desert." McCauley (1877), an ornithologist with on the Ruffner Expedition, surveyed birds in the "...region about the source of the Red River of Texas," and Streeker (1910), curator of the museum at Baylor University, recorded the reptiles, mammals, fishes, and other components of the fauna in the "...arroyos and draws forming a portion of the great Paloduro [sic] system of plains canyons in northwestern Texas." Regarding birds, Streeker noted that his list is not very complete but perhaps might "...add a mite to our not any too extensive knowledge of the habitat associations of the Aves of the Panhandle" but none of the species he listed was associated with playa lakes. Indeed, the focus of these naturalists on the rough landscape cutting through the Llano echoes similar preferences shown by early ranchers (e.g., Charles Goodnight).
who established their headquarters in the canyons rather than on the surrounding prairie.

Only later in the present century were relatively complete checklists published for birds of the Llano. These include Stevenson (1942), Hawkins (1945), and, of direct concern to the avifauna of playas, Fischer et al. (1982). An excerpt from Hawkins underscores the importance of playas to birds, "Fewer than forty kinds of birds use the open plains to any great extent...but give the plains a few lakes and it becomes a bird haven, increasing its bird potential by at least eighty species."

PLAYAS AND LAND-USE PATTERNS

Irrigation rapidly turned the Llano into one of the most intensively cultivated regions in the Western Hemisphere. New pumping technologies in the wake of World War II gave farmers access to the deep bed of water in the Ogallala, and more than 70,000 wells eventually tapped the huge aquifer (New 1979). Playas thus gained additional significance as wetlands since the basins thereafter captured the runoff from irrigation in addition to the far more unpredictable influx of rainwater. As might be expected, tailwater exerted a strong ecological force on the playas since it increased the richness and interspersion of plant communities within the basins (Guthery et al. 1982). More recently, however, pumping expenses and the decline of water levels in the Ogallala have stimulated newer, more conservative irrigation methods that steadily reduce the amounts of tailwater reaching playas.

Modification of the playa basins is an associated factor of importance to the status of these shallow wetlands. To collect and store surface runoff, and especially tailwater, farmers have excavated pits or otherwise affected the drainage in nearly 70% of the playas of 4 ha (10 acres) or more in area (Guthery and Bryant 1982). Once in the pits, water remains available for another irrigation cycle but without the expensive burden of deep-pumping from the Ogallala. The pits are steep-sided so that evaporative losses are minimized by a favorable ratio of volume-to-surface area. However, the same construction also reduces the natural littoral zones in most playas. That loss, in turn, diminishes the carrying capacity of playas as habitat for birds and other wildlife dependent on wetlands (Bolen et al. 1979).

The setting thus remains uncertain. Modern methods of irrigation surely will alter the water regime in playas, yet as the Ogallala steadily diminishes and the cost of pumping increases, dryland farming will replace much of the water-demanding agriculture currently in place. The dynamics of these situations in relation to wildlife are not clear. Nor can we be sure if playas still might retain their pristine values as wildlife habitat since years of irrigation have deposited heavy silt loads in many of the basins. Moreover, those playas with pits probably will remain ecologically impaired long after irrigation no longer produces the tailwater for which the excavations were designed. New technologies may add further impacts. For example, hydrologists continue searching for ways that water collecting in the playas might recharge the Ogallala and, if so, then even more playas probably will be modified for that purpose.

CONCLUSION

Curiously, playa lakes did not warrant mention in the classic environmental interpretation posed by Walter Prescott Webb (1931) in The Great Plains. Our evidence nonetheless underscores that these unique landforms indeed were important ecological features in the human history of the Llano. The ephemeral nature of the playas, in fact, symbolizes the aspect of promise versus reality so forcefully presented in Webb's account of the human experience on the American plains. Strange as the vast countryside must have seemed to early Anglo-Americans, the playas—and indeed the entire Llano—seen at certain seasons appear verdant and enriched with wildlife. But the effect is commonly as transitory and fleeting as a mirage—for, in reality, the landscape of playas and prairie continues to impress modern societies, as it no doubt did those of the past, with the fragility of human existence on the Llano Estacado.

ACKNOWLEDGMENTS

We thank C. C. Reeves, V. T. Holliday, E. Johnson, J. W. Perez, Byron Price, and J. Knox Jones, Jr., for their advice and contributions. The manuscript was typed by Alda S. Ingram, to whom we owe a large debt of gratitude. This is Contribution T-9-450, College of Agricultural Sciences, Texas Tech University.

LITERATURE CITED


