

BIOLOGICAL INVENTORY, NATURAL HISTORY,
AND HUMAN IMPACT OF PALO ALTO
NATIONAL BATTLEFIELD

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Submitted to
National Park Service
P.O. Box 25287
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Norman L. Richard received his BS in Biology in 1957 from Illinois State University and his MA in Biology (Zoology emphasis) in 1969, from Sam Houston State University. While there he studied the reptiles and amphibians of East, South, and West Texas.

He has completed additional graduate studies at Duke University's Marine Laboratory, Florida State University, and Corpus Christi State University.

He began teaching in the Biology Department at Texas Southmost College in 1969, and became an assistant professor in the Biology Department of the University of Texas at Brownsville upon the implementation of a partnership agreement between the two institutions in 1992.

He has investigated the Rio Grande riverine microhabitats and their value to endangered species for USFWS - Lower Rio Grande National Wildlife Refuge.

In addition, he has also been associate producer and researcher for two natural history documentaries on the El Cielo Biosphere Reserve in Southern Tamaulipas, Mexico for the Gorgas Science Foundation, Inc., and is currently developing another on the wildlife of the Lower Rio Grande Valley.

Dr. Alfred T. Richardson received his BA in Botany and Zoology in 1969, and the MA in Botany at the University of Texas at Austin in 1970. He received the PhD in Botany (Plant Taxonomy) and Chemistry at The University of Texas at Austin in 1975. His research took him to Mexico, Peru, Chile, Argentina, and Ecuador as well as the southwestern United States.

He began teaching in the Biology Department at Texas Southmost College in January of 1976, and continued at that institution until it entered into a partnership with The University of Texas in Fall of 1992. He is now a professor in the Biology Department of The University of Texas at Brownsville. During his employment with Texas Southmost College, he was chairman of the Biology Department for eight years.

Among his publications are the following:

- 1969. Louteridium tamaulipense A. Richardson (Acanthaceae), A new species from Northeastern Mexico. Sida 3:448.
- 1972. Revision of Louteridium (Acanthaceae). Tulane Studies in Zoology and Botany 17:63-76.
- 1976. Reinstatement of the Genus Tiquilia (Boraginaceae: Ehretioideae) and Descriptions of Four New Species. Sida 6:235-240.
- 1977. Monograph of the Genus Tiquilia (Coldenia, sensu lato) Boraginaceae: Ehretioideae. Rhodora 79:467-572.
- 1990. Plants of Southernmost Texas. Gorgas Science Foundation. 298-pp.

ABSTRACT

During 1993 a floral and faunal inventory was conducted on the Palo Alto National Battlefield Historic Site. Vegetational associations were mapped, and the impacts of agriculture and ranching were assessed. Attention was given to identifying endangered, threatened, or candidate species present within the site boundaries, and also species which may have been extirpated. An attempt has been made to envision where historic roadways were located and how the 1846 landscape may have appeared.

INTRODUCTION

The Palo Alto National Battlefield exists within the recent delta of the Rio Grande River a scant eleven miles from the southern terminus of the Laguna Madre (250° 30' N. to 260° N. latitude). The climate is both subtropical and semi-arid. Within the site (which is wholly within the Tamaulipan Biotic Province, Matamorán District), coastal halophytic vegetation interdigitates with Tamaulipan brushlands.

Relief is low, ranging from 9.7 feet to 20.9 feet, and small gradations in elevation have a profound effect upon the vegetation and its animal associations.

Floral and Faunal inventories were begun in March 1993 and are ongoing as the seasons progress. During these studies, understanding of vegetational associations and the impacts of agriculture and ranching began to emerge. From field observations (ground truth) and color aerial photographs, a vegetational map was constructed, taking into consideration natural and altered landscapes.

Subsequently, communication with current and former landowners helped direct interpretation of human and animal impacts which have altered drainages or plant cover.

NATURAL HISTORY AND LAND USE

GEOLOGY

Palo Alto Battlefield National Historic Site lies within the Rio Grande delta plain, a part of the Gulf Coast Plain physiographic province. The delta was built after the sea level

rose, approximately seven thousand years ago, subsequent to late Pleistocene glacial melting.

At least three major deltas have been built since that time. The oldest, Los Cuates was formed north of Port Isabel between seven-thousand and five thousand years ago. Palo Alto is located within the intermediate subdelta (Del Tigre) which was created when the flow of the Rio Grande shifted southeastward into Mexico. The position occupied by the Del Tigre subdelta is marked by numerous resacas. The word resaca comes from the Spanish word "resacar", which means "to take back".

Resaca del Rancho Viejo, Resaca de la Palma and Resaca del Tigre are all distributory channels of the Del Tigre subdelta. The soils created on their flood plains are primarily over bank silts and clays, and many river-created landforms are still evident.

Erosion and agricultural land preparation have obscured the cut (undercut) banks created on the outside of meander bends and the point bars created on the inside.

Point bars grow by accretion of usually sandy sediment which accompanies the downstream migration of meanders. Successive accretion curves develop in the direction of the undercut banks. Arcuate ridges and sloughs mark individual accretions.

Meanders may be abandoned during periods of flooding when the river cuts through a slough of a point bar or across the adpressed ends of a meander. Cut off ends are commonly plugged with sediments. Eventually erosion will create a meander scar in the landscape by filling the old resaca bed.

The Palo Alto site is rich in features which exhibit the handiwork of the Rio Grande River.

SOILS OF PALO ALTO

All soils at Palo Alto (Exhibit) are either clay or clay loam, and have their origins in the former Rio Grande delta, adjacent to the current Gulf of Mexico shore. All are saline and have generally poor drainage.

1. LOMALTA CLAY (LM)

Approximately 62.6% of the soil included within the Palo Alto site is Lomalta Clay. Broad areas, mostly level, and some slight depressions are found on the northwestern and southeastern portions. Also the Lomalta Clay is confined to the long narrow drainage channel.

This soil is very slowly permeable and both calcareous and saline (>15%) with a slope of less than 0.5%. Runoff is very slow and pools remain for several days or even weeks after heavy rains. These conditions provide semimarsh conditions which are useful to wildlife. Lomalta Clay is the predominant soil type at Palo Alto and all cattle tanks or bar ditches have been placed

within areas of Lomalta Clay soil. Palo Alto Pond rested on this soil type.

2. CHARGO SILTY CLAY (CH)

Chargo Silty Clay occupies approximately 12.9% of Palo Alto. The slopes are similar to that of Lomalta Clay and also contain some depressions, but they drain better because of slightly greater permeability and runoff. This soil is also calcareous and highly saline. The soil surface becomes hard and crusty when dry.

On the Palo Alto site it mostly surrounds Palo Alto Pond, forms the northern and southern edges of the northwestern Tamaulipan Brushlands and lies on either side of the wheeler/Longoria resaca.

Laredo soils are enclosed within this soil type at the edges of the western and northern resaca system.

3. LAREDO SILTY CLAY LOAM (LAA)

Laredo Silty Clay Loam covers 6.0% of Palo Alto. Its slope is up to 1%, generally, but some slopes up to 3% exist. It has a level or slightly convex surface. This is calcareous soil which varies in salinity and contains 1-8% near fine sands. Permeability is moderate and runoff is slow. Field observations indicate the color is light and the surface becomes powdery during dry periods.

This soil, along with Chargo Silty Clay, mostly defines the boundaries of the northeastern Tamaulipan Brushlands.

4. LAREDO SILTY CLAY LOAM, SALINE (LC)

Palo Alto contains 8.4% Laredo Silty Clay Loam, Saline, generally adjacent to old river meanders. It slopes less than 2% and is generally level to slightly convex. This calcareous soil is about 12" thick, has moderate permeability and slow runoff. On the Palo Alto site this soil type surrounds the great meanders of the western resaca system as well as an ancient meander at the southwest corner. It also borders both sides of the old resaca bed which runs southeast from Arista's Hill. All three "Motas de Arista" are of this soil type.

5. SEJITA SILTY CLAY LOAM (SE)

Sejita Silty Clay Loam occupies 4.97% of Palo Alto. It is also calcareous and saline and slopes less than 0.5%. Its surface is level or concave. Lomalta (LA) soils may be found in slight depressions and Latina soils (LK) may be on higher elevations. Since permeability is moderately slow and the runoff is very slow, ponding may occur. This soil type is found only in

Soils of Palo Alto



Soil Survey of Cameron County, Texas
May, 1977.

the southeastern portion of the battlefield Sacahuistal. Conditions are semimarshy.

6. LATINA SANDY CLAY (LK)

Latina Sandy Clay Loam is noncalcareous but saline and found within deltas and coastal terraces. It is nearly level, has slow permeability and very slow runoff. It contains 1-2.5% organic matter. Small depressions may contain Sejita or Lomalta soils. The slope is less than 0.5%. This soil type is found on the north half of the extreme eastern portion of Palo Alto interdigitating with Lomalta Clay.

7. BENITO CLAY (BE)

Benito Clay is the least common soil present at Palo Alto (2.2%). It is slightly depressed and slopes less than 0.5%. Exchangeable sodium increases with depth and may exceed 15%. This soil has very poor drainage; the permeability and runoff are very slow. Standing water lasts several weeks after heavy rains. The surface is crusty and cloddy. This soil interdigitates with Lomalta Clay on the southeastern edge of Palo Alto. This soil is found along Paredes Line Road on the north and is cultivated for row crops.

TOPOGRAPHICS AND PHYSIOGRAPHIC FEATURES

Four irregular depressions are notable topographically. One is "Palo Alto Pond" shown as an intermittent pond on the 1953 USGS topographic map. A portion of another, located at the extreme northwestern corner, is known as El Tule Grande (Exhibit) and represents an historic cattail marsh which was drained about 1915. It is bordered by a 15" contour. Immediately southeast of El Tule Grande is another depressed area which shares the 15" contour. It is designated PEMIC (Palestine, emergent, persistent, seasonal) in the 1979 wetlands inventory. A fourth depression lies midway along the eastern boundary of Palo Alto. Its border is a 10 foot contour.

Many old resaca beds generally retain water to varying degrees and for various periods. All cattle tanks have been dug into the clay soils where these channels are found.

The resaca beds south of Arista's Hill, Resaca de Palo Alto and another one located running north to southeast of Arista's Hill are classified as PEMIF (Palestine, emergent, persistent, semipermanent). The curved tank which runs between the southern portions of the Wheeler and Longoria properties, Palo Alto Pond, and the northernmost tank are also classified PEMIF (Exhibit). Two areas designated PEMIC (Palestine, emergent, persistent,

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seasonal) and PEMIA (Palestine, emergent, persistent, temporary lie in the extreme southern and southwestern portions of the Wheeler property.

In addition, while all large meanders of old channels on Palo Alto exhibit meander accretion curves created as the meanders migrated downstream, two areas are more clearly evident (inside the most northwestern and northeastern meanders) on an early (1939) aerial photograph.

The areas of highest relief (greater than 15 feet) are as follows:

1. Northeast (20.9 feet)
2. Northwest (five areas of 20 feet)
Both are adjacent to old meanders of the west to northeast resaca system.
3. Three hills in the south central portion are, north to south, 17.4 (Arista's Hill), 17.7 and 17.2 (only a portion of which is within the site boundary).

All of these elevated areas and a small 20 foot hill at the southwest corner are now or were probably once covered with Tamaulipan Brush.

The soils of brush areas on Palo Alto are either Chargo or Laredo Series. Brush clearing has occurred on this soil type and likely on the Benito Clay agricultural fields along Paredes Line Road which have an elevation of approximately 17 feet. It is likely that all areas greater than 15 feet in elevation supported brush.

