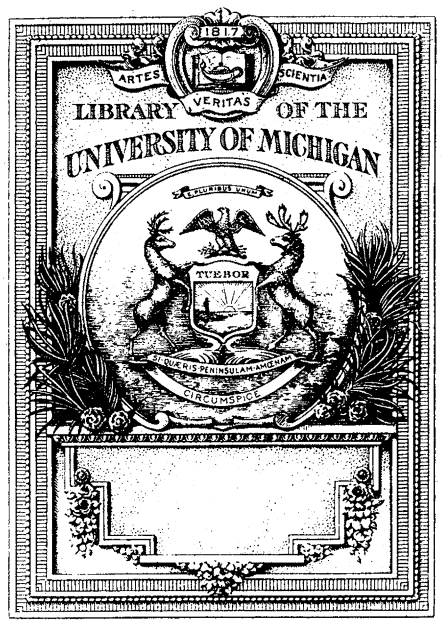
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VEGETATIONAL SURVEY OF THE LOWER RIO GRANDE VALLEY, TEXAS

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the University of Michigan.

May 1, 1935.

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VEGETATIONAL SURVEY OF THE LOWER RIO GRANDE VALLEY, TEXAS

INTRODUCTION

Southern Texas has been known to botanists since 1826 when Berlandier (1850) made the first collection of Texas plants. Hooker and Drummond (Tharp 1926) contributed to this knowledge about 1835. In 1854 the work of making a Mexican boundary survey was begun. John Torrey (1859) made a report on botanical collections of this expedition including Cacti. This part of the report was made by George Engelmann (1859). The men who made these collections had many hardships to endure and almost insurmountable obstacles to overcome. Among other hazards, they were often in danger of being massacred by the Indians. Emory (1857) writes that their horses were sometimes lured away by wild herds, and that the men were often very short of provisions. Lindheimer, who has been called the

"Father of Texas Botany" did extensive collecting in southern Texas, and was probably the first man to do work of a phytogeographic nature in the state. Havard (1895) contributed to collections of west Texas, especially in the region of the Rio Grande. Bray (1901), one of the later investigators, spent eight years studying the various phases of the vegetation of the state. Cook (1908) wrote on the changes of vegetation in south Texas prairies with the conclusion that the prairie has been invaded by chaparral vegetation largely because of overgrazing which has eliminated prairie fires. Tharp (1926) made investigations along the Red River and also wrote on the structure of vegetation of Texas east of the ninety-eigth meridian.

The area with which this paper is concerned is composed of the five counties farthest south in Texas. Four of these, Zapata, Starr, Hidalgo, and Cameron Counties, are bounded on the south by the Rio Grande and Mexico. Willacy County lies just north of Cameron from which it was recently separated. The area extends from the Gulf of Mexico to about thirty miles west of the ninety-ninth meridian, and lies between latitudes 26° and 27°. It contains about five thousand and forty square miles.

Climate

The temperature variation in this region is not great. At Fort Ringgold it ranges from 57.7 in January to 88.7 in July; and at Brownsville, from 59.1 in January to 83.7 in August. (These figures were compiled from statistics of the U. S. Weather Bureau over a period of about forty-seven years (Trowbridge 1932). Killing frosts are rare, but of enough frequency to make the growing of commercial bananas and other tropical fruits practically impossible.

Rainfall at Fort Ringgold averages from 0.29 inches in February to 3.13 inches in September with a total of 17.46 inches annually; at Brownsville, from 1.27 inches in March to 5.62 inches in September, with a total of 26.89 inches annually. This record was made over a period of thirty-nine years at Brownsville and thirty-seven years at Fort Ringgold (Trowbridge 1932). Trowbridge states that this semi-aridity is due in some measure to the location of the area which is just south of a belt of permanent high atmospheric pressure. The air descending and moving toward the equator on its south side becomes warmer as it moves. This causes a decrease in the relative humidity and gives rise to evaporation rather than precipitation.

The weather is usually clear with a brilliant

sun; but in June and September thunder storms amounting to cloudbursts descend upon this area, and as a result in Starr and Zapata counties the usually dry, deep arroyos become impassible torrents. Infrequent hurricanes cause considerable damage to crops and buildings and change the character of the coast vegetation to some extent. The prevailing wind in the Lower Rio Grande Valley is from the southeast. It blows almost steadily in the summer, but decreases during the winter. It is of the monsoon type. Northers occur with varying frequency from late October until March, causing a very sharp drop in temperature within a short space of time. They are called "dry" or "wet" northers, depending upon whether or not the wind is accompanied by precipitation. Since rainfall in this region is so irregular, farming as a rule is very uncertain in unirrigated sections. However, dry land cotton seems to be quite successful because the plants receive less injury from the boll-weevil and the cotton root rot fungus (Phymototrichum omnivorum) than does the cotton grown under moist conditions.

Topographic Features

Beginning at sea level in the low grassland and swampy areas of the coast, the Rio Grande Plain on the average rises at the rate of approximately

five feet per mile. The coast is protected by a barrier, Padre Island, which is a very narrow strip, composed mostly of dune sand, extending along the coast from the mouth of the Rio Grande to Corpus Christi, and separated from the mainland by Laguna Madre which is about four to ten miles wide and rather shallow. In general the coastal area consists of beach with low dunes beyond which are barren salt flats and salt marshes. On the surface of the delta there are numerous low mounds known as "Clay Dunes" (Foscue 1932). In northern Willacy county the wind piles up dunes (some of them twenty-five feet high) and blows out depressions, making the topography irregular. All of Cameron, most of Willacy, and a small portion of Hidalgo counties are included in the Rio Grande delta.

The greater part of Hidalgo and Starr counties are included in the Hebbronville Plain. There is a low rise which includes the towns of Mission, McAllen, San Juan, Pharr, and Donna, and a limited area near Raymondsville. This is known as the Mission Ridge. With the exception of this ridge, all the rest of the Rio Grande Delta has been subject to flood in the past. The delta begins at Penitas, and in ordinary floods the water breakes out here, covering the

Fig. I.

99°

98°

27°

26°

ZAPATA

STARR

HIDALGO

WILLACY

CAMERON

LEGEND

- TERRACE DEPOSITS
- COOK MOUNTAIN FORMATION (VARICOLORED SANDSTONES)
- COCKFIELD FORMATION
- FAYETTE SANDSTONE
- FRIO CLAY
- OAKVILLE SANDSTONE
- REYNOSA FORMATION
- LISSIE GRAVEL (SOME LIMESTONE)
- BEAUMONT CLAY
- FLUVIATILE DEPOSITS
- WIND-BLOWN SAND AND BEACH DEPOSITS

SCALE

0 10 20 MI.

GEOLOGIC MAP OF THE LOWER RIO GRANDE VALLEY

COMPILED IN PART FROM U.S. GEOLOGICAL SURVEY MAP

streets of the village and filling in all of the low places south of the Mission Ridge. This situation has been alleviated somewhat by flood control. Most of the sand belt occurs north of the Lower Rio Grande area; but the southern and extends into northern Hidalgo County and covers a small corner of Starr and a portion of Willacy counties (Fig. 1). The bed rock of this region is covered by wind-blown sand. There are some migrating dunes, and others that support a sufficient growth of grass or shrubs to keep them stable.

The Hebbronville Plain extends from the sand belt and the Rio Grande Delta west and north to a rather spectacular topographic feature known as the Bordas Scarp. The west face of this escarpment averages sixty or seventy feet in height and is composed of Oakville sandstone and Frio Clay (Figure 1). The absence of erosion on the east side is due probably to the type of soil which is a porous caliche overlain with a covering of loose sand (Trowbridge 1932). The water leaches through so rapidly that little or no erosion takes place. Looking at the Bordas Scarp from the west, it is not unlike some of the flat-topped buttes of New Mexico. More than half of Zapata County is included in the Aguilares Plain (Trowbridge 1932).

It is sixty or seventy feet lower than the west side of the Hebbronville Plain and is largely covered with grass and mesquite.

The erosional valley of the Rio Grande begins at Penitas and extends through Zapata County. Numerous arroyos drain this part of the area, and where they join the river the surface is broken. This rough portion of the region is known as the "Breaks of the Rio Grande." This belt varies in width from one to fifteen miles, averaging about seven. In a portion of its course the river lies on an older valley in which terraces were built up, some of which still remain; and at other points, particularly near Zapata and San Ignacio, the river runs along high cliffs and bluffs.

La Sal Vieja and Sal del Rey (Fig. 2) are salt lagoons. It is thought that the salt has been blown inland from the Gulf.

Geology

The oldest formations occuring in this region are the Cook mountain and the Cockfield formations (Trowbridge 1932). They belong to the Claibourne group in the Eocene and extend beyond the limits of Zapata

County to the north. The Fayette sandstone, probably Oligocene, outcrops in western Starr County and covers about one-half of Zapata County, conforming somewhat in extent to the Aguilares Plain. A rather narrow, irregular area of Frio Clay with an outcropping of Oakville sandstone near Rio Grande City joins the Reynosa formation forming the Bordas Scarp mentioned earlier. The Oakville belongs to the Miocene, and the Frio Clay is probably Oligocene.

The Reynosa formation covers the greater part of Starr County and extends along western Hidalgo County. There are small outcroppings elsewhere (Fig. 1). This formation comprises a greater part of the Hebbronville Plain. The Reynosa is probably Pliocene and is composed of an intricate mixture of gravel cemented by lime ~~limestone~~, limestone with embedded pebbles, sand, gravel, and sandstone free and intermixed. Lissie gravel occupies a central part of Hidalgo County. It is of Pleistocene age and is composed chiefly of gravel unconsolidated, balls of clay or irregular masses, lenses and beds of sand and thin beds of limestone. Gravel from pits near Sam Fordyce and Havana has been used for road-making throughout the Valley.

The area of wind blown sand and beach

Fig. II.

RIVERS OF THE LOWER RIO GRANDE VALLEY

99° 98°

27°

26°

ZAPATA

STARR

HIDALGO

WILLACY

CAMERON

ARROYO SALADO

ARROYO EL BURRO

ARROYO VELEÑO

ARROYO LEON

ARROYO LOMA BLANCA

ARROYO EL TIGRE

ARROYO RAMIREÑO

ARROYO LOS MORTEROS

ARROYO LA MINITA

ARROYO ROMA

ARROYO QUILOTE

ARROYO LOS OMOS

SAL DEL REYO

LA SAL VIEJA

RED FISH BAY

LAGUNA MADRE

LAGUNA ATASCOSA

LAKE LA JOLLA (LA JOYA)

LAKE CAMPACUAS (TAMPAGUAS)

HACKNEY LAKE

LLANO GRANDE LAKE

ARROYO COLORADO

RESACA DE LOS CUATES

RESACA DEL RANCHO VIEJO

RESACA DE PALMA

EL RIO GRANDE

LOMA ALTA

LA CANASTA BANCO

SCALE

0 10 20 MI.

deposits is a wide stretch reaching beyond Falfurrias and appearing in the Lower Rio Grande Valley. The Prairie Grass region and this area almost coincide. Beaumont Clay of the Pleistocene begins at Penitas, lying east of the Lissie gravel region and joining the Fluviatile deposits which have their origin near Rio Grande City as a narrow strip along the river. These deposits widen out covering a great many miles toward the coast.

Drainage

With the exception of the Arroyo Colorado, the Rio Grande is the only permanent stream. The upper part of the Lower Rio Grande Valley is drained by arroyos (Fig. 2). These streams are temporary, only functioning in times of infrequent downpours, the deep, ragged cuts testifying to the force of the torrents (Plate 1). These arroyos are not bridged and people using the roads are sometimes forced to wait for hours for the water to go down.

The poor drainage near the coasts has been improved within recent years by the construction of large, open drainage ditches. Poor drainage has been a problem of great concern to the farmers because much of the irrigated land with insufficient drainage became so impregnated with alkali salts that some crops

could no longer be grown successfully. New flood channels and levees, better canal systems and more efficient handling of irrigation water has reduced this condition appreciably.

The Arroyo Colorado (Plate 1), a distributary of the Rio Grande is a deeply cut flood channel starting near Mercedes in eastern Hidalgo County, and continuing in a northeasterly direction through Cameron County to Laguna Madre. The water is salty as far inland as Harlingen because of the fact that the bottom of the channel has been cut below sea-level. (Beck and Hendrickson 1923). Nearly all of the run-off water of Cameron County flows in to the estuaries of Laguna Madre.

In part of Zapata County there is no valley on the Texas side of the Rio Grande, the river flowing against high cliffs (Plate 2). In western Hidalgo County, the valley has attained the width of perhaps a mile. Lower down, it becomes eight miles wide. In western Cameron County the delta is many miles wide, and excess water moves in poorly defined channels across the almost flat surface toward the coastal lowlands. Some of these are <u>resacas</u> and <u>esteros</u>, low places formed by the old river channels.

PROBLEM

The present investigation, a survey of the vegetation of the Lower Rio Grande Valley, is based upon field studies made at three different periods and extending over most of the four seasons. The different periods of study were as follows:

1st. June 30, 1932 - September 15, 1932

2nd. February 25, 1932 - July 8, 1933

3rd. November 30, 1933 - February 18, 1934.