FLOOD HAZARD DESIGNATIONS

The 1979 Revision of the Flood Hazard Boundary Map (Exhibit) classifies portions of Palo Alto in each of the following categories

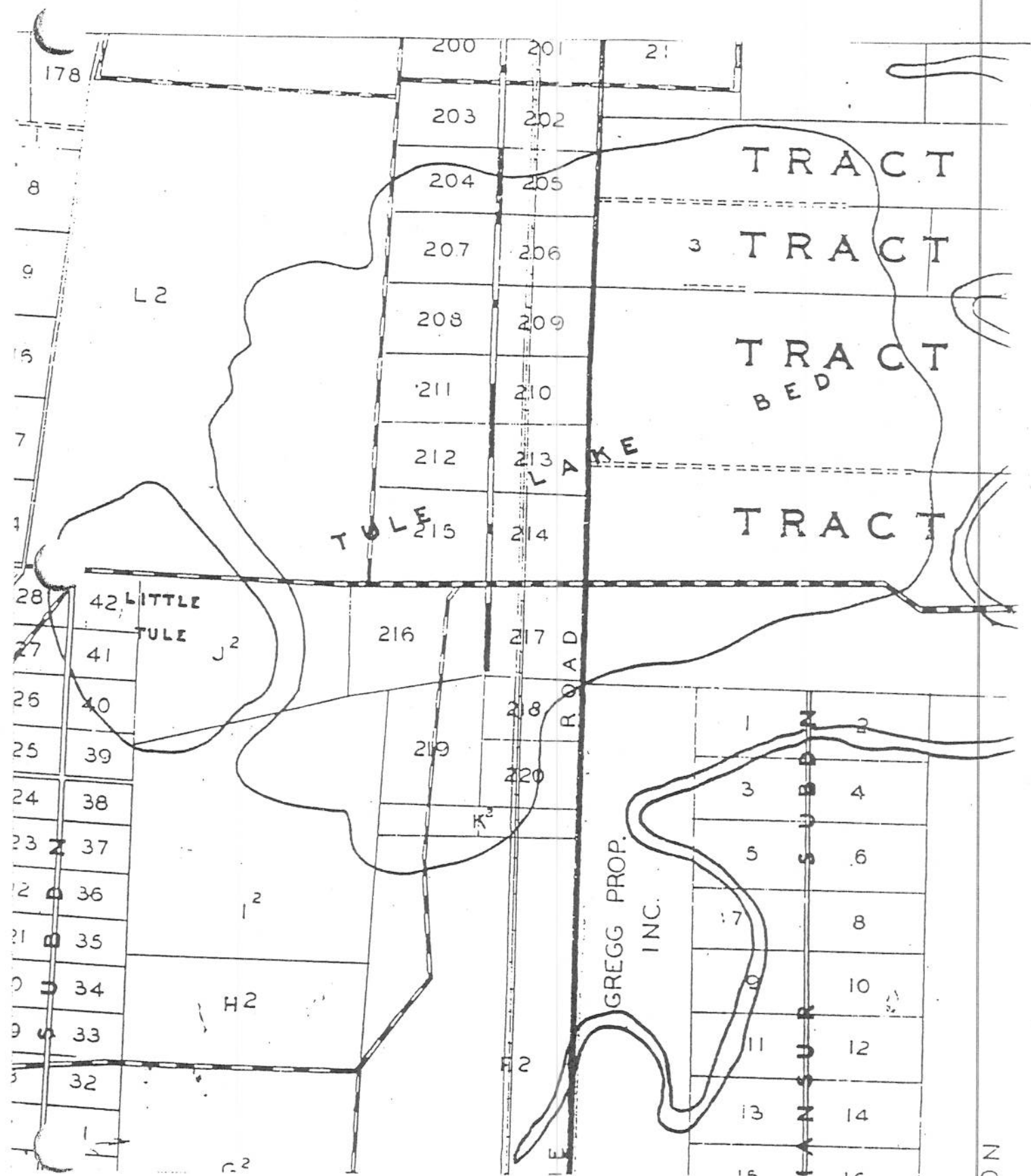
1. ZONE A (Areas of 100 year flood):

The old resaca bed at the western edge of Palo Alto which is located on both the Bert Wheeler and Vidal Longoria properties.

2. ZONE AH (Areas of 100 year shallow flood where depths are between 1 and 3 feet):

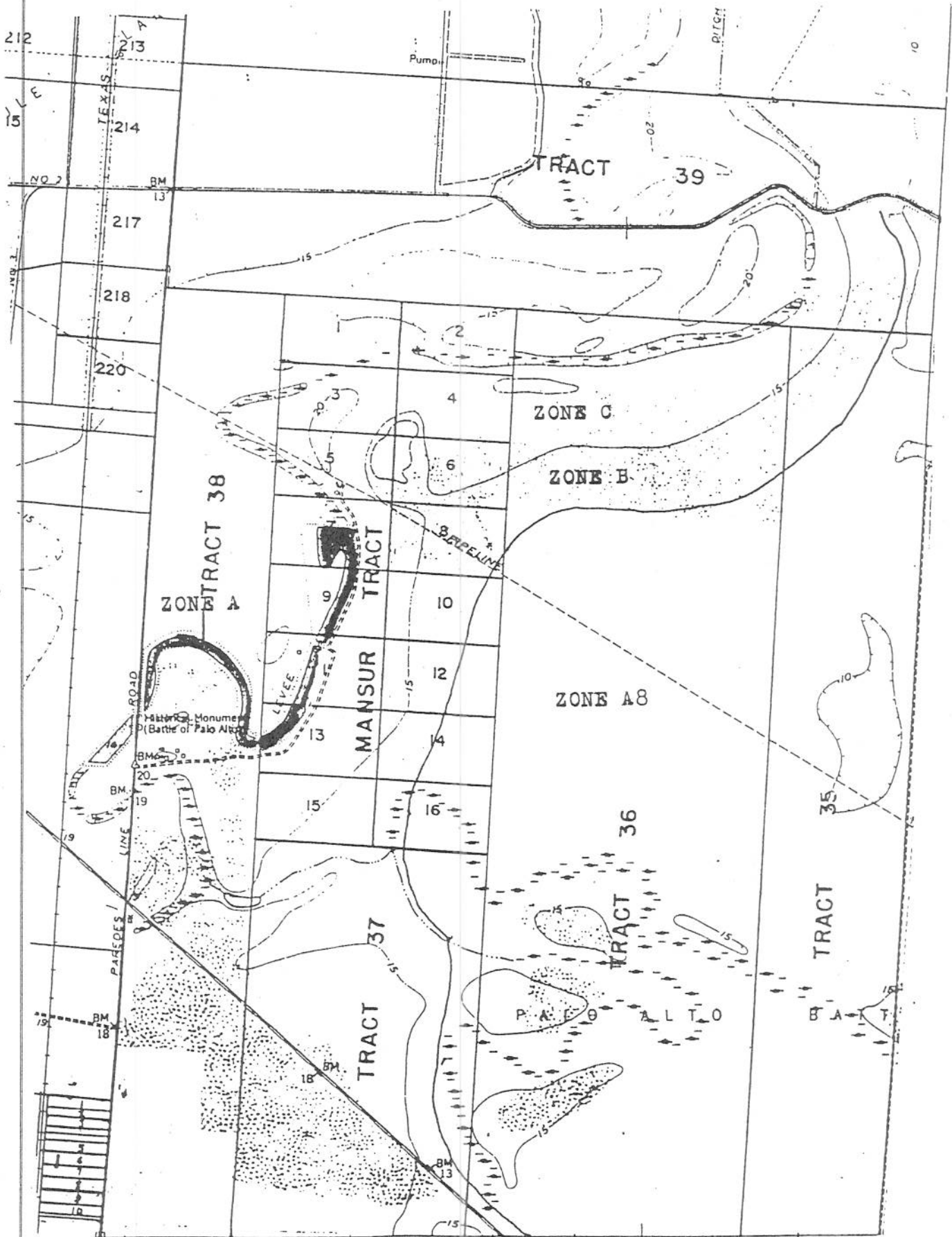
The extreme northwestern portion of Palo Alto which was once a portion of El Tule Grande Marsh. The designated base flood elevation is 15 feet.

3. ZONE A8 (Areas of 100 years flood, base flood elevation is 13 feet):



Map of Cameron County, Texas
A. B. Mason, 1934.

Flood Hazard Boundary Classification



This zone covers substantial portions of central, east and southern Palo Alto.

4. ZONE B (Areas between limits of the 100 year and 500-year flood; or areas subject to 100-year flooding with average depths less than one foot or where the contributing drainage area is less than one square mile):

This is a narrow zone which follows from the eastern edge of the northwestern Tamaulipan Brushlands along the west edge of zone A8. It includes extensions enclosing Palo Alto Pond, the loma at the eastern edge of extreme southwestern Palo Alto, and an adjacent area. The western edge is defined by the 15 foot contour line.

5. ZONE C (Areas of minimal flooding):

This zone covers all areas not included above.

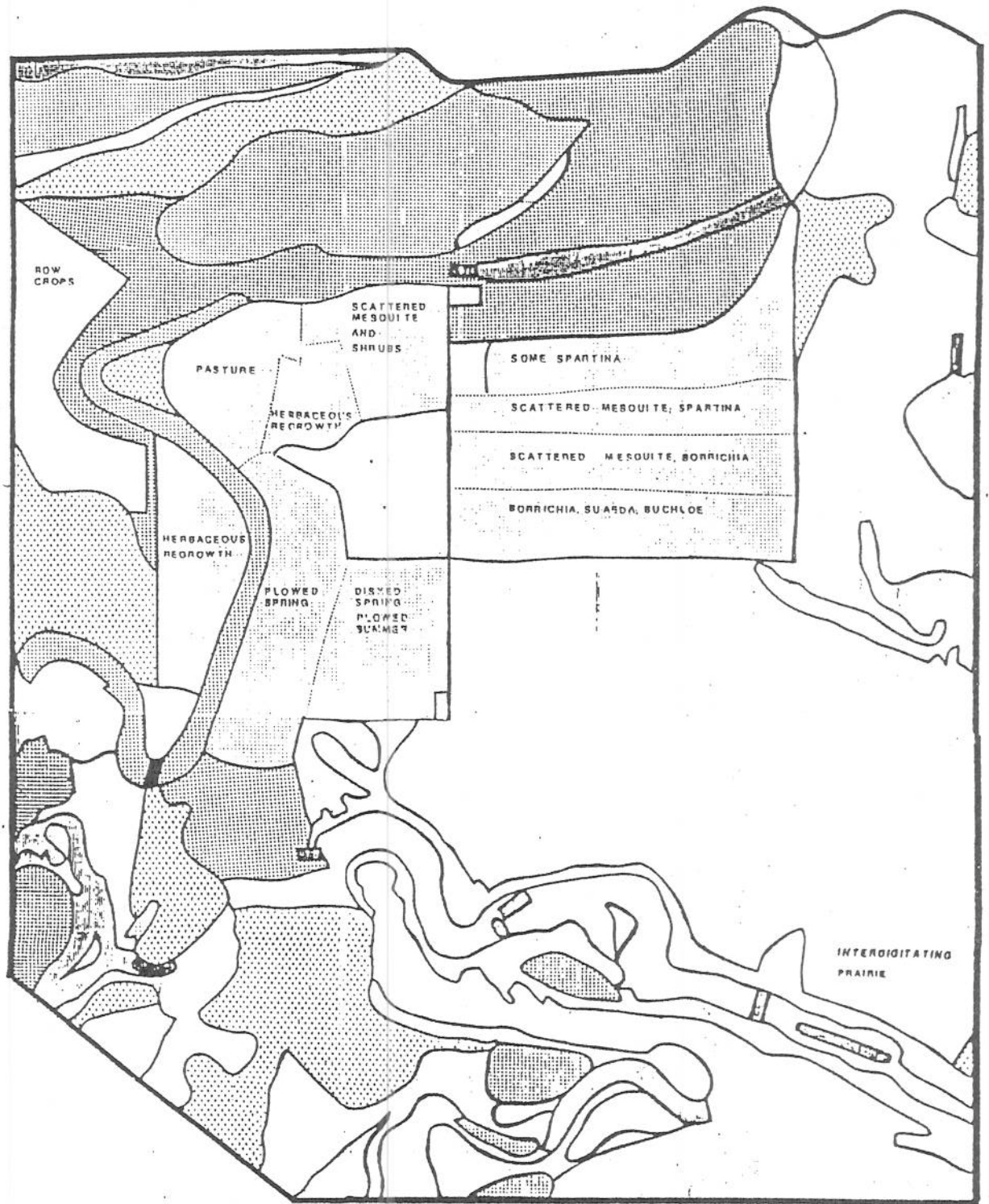
This information generally delimits areas which were brushlands (Zone C) and marshes (Zones with A designation) as well as transition zones between the two (Zone B). Historic roadways would likely have been confined to Zone C. Fifteen foot contours provide a convenient path between hills and depressions which are located in areas of vegetational transition; neither brush nor marsh. A 1939 aerial photograph shows a road trace around the east end of the northwest woodlands which passes toward Palo Alto Pond and southward along the eastern edge of Resaca de Palo Alto. One branch passes westward along the south end of the resaca system and the other is a continuation of the main road passing on either side of the curved wetlands at the extreme southwestern corner of Palo Alto. In the center of Palo Alto, lying within Lomalta Clay soil, is a water retaining swale not delineated on topographic maps. It runs generally southwest to northeast and encloses a north-south oriented cattle tank along the west side of the central roadway. It seems to lie between the curves of the 11 and 12 foot USGS contours.

Water is retained several days after heavy rains. The clay clogs the cleats of four wheel drive tires, making passage difficult or impossible in the vicinity of the N-S tank.

VEGETATION OF THE PALO ALTO BATTLEFIELD SITE

Much of the battlefield site is an inland extension of the coastal prairie with its low elevation and high salt content. This is interrupted by clay hills less than 4 meters above the lowest portions. It has been noted that sometimes only a slight change in elevation, even one or two decimeters, can affect the vegetation type. Especially noticeable is the close association

FIGURE 1: VEGETATION OF THE PALO ALTO BATTLEFIELD SITE



- | | |
|-------------------|----------------|
| Tamulipan Brush | Mesquite |
| Coastal Prairie | Huilachal |
| Sacatal | Wetlands/Tanks |
| Deciduous Prairie | Cleared Land |

of two vegetation types in the old filled-in resaca beds: The Sacatal vegetation (sacahuista) is usually located in the lowest portion, in heavy soil which exhibits wide cracks when dried out. The Coastal Prairie vegetation is immediately adjacent, in light, sandy soil which does not crack when dried. The differences in elevation are not noticeable except when water is present.

The Rio Grande has impacted the area with its meanders along the northern, western, and southern parts of the park. The resulting resacas are of different ages and various stages of change. Erosion has gradually filled in the resacas. Some still hold small amounts of water; the older ones are scarcely evident in the field but show up on aerial photos.

There is some evidence that land clearing has greatly increased the process of filling in the resacas (Farmer, 1992) (Pers. comm. Dr. Vidal Longoria, 1993). Other damage to natural landscapes has been caused by cattle ranching, land management, and by planting of row crops. Sometimes this human impact has erased evidence of the original vegetation type.

An attempt will be made to compare the present vegetation with that which existed in 1846 by analysis of existing plants and soils, old maps, historical records, and interviews with people who have intimately known this particular area for decades.

The battlefield site is characterized by eight general vegetation zones. They are not usually completely uniform in their vegetative composition; more often there are some variations within them. Transition zones between adjoining vegetative zones contain elements of both zones. The vegetative zones tend to correlate with the soil type which in turn is usually correlated with elevation.

The vegetation zones to be discussed are the following: Tamaulipan Brush, Coastal Prairie, Sacatal, Borrchia Prairie, Mesquital, Huisachal, Wetlands/Tanks, and Cleared Land.

TAMAULIPAN BRUSH

The Tamaulipan Brush occupies small portions of the western boundary, a sizable portion near the northern boundary, and some small hills near the southern boundary (Fig. 1). These are the areas of highest elevation, therefore the least saline.

This zone has probably changed very little since 1846. Cattle grazing has created disturbed areas and many dead-end trails into the brush, probably increasing the number of herbaceous plants. Fortunately, the dense thorny nature of the brush has limited inroads by cattle. In addition, extensive land clearing has reduced the total area once occupied by Tamaulipan Brush.

Following is an inventory of the plants, in alphabetical order by family. (Surprisingly, Ehretia anacua, although generally reported in Tamaulipan Brush, has not been observed.)

BLUE GREEN BACTERIA

Nostoc sp.

ACANTHACEAE

Dyschoriste crenulata Kobuski

Ruellia sp.

Siphonoglossa pilosella (Nees) Torr.

AMARYLLIDACEAE

Cooperia sp.

BORAGINACEAE

Heliotropium angiospermum Murr.

BROMELIACEAE

Tillandsia recurvata L. Ball Moss

CACTACEAE

Acanthocercus pentagonus (L.) B. & R. Night Blooming Cereus.

Echinocactus setispinus Engelm. var. setaceus Engelm.
Twisted Rib.

Echinocactus texensis Hopffer. Horse Crippler.

Echinocereus pentalophus (DC.) Rumpier. Lady Finger Cactus.

Mammillaria heyderi Muehl. var. applanata Engelm. Nipple Cactus.

Opuntia engelmannii Engelm. Texas Prickly Pear.

Opuntia leptocaulis DC. Desert Christmas Cactus.

CELASTRACEAE

Maytenus phyllanthoides Benth. Leatherleaf.

Schaefferia cuneifolia Gray. Desert Yaupon.

COMMELINACEAE

Tradescantia micrantha Torr. Spiderwort.

COMPOSITAE

Ambrosia psilostachya DC. Western Ragweed.

Aster subulatus Michx. var. ligulatus Shinnars. Hierba del
Marrano.

Bidens laevis (L.) B.S.P.

Borrchia frutescens (L.) DC. Sea Ox Eye.

Clappia suaedaefolia Gray

Erigeron tenellus DC.

Evax verna Raf. Rabbit Tobacco.

Florestina tripteris DC.

Gutierrezia texana (DC.) T. & G.

Machaeranthera phyllocephala (DC.) Shinnars. Camphor Daisy.

Parthenium hysterophorus L. False Ragweed.

Simsia calva (Engelm. & Gray) Gray. Bush Sunflower.

Thymophylla tenuiloba (DC.) Small. Parralena.

Trixis inula Crantz.

CONVOLVULACEAE

Evolvulus alsinoides L. var. hirticaulis Torr. Ojo de Vibora.

Evolvulus sericeus Sw. White Evolvulus.

CRASSULACEAE

Sedum texanum J.G. Sm. Stonecrop.

CRUCIFERAE

Lepidium austrinum Small. Peppergrass.

CUCURBITACEAE

Ibervillea lindheimeri (Gray) Greene var. lindheimeri. Globe
Berry.

EUPHORBIACEAE

Jatropha cathartica Teran & Berl. Jicamilla.
Jatropha dioica Cerv. var. dioica. Sangre de Drago. Leather Stem.

GRAMINEAE

Cenchrus ciliaris L. Buffelgrass.
Chloris cantherae Arech.
Panicum hallii Vasey
Panicum maximum Jacq. Guineagrass.
Sporobolus pyramidatus (Lam.) Hitchc.
Sporobolus virginicus (L.) Kunth. Seashore Dropseed.

HYPERICACEAE

Hypericum pauciflorum H.B.K. St. John's Wort.

KOEBERLINIACEAE

Koeberlinia spinosa Zucc.

LABIATAE

Salvia coccinea Murr. Red Sage.
Teucrium cubense Jacq.

LEGUMINOSAE

Dalea pogonathera Gray var. walkerae (Tharp & Barkl.) B.L. Turner.

Bearded Dalea.

Dalea scandens (Mill.) R.T. Clausen var. paucifolia (Colt.) Barneby.

Desmanthus virgatus (L.) Willd. var. depressus (Willd.) B.L. Turner. Senna.

Pithecellobium ebano (Berl.) C.H. Mull. Texas Ebony.
Prosopis glandulosa Torr. var. glandulosa. Honey Mesquite.
Prosopis reptans Benth. var. cinerascens (Gray) Burk. Tornillo.

LILIACEAE

Yucca treculeana Carr. Spanish Dagger.

MALVACEAE

Billieturnera helleri (Rose) Fryx.
Malvastrum americanum (L.) Torr. Malva Loca.
Rhynchosida physocalyx (Gray) Fryx.

NYCTAGINACEAE

Acleisanthes obtusa (Choisy) Standl.

OLEACEAE

Forestiera angustifolia Torr. Tanglewood.

ONAGRACEAE

Oenothera speciosa Nutt. Buttercup.

PHYTOLACCACEAE

Phaulothamnus spinescens Gray. Snake Eyes.
Rivina humilis L. Pigeon Berry.

PLANTAGINACEAE

Plantago rhodosperma Dcne. Red Seeded Plantain.

PORTULACACEAE

Portulaca pilosa L.
Portulaca umbraticola H.B.K.

RHAMNACEAE

Condalia hookeri M.C. Johnst.
Karwinskia humboldtiana (Schult. f.) Sarg. Coyotillo.

Ziziphus obtusifolia (T. & G.) Gray. Lotebush.

RUTACEAE

Zanthoxylum fagara (L.) Sarg. Colima.

SAPINDACEAE

Cardiospermum halicacabum L. Common Balloon vine

SCROPHULARIACEAE

Leucophyllum frutescens (Berl.) I.M. Johnst. Cenizo.

SIMAROUBACEAE

Castela erecta Turp. ssp. texana (T. & G.) Cronq. Goat Bush.

ULMACEAE

Celtis pallida Torr. Spiny Hackberry.

VERBENACEAE

Aloysia gratissima (Gill. & Hook.) Troncoso

Lantana macropoda Torr. Desert lantana.

Verbena bipinnatifida Nutt. Dakota Vervain.

Verbena canescens H.B.K. Gray Vervain.

Verbena officinalis L. ssp. halei (Small) Barber. Texas Vervain.

VITACEAE

Cissus incisa (Nutt.) Des Moul. Marine Ivy.

COASTAL PRAIRIE

This zone is significantly lower in elevation than the Tamaulipan Brush. This appears to be a natural zone, limiting plant types by its elevation and salt content (Fig. 1). It is often seen immediately adjacent to the Sacatal in old filled-in resaca bottoms. The two vegetation types are separated by soil type. The Coastal Prairie plants grow in light, powdery soil, and the Sacatal plants grow in heavy clay soil.

Coastal Prairie has likely not changed much since 1846. It has probably grown in area as old resaca beds are filled in, and there is also the possibility that it has grown by invading areas which have been disturbed by ranching and farming.

Coastal Prairie is characterized by more salt-tolerant plants such as Suaeda sp., Borrichia frutescens (sea ox eye), Atriplex sp., Sesuvium verrucosum, Heliotropium curassavicum (seaside heliotrope), Echinocactus texensis (horse creeper), Maytenus phyllanthoides (leatherleaf), Salsola kali (tumbleweed), Monanthochloe littoralis (shoregrass), Limonium nashii (sea lavender), and Lycium carolinianum (carolina wolfberry).

Within the Coastal Prairie are various-sized pockets containing an association of Salicornia bigelovii, Batis maritima (vidrillos), Monanthochloe littoralis (shoregrass), and Suaeda sp.. A significant amount of bare earth is visible here, and the soil is powdery when dry. These pockets are assumed to have the highest salt content, since the occupying plants are among those seen growing closest to the Laguna Madre, often in places where they are sometimes inundated by salt water.

SACATAL

The Sacatal comprises an almost pure stand of Spartina spartinae (sacahuista), with scattered Borrichia frutescens (sea ox eye). It covers a large portion of the eastern, south central, and southwestern part of the battle site (Fig. 1).

In the south central and southwestern localities, the Sacatal follows the old filled-in resaca beds, in heavy clay soil. It is usually bordered by at least a small strip of Coastal Prairie. Sea ox eye occurs here more abundantly than in the eastern locality. Sacatal forms a large prairie in the east. It interdigitates with Coastal Prairie near the eastern border, especially near the southern corner. Sacatal seems to be separated from the Coastal Prairie by soil type.

BORRICHIA PRAIRIE

Borrichia frutescens (sea ox eye) grows here in almost pure stands, but there are a few other scattered herbs. There are three examples of Borrichia prairie: One is near the western boundary, following a resaca bottom partially filled in by erosion; the other two are near the northern boundary (Fig. 1). The northern stands are near the former (now drained) location of El Tule Grande. They appear to be located where the Rio Grande changed course a number of times forming a number of resacas or possibly some larger ponds. The resacas or ponds were subsequently filled in by erosion. Although they appear to be much older than the western stand, the northern stands may not have been present in 1846. The western stand was almost surely not present in 1846. That resaca occupies a position that would be naturally filled in by accelerated erosion caused by nearby brush clearing and agricultural practices.

MESQUITAL

Several stands of Mesquite forest occur in the park. Most of them are located near the perimeter. (Fig. 1). They are interpreted as a result of land management. In a given area, the mesquites are all about the same size, with mostly grasses growing around them. There are usually no other woody plants. Probably they resulted as regrowth in cleared Tamaulipan Brush, the mesquites being allowed to grow as forage and shelter for cattle. The older stands (judged by trunk diameter) contain some elements of the Tamaulipan Brush.

HUISACHAL

Two rather narrow, elongate areas constitute the Huisachal. Both are located near the northern boundary of the park, and both

are almost pure stands of Acacia farnesiana (Huisache). Some small herbs grow in the shade of the huisaches.

One narrow band of huisaches begins at the western boundary and grows along the large canal which is the northern boundary of the park. Individual trees occasionally surmount the levee of the canal. It appears that the tree line is slowly advancing to the south, gradually broadening the band of Huisachal. In order to explain this movement, it is hypothesized that underground drainage into the canal may be slowly causing a reduction in the salinity concentration of the soil. Borrichia Prairie borders this Huisachal on the south.