Information necessary for making a vegetational map was obtained through a series of traverses on roads and trails. In general, the roads are fairly good, but some difficulties were encountered, especially in Zapata County.

The period chosen for study happened to be very dry; consequently, many herbaceous plants which normally occur during a more favorable season were missing from the flora.

In this study an attempt has been made to show that vegetation occurring in this area is influenced markedly by edaphic factors, and that it conforms, more or less, to geological formations (Figs. 1 and 3).

Fig. III.

99°

98°

27°

ZAPATA

SAN IGNACIO

ZAPATA

CHAPARRAL

MESQUITAL ZACATAL

CHAPARRAL

LAS CUEVITAS

LAS VIBORAS

MESQUITAL

SANTA ELENA ZACATAL (PRAIRIE GRASS)

ZACATAL MESQUITAL

LINN

SAL DEL RAY

LA SAL VIEJA

RAYMONDVILLE

LAGUNA MADRE

PADRE ISLAND

EL SAUZ

SALINENO

STARR

NOPALENA

WILLACY

ROMA

RIO GRANDE CITY

MESQUITAL-CHAPARRAL

HIDALGO

SAM FORDYCE

EDINBURG

PENITAS

MISSION

EL RIO GRANDE

CAMERON

HIDALGO

SACAHUISTA (SHORT GRASS)

CLARK ISLAND

BRAZOS SANTIAGO

BOCA CHICA

26°

MONTE DEL RIO (WOODED AREA)

BROWNSVILLE

BOSCAJI DE PALMAS (PALM GROVE)

SCALE

0 10 20 MI.

VEGETATION MAP
OF THE
LOWER RIO GRANDE VALLEY

Local Ecological Nomenclature

The Mexican people in southern Texas have developed a very definite and satisfactory classification of the vegetation. Professor Bartlett (unpublished manuscript) uses local nomenclature for vegetational types in British Honduras and Guatamala. Lundell (1934) adopted this system in a phytogeographical study of Yucatan. The writer is using local Spanish nomenclature to designate physiogeographic divisions, associations and societies within the association.

The writer has spent many years along the Rio Grande and has learned these names directly from the Mexican people.

Frequently the association or society is named for the dominant species. For instance, mesquital applies to the association dominated by the mesquite, (Prosopis juliflora var. glandulosa Torr.) A society within this Association in which the mesquite is dominant is also called mesquital. Zacatal derived from Zacate or grass designates the grassland association. This name is used particularly for prairie grass. The grassland area is known as los-llanos. The coastal marsh grass, (Spartina spartinae (Trin.) Merr.) is known as sacahuista, so the community which this

species dominates is a sacahuistal, and the area is called llano salitroso. That part of the salt marsh occupied by water, and in which aquatic plants occur is designated as badilla salitrosa, and sometimes as pantaño. A charco is a depression or low place which supports a growth of cat-tails, (Typha latifolia L.), charas, sedges, and other aquatics; while the resaca is a larger, more permanent body of water formed by the old river channel. The borders of the resacas are sometimes dominated by Parkinsonia aculeata L. (retama), and the plant group is called a retamal. Other resaca-communities are named huisachal for Acacia Farnesiana Willd. (huisache); or mimosal for Mimosa strigillosa T. and G. One resaca in Cameron County near Rio Hondo has Ipomea fistulosa Mart. (Amor) growing abundantly with both Parkinsonia aculeata L. and Acacia Farnesiana Willd. This is a rather unusual situation, since Ipomea fistulosa Mart. is an escape and even though the species is equalled in dominance by the other two, the plant group receives the name amoral (Plate 2).

Hilly territory, chiefly the Bordas Scarp region, is known as lomeria; and the high dry land in the upper counties and away from the river is the mesa. The lomeria and parts of the mesa have a

characteristic growth consisting mostly of spiny shrubs and stunted trees including many species. The Mexicans call this growth chaparral, named from Acacia amentacea DC. or chaparro praeto (black chaparral) which is usually an important part of the vegetation. A small area, usually a limestone or gravel hill, dominated by this species is also a chaparral.*

Palma is the Spanish name for palm, and the palm grove or small forest formation near Brownsville is known as boscaji de palma.

In general the suffix al, added to the Spanish name of the plant in dominance (sometimes with vowel elision) designates the plant group. An exception to this is nopalera, the name used for an association and also for a society of Opuntia (nopal).

Such nomenclature as described will have no value in regions where the Spanish language is not spoken; but in Spanish-speaking localities an acquaintance with this method is important. Bartlett (unpublished manuscript) considers that much of this folk knowledge can be systematically formulated in an ecological study. It is my purpose to use it in connection with terms ordinarily applied to vegetational groups.

Footnote (page 14)

*Cooper (1922) refers to broad - sclerophyll scrub as chaparral. He explains that the word "chaparral" is of Spanish origin meaning scrub oak. In south Texas this is not the case. Chaparro praeto or black chaparral is the Spanish name for Acacia amentacea DC., and any phytogeographic division large or small which this species dominates is referred to as chaparral. This term is also used to designate an area covered by a scrubby growth in which the mesquite is inconspicuous or absent. Authors usually include the mesquite in a chaparral especially in localities in which the species is stunted and scrubby. Since this paper is following the local Spanish nomenclature for these ecological areas it is necessary to exclude the mesquite. The author feels justified in using the name chaparral for the semi-desert brush in view of the fact that it has been used in this sense by several ecologists and other botanists for many years. Emory (1857) refers to the vegetation along the Rio Grande as chaparral. Warming (1909), Drude (1890), Bray (1901), Engler (1902), Harshberger (1911), and Tharp (1926) are other authors giving this interpretation to the word.

The writer is intentionally avoiding the use of many ecological terms in English since they are often confusing even when not accompanied by a local terminology. The association is used in this paper to designate the larger, distinct plant groups, and society for smaller groups within the association. The word community is used for groups in which rank is uncertain (Weaver and Clements 1929).

Phytogeographic Study

There is no true tropical area in Texas. The freezing temperatures which sometimes occur limit genuine tropical life to a few insects, reptiles, and birds (Bailey 1905). However, near the mouth of the Rio Grande and extending inland some distance are plants which show tropical affinities. One would place Inodes Texana Cook foremost in this list. Others are Daubentonia longifolia (Cav.) DC., Lantana horrida H. B. K., Malphigia glabra L., Amyris parvifolia A. Gray, Helietta parvifolia Benth., Schaefferia cuneifolia A. Gray, Serjania incisa Torr., Cardiospermum Halicacabum L., Ruellia tuberculosa L., and Rhizophora mangle L.

The Rio Grande Valley is of much interest botanically because plants representing western desert, northern, coastal, and tropical floras are all found

in this relatively small area.

Climax Associations

I. The Mesquital

Prosopis juliflora var glandulosa Torr. is classed as a chaparral plant in parts of the United States where it is so stunted as to appear shrubby. In the Rio Grande Valley, it often reaches a height of thirty-five feet and is sometimes two feet in diameter. Here the mesquite is considered a tree by the Mexicans, and any association or plant group in which the mesquite is dominant or more conspicuous is known as mesquital. The mesquital covers most of the area and exhibits several phases (Fig. 3).

1) Mesquital - zacatal

This phase covers the greater part of Zapata County conforming rather closely to the area known as the Aguilares Plain. It is interrupted by the Bordas Scarp, but continues on the other side as a narrow strip through the northern part of Starr County and across Cameron County to the Gulf.

Most of this territory is a flat sandy plain. Even though the area west of the Bordas Scarp has the same dominating ecological characters as that on the

east side, the composition is quite different. The dominants in this western part in Zapata County are: Prosopis juliflora Var. glandulosa Torr. with Bouteloua barbata Lag. and Aristida purpurea Nutt. Probably dominant among the grasses, although it is difficult to name dominance where over-grazing interferes. Other grasses enter this phase of the mesquital and there are many societies of mixed shrubs occurring with varying dominance. The most important ones are: Zizyphus obtusifolia Gray, Leucophyllum texanum Benth., Acacia Berlandieri Benth., Bumelia lycioides Pers., Celtis pallida Torr., Schaefferia cuneifolia Gray, Forestiera angustifolia Torr., Acacia amentacia DC., and Circidium texanum A.Gray. These shrubs are often scattered through the open mesquite woods and occasionally form a heavy growth near an arroyo.

Yucca tenuistyla, Trelease is rather abundant northeast of San Ignacio forming societies in open grassy areas. Such a society is known as an aguapal. This species is often found in open brush-land (Plate 3).

Herbaceous plants form many of the societies. The most important of these are: Gaillardia pulchella Foug., Lupinus Texensis Hook, Oenothera laciniata, var Mexicana Spach., Parthenium hysterophorus L., Verbesina encelioides Benth. and Hook., Aphanostephus

skirrhobasis var. hallii (Gray) Blake, Jatropha spathulata Muell.

By far the greatest portion of the mesquital-zacatal lies east of the Bordas Scarp. The dominants here are Prosopis juliflora var. glandulosa Torr. and probably Aristida purpurea Nutt., Eragrostis curtipedicellata Bukl., and Erogrostis secundiflora Presl. It is difficult to name a single grass which dominates the entire phase, for there is varying dominance depending upon edaphic factors and light conditions. In poorer soil the grama grasses (Bouteloua) grow with little competition, while in other situations they form the layer under taller grasses such as Erogrostis curtipedicellata Buckl., Erogrostis secundiflora Presl., Chloris cucullata Bisch., and Aristida purpurea Nutt.

Other herbaceous plants forming societies are: Callirhoe digitata Nutt., Commelina Crispa Wooten, Jatropha texana (Muell.), Arg., and Jatropha stimulosa Michx. Shrubs invading this phase are: Celtis pallida Torr., Zizyphus obtusifolia Gray, Leucophyllum texanum Benth., Acacia amentacea De., Societies, and clans of Opuntia Lindheimeri Engelm., and Opuntia leptocaulis DC. are occasionally found.

One of the species of Cacti, Echinocereus angusticeps Clover (1935), recently described as a species distinct from E. papillosus Linke occurs near Linn. This new species is found nowhere else except in this limited area. It would be interesting to know the conditions making this locality especially favorable for the growth of this species. The only other cacti found here are: Dolicothele Spherica (Dietrich) Br. and Rose, Neomammillaria hemispherica (Engelm.) Br. and Rose, Opuntia Lindheimeri Engelm., O. leptocaulis DC. Plants other than cacti occurring here are: Convolvulus incanus Vahl., Jatropha spathulata L., Prosopis juliflora var glandulosa Torr., Zizyphus obtusifolia (Hook.) Gray, Celtis pallida Torr;, Aristida purpurea Nutt., and Bouteloua barbata Lag.

The mesquite trees are often infested with mistletoe Phoradendron flavescens Nutt. (Plate 3). In the region of Zapata and San Ignacio many of them have been seriously damaged by this parasite (Bray 1910). Ardund Aguilares the infestation is particularly heavy, and many trees are dying as a result.

2. Mesquital-Nopalera

It is impossible to draw a definite line between the phases of the mesquital area. An attempt has been made (Fig. 3) to show the merging of one phase into the other. There is a narrow strip from east to west in which conditions seem optimum for the growth of opuntias. They vie with mesquite for dominance; and, in some places, crowd out most other species. Celtis pallida Torr., Viguiera stenoloba Blake, Lippia ligustrina Lag., Lantana horrida H. B. K., and Bouteloua barbata Lag. are commonly found even in the densest growths. Cleared land which has been abandoned is soon covered by a heavy growth of Opuntia (Plate 4). The opuntias reproduce readily vegetatively, since a single joint is capable of giving rise to one or more new plants. These joints are rather easily broken from the parent plants. For this reason the spread of the genus in a free area is extremely rapid. The soil in this locality is a deep sandy loam. There is a gentle slope to the east, providing good drainage, and here the mesquite is probably more abundant than in any other part of the Rio Grande Valley.

Included in the Mesquital-Nopalera

there are two depressions known as Sal del Rey (Plate 4), Hidalgo County, and La Sal Vieja, Willacy County. The sparse vegetation at the margin of the lake is of the beach and coastal prairie type. Monanthocloë littoralis Engelm., Strombocarpa gineresoens A. Gray and Chenopodium album are most abundant.

3. Mesquital-Chaparral

The invasion of the chaparral vegetation is comparatively recent and thought to be the result of over-grazing and drought. The mesquital Chaparral is by far the most important phase of the mesquital. It covers the greater part of the territory in the Lower Rio Grande Valley, and in general typifies the vegetation which is found in much of south-western Texas.

There is a marked variation in soil conditions here; and this difference affects the size and luxuriance of the growth. Many species occur throughout the range, and others are limited in extent.

On the surface of the delta in eastern Cameron County there are numerous small mounds known as "clay dunes." They project several feet above

the coastal plain and are often covered with a dense growth of chaparral and mesquite (Plate 5). This growth is similar in structure to much of the vegetation found between Brownsville and San Benito, but the shrubs near the coast are characteristically twisted as a result of heavy winds. In general there is no dominant. Some definite societies are: Siderocarpos flexicaulis (Benth.) Small, Leucophyllum Texanum Benth, Zizyphus obtusifolia (Hook.) Gray, Castela Nicholsonii Hook., Randia aculeata L., Forestiera angustifolia Torr., Prosopis juliflora var. glandulosa Torr., and Celtis pallida Torr. A high ridge near the Rio Grande supports a much sparser growth of shrubs interspersed with mesquite and the following cacti: Ferocatus hamatacanthus (Muhlenpfordt) Br. and Rose, Echinocereus pentalophus (DC.) Rumpler, Ancistrocactus Scheeri Salm-Dyck, Hamatocactus setispinus Engelm., Neomammillaria hemispherica (Engelm.) Br. and Rose.