The second band of huisaches begins about midpoint between the western and eastern boundaries and extends toward the eastern boundary. The trees grow along a slight depression which is the remaining evidence of a former very old resaca. These huisaches are surrounded by Tamaulipan Brush.

WETLANDS/TANKS

There are several scattered tanks which have been dug in old resaca beds (presumably for the cattle), where natural drainage brings in water and clay soils allow them to persist (Fig. 1). When rain is lacking, irrigation is used to keep water in some of the tanks. The spoil was piled on each side, providing habitat for mesquite and other plants of the Tamaulipan Brush.

The natural wetlands are located in the southern and southwestern part of the site (Fig. 1). They are small shallow portions of the old resacas. Small portions of them retain water much of the year. Before the heavy rains in June, 1993, most of the beds were dry and covered with grasses and a few shrubs. After the rains, a much greater portion of the resaca beds remained covered with water. Of particular note was the abundance of the water lily, Nymphaea elegans (July 1993) in places which were thought to be almost always dry.

Following is an inventory of plants found in the wetlands:

ALISMATACEAE

Sagittaria longiloba Engelm. Flecha de Agua.

CHENOPODIACEAE

Rumex chrysocarpus Moric. Dock.

COMPOSITAE

Pluchea odorata (L.) Cass. Stinkweed.

CYPERACEAE

Cyperus articulatus L. Chintul.

Eleocharis acicularis (L.) R. & S.

LEGUMINOSAE

Mimosa pigra L. var. berlandieri (Gray) B.L. Turner. Zarza.

Parkinsonia aculeata L. Retama.

LYTHRACEAE

Lythrum californicum T. & G. Hierba del Cancer.

MARSILEACEAE

Marsilea macropoda A. Br. Water Clover.

NYPHAEACEAE

Nymphaea elegans Hook. Blue Water Lily. Lampazos.

POLYGONACEAE

Rumex chrysocarpus Moric. Dock.

PONTEDERIACEAE

Heteranthera liebmanna (Buch.) Shinn. Water Stargrass.

SCROPHULARIACEAE

Bacopa monnieri (L.) Wettst.

SOLANACEAE

Lycium carolinianum Walt. var. quadrifidum (Dun.) C.L. Hitch.
Carolina Wolfberry.

TYPHACEAE

Typha domingensis Pers. Cat Tail.

CLEARED LAND

Much of the cleared land was formerly Tamaulipan Brush. The cleared land was used for various purposes (Fig. 1).

Row Crops occupy a portion of the extreme northwestern boundary of the battle site. Portions farther east and south were cleared and farmed in the past and are in various stages of regrowth.

There are two major areas of Herbaceous Regrowth. The largest area is located in the west-central part of the park. It has been periodically plowed and disked. Much, if not all of this was formerly Tamaulipan Brush (pers. comm. Alfred Munoz, June 1993; Dr. Vidal Longoria, July 1993). The second area is located nearby, to the northeast. It also appears to have been formerly Tamaulipan Brush. There is no dominant plant species in either locality. The plants growing here are included in the general checklist.

Pasture borders the two areas of Herbaceous Regrowth, and is similar in structure to them.

East of the largest area of Herbaceous Regrowth and separated from it by a strip of Sea Ox Eye is another large disturbed area which was plowed in the Spring of 1993.

Directly east and adjacent to the plowed area is another disturbed area which was disked in the Spring of 1993 and plowed in the Summer of 1993.

Toward the North, and slightly east of center of the park are four more large cleared areas. The northernmost one was either Tamaulipan Brush or a transition zone between Tamaulipan Brush and the Sacatal. It now consists of mesquite growth mixed with sacahuista. Directly South is a second cleared area. It was formerly a transition zone or Sacatal. The third cleared area, again to the south, was probably formerly Sacatal. It contains sea ox eye with scattered mesquite. The fourth and southernmost cleared area definitely was originally Sacatal. It is bordered on the south by the Sacatal. It contains sea ox eye, buffalo grass, and Suaeda sp. Cattle were observed grazing in

this disturbed area rather than on the adjacent lush-appearing sacahuista (after recent rains). Of the herbs present, cattle prefer first buffalo grass, then sea ox eye, and will eat young sacahuista only if there is nothing else (pers. comm. Lino Torres, Jr., June 1993).

RARE\ENDANGERED SPECIES

No plants were found which are on the list of rare or endangered plant species.

ADDENDUM I PLANTS OF PALO ALTO BATTLEFIELD SITE

BLUE GREEN BACTERIA

Nostoc sp.

ACANTHACEAE

Dyschoriste crenulata Kobuski

Ruellia sp.

Siphonoglossa pilosella (Nees) Torr.

AIZOACEAE

Sesuvium verrucosum Raf.

Trianthema portulacastrum L. Horse Purslane.

ALISMACEAE

Sagittaria longiloba Engelm. Flecha de Agua.

AMARANTHACEAE

Alternanthera polygonoides (L.) R. Br. Smooth Chaff Flower.

AMARYLLIDACEAE

Cooperia sp.

BATIDACEAE

Batis maritima L. Vidrillos.

BORAGINACEAE

Heliotropium angiospermum Murr.

Heliotropium curassavicum L. var. curassavicum. Seaside Heliotrope.

BROMELIACEAE

Tillandsia recurvata L. Ball Moss.

CACTACEAE

Acanthocereus pentagonus (L.) B. & R. Night Blooming (cereus),

Echinocactus setispinus Engelm. var. setaceus Engelm.

Twisted Rib. Hedgehog Cactus.

Echinocactus texensis Hopffer. Horse Crippler.

Echinocereus pentaloophus (DC.) Rumpler. Lady Finger Cactus.

Mammillaria heyderi Muehlenpf.

Opuntia engelmannii Engelm. var. alta (Gr.) Weniger.

Texas Prickly Pear.

Opuntia leptocaulis DC. Desert Christmas Cactus.

CELASTRACEAE

Maytenus phyllanthoides Benth. Leatherleaf.

Schaefferia cuneifolia Gray. Desert Yaupon.

CHENOPODIACEAE

Atriplex matamorenensis A. Nels. Quelite Cenizo.

Atriplex sp.

Chenopodium murale L.

Rumex chrysocarpus Moric. Dock.

Salicornia bigelovii Torr.

Salsola kali L. Tumbleweed.

Suaeda linearis (Ell.) Moq.

Suaeda tampicensis (Standl.) I.M. Johnst.

COMMELINACEAE

Tradescantia micrantha Torr. Spiderwort.

COMPOSITAE

Ambrosia psilostachya DC. Western Ragweed.

Aphanostephus ramosissimus DC.

Aster subulatus Michx. var. ligulatus Shinnars. Hierba del Marrano.

Bidens laevis (L.) B.S.P.

Borrchia frutescens (L.) DC. Sea Ox Eye.

Clappia suaedaefolia Gray

Erigeron tenellus DC.

Eupatorium incarnatum Walt.

Evax verna Raf. Rabbit Tobacco.

Florestina tripteris DC.

Gutierrezia texana (DC.) T. & G.

Helenium microcephalum DC. var. microcephalum. Sneezeweed.

Isocoma drummondii (T. & G.) Greene. Goldenweed.

Machaeranthera phyllocephala (DC.) Shinnars. Camphor Daisy.

Parthenium hysterophorus L. False Ragweed.

Pluchea odorata (L.) Cass. Stinkweed.

Senecio tampicanus DC. Butterweed.

imsia calva (Engelm. & Gray) Gray. Bush Sunflower.

Sonchus asper (L.) Hill. Sow Thistle.

Thymophylla tenuiloba (DC.) Small. Parralena.

Trixis inula Crantz.

Verbesina encelioides (Cav.) Gray. Cowpen Daisy.

Verbesina microptera DC. Frostweed.

CONVOLVULACEAE

Evolvulus alsinoides L. var. hirticaulis Torr. Ojo de Vibora.

Evolvulus sericeus Sw. White Evolvulus.

CRASSULACEAE

Sedum texanum J.G. Sm. Stonecrop.

CRUCIFERAE

Lepidium austrinum Small. Peppergrass.

Sisymbrium irio L. Rocket Mustard.

CUCURBITACEAE

Ibervillea lindheimeri (Gray) Greene var. lindheimeri. Globe Berry.

CYPERACEAE

Cyperus articulatus L. Chintul.

Eleocharis acicularis (L.) R. & S.

EUPHORBIACEAE

Jatropha cathartica Teran & Berl. Jicamilla.

Jatropha dioica Cerv. var. dioica. Sangre de Drago. Leather Stem.

GRAMINEAE

Buchloe dactyloides (Nutt.) Engelm. Buffalo Grass.

Cenchrus ciliaris L. Buffelgrass.

Chloris cantherae Arech.

Cynodon dactylon (L.) Pers. Bermuda Grass.

Dicanthium aristum (Poir). C.E. Hubb. Angleton Bluestem.

Monanthochloe littoralis Engelm. Shoregrass.

Panicum hallii Vasey.

Panicum maximum Jacq. Guineagrass.

Paspalum distichum L. Seashore Paspalum

Spartina patens (Ait.) Muhl. Saltmeadow Cordgrass.

Spartina spartinae (Trin.) Hitchc. Sacahuista.

Sporobolus pyramidatus (Lam.) Hitchc.

Sporobolus virginicus (L.) Kunth. Seashore Dropseed.

HYDROPHYLLACEAE

Nama hispidum Gray. Sandbell.

HYPERICACEAE

Hypericum pauciflorum H.B.K. St. John's Wort.

KOEBERLINIACEAE

Koeberlinia spinosa Zucc.

LABIATAE

Salvia coccinea Murr. Red Sage.

Teucrium cubense Jacq.

LEGUMINOSAE

Acacia farnesiana (L.) Willd. Huisache.

Dalea pogonathera Gray var. walkerae (Tharp & Barkl.) B.L. Turner. Bearded Dalea.

Dalea scandens (Mill.) R.T. Clausen var. panicifolia (Coult.) Barneby.

Desmanthus virgatus (L.) Willd. var. depressa (Willd.) B.L. Turner.

Mimosa pigra L. var. berlandieri (Gray) B.L. Turner. Zarza.

Parkinsonia aculeata L. Retama.

Pithecellobium ebano (Berl.) C.H. Mull. Texas Ebony.

Prosopis glandulosa Torr. var. glandulosa. Honey Mesquite.

Prosopis reptans Benth. var. cinerascens (Gray) Burk. Tornillo.

LILIACEAE

Yucca treculeana Carr. Spanish Dagger.

LYTHRACEAE

Lythrum californicum T. & G. Hierba del Cancer.

MALVACEAE

Anoda pentaschista Gray

Bastardia viscosa (L.) H.B.K. Mexican Bastardia.

Billieturnera helleri (Rose) Fryx.

Malvastrum americanum (L.) Torr. Malva Loca.

Malvastrum coromandelium (L.) Gke.

Rhynchosida physocalyx (Gray) Fryx.

MARSILEACEAE

Marsilea macropoda A. Br. Water Clover.

NYCTAGINACEAE

Acleisanthes obtusa (Choisy) Standl.
NYMPHAEACEAE
Nymphaea elegans Hook. Blue Water Lily. Lampazos.
OLEACEAE
Forestiera angustifolia Torr. Tanglewood.
ONAGRACEAE
Oenothera speciosa Nutt. Buttercup.
OXALIDACEAE
Oxalis dichondrifolia Gray. Agrito.
Oxalis stricta L. Yellow Wood Sorrel.
PHYTOLACCACEAE
Phaulothamnus spinescens Gray. Snake Eyes.
Rivina humilis L. Pigeon Berry.
PLANTAGINACEAE
Plantago rhodosperma Dcne. Red Seeded Plantain.
PLUMBAGINACEAE
Limonium nashii Small
POLYGONACEAE
Rumex chrysocarpus Moric. Dock.
PONTEDERIACEAE
Heteranthera liebmannii (Buch.) Shinn. Water Stargrass.
PORTULACACEAE
Portulaca pilosa L.
Portulaca umbraticola H.B.K.
PRIMULACEAE
Anagallis arvensis L. Scarlet Pimpernel.
RHAMNACEAE
Condalia hookeri M.C. Johnst.
Karwinskia humboldtiana (Schult. f.) Sarg. Coyotillo.
Ziziphus obtusifolia (T. & G.) Gray. Lotebush.
RUTACEAE
Zanthoxylum fagara (L.) Sarg. Colima.
SAPINDACEAE
Cardiospermum halicacabum L. Common Balloon Vine.
SCROPHULARIACEAE
Leucophyllum frutesce (Berl.) I.M. Johnst. Cenizo.
Bacopa monnieri (L.)
SIMAROUBACEAE
Castela erecta Turp. ssp. texana (T. & G.) Cronq. Goat Bush.
SOLANACEAE
Lycium carolinianum Walt. var. quadrifidum (Dun.) C.L. Hitchc.
 Carolina Wolfberry.
Solanum americanum Mill. American Nightshade.
Solanum eleagnifolium Cav. Silver Leaf Nightshade.
TYPHACEAE
Typha dominguensis Pers. Cat Tail.
ULMACEAE
Celtis laevigata Willd. Hackberry.
Celtis pallida Torr. Spiny Hackberry.
UMBELLIFERAE
Ciclospermum leptophyllum (Pers.) Sprague. Marsh Parsley.
URTICACEAE

Urtica chamaedryoides Pursh. Stinging Weed.