These "islands" of chaparral are separated from the main chaparral-mesquital area by the sacahuistal and a transition zone (Plate 5). There is at first an invasion of mesquite into the coastal prairie area. Lycium carolinianum Walt., Celtis pallida Torr., and Zizyphus obtusifolia (Hook.) Gray

are usually the first shrubs to enter. The composition of the mesquital-chaparral is similar in parts of Hidalgo and Willacy counties and in Cameron County. The brush is usually five to eight feet tall and rather dense. Dominance is dependent on several conditions, and is difficult to place in much of this area. The flora is more or less characteristic through-out, but it is varied in its distribution and aspects by several factors. Because of this complexity, characteristic plant groups will be presented in outline form.

I. Low Hills - La Lomeria.

1. Limestone outcrops in the Reynosa Formation.

a. Cenizal-chaparral (Plate 6).

Dominants: Leucophyllum texanum Benth. and Acacia amentacea DC. Other prominent plants: Jatropha spathulata Muell, Opuntia Lindheimeri Engelm., Neomamillaria hemisphaerica (Engelm.) Br. & Rose, Hamatocactus setispinus Engelm., Bouteloua trifida Thurb., Panicum Hallii Vasey, Karwinskia Humboldtiana Zucc., and Prosopis juliflora var. glandulosa Torr. (stunted).

2. Gravel with some limestone - Reynosa Formation.

a. Cenizal-chaparral-huajillal.

Example used: hill near Rucio Ranch, northeast of Rio Grande City.

Dominants: Leucophyllum texanum Benth., Acacia amentacea DC., Acacia Berlandieri Benth. Other prominent plants: Bumelia angustifolia Nutt., Condalia obovata Hook., Karwinskia Humboldtiana Zucc., Aristida purpurea Nutt., Bouteloua barbata Lag., Echinocereus papillosus Linke, Aphanostephus skirrhobasis var Hallii (Gray) Blake.

b. Mortonia Greggii A. Gray Society (Plate 6) Lissie Gravel. Locality: About five miles north of Tabasco. Sub-dominants: C Cordia Boissieri A. DC., Acacia Berlandieri Benth., Lippia ligustrina Lag., Leucophyllum texanum Benth.

Mortonia Greggii A. Gray occurs in a very limited area as a rather heavy growth on hillsides. A few plants were found near Lake La Joya, which is four miles from this locality. Near Rio Grande City a few stunted plants were found growing in a limestone outcrop on a gravel hill. The area just mentioned is considered to be Lissie Gravel.

3. Sandstone and gravel - probably Reynosa Formation. Mixed Vegetation with no outstanding dominant. Prominent plants: Adelia Vaseyi (Coulter) Pax & Hoff., Schaefferia cuneifolia Gray, Bernardia myricaefolia (Scheele) Wats., Coursetia axillaris Coulter & Rose (very rare in the Rio Grande Valley), Randia aculeata L., Acacia amentacea DC., Prosopis juliflora var glandulosa Torr. This small area has probably more species represented than any other area its size in the mesquital-chaparral phase. (Plate 7).

4. Amargosal - Lissie Gravel. (Plate 7)

Example used: Hill south of Lake La Joya.

Dominant: Castela Nicholsonii Hook. (Plate 7).

Sub-dominants: Acacia amentacea DC., Zizyphus obtusifolia (Hook.) Gray.

Other prominent plants: Schaefferia cuneifolia Gray, Viguiera stenoloba Blake, Celtis pallida Torr., Porlieria angustifolia (Engelm.) Gray, Echinocereus enneacanthus Engelm., E. pentalophus (DC.) Rumpler, Neomamillaria hemisphaerica (Engelm.) Br. & Rose, M. Heyderi (Muhlenpfordt) Br. & Rose, Dolicothele sphaerica (Dietrich) Br. & Rose, Hamatocactus setispinus Engelm., Ancistrocactus Scheeri Salm-Dyck, Homalocephala texensis (Hoeffer) Br. & Rose, Opuntia Schottii Engelm., O. leptocaulis DC., O. Lindheimeri Engelm.

II. La Mesa - High, dry land mostly included in the Hebbronville Plain. Soil- sandy loam, with limestone and gravel outcrops.

Characteristic societies:

1. Ebonal.

Dominant: Siderocarpos flexicaulis (Benth.) Small.

Sub-dominants: Schaefferia cuneifolia Gray, Castela Nicholsonii Hook., Porlieria angustifolia (Engelm.) Gray, Jatropha spathulata Muell.

2. Nacahuital (Plate 7).

Dominant: Cordia Böissieri A. DC.

Sub-dominants: Lippia ligustrina (Lag.) Small, Celtis pallida Torr., Prosopis juliflora var. glandulosa Torr.

3. Comal.

Dominant: Dumelia lycioides Pers.

Celtis pallida Torr., Condalia obovata Hook., and Viguiera stenoloba Blake present.

4. Mesquital.

Dominant: Prosopis juliflora var. glandulosa Torr.

Sub-dominants: Celtis pallida Torr., Zizyphus obtusifolia (Hook.) Gray, Opuntia Lindheimeri Engelm.

5. Nopalera.

Dominant: Opuntia Lindheimeri Engelm.

Sub-dominants: O. leptocaulis DC., Jatropha spathulata Muell., Echinocereus enneacanthus Engelm., Bouteloua barbata Lag. Cenchrus pauciflorus Benth.

III. Lower Land - Western part of Rio Grande Delta.

1. Mixed vegetation, locality near San Benito. Soil - Harlingen Clay.

Prominent plants:

Upper layer: Shrubs 5 - 8 feet high, mesquites

10 - 15. Prosopis juliflora var. glandulosa Torr., Castela Nicholsonii Hook., Pithecolobium brevifolium Benth., Leucophyllum texanum Benth. Bumelia angustifolia Nutt., Forestiera angustifolia Torr., Zizyphus obtusifolia (Hook.) Gray, Lantana horrida H. B. K., Celtis pallida Torr., Heimia salicifolia Link., Opuntia Lindheimeri Engelm.

Lower layer: Viguiera stenoloba Blake, Salvia coccinea L., Croton cortesianus Kunth., Parthenium hysterophorus L., Trichloris pluriflora Fourn., Setaria macrostachya H. B. K., Opuntia Lindheimeri Engelm.

2. Acanthocereus pentagonus (L.) Br. & Rose Association. (Plate 8). Low flat land near resacas. Flooded in places with water sometimes standing for months.

Sub-dominants:

Upper layer: Prosopis juliflora var. glandulosa Torr., Zizyphus obtusifolia (Hook.) Gray, Celtis pallida Torr., Opuntia Lindheimeri Engelm., Xanthoxylum pterota H. B. K.

Lower layer: Rivina laevis L., Heliotropium indicum L., Gilia incisa Benth., Sida paniculata L., Malvastrum coromandelianum (L.) Garcke, Salvia coccinea L., Hamatocactus setispinus Engelm.

3. Retamal - In low places or depressions throughout the mesquital-chaparral.

Dominants: Parkinsonia aculeata.

Sub-dominant: Acacia Farnesiana.

4. Huisachal (Plate 8).

Dominant: Acacia Farnesiana (L.) Willd.

Example used: Depression near La Joya.

Subject to overflow from the lake.

Usually the only species growing here.

IV. Charcos, Resacas and Canals.

1. Charco - Water shallow, area small.

Example used: Penitas.

Dominant: Typha latifolia L.

Subdominants: Cyperus articulatus L., Scirpus validus Vahl, Marsilea macropoda Engelm., M. vestita Hook. & Grev., Naias Guadelupensis (Spreng.) Morong., Aster exilis, Oenothera rosea Ait.

2. Resacas. Formed from the old river channel, usually shallow.

Plants usually dominant in such a habitat are as follows: Parkinsonia aculeata L., Acacia amentacea DC., Mimosa strigillosa T. & G., Dominance varies depending on the locality, amount of flood water and possibly soil content.

Societies are named Retamal, Huisachal, and Mimosal (~~Plate ~~), respectively. Other plants prominent in such societies are:

Aquatics

Utricularia, Lemna, Radicula Walteri (Ell.) Small, Chara, Castalea elegans Gr. (Plate 9), Atamosco texana (Herb.) Greene, sedges (given in list at end of paper), Marsilea vestita Hook. & Grev., M. macropoda, Typha latifolia L., Piaropus crassipes (Mart.) Britton, Sagittaria variabilis Engelm.

Wet bank vegetation

Sedges, Aster exilis Ell., Lycium carolinianum Walt., Cynodon dactylon (L.) Pers.

Moist, shady zone

Lycopersicon esculentum var. cerasiforme Gray, Oenothera rosea Ait., Urtica chamaedryoides Pursh, Lepidium virginicum L.

A resaca near Rio Hondo has an abundance of Mimosa fistulosa Mart. occurring with the usual dominants. This plant group is called Amoral.

5. Canals

a. Banks of main canal always filled with water.

Example used: Canal east of Mercedes.

Common species: Cynodon dactylon (L.) Pers., Holcus halepensis L., Aster exilis L., Paspalum Langei (Fourn.) Nash, Commelina longicaulis Jacq., Parthenium hysterophorus L.

In seepage or barrow-pits at side of canal: Phragmites communis Trin., Typha latifolia L., Scirpus validus Vahl., Cyperus acuminatus Torr. & Hook., Cyperus oxycarioides Britton, Cestalia elegans Greene, Echinodorus cordifolius (L.) Griseb., Marsilea vestita Hook. & Grev., Naias Guadalupensis, Jussiaea diffusa Forskl.

b. Small canal almost dry at times.

Example used: canal east of Rio Hondo (Plate 9).

Dominant: Piaropis crassipes (Mart.) Britt.

Other plants present: Typha latifolia L., Salix longifolia Muhl., Cynodon dactylon (L.) Pers. Celtis pallida Torr.

v. Wooded area along the Rio Grande.

Example used: Woods near Swallow's Club House south of Alamo (Plate 10).

1. Heavily wooded portion - El Monte.

a. Upper layer:

Ulmus crassifolia Nutt., Sapindus Drummondi Hook. & Arn., Celtis Mississippiensis Bosc., Fraxinus Berlandieri DC., Siderocarpos flexicaulis (Benth.) Small. (Plate 10)

b. Middle layer:

Dominants: Bumelia angustifolia Nutt., Porlieria angustifolia Engelm. & Gray, Zizyphus obtusifolia Hook. & Gray, Diospyros texana Scheele, Celtis pallida Torr.

c. Lower layer:

Dominants: Cardiospermum Halicacabum L., Parthenium hysterophorus L., Capsicum baccatum L., Clematis Drummondi Torr. & Gray, Urtica Chamaedryoides Pursh., Cuscuta indecora Choisy, Monarda dispersa Small (Plate 11).

Epiphytes: Tillandsia usneoides, T. recurvata, T. Baileyi.

2. El Jaral - Association in sandy soil along the river banks.

Species of Baccharis grow with little or no competition (Plate 11). These also enter a flooded area which has been denuded.

A single specimen of Taxodium mucronatum Tenore stands in the woods south of Havana. The tree is approximately forty feet tall. Mexican residents report that it has been there for at least one hundred years. Emory (1857) states that cypress was found near the mouth of the Rio Salado, which is a tributary of the Rio Grande, and expressed the hope that some future day this species would spread down the river, furnishing building material for inhabitants.

The Chaparral

The Bordas Scarp and a strip along the Rio Grande between Roma and San Ignacio is covered with a low shrubby growth which seems fairly stable. There are societies of Mesquite on flats and along arroyos, but in general the hilly broken territory known as the "Breaks of the Rio Grande" is a distinct chaparral (Plate 12) as the term is used in this paper. Acacia amentacea is probably a general dominant with sub-dominants varying with the locality. Some of the most outstanding associations, societies and communities are given below.

1. Cenizal.

This association is dominated by Leucophyllum Texanum Benth. with sub-dominants Acacia amentacea DC. and Acacia Berlandieri Benth. The presence of Leucophyllum usually indicates a limestone outcrop, and Acacia Berlandieri Benth. is often found on gravel hills. A cenizal association occurs about two miles west of Roma and is several miles in extent. (Plate 6). The following plants were collected in this area:

Leucophyllum Texanum Benth.
Acacia amentacea DC.
Acacia Berlandieri Benth.
Jatropha spathulata Muell.

Sohaefferia cuneifolia Gray

Karwinskia Humboldtiana Zucc.

Pappophorum mucronulatum Nees

Bouteloua barbata Lag.

Bouteloua trifida Thurb.

Cenchrus pauciflorus Benth

Coldenia canescens DC.

Heliotropium confertifolium Torr.

Opuntia leptocaulis DC.

Opuntia Lindheimeri Engelm.

Echinocereus enneacanthus Engelm.

Ancistrocactus Scheeri Salm-Dyck.

Hamatocactus setispinus Engelm.

Neomammillaria hemisphaerica (Engelm.) Br. and Rose

Actinea odorata (DC.) Kuntze

Ephedra antisiphilitica Meyer

Talinum angustissimum (A. Gray) Wooten and Standl.

Marilaunidium hispidum (A. Gray) Kuntze

Croton fruticulosis Engelm.

Parosela nana (Torr.) Heller

Gayoides crispum (L.) Small

Gomiostachyum citrosum Small

Sida filipes A. Gray

Abutilon Americanum (L.) Sweet

Abutilon incanum (Link.) Sweet

Croton ciliato - glandulosus Ort.

Atriplex acanthocarpa (Torr.) S. Wats.

Nicotiana repanda Willd.

8. Barrettal.

On gravel and limestone hills (Plate 13).

Dominant species - Helietta parvifolia.

This is a rather large community extending over several hills east of Rio Grande City. A few scattering plants are found as far east as Penitas, and some grow in the region of the petrified forest east of Roma. Other prominent plants in this community are as follows:

Castela Nicholsonii Hook.

Cercidium floridum Benth.

Acacia amentacea DC.

Lippia ligustrina (Lag.) Small

Opuntia Lindheimeri Engelm.

Opuntia leptocaulis DC.

Thelocactus bicolor (Galeotti) Br. and Rose

Coryphantha Runyonii Br. and Rose

Ancistrocactus Scheeri Salm-Dyck

Setaria macrostachya H. B. K.

Bouteloua barbata Lag.

Goldenia canescens DC.

Cordia Boissieri A. DC.

Koeberlinia spinosa Zucc.

Agave lechuguilla Torr. is not abundant but is worthy of mention as this seems to be the eastern limit of its range. A new species Coryphantha Pirtaliana was recently found here by the Pirtle brothers of Alamo.

3. Hechtia Texensis community (Plate 13).

The soil may be somewhat saline since Varilla Texana, which is a halophyte (Coulter 1891-1894) is always present. Burros enjoy eating the succulent flower stalks and many are prevented from seeding by being nipped off early. New plants are produced at the base of the parent plant, forming large mounds so dense that no other species can gain a foothold. Some of the plants commonly found with Hechtia are Zizyphus obtusifolia (Hook.) Gray, Sida filipes Gray, Schaefferia cuneifolia Gray, Jatropha spathulata Muell., Porliera angustifolia, Pappophorum bicolor Fourn., Panicum Halli Vasey, Echinocereus enneacanthus Engelm., and Opuntia Lindheimeri Engelm.

4. Agave Society (Plate 14) in sandy loam and on limestone hills. Agaves are found in only a few localities in the two upper counties. Probably the largest group is five miles south of Zapata. The vegetation growing with this species is characteristic

of that found in much of the chaparral.

5. Bordas Scarp vegetation.

The approach to the Bordas Scarp is a gentle slope toward the west. The vegetation is of the mesquital - chaparral type changing to the lower, sparse chaparral found on gravel. An area about a mile in length was chosen as representative of the chaparral of the escarpment. An interesting species of Cactus Astrophytum asterias (Zucc.) Lemaire, is found here which, as far as known, occurs nowhere else in the United States. (Clover 1932). The following species were collected in this locality:

Acacia amentacea DC.
Leucophyllum Texanum Benth.
Zizyphus obtusifolia (Hook.) Gray
Celtis pallida Torr.
Ephedra antisiphilitica Meyer
Microrhamnus ericoides Gray (scarce)
Talinopsis frutescens Gray
Karwinskia Humboldtiana Zucc.
Prosopis juliflora var. glandulosa Torr. (few and stunted)
Opuntia Lindheimeri Engelm.
Opuntia leptocaulis DC.
Neomammillaria hemisphaerica (Engelm.) Br. and Rose

Neomammillaria heyderi (Muhlenpfordt) Br. and Rose

Echinocereus enneacanthus Engelm.

Echinocereus pentalophus (DC.) Rumpler

Echinocereus Fitchii Br. and Rose (called E. perbellus (Clover 1932))

Corypantha Runyonii Br. and Rose

Lophophora williamsii (P late 14) (Lemaire) Coulter

Hamatocactus setispinus Engelm.

Dolicothele sphaerica (Dietrich) Br. and Rose

Wilcoxia poselgeri (Lemaire) Br. and Rose

Thelocactus bicolor (Galeotti) Br. and Rose

Jatropha spathulata Muell.

Verbesina encelioides (Cav.) Benth. and Hook.

Lippia macrostachya (Torr.) Moldenke

Menodora heterophylla Moricand

Runyonia longiflora Rose

Zinnia pumila Gray

Ibervillea Lindheimeri (Gray) Greene

Varilla Texana Gray

Yucca sp.

Koeberlinia spinosa Zucc.

Aristida purpurea Nutt.

Chloris cucullata Bisch.

Eragrostis curtipedicellata Buckl.

Polanisia trachysperma T. and G.

The following plants were found at the base of the escarpment:

Amoreuxia Wrightii A. Gray

Rivina laevis L.

Jatropha Berlandieri Torr.

Sporobolus Wrightii (Munro.) Scribn.

Abutilon Wrightii A. Gray

Triodia mutica (Torr.) Scribn.

Aphanostephus skirrhobasis var. hallii (Gray) Blake

Dyssodia tephroleuca Blake (new species)

Simsia calva (Gray and Engelm.) Gray

Zexemenia hispida (H. B. K.) Gray

6. Costillal (Plate 15). Distribution mostly in Zapata County.

Dominant - Microrhamnus ericoides Gray. In places this species is so dense as to almost crowd out competitors. Low mesquites, Zizyphus obtusifolia (Hook.) Gray, and Colubrina Texensis Gray are frequently associated with it.

7. Palo Verde Society.

Dominant - Cercidium Texanum Gray in the region of Zapata, and Cercidium floridum Benth. near Penitas. These species usually occur on dry mesas in open brushland. They thrive in dry gravel soil as the leaves are early deciduous and the stems are

capable of photosynthesis. Bouteloua barbata Lag., B. trifida Thurb., Goldenia canescens DC., Heliotropium confertifolium Torr., Parthenium hysterophorus L. are some of the herbaceous species commonly associated with Cercidium. The shrubs of this society vary with the locality.

8. Gobernadoral. Dominant - Covillea tridentata (Cav.) Vail. This plant has invaded northern Zapata County from the northwest. The fact that it is most abundant on very dry and unproductive soil might give the impression that it prefers that habitat. Such however is not the case. The plant is easily crowded out by other vegetation in more favorable situations. (Spaulding 1904) states that this species is capable of adapting itself to desert conditions by reducing the leaf surface and by abstracting water from very dry soil, while at the same time it is capable of living and does live as an ordinary mesophyte if given a suitable supply of water.

9. Vegetation along arroyos.

Shrubs inhabiting areas cut by arroyos are often larger near the banks where water stands after a storm. Species such as Acacia Farnesiana (L.) Willd., and Parkinsonia aculeata L. grow near

these water-holes (Plate 15). Cynodon dactylon, Pappophorum bicolor Fourn., P. mucronulatum Nees, Sporobolus argutus (Nees) Kunth., Trichloris mendocina (Phil.) Kurtz, Triodia pilosa Buckl. Merr., Panicum Hallii, Vasey, Lepachys columnaris, var. pulcherrima (D. Don) T. and G., Nicotiana longiflora Cav., Parosela Nana (Torr.) Heller, Verbesina encelioides (Cav.) Benth. and Hook., Chamaesyce Laredana (Millsp.) Small are plants growing in dry arroyo beds. At Arroyo Loma Blanca Ferocactus hamatacanthus (Muhlenpfordt) Br. and Rose (Plate 16) is abundant. One plant has persisted in the crotch of a tree for at least four years in spite of the fact that water has washed away all the soil in which it originally grew (Plate 16). Echinocereus enneacanthus Engelm., the species of Cactus which has a greater distribution than any other in the Lower Rio Grande excepting the Opuntias, often grows to the edge of arroyos.

There are other societies formed in the chaparral which may also be found in the mesquital - chaparral phase. Bumelia lycioides Pers. and B. angustifolia Nutt. occur as societies, families and clans throughout the area. Such plant groups are known as comales, singular, comal. Diospyros Texana

Scheele forms a Zapotal, and Yucca a pital. There are few areas in which Yucca grows abundantly. It is usually scattered singly or in very small groups (Plate 17).

Coastal Area.

This area includes the sandy beach, sand-dunes or medanos, salt flats, or badilla salitrosa and the salt grass region known as the sachuistal.

There are certain differences in the types of vegetation at different points along the coast. At Red-Fish Bay (Willacy County) where the Sand Belt dips down to the coast, the zacatal vegetation persists to the water's edge. Some Spartina spartinae may be found but in general the typical coast flora is lacking. Just south of the Bay, long estuaries reach inland for some distance and the Raymondville and Port Isabel Clays support the flora common to salt marshes.

Boca Chica offers an excellent opportunity for a study of coast phytogeography. The beach is sandy with shifting dunes. Back of these low dunes there are others sometimes 20 to 25 feet high which are stable and covered with vegetation. Barren salt flats and salt marshes reach out into

the grassland along the coast, and small islands lie between Brazos, Santiago Island, and the mainland.

1. Beach vegetation:

There are few plants along the beach which are not found on the dunes. In fact the dunes usually are reached by high tides. Cakile maritima Scop., var. aequalis Chapman, Portulaca pilosa L., and Oenothera Drummondii Hook. are found on sandy flats between dunes.

2. Shifting dunes (Plate 17).

Uniola paniculata L., Ipomoea Pes Caprae L. Sweet, Sesuvium verrucosum Raf., and Fimbristylis castanea (Michx.) Vahl. serve as sand binders on the shifting dunes.

3. Permanent dunes.

These dunes are covered by a prairie phase of the coastal vegetation. A list of plants found on permanent and shifting dunes at Boca Chica is listed below:

Sabbatia carnosa Small
Ipomea carnosa Br. and Rose
Agalinis heterophylla Nutt.
Catharolinum alatum Small
Gaillardia pulchella Foug.
Samodia ebracteata (H. B. K.) Baudo.

Strombocarpa cinaerescens A. Gray

Mimosa strigillosa T. and G.

Ipomea Pes Caprae (L.) Sweet

Abutilon incanum (Link.) Sweet

Borrichia frutescens (L.) DC.

Sesuvium verrucosum Raf.

Batis maritima L.

Dondia linearis (Ell.) Millsp.

Oenothera Drummondii Hook.

Dondia multiflora (Torr.) Heller

Portulaca oleracea L.

Cakile americana Nutt.

Dondia conferta Small

Limonium Nashii Nashii Small

Cladothrix lanuginosa Nutt.

Portulaca oleracea L.

Hoffmanseggia densiflora Benth.

Philozerus vermicularis (L.) R. and Br.

Sporobolus Wrightii (Munro.) Scribn.

Distichlis spicata (L.) Greene

SPartina spartinae (Trin.) Merr.

Uniola paniculata L.

Scirpus americanus Pers.

Sabbatia carnosa Small

Indigofera leptosepala Nutt

Sisyrinchium longipedunculatum Bick.

Petalostemon emarginatus Torr. and Gray

Eleocharis albida Torr.

Opuntia sp.

Aplopappus phyllocephalus DC.

Erigeron repens Gray

4. The salt-flat.

Salt flats which are covered with water by Gulf storms are almost barren. Most vegetation occurs near the margins with a few straggling plants, mostly Salicornias invading the salt-incrusted flat. Paspalum distichum, Monathochloe littoralis, and Chamaecrista littoralis venture beyond the margins and an occasional sand-dune out in the barren flat has the usual dune vegetation.

5. Hurricanes are of infrequent occurrence, sometimes doing little or no damage to the South-Texas Coast for periods of ten or fifteen years. The flora farther inland becomes fairly well established. Minor storms keep the vegetation of the salt flats and marshes and some of the low islands in stages of both progressive and retrogressive succession (Clements 1916) (Cowles 1919). Clark Island which lies one mile west of the northern end of Brazos Island is an exception. It is somewhat

higher, at least parts of it, than the others, and is also protected by Brazos Island, thus escaping the violent action of the waves. This island is roughly elliptical in shape, measuring about one mile in length and one-half mile across. The north end is several feet above water level, and is covered with mesquite trees which are ten to twelve feet high. This is a nesting place for herons, and the trees are weighted down with bulky masses of sticks which constitute the nests. A single specimen of Yucca treculeana measuring ten feet grew on the island, but was blown down in the hurricane of 1933. About one-third of the island is covered by a coastal prairie and upland vegetation, and the southeast portion is low and covered with water in places. The southeast margin is bordered by a low growth of Avicennia nitida Jacq. (Black Mangrove) (Plate 18). Salicornia, Atriplex and Dondia inhabit the wet area. It is interesting to find coastal flora such as Avicennia nitida Jacq. with gradations to the semi-desert vegetation. A complete list of the island flora is given below:

Physalis viscosa L.

Spartina spartinae (Trin.) Merr.

Cenchrus pauciflorus Benth.

Aristida purpurea Nutt.

Verbena Halei Small

Commelina crispa Wooten

Strombacarpa cinerescens

Sophora tomentosa L.

Chloris petraea Swartz

Polygala Boykinii Nutt.