VERBENACEAE

Aloysia gratissima (Gill. & Hook.) Troncoso

Lantana horrida H.B.K. Calico Bush.

Lantana macropoda Torr. Desert Lantana.

Phyla nodiflora (L.) Greene. Texas Frog Fruit.

Verbena bipinnatifida Nutt. Dakota Vervain.

Verbena canescens H.B.K. Gray Vervain.

Verbena officinalis L. ssp. halei (Small) Barber. Texas Vervain.

Verbena quadrangulata Heller. Beaked Vervain.

Verbena runyonii Moldenke. Rio Grande Vervain.

VISCACEAE

Phoradendron tomentosum (DC.) Gray. Mistletoe.

VITACEAE

Cissus incisa (Nutt.) Des Moul. Marine Ivy.

GENERAL ECOLOGY OF PALO ALTO

Palo Alto National Battlefield lies in the coastal plain of southernmost Texas at a point where the short grass prairie reaches its attenuated southern limit, adjacent to the tidal flats of the Laguna Madre system.

Rainfall is approximately twenty-seven inches annually and evaporation is high. All natural aquatic habitats on site are subject to cycles of drying which produces varying water levels important to various species of wildlife.

The influence of the coastal environment is strong. There is more rainfall near the coast than immediately west of the site. While all locations on site are above tidal and wind tidal influence, occasional storms inundate the area with salt water. Paredes Line Road at the west boundary forms an indefinite but recognizable limit to coastal halophytic vegetation. This same boundary appears to represent the approximate eastern limit of Tamaulipan Brushland which is largely confined to island-like elevations of 10-15 feet or slightly greater in the park site. Both ecological associations interdigitate within the boundaries of the site.

Within the halophytic landscape are vegetation covered knolls either termed motas (= mots) or lomas (clay-based dunes). The halopytes are confined to elevations below 10' where various poorly drained saline clay soils are located. Numerous old river channels traverse the low areas. They are of various ages and many have been "recrossed" by others in more recent times. One river channel now exists as a slough on the eastern edge of the battlefield location.

Some of the more recent highwater, river activity, has isolated meanders which exist as semi-active ox bow lakes (locally called resacas) or inactive meander scars. After rains, which occur typically in spring and fall, most of the clay soils of Palo Alto are generally impassible, and water

is retained in the most recently formed resacas. One such area exists along Paredes Line road and another near the southern boundary of the site. All areas are above tidal influence except during tropical storms and hurricanes when salt water inundation may occur and helps to maintain the halophytic vegetation and influences the salinity of the resacas. The resaca proximate to the western edge of the battlefield is likely to have been periodically active before erosion filled it. It is centered in the area where agricultural use has been most intense. Row crops or pasturage surround it.

In past years, a channel was cut from the portion along Paredes Line road to this resaca.

Other than the semiaactive resacas, a series of cattle tanks have been cut within old river channels. Some quite successfully hold water throughout the year. One near the north park boundary is reputed to have been excavated below the retentive clay and must be kept filled by pumping from the nearby drainage ditch by way of a feeder canal.

The fauna of Palo Alto is unique and "crossroads" in nature. tropical and coastal species mix with temperate and desert species.

TAMAULIPAN BRUSH ASSOCIATION

Tamalipan Brush plants are thorny, small-leaved and water efficient. They grow above the influence of saline ground water on slight elevations. Significant acreage of ecologically valuable brushland exists in the northeastern portion of the site. Additional but smaller portions of brush are located throughout the site and once likely existed on all the cleared agricultural lands. In addition, brush may be found on the spoil banks from cattle tank or drainage canal excavation.

The drainage canal which forms the Northern boundary was completed in 1915 and has drained the subsoil saline water. This has allowed the spread of brushland plants onto adjacent lower elevations. This is very noticeable along the drainage ditch where a line of huisache is progressively advancing southward. In the northeastern brushlands, leaves, fruits and seeds provide food for the primary consumers.

Significant food species are prickly pear (pads and fruits) spiny hackberry (fruits) and the seeds of grasses. A large variety of insects and eastern cottontail rabbits, along with southern plains woodrats form the herbivore trophic level. Woodrats make heavy use of cactus pads and fruits and build extensive mounds of sticks, twigs and branches around the cactus bases and between mesquite trees. Their diet is exclusively vegetarian. Coyotes, bobcats and several raptors are dependent on these herbivores. Activity of Golden-fronted woodpeckers is confined to these brush areas or mesquite regrowth where they feed on insects, prickly pear and other fruits. Coyotes are omnivorous and depend heavily on mature prickly pear

fruit in mid summer. During this season the scats are made exclusively of these fruits.

Prairie and sixlined race runners are carnivorous components of the ecosystem.

Harris hawk and crested caracara appear to nest within these woodlands.

Javelina and feral hog are found here too. Chihuahuan desert species such as cactus wren, curve-billed thrasher and roadrunner are characteristic. The roadrunner is dependent on snakes, lizards, and insects. The cactus wren inhabits the denser brush areas. Mocking birds are ubiquitous throughout any brush or shrub landscapes.

White-eyed vireo and Bewick's wren are found where brush is moderately dense.

Armadillos are infrequently seen at the edges of brush areas - especially in distributed areas.

HALOPHYTIC LANDSCAPES

Broad flat salt prairies exist between resaca beds and mots. In general, both obligate halophytic associations and stands of sea ox eye and gulf cordgrass (sacahuistal) occupy these areas. The primary producers provide leaves and detritus upon which a number of herbivores depend. This is a harsh landscape and the animal associates tolerate extremes of hydration and temperature. Grasshoppers, dragonflies, and butterflies are found here along with paper wasps and other insects. The clay substrate supports exceptional numbers of fiddler crabs (Uca subcylindrica) and isopods, also herbivores.

Three species of terrestrial snails are common. The vertebrate primary consumers are sparrow species, meadowlarks and rodents.

Three species of birds and one mammal (secondary consumers) are heavily dependent on the fiddler crabs. A breeding population of willets and a wintering population of long-billed curlew use them extensively. Willets are in turn fed upon by large raptors. Horned larks show a decided interest in the crab chimneys which dot the landscape, and they actively search for the fiddler crabs. When prickly pear fruit are not available coyote scat may consist solely of fiddler crab parts. American kestrels hunt insects from fences and wires as do scissor-tailed fly catchers and loggerhead shrikes. Insectivorous horned lizards are found here as well as in the brushlands.

One species of the prairielands which deserves special consideration is Botteri's sparrow (USFWS Category 2) which is specific to and breeds within the central and southern prairies. Blacktailed jackrabbits are present on all disturbed areas, lowland prairie and intermediate habitats and do not seem to inhabit the brushlands. They are Chihuahuan Desert components of this region. Other species of vertebrates are not clearly

associated with either brush or prairie.

Black shouldered kites seem to prefer the ecotone between prairie and brushland. They use young mesquite regrowth with a substantial view of open lands over which they often hover. Two sets of long-tailed weasel tracks were found on slightly elevated areas near Arista's Hill. Over-laying tracks of a cat were also found along their course. The Weasel's diet consists of mammals, birds and eggs, as well as reptiles, amphibians and fish.

Wilson's Plover is unique in that it is a summer breeding bird on the site and is confined to the higher elevations and around tanks in the vicinity of Arista's Hill. During the early spring a large population of Savannah sparrows occupied the grassy places around the cultivated fields but were gone by summer. They are known to feed on crabs and a variety of insects. Grasses are also abundant in their diet. Mexican ground squirrels are found in diverse places and are omnivorous. Several birds are ubiquitous on the Palo Alto site. Quail, mourning dove and great-tailed grackle range throughout as do the lesser nighthawk, the common nighthawk and the common parakee (all dependent upon flying insects).

AQUATIC AND SEMIAQUATIC HABITATS

Amphibians are confined rather exclusively to tank and resaca locations. Their highly permeable skin and the absence of mechanisms for osmoregulation in saline environments preclude their presence in most of the areas. Only the gulf coast toad and Couche's spadefoot toad were found within the woodlands some distance from standing water, and only nocturnally.

Ten species of fish were identified from the tank north of Arista's Hill. All are euryhaline species, which may also be found in coastal salt water marshes with the exception of the bluegill which is freshwater.

1. Rio Grande Cichlid
2. Sailfin Molly
3. Bluegill
4. Striped Mullet
5. Inland Silversides
6. Mexican Tetra (Caracin)
7. Gulf Killfish
8. Mosquito Fish
9. Fat Sleeper
10. Sheepshead Minnow

Where standing water is present, herons, egrets, curlews, white-face ibis and willets can be found. Mottled ducks appear to breed here in summer and other ducks such as American widgeon it in winter. Black-bellied whistling ducks are more numerous and are particularly noticeable during summer as they return to roost sites near water. They also appear to breed on the site. The freshwater tanks which support cattails are populated with

numerous red-wing blackbirds.

SPECIES WHICH DESERVE SPECIAL ATTENTION

Two white-tailed hawks (threatened species) inhabit the woodlands west of the battlefield. They are likely to be a mated pair which has been here for at least two seasons (Farmer, 1992). They have been seen soaring over all parts of the site, and on the ground in the Longoria fields.

Botteri's sparrow arrived at the battlefield site and south prairie areas 22 March (Farmer, pers com, 1993), almost coincident with the departure of savannah sparrows in nearby areas. Their breeding calls were frequent and persisted throughout June. In July a new call was added which is likely to be associated with nesting. Their preferred habitat is either sacahuistal or prairies with some taller shrub growth, peripheral to sacahuistal. The males call from short shrubs or tall herbs and fences. In August they were still visible but notably quieter.

Aplomado Falcon - one lone specimen from a population of captive-bred birds was visually tracked by Tyland Dean during the Spring of 1992 in the Port of Brownsville area which lies within sight of the eastern edge of the Palo Alto site. It is possible that during March and April this bird was present on Palo Alto. Short glimpses at a distance revealed a dark back, some rufous coloration underneath and a decided penchant for hovering over open fields in the area east and south of the Dr. Longoria plowed field. Hector (1987) noted that F.B. Armstrong's egg sets (collected between 1890 and 1914 around Brownsville) account for no less than 67% of all U.S. egg sets of the Aplomado Falcon and that in the 1920, R.D. Camp took a number of Aplomado Falcons from Palo Alto Prairie. Camp also collected egg sets between 1923 and 1928. Hector concluded that the preferred habitat of the Aplomado Falcon was coastal prairie with scattered yuccas and mesquites and the greatest expanse of coastal prairie at the time of Armstrong's collecting activities stretched north from Brownsville. Appropriate habitat appears to exist on Palo Alto and consideration needs to be given to participation in their recovery plan.