Stemodia lanata Ruiz and Pavon

Eleocharis albida Torr.

Lepidium Virginicum L.

Avicennia Nitida Jacq.

Solanum triquetrum Cav.

Galpinsia tubicula (A. Gray) Small

Eragrostis secundiflora Presl.

Plantago rhodosperma Decne.

Calceolaria verticillata (Ortega) Kuntze

Dolicholus americanus (Mill.) Vail.

Rivina laevis L.

Andropogon littoralis Nash

Indigofera leptosepala Nutt.

Coreopsis cardeminefolia (DC.) T. and G.

Croton ciliato-glandulosus Ort.

Physalis mollis Nutt.

Opuntia dillenii (Ker - Gawler) Haworth

Yucca Treculeana Carr.

Prosopis juliflora var. glandulosa Torr.

Dondia linearis (Ell.) Millsp.

Gaillardia pulchella Foug.

Atriplex Matamorense Nels.

Eragrostis sessilispica Buckl.

Monanthochloe littoralis Engelm.

Polypogon monspeliesis (L.) Desf.

Sporobolus argutus

Vaseyochloa multinervosa

Hamosa Nuttalliana

Sabbatia carnosa Small

Batis maritima L.

Salicornia herbacea L.

Salicornia ambigua Michx.

Baptisia leucophaea Nutt.

Allionia mycteginea Michx.

Polygala alba Nutt.

Cladothrix lanuginosa Nutt.

Cyperus uniflorus Torr. and Hook.

Kallstroemia parviflora Norton

A phanostephus skirrhobasis (DC.) Trel.

Baccharis texana (T. and G.) Gray

Othake robustum Rydb.

6. The Sachuistal (Plate 18).

This area extends several miles inland. The dominant plant is Spartina spartinae. In the marshes it is associated with Dondia, Salicornia, and sedges, and farther inland by Eupatorium odoratum L., Aplopappus phyllocephalus DC., Franseria confertifolia (DC.) Rydb., Pulchea camphorata (L.) DC., Senecio glabellus Poir., Setaria macrostachya H. B. K., and Sporobolus argutus (Nees) Kunth, Mesquite trees invade this coastal grass area with Opuntia and some Yucca. Finally shrubs especially Lycium carolinianum Walt., Zizyphus obtusifolia (Hook.) Gray, Celtis pallida Torr., and Forestiera angustifolia Torr. help form the transition zone between the sacahuistal and the mesquital - chaparral.

Yucca Treculeana Carr. occurs as "forests" near Boca Chica and Port Isabel (Plate 19). The hurricane of 1933 completely wiped out this species at Boca Chica (Plate 19).

7. Boscaji de Palma - Palm Association. (Plate 20).

Probably the most picturesque and certainly one of the most interesting associations in the Lower Rio Grande Valley is the native palm grove ten miles below Brownsville. Rio de las Palmas was the first name

for the river later known as Rio Bravo del Norte, (Emory - 1857), and now called El Rio Grande. This first name is found on an old Spanish map (Cantino, 1502) of North America, perhaps the first one made (Small, 1927). No doubt the name was suggested by the native palms which grew on its banks. This palm, Inodes Texana O. F. Cook (Sabal Texana) Becc., La Palma de Micharo, is one of the four aborescent palms occurring in the continental United States outside of Florida. The others are the delta palm, Sabal Deeringiana, of the Mississippi delta, the cabbage tree, Sabal Palmetto, of the southeastern Atlantic region, and the fan-leaf palm, Neowashingtonia robusta, of the California deserts.

Arthur V. Schott, a geologist and surveyer in the Mexican-United States Boundary Survey, collected plants in the Lower Rio Grande Valley, and probably made the first report of any importance regarding these palms. The following is a quotation from his report (Schott 1852): "It is also in the lower portion of this belt (coastal plain of Texas), (the italics are the author's) where the palm tribe is represented by Chamaerops Palmetto that the palmetto attains a growth as gorgeous even as that on the lower Mississippi; it

extends on the Rio Bravo up to about eighty miles from the Gulf."

This palm has often been confused with a species native in southern Mexico, known as Sabal Mexicana.

The distribution of Inodes texana in the United States is confined to a limited area in Cameron County near the Rio Grande. This palm extends from El Salado ranch ten miles below Brownsville up the river three or four miles, forming a heavy growth. This virgin tropical forest with its tangle of vines, shrubs and fallen trees forms an almost inpenetrable jungle. The palms grow to the height of fifty feet on the Rabb ranch where the finest growth occurs. The bamboo, Arundo donax L., grows twenty feet tall here and aids in giving a tropical appearance as does Malvaviscus Drummondii. It is difficult to tell what plants rank second or third in dominance, but the most prominent ones are: Ulmus crassifolia Nutt., Pithecolobium brevifolium Benth., Celtis missisippiensis Bose., Celtis pallida Torr., Fraxinus Berlandieri DC., Leucaena pulverulenta (Schl.) Benth., Tillandsia usnioides L., and Arundo donax L. Below is a list of plants collected from the river's edge into the densest palm growth:

Inodes texana O. F. Cook

Lippia alba (Mill.) M. E. Brown

Lantana horrida H. B. K.

Tillandsia usnioides L.

Tillandsia recurvata L.

Fraxinus Berlandieri DC.

Gaura parviflora

Solanum nigrum L.

Passiflora lutea L.

Chamaesyce hypericifolia (L.) Small

Bumelia angustifolia Nutt.

Erythrina herbacea L.

Zizyphus obtusifolia (Hook.) Gray

Rorippa Nasturtium (L.) Rusby

Ionoxalis sp.

Amaranthus spinosus L.

Amaranthus hybridus L.

Acanthochiton Wrightii Torr.

Melothria pendula L.

Malvastrum spicatum (L.) Gray

Malachra urens Poit.

Malvaviscus Drummondi T. and G.

Forestiera angustifolia Torr.

Galium Aparine L.

Rumex Berlandieri Meism.

Persicaria mexicana Small

Persicaria longistyla Small

Cardiospermum corindum L.

Cardiospermum Halicacabum L.

Tragia neptaefolia Cav.

Metastelma barbigerum Scheele

Anredera vesicaria (Lam.) Gaertn.

Wissadula amplissima (L.) R. E. Fries

Verbena hybrid?

Diospyros texana Scheele

Plumbago scandens L.

Xanthoxylum insulare Rose

Xanthoxylum Pterota H. B. K.

Celtis mississippiensis Bosc.

Celtis Pallida Torr.

Salvia coccinea L.

Ampelopsis arborea L. Rusby.

Ulmus crassifolia Nutt.

Smilax renifolia Small

Malphigia glabra L.

Clematis Drummondii Torr. and Gray

Pithecolobium brevifolium Benth.

Arundo donax L.

Echinochloa colonum (L.) Link

Echinochloa crusgalli (L.) Beauv.

Eragrostis hypnoides (Lam.) B. S. P.

Oplimenus setarius (Lam.) Roem. and Schult.

Panicum fasciculatum Swartz

Panicum purpurescens Raddi (P. barbinode)

Paspulum conjugatum Berg.

Sporobolus Buckleyi Vasey

Cyperus ochraceus Vahl.

Carex Brittoniana Bailey

Centaurea americana Nutt.

Eclipta alba (L.) Hssk.

Eupatorium odoratum L.

Erigeron tenuis T. and G.

Senecio ampullaceus Hook.

Verbesina virginica L.

Parthenium hysterophorus L .

Rubus trivialis Michx.

Leuceana pulverulanta (Schl.) Benth.

Commelina longicaulis Jacq.

Abutilon Jaquinii Don.

Succession in Cultivated areas.

Much of the land below Penitas has been cleared for several miles back from the river and is under cultivation. Irrigation projects have been responsible for much of this clearing. Some of this land has been abandoned. Primary succession in the unirrigated region consists largely of the following species: Verbesina encleioides, Panicum firmulum, Panicum Hallii Hitchc. and Chase, Paspalum Langei (Fourn.) Nash,

Parthenium hysterophorus L., Ambrosia elatior L., Verbena Halei Small, Chamaesyce cordifolia (Ell.) Small, Croton leucophyllus Muell. Arg., and Solanum elaeagnifolium Cav. This is usually followed by Opuntia Lindheimeri Engelm., Celtis pallida Torr., Zizyphus obtusifolia (Hook.) Gray, and Prosopis juliflora var. glandulosa Torr. Near the river Cardiospermum Halicacabum L., Clematis Drummondii Torr. and Gray, Cuscuta arvensis Beyrich, Parthenium hysterophorus L., Amaranthus hybridus L., and Solanum triquetrum Cav. are some of the first plants to invade an abandoned clearing. In the irrigated section, Hedhus halepensis L., Trichloris pluriflora Fourn., Cynodon dactylon (L.) Pers., Cenchrus pauciflorus Benth., Setaria macrostachya H. B. K., Parthenium hysterophorus L., and Amaranthus hybridus L. are perhaps most important in primary succession.

In many places native trees have been permitted to stand in clearings; and when the land is abandoned, seeds from these trees start new colonies of the former vegetation. Some of these favored species are: Cordia Boissieri A. DC. (Plate 20), Siderocarpos flexicaulis (Benth.) Small, Diospyros Texana Sheele, and Prosopis juliflora var. glandulosa Torr.

Relations of the Edaphic Factors and Geological Formations to Plant Distribution.

There is no doubt that moisture is an important limiting factor. The vegetation along the river in the lower part of this region is composed of species which require more moisture than those in the upper valley. Some species which grow well near the coast are hardly recognizable for thier diminutive size in dry gravel areas.

Salt depressions have characteristic beach and coastal prairie vegetation at their margins, although a few yards distant the inland type of plant growth is dominant. Poorly drained soil has become so impregnated with alkali salts as to become practically useless for farming. This condition naturally limits all vegetation to alkali resistant plants such as the salt grasses, Dondia, Varilla texana Gray, Salicornia and Lycium carolininanum.

Hechtia texensis Watson seems to prefer soil of the type found in the Cockfield formation. This soil must be at least slightly saline since Varilla texana Gray (a halophyte) is always associated with it. Dry Gravel hills are covered with Acacia amentacea DC./ often accompanied by Acacia Berlandieri Benth.,

Leucophyllum texanum Benth., and Mortonia Greggii A. Gray prefer limestone soil and Cordia Boissieri A. DC. also seems to have a preference for it. More species of cacti are found in this Lissie gravel than in any other formation. This may be either because they prefer this soil, or because there is a sparse growth of brush, thus permitting them to have better light conditions.

Covillea tridentata (DC.) Vail is able to survive on soil unsuitable for other species. This plant can adapt itself to desert conditions although it is a true mesophyte if given an opportunity.

The zacatal or grassland conforms to the Sand Belt area (Figs. 1 and 3). The Aguilares Plain is sandy soil with grass a very important constituent in the vegetation.

The most luxuriant vegetation is in the alluvial soil along the Rio Grande below Penitas. As moisture increases toward the coast the vegetation increases in size and number of species. Plants with tropical affinities are more abundant in the region of Brownsville probably because of better moisture conditions and slightly higher temperature. The soil is more favorable for growth allowing chance seeds to

germinate more readily than under dry conditions.

Effect of Changes in Physiography

The changing course of the Rio Grande causes changes in vegetation. Alluvial soil is deposited in places and carried away in others. Floods fill up resacas, killing some plants and permitting the growth of others. Gulf storms destroy vegetation by wind-action and by blowing salt water inland. Estuaries are filled causing very unstable conditions for plant development. Arroyos dig deeper and wider at each succeeding storm, influencing the vegetation along the banks. Water holes are formed in the beds of arroyos (Plate 15) allowing such trees as Acacia Farnesiana (L.) Willd. and Parkinsonia aculeata L. to become established on the banks.

Summary

The area under investigation covers about 5000 Square miles, extending from the Gulf of Mexico to Webb County on the north-west, and from the Rio Grande north about thirty miles. Elevation ranges from sea-level to approximately 350 feet. The temperature ranges from 57.7 degrees in January to

to 88.7 degrees in July with an average of not more than 2 degrees difference between Rio Grande City and Brownsville. Rainfall averages from .29 inches in February to 5.62 inches in September, with a total annual rainfall of 17.46 inches at Rio Grande City and 26.89 inches at Brownsville.

The Mesquital

Mesquital is the name given to the mesquite-covered area which occupies the greater part of the Lower Rio Grande Valley. The author divides this area into three phases, which are discussed separately.

1. Mesquital - zacatal

This association, as it may be termed, is the southern portion of the grass-land formation which begins in the region of Falfurrias. Dominants other than the mesquite are Bouteloua barbata Lag., Aristida purpurea Nutt., and Eragrostis curtipedicellata Buckl. Societies within this association are various. Some shrubs are Zizyphus obtusifolia (Hook.) Gray, Celtis pallida Torr., and Forestiera angustifolia Torr.

2. Mesquital - nopalera

This is a narrow, somewhat irregular strip

just south of the mesquital-zacatal in which Opuntia Lindheimeri Engelm. is particularly large and abundant. It shares dominance with the mesquite sometimes almost to the exclusion of other species. Two salt lakes or depressions, Sal del Rey and La Sal vieja are in this phase and a characteristic beach and coastal prairie vegetation is found in the immediate vicinity.

3. Mesquital - chaparral.

This phase of the vegetation covers most of the mesquital. In general dominance is shared by several shrubs which become sole dominant where conditions are particularly favorable. The composition changes from the coast toward the drier area in Starr and Zapata counties. Some of the conspicuous forms which occur only in the lower part of the valley are Citharexylum Berlandieri B. L. Robinson, Myroxylon celastrinum H. B. K. Kuntze., Sophora secundiflora (Ortega) DC., Heimia salicifolia, Maytenus phyllanthoides Benth., Acanthocereus pentagonus (L.) Br. & Rose. Shrubs occurring only in the drier part of this phase are Microrhamnus ericoides Gray, Colubrina texensis Gray, Ephedra pedunculata Engelm., and Covillea tridentata (DC.) Vail.

Aquatic forms commonly found in resacas, canals, barrow-pits and charcos are as follows:

1. Submerged - Utricularia subulata L., Chara and Nitella.

2. Floating - Piaropis crassipes (Mart.) Britton, Richardia braziliensis (Moq.) Gomez, Lemna minor L., and Castalia elegans Greene.

3. Shallow water - Naias Guadalupensis (Spreng.) Morong., Heteranthera limosa (Sw.) Willd., Marsilea vestita Hook. and Grev., M. macropoda Engelm., Typha Latifolia L., Scripus Hallii A. Gray, Cyperus oxycarioides Britton, Phragmites communis Trin., Aster exilis Ell., Atamosco texana (Herb.) Greene.

4. Zone usually moist - Acacia Farnesiana (L.) Willd, Parkinsonia aculeata L., Rivina laevis L., Lycopersicon esculentum Mill. var. cerasiforme Gray, Cynodon dactylon (L.) Pers., and Lycium carolinianum Walt.

5. Wooded area along the river.

The Chaparral

This association consists of shrubs either with mesquite absent or inconspicuous. Societies are sometimes found within the mesquital area. There is a definite strip along the "Breaks of the Rio Grande" and another on the "Bordas Scarp" which is covered by this chaparral. Outstanding societies in this association are as follows: cenizal (Leucophyl-

lum texanum Benth. dominant), barretal (Helietta parvifolia Benth. and Hook. dominant), aguapal (Hechtia texensis Watson dominant), Agave society, Costillal (Microrhamnus ericoides Gray dominant), gobernadoral (Covillea tridehtata (DC.) Vail. dominant), Palo Verde (Cercidium dominant), chaparral (Acacia amentacea DC. dominant), cenizal - chaparral - huajillal (Leucophyllum texanum Benth. - Acacia amentacea DC. - A. Berlandieri Benth. dominants).

Coastal Area

1. Dunes
   a. Shifting dunes have little vegetation. Uniola paniculata L., Ipomoea Pes Caprae (L.) Pers., Croton punctatus Jacq., and other plants acting as sand binders, finally reduce dunes to a fixed state.
   b. Permanent dunes support a coastal prairie vegetation including many grasses and legumes. Some common species are Indigofera leptosepala Nutt., Mimosa strigillosa T. and G., Oenothera Drummondii Hook., Distichlis apicata (L.) Greene, Scirpus ameri-

canus Pers., Polypogon monspeliensis (L.) Desf., Sporobolus argutus (Nees) Kunth, Lepidium virginicum L., Coreopsis cardaminefolia (DC.) T. and G.

2. Salt flats. There is little vegetation here due both to extreme salinity and to periodic submergence. Salicornia herbacea L., S. ambigua Michx., S. Bigelovii Torr., Dondia conferta Small, D. multiflora (Torr.) Heller, are some species which invade the salt flat after the water dries up.

3. Sacahuistal

Spartina spartinae Trin. Mer. is dominant here with societies of Yucca Treculeana Carr. and various herbaceous plants. Clay dunes covered with chaparral and mesquite occur in this coastal strip. These same plants invade the sacahuistal from the west, forming a wide transition zone east of Brownsville.

Boscaji de Palma

This palm association is almost tropical and is one of the most interesting and picturesque places in the Lower Rio Grande Valley. It covers approximately one hundred acres. This place was noted on an old Spanish map in 1503. Important species associated with the palm are Celtis mississippiensis

Bosc., Fraxinus Berlandieri DC., Leucaena pulverulenta (Schl.) Benth. Arundo donax L., Ulmus crassifolia Nutt., Pithecolobium brevifolium Benth., and Tillandsia usneoides L.

The Lower Rio Grande Valley is of interest from the standpoint of systematic botany and ecology because there is a mingling of northern, western, east coastal, desert and tropical vegetation in this comparatively small area.

In conclusion I wish to express appreciation to Dr. E. J. Alexander, Assistant Curator at the New York Botanical Gardens for determining and checking much of the material; to Dr. Sidney Blake of the National Herbarium, Smithsonian Institution, who determined most of the Compositae; to Dr. Hugh O'Neill, Catholic University, Washington, D. C., who determined the Cyperaceae; to Dr. A. S. Hitchcock, Department of Agriculture, Bureau of Plant Industry, for his determination of the Gramineae; and to Dr. William C. Steere who determined the Hepaticae and Musci. I am much indebted to Professor H. H. Bartlett and to Dr. J. H. Ehlers for their helpful advice in the study of the problem and the preparation of this paper, and to the Department of Botany and the Botanical Gardens for making possible the field survey.

LIST OF SPECIES COLLECTED IN THE LOWER RIO GRANDE VALLEY

LEJEUNEACEAE

Frullania squarrosa (R. BL. & N.) Dumort. Raymondville.
Frullania eboracensis Gottsche. Rio Hondo.

RICCIACEAE

Oxymitra androgyna Howe Rio Grande City.
Riccia sp. Camp Perry, Rio Hondo.

PLAGIOTHECIACEAE

Stereophyllum Wrightii (Sull.) Ren. & Card. Alamo.

THUIDIACEAE

Haplocladium microphyllum (Hedw.) Broth. Palm Grove, Brownsville.

ERPODIACEAE

Erpodium domingense (Brid.) C. Mull. Rio Hondo.

BRYACEAE

Bryum argentium Hedw. Var. lanatum Bry. Eur. Raymondville.

FUNARIACEAE

Pyramidula tetragona (Brid.) Brid. Raymondville.
Physcomitrium turbinatum (Michx.) Brid. Barreda.
Physcomitrium immersum Sukl. Penitas.

POTTIACEAE

Pterygoneurum cavifolium (Ehrh.) Jur. Rio Grande City.
Trichostomum brachydontium Bruch. Zapata.
Weisia Andrewsii Bartr. La Joya.

MARSILEACEAE

Marsilea macropoda Engelm. Progresso (18).
Marsilea vestita Hook. & Grav. Mission (115).

FILICINEAE

Notholaena dealbata (Pursh) Kunze. Roma (791).

PINACEAE

Taxodium mucronatum Tenore. Havana (1123).

GNETACEAE

Ephedra antisiphilitica Meyer. Edinburg (1593).
Ephedra pedunculata Engelm. Barrocetes ranch, San Ignacio (1584).

POTAMOGETONEAE

Zosterella dubia (Jacq.) Small. La Joya Lake (640).

TYPHACEAE

Typha latifolia L. Chihuahua (214).

NAJADACEAE

Naias guadalupensis (Spreng.) Morong. Alamo (894).

ALISMACEAE

Echinodorus cordifolius (L.) Griseb. Alamo, Brooks
Sagittaria variabilis Engelm. Alamo (265) Co. (639).

GRAMINEAE

Andropogon barbinodis Lag. Laredo (1278).
Andropogon glomeratus (Walt.) B. S. P. Weslaco (462).
Andropogon littoralis Nash. Padre Island (1633).
Andropogon saccharoides Swartz. Edinburg (440).
Aristida purpurea Nutt. Penitas (575).
Arundo donax L. Palm Grove, Brownsville
Bouteloua barbata Lag. (Alamo (8).
Bouteloua hirsuta Lag. San Ignacio (1586).
Bouteloua trifida Thurb. Salineno (1406).

Brachiaria ciliatissima (Buckl.) Chase. Monte Cristo (927).
Cenchrus incertus M. A. Curtis. San Juan (305).
Cenchrus pauciflorus Benth. La Joya (586).
Chloris andropogonoides Fourn. Mission (162).
Chloris cucullata Bisbh. Tabasco (91).
Chloris gayena Kunth. Donna (625).
Chloris Petraea Swartz. Clark Island (740 A.).
Cynodon dactylon (L.) Pers. Alamo (433).
Dactyloctenium aegyptium (L.) Richt. San Juan (107).
Digitaria sanguinalis (L.) Scop. Harlingen (1211).
Distichlis spicata (L.) Greene. Boca Chica (383).
Echinochloa colonum (L.) Link. Chihuahua (985).
Echinochloa crusgalli (L.) Beauv. Palm Grove, Brownsville (1518).
Echinochloa crusgalli zelayensis (H. B. K.) Hitchc. Alamo (389).
Eleusine indica (L.) Gaertn. Alamo (1350).
Eragrostis barrelieri Daveau. San Juan (451).
Eragrostis beyrichii J. G. Smith. Guevitas (1095).
Eragrostis curtipedicellata Buckl. La Joya Lake (42).
Eragrostis hypnoides (Lam.) B. S. P. Palm Grove Brownsville (950).
Eragrostis lugens Nees. Kingsville (837).
Eragrostis secundiflora Presl. Boca Chica (720).
Eragrostis sessilispica Buckl. Clark Island (740).
Eragrostis reptans (Michx.) Nees. Alamo (432).
Eragrostis spicta Vasey. Alamo (297).
Eriochloa punctata (L.) Desv., Hamilt. Brownsville (1650).
Heteropogon contortus (L.) Beauv. Linn (847).
Holcus halapensis L. Alamo (149).
Leptoloma cognatum (Schult.) Chase. Boca Chica (727).
Leptochloa dubia (H. B. K.) Nees. Alamo (1481).
Leptochloa filiformis (Lam.) Beauv. San Juan (559).
Leptochloa nealleyi Vasey. Rio Mondo (1580)
Leptochloa uninervia (Presl.) Hitchc. & Chase. Alamo (918).
Monanthchloe littoralis Engelm. Clark Island (759).
Oplismenus setarius (Lam.) Roem. & Schult. Palm Grove (1508).
Panicum fasciculatum Swartz. Palm Grove (956).
Panicum firmulum Hitchc. & Chase. La Joya (580).
Panicum Hallii Vasey. La Joya (557).
Panicum hians Ell. Encino (836).
Panicum nodatum Hitchc. & Chase. Encino (834).
Panicum purpurascens Raddi. Palm Grove (1511).
Panicum sphaerocarpon Ell. Encino (858).
Panicum texanum Buckl. Alamo (1347).

Pappophorum bicolor Fourn. Arroyo el Tigre (697)
Pappophorum mucronulatum Nees. San Manuel Ranch (851).
Paspalum conjugatum Berg. Palm Grove (1507).
Paspalum dilatatum Poir. Alamo (1349).
Paspalum distichum L. Boca Chica (365).
Paspalum Langei (Fourn.) Nash. Tabasco (781).
Paspalum lividum Trin. Alamo (1115).
Paspalum stramineum Nash. Encino (860).
Paspalum urvillei Steud. Donna (1014).
Phalaris caroliniana Walt. Encino (832)
Phragmites communis Trin. Mercedes (630)
Polypogon monspeliensis (L.) Desf. Clark Island (758).
Setaria macrostachya H. B. K. Rio Hondo (613).
Setaria Scheeli (Steud.) Hitchc. Alamo (1453).
Setaria setosa (Swartz) Beauv. Alamo (1453)
Setaria geniculata (Lam.) Beauv. Encino (839)
Spartina spartinae (Trin.) Merr. Boca Chica (729).
Sporobolus argutus (Nees) Kunth. Clark Island (1256).
Sporobolus Buckleyi Vasey. Palm Grove (1560).
Sporobolus cryptandrus (Torr.) Gray. Harlingen (1213).
Sporobolus Wrightii (Munro.) Scribn. Boca Chica (402).
Trichachne californica (Benth.) Chase. Mission (1993).
Trichachne saccharatum (Buckl.) Nash. Mission (174).
Trichloris mendocina (Phil.) Kuntz. Arroyo Veleno
Trichloris pluriflora Fourn. Weslaco (628). (1290).
Tricholaena rosea Nees. Donna (466).
Trichoneura elegans Swallen. San Ignacio (1582).
Triodia albescens Vasey. Harlingen (1025).
Triodia mutica (Torr.) Scribn. Salineno (1405).
Triodia pilosa (Buckl.) Merr. Arroyo el Tigre.
Uniola paniculata L. Boca Chica (386).
Vaseyochloa multinervosa (Vasey) Hitchc. Clark Island

CYPERACEAE

Carex Brittoniana Bailey Progresso (18).
Cyperus acuminatus Torr. & Hook. Chihuahua (598).
Cyperus articulatis L. Alamo (1119).
Cyperus cylindricus (Ell.) Britton ? Ojo de Agua (995B)
Cyperus elegans L. Rio Hondo (1030)
Cyperus erythrorhizas Michl. Palm Grove (1529).
Cyperus ferax L. C. Rich. Progresso (15).
Cyperus globosus Aubl. Monte Cristo (929).
Cyperus ochraceus Vahl. Palm Grove (981).
Cyperus oxycarioides Britton. Alamo (995).
Cyperus strigosus L. Alamo (898).
Cyperus uniflorus Torr. & Hook. Alamo (150).
Cyperus virens Michx. Rio Hondo (1030).
Eleocharis albida Torr. Clark Island (747B).
Eleocharis palustris (L.) R. & S. Rio Hondo (1012).