VERTEBRATE FAUNA OF PALO ALTO BATTLEFIELD NATIONAL HISTORIC SITE

Fish

Class Osteichthyes - Bony Fishes
Order Cypriniformes (Ostaropysi)

Characidae - characins and tetras
Mexican tetra - Astyanax mexicanus (Filippi)

Order Cyprinodontiformes (Microcyprini)

Cyprinodontidae - Killifishes
Sheepshead minnow - Cyprinodon variegatus (Lacepede)
Gulf killifish - Fundulus grandis (Baird and Girard)

Poeciliidae - livebearer
Mosquitofish - Gambusia affinis (Baird and Girard)
Sailfin molly - Poecilia latipinna (Le Sueur)

Centrarchidae - sunfishes
Bluegill - Lepomis macrochirus (Rafinesque)

Cichlidae - cichlids
Rio Grande perch - Cichlasoma cyanoguttatum (Baird and Girard)

Eliotridae - sleepers
Fat sleeper - Dormitator maculatus (Bloch)

Mugilidae - mullets
Striped mullet - Mugil cephalus (Linnaeus)

Atherinidae - silversides
Inland silverside - Menidia beryllina (Cope)

Amphibian and Reptiles

Turtles
Order Testudines
Musk and Mud Turtles
Family Kinosternidae
Yellow mud turtle - Kinosternon flavescens flavescens

Cooters, Sliders, and Their Allies

Red-eared turtle - Trachemys scripta elegans
Gopher Tortoises
Family Testudinidae
Texas tortoise - Geochelone berlandieri

Softshell Turtles
Family Trionychidae
Texas spiny softshell - Apalone spinifer emoryi

Lizards
Order Squamata

Suborder Lacertilia

Spiny lizards

Genus *Sceloporus*

Rosebelly Lizard - *Sceloporus variabilis marmoratus*

Texas spiny Lizard - *Sceloporus olivaceus*

Horned Lizards

Genus *Phrynosoma*

Texas horned Lizard - *Phrynosoma cornutum*

Whiptails

Family Teiidae

Rairie Racerunner - *Cnemidophorus sexlineatus viridis*

Texas spotted whiptail *Cnemidophorus gularis gularis*

Snakes

Order Squamata

Suborder Serpentes

Colubrids

Family Colubridae

Diamondbak Water Snake - *Nerodia rhombifer rhombifer*

Garter, Ribbon, and Lined Snakes

Genera *Thamnophis* and *Tropidoclonion*

Gulf coast Ribbonsnake - *Thamnophis proximus orarius*

Racers and Whipsnakes

Genera *Coluber* and *Masticophis*

Mexican Racer - *Coluber constrictor oaxaca*

Speckled Racer and Indigo Snakes

Genera *Drymobius* and *Drymarchon*

Texas Indigo Snake - *Drymarchon corais erebennus*

Patch-Nosed Snakes

Genus *Salvadora*

Texas Patch-Nosed Snake - *Salvadora grahamiae lineata*

Family Viperidae

Pit Vipers - Subfamily Crotalinae

Rattlesnakes: Genera *Sistrurus* and *Crotalus*

Western Diamondback Rattlesnake - *Crotalus atrox*

Toads and Frogs

Order Anura

Spadefoot Toads

Family Pelobatidae

Couch's Spadefoot - *Scaphiopus couchi*

Tropical Frogs

Family Leptodactylidae

Rio Grande Frog - Syrhophus cystignathoides campi

Toads

Family Bufonidae

Gulf Coast Toad - Bufo valliceps

Chorus Frogs

Genus Pseudacris

Spotted Chorus Frog - Pseudacris clarki

Narrow-mouthed Toads

Family Microhylidae

Great Plains Narrow-Mouthed Toad - Gastrophryne olivacea

True Frogs

Family Ranidae

Leopard and Pickerel Frogs

Rana pipiens and Its Relatives

Rio Grande Leopard Frog - Rana berlandieri

Birds

Status at Palo Alto:

1. Permanent Resident
2. Breeding Summer Resident
3. Breeding Winter Resident
4. Non-breeding Winter Resident
5. Transient or Migratory

Podicipedidae - Grebes

Least grebe - Tachybaptus dominicus(1)

Pied-billed grebe - Podilymbus podiceps(1 or 4)

Phalacrocoracidae - Cormorants

Double-crested cormorant - Phalacrocorax auritus(1 and 4)

Ardeidae - Herons and Bitterns

Great blue heron - Ardea herodias(1 or 4)

Little blue heron - Egretta caerulea(1 or 4)

Great egret - Casmerodius albus(1 or 4)

Snowy egret - Egretta thula(1 or 4)

Cattle egret - Bulbulcus ibis(1 or 4)

Tricolored heron - Egretta tricolor(1)

Yellow-crowned night-heron - Nycticorax violaceus(1 or 4)

Threskiornithidae - Ibises and Spoonbills

White-faced ibis - Plegadis chihi(1 or 4)

White ibis - Eudocimus albus(1)

Anatidae - Swans, Geese, and Ducks

Black-bellied whistling-duck - Dendrocygna autumnalis(1 or 2)

Mottled duck - Anas fulvigula(1)

Blue-winged teal - Anas discors(4 or 1)

American wigeon - Anas americana(4)

Hooded merganser - Lophodytes cucullatus (4)

Cathartidae - Vultures

Turkey vulture - Cathartes aura(1 or 4)

Accipitridae - Hawks, Eagles, and Kites

Black Shouldered kite - Elanus caeruleus(1)

White-tailed hawk - Buteo albicaudatus(1)

Red-tailed hawk - Buteo jamaicensis(1 or 4)

Swainson's hawk - Buteo swainsoni(2)

Harris hawk - Parabuteo unicinctus(1)

Northern harrier - Circus cyaneus(4)

Falconidae - Falcons

Crested caracara - Polyborus plancus(1)

American kestrel - Falcon sparverius(4)

Merlin - Falco columbarius (4)

Cracidae - Guans and chachalacas

Plain chachalaca - Ortalis vetula(1)

Phasianidae - partridges, Quails, and Pheasants

Northern bobwhite - Colinus virginianus(1)

Rallidae - Rails and Gallinules

King rail - Rallus elegans(1 or 4)

Clapper rail - Rallus longirostris(1)

Charadriidae - Plovers

Killdeer - Charadrius vociferus(4 or 1)

Wilson's plover - Charadrius wilsonia(2)

Scolopacidae - Sandpipers

Long-billed curlew - Numenius americanus(4 or 1)

Lesser yellowlegs - Tringa flavipes(4 or 1)

Greater yellowlegs - Tringa melanoleuca(4 or 1)

Willet - Catoptrophorus semipalmatus(1)

Recurvirostridae - Avocets and Stilts

Black-necked stilt - Himantopus mexicanus(1)

Laridae - Gulls and Terns

Laughing gull - Larus atricilla(1)

Least tern - Sterna antillarum(2)

Columbidae - Doves and Pigeons

- Mourning dove - Zenaida macroura(1)
White-winged dove - Zenaida asiatica(2)
Inca dove - Scardafella inca(1)
Common ground-dove - Columbina passerina(1)
White-tipped dove - Leptotila verreauxi(1)

Cuculidae - Cuckoos, Anis, and Roadrunners

- Yellow-billed cuckoo - Coccyzus americanus(2)
Groove-billed ani - Crotophaga sulcirostris(1)
Greater roadrunner - Geococcyx californianus(1)

Tytonidae - Barn Owl

- Common barn owl - Tyto alba(1)

Strigidae - Owls

- Eastern screech-owl - Otus asio(1)

Caprimulgidae - Goatsuckers

- Common nighthawk - Chordeiles minor(2)
Lesser nighthawk - Chordeiles acutipennis(2)
Pauraque - Nyctidromus albicollis(1)

Picidae - Woodpecker

- Golden-fronted woodpecker - Melanerpes aurifrons(1)
Ladder-backed woodpecker - Picoides scalaris(1)

Tyrannidae - Tyrant Flycatchers

- Scissor-tailed flycatcher - Tyrannus forficatus(2 or 1)
Eastern kingbird - Tyrannus tyrannus(5)
Couch's kingbird - Tyrannus couchi(4 or 1)
Great kiskadee - Pitangus sulphuratus(1)
Brown-crested flycatcher - Myiarchus tyrannulus(2)

Alaudidae - Larks

- Horn lark - Eremophila alpestris(1)

Hirundinidae - Swallows

- Purple Martin - Progne subis(2)
Cliff swallow - Hirundo pyrrhonota(5 OR 2)

Corvidae - Crows and Jays

- Chihuahuan raven - Corvus cryptoleucus(1)

Paridae - Titmice, Verdins, and Bushtits

- Tufted or Black-crested titmouse - Parus bicolor atricristatus(1)

Troglodytidae - Wrens

- Cactus wren - Campylorhynchus brunneicapillus(1)
Bewick's wren - Thryomanes bewickii(2 or 1)

Mimidae - Mockingbirds and Thrashers

Long-billed thrasher - Toxostoma longirostre(1)
Curve-billed Thrasher - Toxostoma curvirostre(1)
Northern mockingbird - Mimus polyglottos(1)

Laniidae - Shrikes

Loggerhead shrike - Lanius ludovicianus(4 or 1)

Vireolaniidae - Vireos

White-eyed vireo - Vireo griseus(1 or 4, 2)

Emberizidae - Warblers and Sparrows

Blackburnian warbler - Dendroica fusca(5)

Cardinal - Cardinals cardinalis(1)

Pyrrhuloxia Cardinalis sinuatus (1)

Olive sparrow - Arremonops rufivirgatus(1)

Savannah sparrow - Passerculus sandwichensis(4)

Lark sparrow - Chondestes grammacus(4 or 1)

Botteri's sparrow - Aimophila botterii(2)

Icteridae - Blackbirds and Orioles

Bronzed cowbird - Molothrus aeneus(1 or 4)

Great-tailed grackle - Quiscalus mexicanus(1)

Northern oriole - Icterus galbula(5)

Red-winged blackbird - Agelaius phoeniceus(1)

Eastern meadowlark - Sturnella magna(1 or 4)

Mammals

Edentates

Order Edentata

Nine-banded armadillo - Dasypus novemcinctus

Pikas, Rabbits, and Hares

Order Lagomorpha

Rabbits and Hares

Family Leporidae

Eastern cottontail - Sylvilagus floridanus

Black-tailed jack rabbit - Lepus californicus

Rodents

Order Rodentia

Squirrels

Family Sciuridae

Mexican ground squirrel - Spermophilus mexicanus

New World Rats and Mice

Family Cricetidae
Southern plain woodrat - Neotoma micropus

Carnivores
Order Carnivora
Dogs Family Canidae
Cats Family Felidae
Coyote - Canis latrans
Bobcat - Lynx rufus

Raccon, Rigtail, and Coati
Family Procyonidae
Raccoon - Procyon lotor

Old World Swine
Family Suidae
Wild boar - (Feral Hog) - Sus scrofa

Peccaries
Family Tayassuidae
Collared peccary "Javelina" - Dicotyles tajacu
Exotic Mammal Species: Nilgai - Boselophus tragocamelus (probably strays from South Texas game ranches)

Effects on the Landscape as a Result of Recent Human Activity

1. CAMERON COUNTY DRAINAGE DITCH #2

Interviews, aerial photographs and maps gain (maps 1-7) were used to obtain the following information:
The drainage ditch forms the northern boundary of the Palo Alto site. Right-of-way was granted to Cameron County Drainage District #1 on 13 April, 1912. It appears to have been completed in 1915 and drains into Lake San Martin. The predominant observable effect is an advancing tree line into the flat area adjacent to the spoil bank. The advancing vegetation encroaches into the southeastern edge of El Tule Grande. This appears to be the direct effect of subsoil drainage lowering the saline water table by draining soil salts, or perhaps by erosion of the spoils onto the adjacent fields.

When the water table is close to the surface (low areas) surface evaporation, along with capillarity, allow saline water to percolate to the surface.

Both the draining of El Tule Grande and the construction of Cameron County Drainage Ditch #2 were done by the Ballinger Construction Company.

El Tule Grande is reported to have been used for growing melons for a few years after it was drained.

PIPELINE

A natural gas pipeline passes diagonally (NW to SE) across the entire Palo Alto site, subsurface. Easement was granted to Carthage Hydrocol, Inc. 7 April, 1949 for supplying Stanolind Corporation, the predecessor of Union Carbide at the Port of Brownsville. It appears to have little effect on the vegetation composition.

3. EL TESORO RANCH (THE TREASURE)

Milton E. Wentz purchased the property, once a part of the Espiritu Santo Land Grant, (now identified as that owned by Emilio Sanchez and leased to Lynn Anderson) from the Martha Dana Mercer Trust in 1960 [Old Colony Trust of Boston, now First National Trust]. It had been used for dairy cattle pasturage for many years before he acquired it.

Milton E. Wentz, Jr. recounts that it was inundated by storm surge from an unnamed hurricane in 1933 and Hurricane Beulah in 1967 when two feet of water covered FM 511, and the "flats" were covered to a similar depth.

In the late 1920's and 30's the army from Fort Brown "declared war" on the burros of "Jackass flats" using shells with timing devices which contained small balls. Wentz also reported that A.A. Champion called Artista's Hill Echavarria Mot.

In the early 60's Wentzes cut senderos into the northeastern Tamaulipan Brush and dug a cattle tank on both sides of the road in the area. Only the one on the east side is maintained as a tank by pumping from the drainage ditch into a channel system. In the northwestern area, now drained by the drainage ditch on the north, a series of concentric areas were plowed and planted with African Star Grass, a form of Bermuda grass. The endeavor was unsuccessful.

The central roadway was put in by Milton E. Wentz, Sr. It is not present on a 1962 aerial photograph. The Wentz family also plowed strips into the sacahuistal in the east-central portion. Again, the area was planted with African Star Grass. This was also unsuccessful.