Fimbristylis castanea (Michx.) Vahl. Boca Chica (771).
Scirpus americanus Pers. Boca Chica (701).
Scirpus californicus Britton. Brownsville (973).
Scirpus Hallii A. Gray. Alamo (887).
Scirpus validus Vahl. La Feria (633).

PALMAE

Inodes texana O. Fl Cook. Brownsville (1504)

LEMNACEAE

Lemna minor L. Rio Hondo.
Wolffia columbiana Karsten. Rio Hondo

BROMELIACEAE

Hechtia texensis Watson. Roma (523).
Tillandsia Baileyii Rose Alamo (637).
Tillandsia recurvata L. La Joya (69).
Tillandsia usneoides L. Tabasco (226).

COMMELINACEAE

Commelina crispa Wooten. Roma (161).
Commelina longicaulis Jacq. Alamo (1422).
Tradescantia micrantha Torr. Port Isabel (974).

PONTEDERIACEAE

Heteranthera limosa (Sw.) Willd. Rio Hondo (1038).
Piaropis crassipes (Mart.) Britton. Brownsville (361.)

JUNCACEAE

Juncus aristulatus Michx. Raymondville (833).

LILIACEAE

Allium arenicola Small. Arroyo el Tigre (1797).
Allium scaposum Benth. Boca Chica (1709).
Smilax renifolia Small. Tabasco (227).

Yucca rupicola Scheele. San Manuel Ranch (820).
Yucca tenuistyla Trelease. San Ignacio (505).
Yucca treculeana Carr. Boca Chica.
Yucca sp. Penitas (135).

AMARYLLIDACEAE

Agave americana L. El Conchito Ranch. Zapata (1295).
Agave lechiguilla Torr. Roma (477).
Agave sp. Rio Grande City (384).
Atamosco texana (Herb.) Greene. Alamo (1421).
Cooperia Drummondii Herb. San Juan (4).
Manfreda maculosa (Hook.) Rose. La Joya (62).
Manfreda variegata (Jacobi) Rose. Alamo (12).
Runyonia longiflora Rose. Rio Grande City (483).

IRIDACEAE

Sisyrinchium amoenum Bick. Padre Island (1640).
Sisyrinchinum furcatum Bick. San Manuel Ranch (808).
Sisyrinchium longipedunculatum Bick. Boca Chica (707).

ZINGIBERACEAE

Croftia parvifolia (Torr.) Small. Edinburg (1587).

SALICACEAE

Salix longifolia Muhl. Alamo (261).

BATIDACEAE

Batis maritima L. Clark Island (764).

FAGACEAE

Quercus virginiana Mill. N. Willacy County (638).

ULMACEAE

Celtis pallida Torr. La Joya (75).
Celtis mississipoiensis Bosc. Palm Grove (457).
Ulmus crassifolia Nutt. Tabasco (224).

URTICACEAE

Parietaria obtusa Rydb. Alamo (1780).
Urtica chamaedroides Pursh. Alamo (1863).

LORANTHACEAE

Phoradendron flavescens Nutt. Rio Grande City (525).

ARISTOLOCHIACEAE

Aristolochia longifolia Engelm. & Gray. Arroyo el Tigre (751).

POLYGONACEAE

Eriogonum multiflorum Benth. Boca Chica (1913).
Persicaria longistyla Small. Palm Grove (1514).
Persicaria mexicana Small. Palm Grove (1455).
Persicaria pennsylvania (L.) Small. Alamo (903).
Rumex Berlandieri Meisn. Palm Grove (1530).
Rumex crispus L. Weslaco (608).
Rumex mexicanus Meisn. Tabasco (166).
Rumex spiralis Small. Havana (1127).

CHENOPODACEAE

Atriplex acanthocarpa (Torr.) S. Wats. Roma (1090).
Atriplex arenaria Nutt. Port Isabel (1263)
Atriplex canescens (Pursh.) Nutt. El Jaral Ranch, Zapata Co. (1581).
Atriplex matamorense Nels. Boca Chica (374).
Chenopodium album L. Boca Chica (1710).
Chenopodium viride L. San Benito (1929).
Dondia conferta Small. Boca Chica (354).
Dondia linearis (Ell.) Millsp. Port Isable (1262).
Dondia multiflora (Torr.) Heller. Boca Chica (377).
* Dondia sp. Clark Island (329)
Salicornia ambigua(Michx.). Clark Island (767).
Salicornia Bigelovii Torr. Boca Chica (359).
Salicornia herbacea L. Clark Island (766).

AMARANTACEAE

Acanthochiton Wrightii Torr. Palm Grove (1535).

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* Plants marked with the asterisk are possible new species.

Achyranthes repens L. Boca Chica (395).
Amaxanthus Berlandieri (Moq.) Uline & Gray. San Juan (444).
Amaranthus hybridus L. Alamo (1342).
Amaranthus spinosus L. Palm Grove (1534).
Celosia paniculata L. Salino Station, No. Hidalgo Co. (1609).
Cladothrix lanuginosa Nutt. Boca Chica (357).
Froelichia campestris Small. Rio Grande City (1939).
Froelichia Drummondii Moq. No. Hidalgo Co. (855).
Philoxerus vermicularis (L.) R & Br. Padre Island (380).

NYCTAGINACEAE

Acleisanthes Greggii Standley. San Juan (464).
Acleisanthes obtusa (Choisy) Standley. Roma (1386).
Allionia nyctaginea Michx. Clark Island (1715).
Boerhaavia erecta L. San Juan (302).
Boerhaavia viscosa Lag. and Rodr. Rio Grande City (1312).
Nyctaginia capitata Chois. Rio Grande City (187).
Nodeliella incarnata (L.) Cockerell. Zapata (1358).

PHYTOLACCACEAE

Phaulothamnus spinescens A. Gray. Rio Hondo (1034).
Rivina laevis L. Alamo (13).

AIZOACEAE

Mollugo verticillata L. Harlingen (1201).
Sesuvium verrucosum Raf. Boca Chica (1713).

PORTULACACEAE

Portulaca oleracea L. Boca Chica (352).
Talinum angustissimum (A. Gray) Wooten & Standley. McAllen (1001).
Talinum reflexum Cav. Tabasco (79).
Talinopsis frutescens Gray. Rio Grande City (481).

CARYOPHYLLACEAE

Alsine Baldwinii Small. San Benito (617).

NYMPHACEAE

Castalia elegans Greene A lamo (944).

RANUNCULACEAE

Clematis Drummondii Torr. & Gray. San Juan (1).

MENISPERMACEAE

Cocculus diversifolius DC. Santa Maria (1215).

PAPVERACEAE

Argemone alba Lestib. Mercedes (467).
Argemone mexicana L. Alamo (192).
Argemone platyceras Link & Otto. Chihuahua (601).

CRUCIFERAE

Cakile americana Nutt. Boca Chica (353).
Lepidium austrinum (Millsp.) Small. La Joya (1876).
Lepidium virginicum L. Clark Island (749).
Lesquerella auriculata (Eng. & Gray) Wats. Barreda (1648).
Lesquerella densiflora (A. Gray) S. Wats. Zapata (1794).
Lesquerella lasiocarpa (Hook.) S. Wats. Donna (624).
Nerisyrenia camporum (Gray) Greene. San Ignacio (684).
Radicula Walteri (Ell.) Small. Chihuahua (597).
Roripa nasturtium (L.) Rusby. Palm Grove (1795).
* Selenia sp. Alamo (1424).
Synthlipsis Berlandieri A. Gray ? Zapata (1795).

CAPPARIDACEAE

Cristatella erosa Nutt. Monte Cristo (931).
Polanisia trachysperma T. & G. Rio Grande City (474).

CRASSULACEAE

Lenophyllum texanum (J. G. Smith) Rose. Tabasco.

ROSACEAE

Rubus trivialis Michx. Brownsville (1711).

LEGUMINOSAE

Acacia amentacea DC. Rio Grande City (472).
Acacia Berlandieri Benth. Alamo (1337).

Acacia Farnesiana (L.) Willd. Alamo (293).
Acacia Greggii A. Gray. San Juan (3).
Acacia Roemeriana Schlecht. Monte Cristo (935).
Aguan depressa (Willd.) Kuntze. San Juan (303).
Anneslia eriophylla (Benth.) Britton. Rio Grande City (1677).
Baptisia leucophaea Nutt. Clark Island (769).
Cassia Bauhinioides Gray. Rio Grande City (1321).
Cassia Medsgeri Shafer. Edinburg (1588).
Cassia pumilio A. Gray. Zapata (679).
Cercidium floridum Benth. La Joya (65).
Cercidium texanum A. Gray (1321).
Chamaecrista cinerea (Cham. & Schlecht.) Poll. No. Starr Co. (1102).
Chamaecrista littoralis Pollard. Padre Island (1638).
Cologania sp. Clark Island (746).
Coursetia axillaris Coult. & Rose La Lomita (Mission) (1060).
Cracca Lindheimeri (A. Gray) Kuntze. Raymondville (1198).
Daubentonia pavinillesii (S. Wats.) Standl. Boca Chica (388).
Dolicholus americanus (Mill.) Vail. Clark Island (814).
Dolicholus minimus (L.) Medic. Weslaco (459).
Erythrina herbacea L. Palm Grove (1925).
Eysenhardtia texana Scheele. La Joya (72).
Hamosa Nuttalliana (DC.) Rydb. (754).
Hoffmanseggia caudata A. Gray. (1275).
Hoffmanseggia densiflora Benth. Boca Chica (360).
Indigofera leptosepala Nutt. Boca Chica (704).
Leucaena pulverulenta (Schl.) Benth. Alamo (455).
Lupinus texensis Hook. La Joya (104).
Mimosa Berlandieri A. Gray. Boca Chica (393).
Mimosa Berlandieri A. Gray. Alamo (892).
Mimosa strigillosa T. & G. Boca Chica (712).
Parkinsonia aculeata L. Alamo (105).
Parosela aurea (Nutt.) Britton. No. Starr Co. (1106)
Parosela humilis (Mill.) Rydb. Boca Chica (1242).
Parosela nana (Torr.) Heller. Arroyo el Tigre (694).
Parosela pogonathera (Gray) Vail. Havana (646).
Petalostemon emarginatus T. & G. Boca Chica (703).
Pithecolobium brevifolium Benth. La Lomita (Mission) (1072).
Prosopis juliflora Var. glandulosa Torr. San Juan (2).
Siderocarpos flexicaulis (Benth.) Small. San Juan (7).
Sophora secundiflora Lag. San Benito (1743).
Sophora tomentosa L. Boca Chica (768).
Strombocarpa cinerescens A. Gray. Los Fresnos (969).
Vicia texana (T. & G.) Small. Rio Hondo (611).

GERANIACEAE

Geranium carolinianum L. Alamo (1779).

OXALIDACEAE

Ionoxalis violacea (L.) Small Alamo (1425).
Ionoxalis sp. Palm Grove (1512).
Monoxalis dichondraefolia (A. Gray) Small. Rio Grande City (1046).
Oxalis corniculata L. Alamo (1423).

LINACEAE

Cathartolinum alatum Small. Boca Chica (316).
Cathartolinum multicaule (Hook.) Small. No. Starr Co. (1097).

ZYGOPHYLLACEAE

Covillea tridentata (DC.) Vail. San Ignacio (1938).
Kallstromia parviflora Norton. Clark Island (1308).
Porbieria angustifolia Engelm. Tabasco (89).
Tribulus terrestris L. San Juan (299).

RUTACEAE

Amyris parvifolia Gray. Rio Hondo (242).
Esenbeckia Runyonii Morton (Not collected) Santa Maria.
Helietta parvifolia Benth. & Hook. Rio Grande City (1317).
Thamnosma texana (A. Gray) Torr. Tabasco (581).
Zanthoxylum insulare Rose. Rio Hondo (1035).
Xanthoxylum Pterota H. B. K. Rio Hondo (239).

SIMARUBACEAE

Castela Nicholsonii Hook. Rio Hondo (241).
Castelaria texana (T. & G.) Small. Alamo (1501).

MALPHIGIACEAE

Coelostylis texana T. & G. Alamo (881).
Malphigia glabra L. Alamo (553).

POLYGALACEAE

Polygala alba Nutt. Boca Chica (706).
Polygala Boykinii Nutt. Clark Island (745).
Polygala macradenia Gray. Rio Grande City (488).