One area which was plowed completely and planted with African Star Grass lies contiguous to these strips. This endeavor was more successful sustaining the grass for 6 or 7 years until it declined during the drought of the late 20's. Much of the area which lies at the southeast corner and that which lies between the southern resaca and the current roadway were deep plowed to a depth of 12" but not planted. There seems to have been no persistent effect.

The use of the land for cattle grazing must have kept the native grasses low, reduced fires and allowed young brush plants to get started by seeding from adjacent Tamaulipan Brush on the

more elevated areas. In 1972 it was sold to James L. Brockie, an airline pilot, who sold it to the Sanchez Trust, 12 January, 1976.

4. CONTROLLED BURNING

During dry seasons, areas of Sacahuiste (Spartina spartinae), whether pure or with small mesquites, and yucca are burned. The fires burn hot and fast and die out at roads or other vegetational breaks. The new shoots are used for grazing. As a last resort cattle use mature sacahuiste but it cuts their mouths, forms callus inside, and erodes teeth. The young growth is more desirable.

Local ranchers allow 10-15 acres of burn per head and do not burn more than needed at any one time.

In general, cattle prefer native grasses of the coastal prairie and those grasses which have been introduced:

- | | |
|--------------------|------------------------|
| a. Johnson | d. Buffel |
| b. Coastal Bermuda | e. Blue Panicunn |
| c. African Star | f. Angleton (seasonal) |
| g. Sudan | |

In addition, cattle graze on Sea Oxeye and browse on mesquite beans and to a lesser degree, the leaves.

5. TREASURE HUNTING

Milton E. Wentz, Jr. recounted the legend that general Arista's payroll wagon was driven into a hole of quicksand, mules and all.

In the late 60's a water-well contractor from Mercedes asked for and received a contract from the senior Wentz to search on Arista's Hill. The contractor and his son camped on the site in a tent and dug down 10-15 feet by hand before the excavation collapsed. A year or two later a second contract of 30 days was granted. He used well drilling bits to excavate to a depth of 50-60' and reported finding a wagon wheel rim and spokes, as well as gold shavings and a piece of leather with a Mexican insignia. Suddenly, he disappeared. Repeated efforts to contact him were unsuccessful and he has not continued to drill wells in the Mercedes area. Evidence of excavation and rusting machinery is still evident near the roadway on Arista's Hill.

Dr. Vidal Longoria reported that he arrived at his property one morning about (1985 or 1987) to find that 200 holes, between 2 and 4' wide, had been dug northwest and south of his pond (Palo Alto Pond), evidently with a backhoe. A 30' wide cut had been made in one of his fences presumably to move in machinery.

6. THE VIDAL LONGORIA RANCH

Between approximately 1920 and the late 1960's Armando

Martinez and his wife Santo lived within the north meander of the western resaca. Except for the small area where the house, barn, goat corral and water well were located, the area east toward Palo Alto Pond was heavily wooded. A covered cock-fighting ring was set into the edge of the woods (Alfredo Munoz, pres. comm, 1993) In addition to goats, raised for sale as cabrito, chickens and a few cattle were present. The mesquite trees were reported to be very large in the 1950's. A trail passed alongside the resaca from a gatehouse located near the present south Paredes Line Road gate. The Martinez Family owned approximately 175 acres. He died in the late 60's in the "field" along the west edge of the resaca on a cold night. Dr. Vidal Longoria is reported to have purchased the property in the 1970's and the family house was removed. Dr. Longoria reports light brush (regrowth) existed in the field west of the resaca. Dr. Vidal Longoria made several modifications to the landscape.

1. A tank was cut into the southeastern portion of Palo Alto Pond. While it was able to hold substantial water (neck deep on Dr. Longoria about 1973), it has silted to three feet deep from the adjacent agricultural fields. It became dry for the first time in 1992.
2. East of Palo Alto Pond (and west) he used a bulldozer to clear "alleys" through the brush, leaving strips of vegetation, and planted Giant Bermuda grass (NK 37). Some brush piles remain nearby but other brush was pushed northward to the resaca edge.
3. He cleared brush in the extreme southern portion of his property but did not maintain it. Mostly mesquite has regrown. He reported finding 40 "steel" cannonballs in the area.
4. The first land cleared was 110 acres for growing cotton, presumably east of the resaca where a cannon was found in 1978. Later, he had 200 additional acres cleared. He also closed off the south end of the resaca to allow access to the field west of the resaca.
5. He also "cut in" the N-S tank and dug canal with lateral "feeder" channels to its southwestern corner. In addition, he dug the ditch along the west side of the central roadway from the tank to a point east of Palo Alto Pond, and then to the pond, to fill it with tank overflow after rains.

Joe Collingsworth of Los Fresnos, who has lived and worked in the area all his life, reported this tank provided fill to build up adjacent the road and that cattle tanks are evaluated by how many days (30-45, 60 etc.) they hold water for 100 cattle. He also reported that during the 1950's the resaca portion near Paredes Line Road was dug out (deepened) for water storage and a canal was built along the west side of the resaca to fill areas on the north. He has also concluded that the 1933 Hurricane storm surge so completely inundated the area that the grassy coastal prairie (less salty) declined and halophytic vegetation has replaced it.

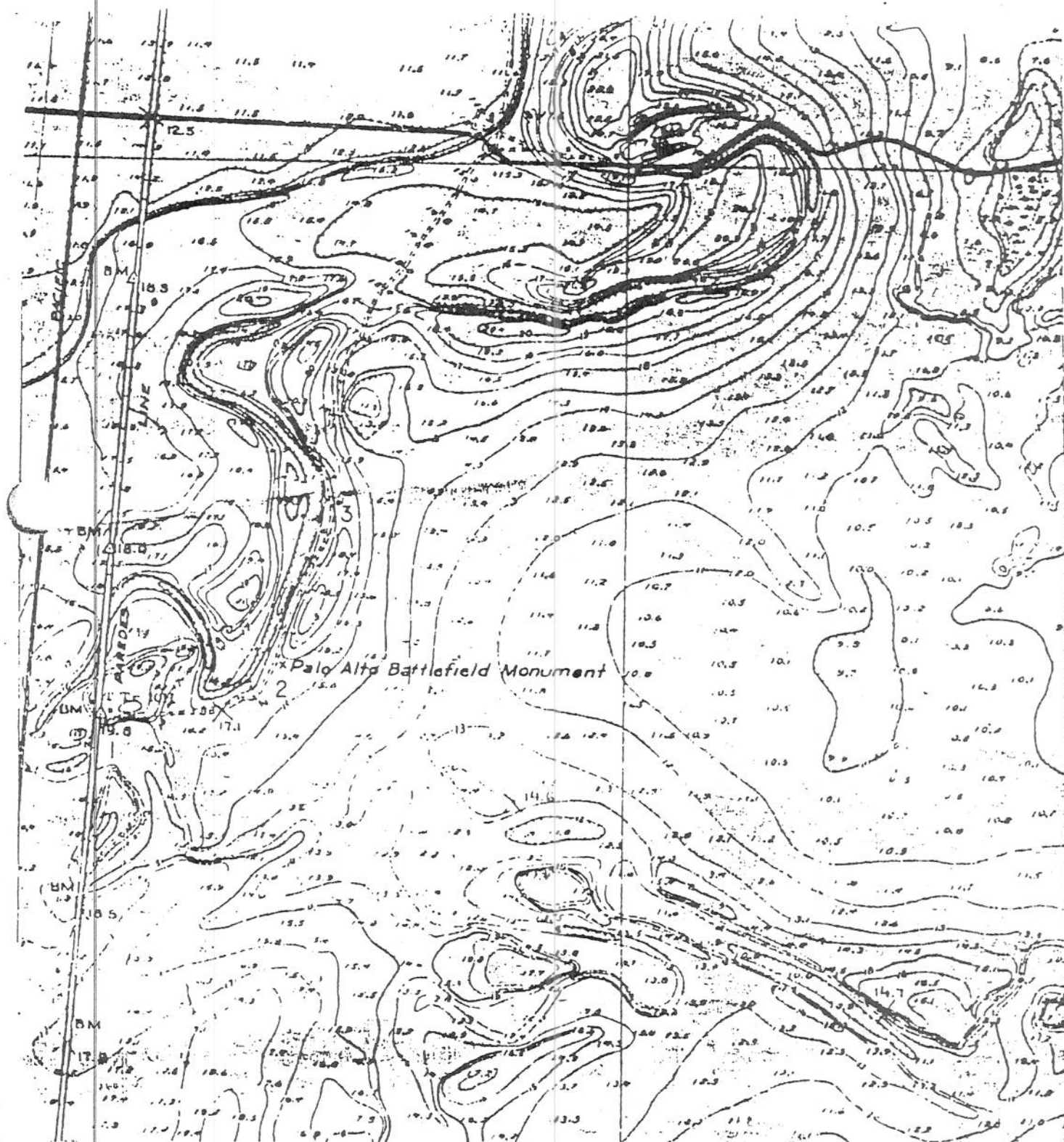
This and the close cropping of cattle may account for the paucity of native grasses on most Palo Alto landscapes.

MAP 1.

Source: United States Geological Survey, 1930 Survey

Features:

1. Small Dwelling Near South Highway 1847(Paredes Line Road) Gate.
2. Palo Alto Battlefield Monument East of Resaca.
3. Unimproved Road Following Eastern Edge of Resaca.



MAP 2a.

Source: Walter Plitt Archives- 1939 Aerial Photograph

Features:

1. Trail Around Eastern Edge of Tamaulipan Brush-Southwest
Toward Palo Alto Pond and Resaca.
2. Trails Crossing An Old Resaca Bed East of Arista's Hill.
3. Suggestion of Brush East of Resaca.
4. Ecotone Extending Between Tamaulipan Brush and Sacahuistal
and Halophytic Prairie.
5. Meander Accretion Curves With Tamaulipan Brush.

MAP 2a.



12-10-39

MAP 2b.

Features:

1. Accretion Curves Covered With Tamaulipan Brush West of Palo Alto Pond.
2. Retention of Water in Southeastern and Western Resacas and at Southwestern Meander.
3. Series of Traces in Southwestern Portion.
4. Possible Marsh in Central Sacahuistal.
5. Possible Small Traces West and South of West Resaca System.

12-10-38

001



MAP 3a.

Source: Milton E. Wentz Jr.-Aerial Photograph CG1-11AA-113,
(9 February, 1962).

Features:

1. Absence of Central Roadway Around Resaca.
2. Trees Appear to Line Resaca Course North and East From Arista's Hill.
3. Possible Scattered Brush East and Southeast of Resaca.
4. Apparent Trail Running North/South East of Resaca.



Map 3b.

Source: Milton E. Wentz Jr.-Aerial Photograph CG1-11AA-113
(9 February, 1962).

Features:

1. Cut for Natural Gas Pipeline.
2. Possible Scattered Brush Adjacent to Pipeline.



MAP 4.

Source: Milton E. Wentz Jr.-An Enlarged Additional Portion of Map 3

1. Fenclines Appear to be Present, Running East and South From the Southeast Corner of the Northeastern Tamaulipan Brush.
2. Some Scattered Brush Appears to be Present East of the Greatest Tamaulipan Brush Concentration.

MAP 4



Map 5.

Source: Milton E. Wentz Jr.- Aerial Photograph, Likely
CG1-3KK-142(25 October, 1968)

1. Row Cropping North, West, and East of Resaca
2. Brush Clearing With Windbreaks Remaining or Grass Planting Between Them Around Northwest Meander.
3. All Cattle Watering Tanks in Place.
4. Strips Cut Into the Sacahuistal for Planting African Star Grass.
5. Plowing Effects At North Edge of Sacahuistal.
6. Roads delineating Management Sections. Central Road Complete.
7. Fencerows In Place.
8. Senderos Cut Into Northeastern Tamaulipan Brush.
9. Location of Pipeline Evident.

MAIN DRAINAGE OUTLET CCDD#1

PAREDES LINE ROAD

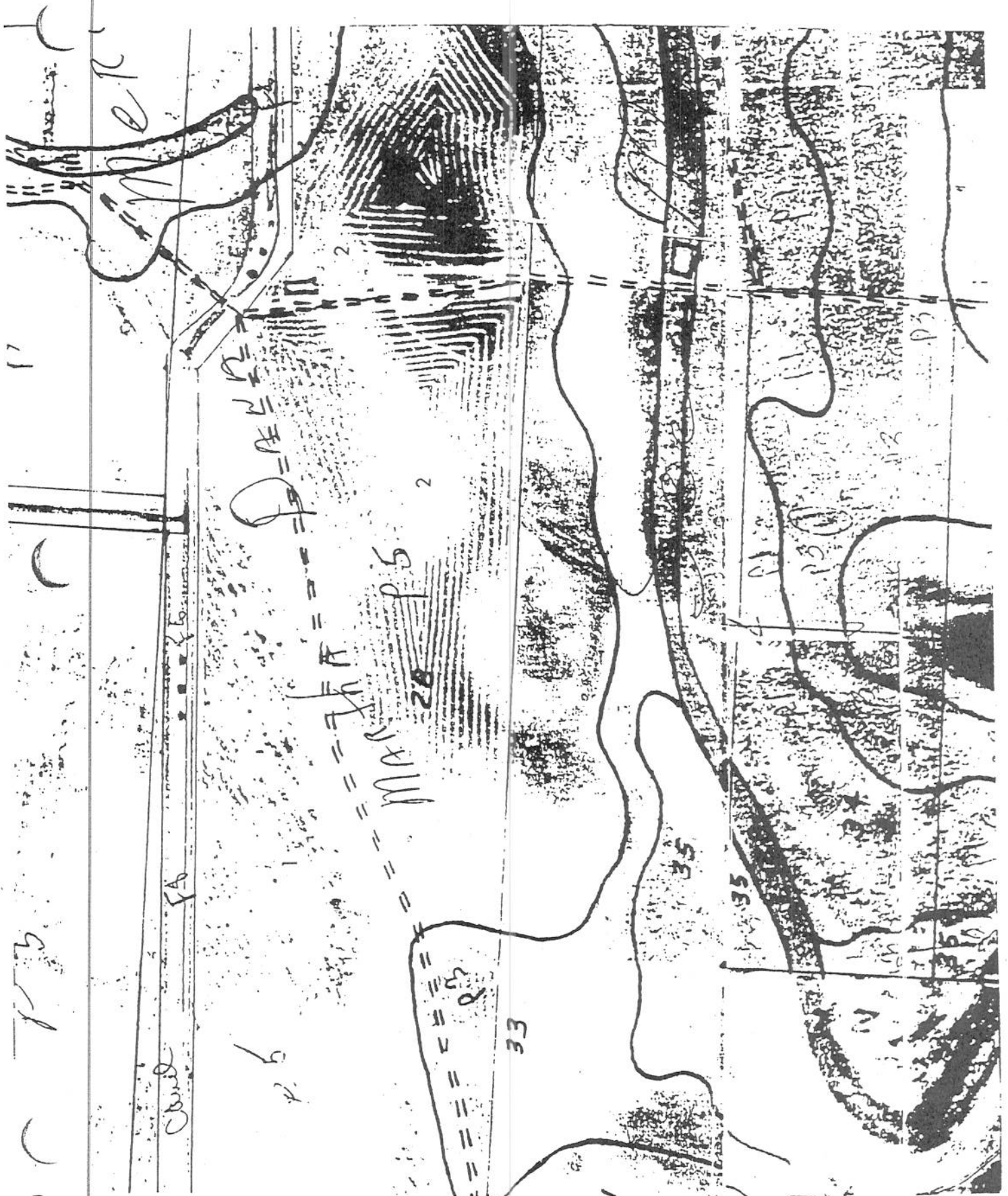


MAP 6.

Source: United States Agricultural Stabilization and Conservation
(GCT-11AA-109); First Draft March, 1965 and Last Draft
May, 1969.

Features:

1. Apparent Row Cropping in Northwest Corner-North of Roadway.
2. Concentric Plowing South and East of Roadway Prepared for
Planting African Star Grass.



Map 7.

Source: Jim Holdar Engineering (Cameron County Drainage District)-
United States Department of Agriculture(48061-175-109R
and 110R), 1975 Aerial Photograph.

Features:

1. Brush Clearing Completed West of Palo Alto Pond.
2. Brush(chaparral) Succession West and North of Resaca System.



MAP 7

THE HISTORIC LANDSCAPE

In 1840 George W. Bonnell wrote

"After passing the Wild Horse desert, there is but little variation in the land south of it until you reach the Rio Grande. It is all a musquit prairie country, of great fertility, but nearly destitute of timber, except musquit and live oak, which grows in great abundance in some places. In this country the prickly pear, and most of the species of cactus, reach extraordinary size. That, and the miga, which is a species of the aloe, are the two most magnificent plants on earth. Here the prickly pear reaches a height of fifteen or twenty feet, and in the spring, when covered all over with its white, yellow and deep crimson flowers, it is difficult to conceive of a more beautiful sight.

The miga is a plant not less interesting. It is composed of a great number of leaves which spring out of the ground like the leaves of the flag. They are generally an inch and a half in thickness from twelve to sixteen inches width and twelve feet long. From the center of those leaves springs up a stem from eighteen to thirty feet in height, which from six feet above the ground throws off branches of twelve and eighteen inches in length to the top of the stem.

In the spring of the year, this stem and its branches are covered with a solid mass of large white flowers.

The Spanish palmetto, also reaches an extraordinary height and beauty. These plants and the thousand varieties of nameless, beautiful shrubbery, and the more unobtrusive flowers which carpet the prairie, render this one of the most interesting countries of the world. There are also great varieties of wild fruits of an exquisite flavor to be met with in this country."

Bonnell must have been describing Opuntia lindheimeri, Agave americana (century plant, maguey) and Yucca treculeana as well as Tamaulipan Brushland species. Live oak (Quercus virginiana) occurs in Willacy County but usually not in Cameron County. Captain E. Kirby Smith (Smith, 1917) began describing regional vegetation as he moved toward the Rio Grande River with Zachary Taylor in March of 1846 while traveling from Corpus Christi. Upon leaving Corpus Christi he noted that the prairie was "sprinkled with "mots" (Mexican vernacular) of stunted timber." He also noted that near the Nueces river the Spanish bayonet was in full bloom. "The plant towers to a gigantic size, the shaft or body like the palmetto running up some ten or fifteen feet, from six to ten inches in diameter, crowned with a cluster of glossy green bayonets radiating in very direction from the center of which, and towering several feet above all, is a glorious pyramid of white flowers hanging in clusters or [on] lateral branches from the main stem. These are visible for many miles on

the open prairie".

He, like Bonnell, was impressed by the Century Plant (Agave americana) which he called the Spanish Bayonet. On the 23rd of March after breaking camp twenty eight miles north of Matamoros, he traveled 12 miles before encamping in a deep ravine. The location may have been perhaps 4 miles north of Palo Alto. "The country was beautiful during the whole day, the ground clothed with flowers which at the North are rare exotics. Many varieties of cactus were budding and blossoming around us, from giant prickly pear to a diminutive little fellow just poking his thorny nose through the soil crowned with a brilliant blossom. I know the names of but a few of this numerous family. The Turk's head is perhaps the most beautiful we have seen, presenting a semisphere only above the ground the size of a tolerably large watermelon while on the apex is a crown of brilliant feather-petalled blossom."

As did Smith, he noted giant prickly pear like those of the Tamaulipan Brushlands at Palo Alto. In addition, he accurately described the cactus known locally as horse crippler (Echinocactus texensis).

Judging by his letter of 24 March the former location becomes less definite "we crossed the road from Matamoros to Point Isabel, at a place we supposed [to be] about ...eighteen miles from the city [Matamoros]. "While at the Rio Grande opposite Matamoros he wrote that on the 8th of May "the enemy were in great force in our front some two miles." He also reported stopping at some ponds..."all getting a refreshing drink" and wrote that later in the evening "The prairie was burning brilliantly between the two armies..." These are his only clues on the nature of the Palo Alto battlefield.

In 1851 Abbe Domenech wrote: "The route from Isabella Point of Brownsville lies for some distance along the bay; then turning to the left it enters a vast marshy plain, indented with natural salt-pits, and often presenting the phenomenon of the mirage. This plain at its north-western extremity joins that of Palo-Alto in which was fought the first battle between the Americans...and the Mexicans." (Del Weniger, 1984)

Also while traveling in the area he wrote: "We then passed over glades and prairies where the earth was so light and soft that sometimes it gave way under our horses feet. The rancheros call these **tierras falsas** (treacherous grounds): after rain they are very dangerous; man and horse sometimes sink and disappear in them, as in shaking prairies.

Del Weniger suggests the possibility of old resacas, choked with partially decayed plant material, as a possible explanation.

In November of 1851 Abbe Domenech described an idyllic resaca (ox-bow lake): "...we reached the banks of a large resaca of limpid transparency. It formed an oval regularly-shaped lake, skirted, as though by a frame-work with palm trees, cedars, green oaks and sycamores, while wild vines connected one with another by their graceful garlands, and a verdant slope adorned with fern

and flowers, trended from the food of the trees to the water's edge. A multitude of water fowls gambolled beneath. In the distance we saw stags and tawny animals slaking their thirst." While lack of familiarity with local flora may have led to misidentifications ("cedars" may have been Montezuma's bald cypress), perhaps the resaca at Palo Alto looked similar in 1846.

In 1852 Abbe Domenech wrote: "...as the gulf is neared, the land becomes arid, sandy or marshy, trees more rare. The Spaniards of the sixteenth century well designated this coast by calling it **Costa Deserta**. It is a veritable desert."

Del Weniger considers this to be an apt description of the Port Isabel area.

Endangered, Threatened or Candidate Species

TOES = Texas Organization for Endangered Species
 TPWD = Texas Parks and Wildlife Department
 USFWS = United States Fish and Wildlife Service
 C2 = Candidate for Listings as Endangered or Threatened
 T = Threatened
 WL = Watch List
 E = Endangered
 X = Not Categorized
 NL = Not Listed

Palo Alto Status

P = Present
 L = Likely to be Present
 M = May be Present
 * = Special Concern

Amphibians:

	TOES	TPWD	USFWS
Sheep Frog (<i>Hypopachus variolosus</i>)M Land Clearing Pesticides		T	T NL
White-lipped frog (<i>Leptodactylus fragilis</i>)M Low numbers, clearing draining		E	E NL
Mexican Tree Frog (<i>Smilisla baudini</i>)M Cleaning, draining		T	T NL
Rio Grande Chirping Frog (<i>Syrhophus cystignathoides campi</i>)M Restricted range clearing pesticides		WL	NL NL
Black-spotted Newt (<i>Notophthalmus meridionalis</i>)M Draining, pollution		E	E C2
Rio Gande Lesser Siren (<i>Siren intermedia texana</i>)M Draining, clearing, pollution		E	E C2

Reptiles:

Texas Tortoise (<i>Gopheras perlandieri</i>)L-Protected, habitat destructin		T	T T
Black-Striped Snake (<i>Coniophanes imperialis</i>)L - Clearing, over- collecting		WL	T NL
Texas, Indigo Snake (<i>Drymarchon corais erebennus</i>)P-Habitat destruction, commericla exploitation		WL	T NL
Texas Horned Lizard (<i>Phrynosoma cornutum</i>)P -Pesticides, commercial exploitation		T	T C2
Milk Snake (<i>Lampropeltus triangulum</i>)M-Commerical exploitation, habitat destruction		T	NL NL

Birds:

Wood Stork (<i>Mycteria americana</i>)M -Habitat loss		T	T NL
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White-faced Ibis (<u>Plegadis chihi</u>) P - Pesticides	T	T	C2
White-tailed Hawk (<u>Buteo albicaudatus</u>) P -Unlawful shooting,habitat loss	T	T	NL
Merlin (<u>Falco columbaris</u>) L - Pesticides	T	NL	NL
Coastal Least Tern (<u>Sterna antillarum antillarum</u>) P - Declining population, coastal development	T	NL	NL
Fulvous Whistling-Duck (<u>Dendrocygna bicolor</u>) M -Pesticides, land conversion	T	NL	NL
Brownsville Common Yellowthroat (<u>Geothlypis trichas insperata</u>) M	X	X	C2
Long-billed Curlew (<u>Numenius americanus</u>) P	X	X	C2
Logger-head Shrike (<u>Lanius ludovicianus</u>) P	X	X	C2
Texas Botteri's Sparrow (<u>Aimophila botterii yexana</u>) P - Restricted distributions, small population	T	T	C2
Texas Olive Sparrow (<u>Arremonops rufivirgatus rufivirgatus</u>)P	X	X	C2

Mammals:

TOES TPWD USFWS

Southern Yellowbat (<u>Lasinrus eca</u>) M -Habitat destruction	WL	T	NL
Coues' Rice Rat (<u>Oryzomys couesi aquaticus</u>)M-Habitat destruction	T	T	NL
Jaguarundi (<u>Felis yagouaroundi</u>)M-Habitat destruction, predator control, hunting	E	E	E
Ocelot (<u>Felis pardalis</u>) M -Habitat destruction, predator control	E	E	E

Extirpated Species

Northern Aplonado Falcon - Falco septentrionalis Habitat destruction, reduction of sticknester nests.

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