EUPHORBIACEAE

Acalypha hederacea Torr. La Joya (183).
Adelia Vaseyi (Coulter) Pax & Hoff. Mission (1077).
Bernardia myricaefolia (Scheele) Wats. Rio Hondo (1036).
Chamaesyce cordifolia (Ell.) Small. Mission (356).
Chamaesyce hypericifolia (L.) Small. Alamo (356).
Chamaesyce laredana (Millsp.) Small. Rio Grande City (1363).
Chamaesyce serpens (H. B. K.) Small. Rio Grande City (1364).
Croton ciliato-glandulosus Ort. Roma (1392).
Croton cortesianus Kunth. Raymondville (190).
Croton Engelmannii Ferguson. Raymondville (1216).
Croton fruticulosus Engelm. Alamo (1483).
Croton leucophyllus Muell. Arg. Ojo de Agua (999).
Croton neomexicanus Muell. Arg. Edinburg (1596).
Croton punctatus Jacq. Padre Island (1635).
Croton Torreyanus Muell. Arg. Rio Grande City (1330).
* Croton sp. Alamo (1776).
Ditaxis humilis (Engelm. & Gray) Arroyo Veleno (1786).
Galarhoeus arkansanus (Engelm. & Gray) Small. Alamo (872).
* Galarhoeus sp. Alamo (889).
Jatropha Berlandieri Torr. Rio Grande City (478).
Jatropha spathulata Muell. La Joya (39).
Jatropha stimulosa Michx. Santa Elena Ranch
Poinsettia heterophylla L. San Juan (109).
Stillingia Torreyana Watson. Zapata (498).
Tragia nepetaefolia Cav. Palm Grove (1562).
Tragia urticaefolia Michx. Camp Perry (1758).

CELASTRACEAE

Maytenus phyllanthoides Benth. Brownsville (417).
Mortonia Greggii Gray. La Joya (1791).
Schaefferia cuneifolia Gray. La Joya (73).

SAPINDACEAE

Cardiospermum corindum L. Palm Grove (1558).
Cardiospermum Halicacabum L. Tabasco (205).
Sapindus Drummondii Hook. & Arn. Alamo (779).
Serjania brachycarpa Gray. Alamo (1468).

RHAMNACEAE

Colubrina texensis Gray Zapata (1033).
Condalia obovata Hook. Havana (1129).
Condalia obtusifolia (Hook). Weberbauer Rio Grande City (1371).
Karwinskia Humboldtiana Zucc. Alamo (11).
Microrhamnus ericoides Gray. Rio Grande City (470).
Zizyphus obtusifolia (Hook.) Gray. Palm Grove (1087).

VITACEAE

Ampelopsis arborea (L.) Rusby. Tabasco (209).
Ampelopsis mexicana Rose. Barreda (1702).
Cissus incisa Desmoul. Zapata (1272).

MALVACEAE

Abutilon americanus (L.) Sweet. Rio Grande City (185).
Abutilon incanum (Link.) Sweet. Boca Chica (1238).
Abutilon Jacq. Don. Palm Grove (1505).
Abutilon texense T. & G. Alamo (1454).
Abutilon triquetrum (L.) Presl. Alamo (1446).
Abutilon Wrightii Gray. Rio Grande City (489).
Callirrhoe digitata Nutt. San Ignacio (685).
Cienfuegosia sulphurea (St. Hil.) Garcke. Alamo (1259).
Gayoides crispum (L.) Small. Roma (1391).
Hibiscus cardiophyllus Gray. La Joya (38).
Kosteletskya hastata Presl. Edinburg (1608).
Malachra urens Poit. Palm Grove (1526).
Malvastrum coromandelianum Garcke. Boca Chica (407).
Malvastrum spicatum (L.) Gray. Boca Chica (406).
Malvaviscus Drummondii T. & G. Palm Grove
Sida diffusa H. B. K. Alamo (1498).
Sida filipes A. Gray. Roma (1406).
Sida hastata St. Hil. Las Comitas (1314).
Sida paniculata L. Rio Hondo (1014).
Sida spinosa L. Mission (112).
Wissadula amplissima (L.) R. E. Fries. Palm Grove (1564).

BOMBACACEAE

Waltheria americana L. San Isidro Ranch (1840).

STERCULIACEAE

Melochia pyramidata L. Olmito (1261).

COCCULOSPERMACEAE

Amoreuxia Wrightii A. Gray. Rio Grande City (486).

KOEBERLINIACEAE

Koeberlinia spinosa Zucc. La Joya (64).

FLACOURTIACEAE

Myroxylon celastrinum (H. B. K.) Kuntze. Combes (1621).

TURNERACEAE

Turnera aphrodisiaca Ward. Zapata (1686).
Passiflora foetida L. Mission (191).
Passiflora lutea L. Palm Grove (1603).

LOASACEAE

Cevallia sinuata Lag. Zapata (1409).

OENOTHERACEA

Galpinsia Hartwegii (Benth.) Britt. Arroyo el Tigre (695).
Galpinsia tubicula (Gray) Small. Clark Island (719).
Gaura Drummondii T. & G. Weslaco (623).
Gaura parviflora Dougl. Tabasco (1005).
Gaura villosa Torr. Las Viboras Ranch (1100).
Jussiaea diffusa Forsskl. Rio Hondo (1040).
Kneiffia arenicola Small. Mission (169).
Oenothera Drummondii Hook. Boca Chica (351).

UMBELLIFERAE

Ammoselinum Popei T. & G. Chihuahua (573).
Apium ammi (L.) Urban. La Joya (1895).
Eryngium compactum Small. Alamo (874).
Eurytaenia texana T. & G. Small. Santa Elena Ranch (1107).
Hydrocotyle umbellata L. Alamo (787).

PRIMULACEAE

Samodia ebracteata (H. B. K.) Baudo Boca Chica (318).
Samolus cuneatus Small. Boca Chica (1248).
Samolus floribundus (H. B. K.) Rio Hondo (1026).

PLUMBAGINACEAE

Limonium Nashii Small. Boca Chica (355).
Plumbago scandens L. Alamo (785).

SAPOTACEAE

Bumelia angustifolia Nutt. Edinburg (1328).
Bumelia lycioides Pers. La Joya (1328).

EBENACEAE

Diospyros texana Scheele. Alamo (784).

OLEACEAE

Forestiera angustifolia Torr. Rio Hondo (1597).
Fraxinus Berlandieri DC. Palm Grove (1924).
Menodora heterophylla Moricand. Mission (1063).

GENTIANACEAE

Eustoma Russellianum (Hook.) Griseb. Chihuahua (199).
Sabbatia campestris Small. No. Hidalgo Co. (831).
Sabbatia carnosa Small. Boca Chica (702).

ASCLEPIADACEAE

Metastelma barbigerum Scheele. Palm Grove (1547).
Podostemma longicornu (Benth.) Greene. San Juan (1906).
*Podostemma sp. Boca Chica (320).
Vincetoxicum brevicoronatum (Rob.) Vail. E. Starr Co. (663).
Vincetoxicum gonocarpos (Walt.) San Ignacio (1907).
Vincetoxicum reticulatum (Engelm.) Heller. Barreda (1624).

CONVOLVULACEAE

Convolvulus incanus Vahl. Lin (1612).
Cuscuta arvensis Beyrich. Rio Hondo (230).
Cuscuta indecora Choisy. Boca Chica (390).
Evolvulus alsinoides L. Tabasco (40).
Evolvulus sericeus Sw. Roma (1091).
Ipomoea carnosa Br. & Rose (314).
Ipomoea dissecta (Jacq.) O. Pursh. Alamo (1457).
Ipomoea fistulosa Mart. Alamo (294).
Ipomoea littoralis (L.) Boiss. Boca Chica
Ipomoea Pes Caprae Sweet. Boca Chica (323).
Ipomoea sinuata Ortega. Raymondville (1196).
Ipomoea trifida (H. B. K.) G. Don. Tabasco (206).

CACTACEAE

Acanthocereus pentagonus (L.) Br. & Rose. Rio Hondo (1872).
Ancistrocactus brevihamatus (Engelm.) Br. & Rose. La Joya.
Ancistrocactus Scheeri Salm-Dyck. La Joya (1887).
Astrophytum asterias (Zucc.) Lemaire. Rio Grande City (1867)
Corypantha Pirtiliana Wright. Rio Grande City (15273). Gard. No.
Coryphantha Runyonii Br. & Rose. Rio Grande City (1875).
Dolicothele sphaerica (Dietrich) Br. & Rose Salineño (1875).
Echinicereus angusticeps Clover. Linn (1870).
Echinocereus Berlandieri Engelm. (doubtful species) Edinburg (1882).
Echinocereus Blankii (Poselger) Palmer. Alamo (1878).
Echinocereus enneacanthus Engelm. La Joya (1874).
Echinocereus Fitchii Br. & Rose. Rio Grande City (1871).
Echinocereus papillosus Linke. Rucio (1869).
Echinocereus pentalophus (DC.) Rumpler. La Joya (1890).

Escobaria Runyonii Br. & Rose. Tabasco (1886).
Ferocactus hamatacanthus (Muhlenpfordt) Br. & Rose. Zapata (1873).
Hamatocactus setispinus Engelm. La Joya (1876).
Homalocephala texensis (Hopffer) Br. & Rose. La Joya (1868).
Lophophora Williamsii (Lemaire) Coulter. Rio Grande City (1879).
Neomammillaria aPplanata (Engelm.) Br. & Rose. La Joya (1889).
Neomammillaria hemisphaerica (Engelm.) Br. & Rose. La Joya (1885).
Neomammillaria heyderi (Muhlenpfordt) Br. & Rose. La Joya (1891).
Neomammillaria multiceps (Salm-Dyck.) Raymondville (1865).
Opuntia Engelmanni Salm-Dyck. Zapata
Opuntia leptocaulis DC. Penitas (29).
Opuntia Lindheimeri Engelm. Penitas (35).
Opuntia Schottii Engelm. Rio Grande City (1884).
Thelocactus bicolor (Galeotti) Br. & Rose. Rio Grande City (1880).
Wilcoxia Poselgeri (Lemaire) Coulter. La Joya (1877).

POLEMONIACEAE

Gilia incisa Benth. Rio Hondo (1905).
Phlox pilosa L. Var. detonsa Gray. No. Hidalgo Co. (832).

HYDROPHYLLACEAE

Marilaunidium hispidum (Gray) Kuntze. Chihuahua (585).
Marilaunidium Jamaicense (L.) Kuntze. Chihuahua (593).
Marilaunidium macranthum (Choisy) Kuntze. Alamo (909).
Phacelia parviflora Pursh. Combes (1760).
Phacelia patuliflora (Engelm. & Gray) A. Gray. Mercedes (618).

BORRAGINACEAE

Cordia Boissieri A. DC. Alamo (9).
Ehretia elliptica (DC.) Alamo (896).
Heliotropium confertifolium Torr. Zapata (682)
Heliotropium curassavicum L. Boca Chica (396).
Heliotropium indicum L. Boca Chica (396).
Heliotropium inundatum Sw. Alamo (902).
Heliotropium parviflorum L. E. Starr Co. (659).
Lithospaerum matamorense DC. Tabasco (686).
Tournefortia volubilis L. Camp Perry (1756).

VERBENACEAE

Avicennia nitida Jacq. Clark Island (1251).
Citharexylum Berlandieri B. L. Robinson. Boca Chica (1698).
Goffiostachyum ditrosum Small. Rio Hondo (1566).
Helleranthus quadrangulatus (Heller) Small. Chihuahua (596).
Lantana horrida H. B. K. (1426).
Lantana macropoda Torr. Rio Grande City (1681).
Lippia alba (Mill.) N. E. Brown. Palm Grove (962).
Lippia Berlandieri Schauer. Tabasco (1676).
Lippia lineustrina (Lag.) Small. Tabasco (10).
Lippia macrostachya (Torr.) Moldenenke. Rio Grande City (1268).
Phyla nodiflora (L.) Greene. Mission (119).
Verbena bi-pinnatifida Nutt. Tabasco (106).
Verbena ciliata Benth. Alamo (1450).
Verbena Halei Small. Clark Island (736).
Verbena officinalis L. Barreda (1695).
Verbena Xutha Lehm. Rio Grande City (1618).
Verbena hybrid ? Palm Grove (1519)

LABIATAE

Melosmon cubense (L.) Small. Mission (171).
Micromeria pilosiuscula (Benth.) Small. Camp Perry (1903).
Monarda dispersa Small. San Juan (5).
Monarda punctata L. Alamo (1046).
*Monarda Sp. No. Hidalgo Co. (807).
Melochia pyramidata (L.) Alamo (879).
Salvia ballotaeflora Benth. La Joya (1333).
Salvia coccinea L. Raymondville (606).
Salvia Greggii A. Gray. Brownsville
Stachys agraria Cham. & Schlecht. Rio Hondo (1051).
Stachys Drummondii Benth. Chihuahua (602).
Zornia bracteata (Walt.) Gmel. No. Starr Co. (1841).

SOLANACEAE

Capsicum baccatum L. Alamo (1113).
Chamaesaracha conioides (Moric.) Britt. Barreda (1714).
Datura innoxia Safford. Roma (502).
Lycium Berlandieri Dunal. Rio Grande City (490).
Lycium carolinianum Walt. Olmito (1654)
Lycium Chateaui Standley. La Joya (74).

Lycium Torreyi Gray. Zapata (1301).
Nicotiana glauca Graham. La Joya (184).
Nicotina repanda Willd. Roma (1396).
Petunia parviflora Juss. Chihuahua (505).
Physalis Carpenteri Riddell. Roma (1383).
Physalis mollis Nutt. Clark Island (1926).
Physalis viscosa L. Los Fresnos (1631).
Physalis viscosa L. Var. spathulaefolia Gray. Clark Island (728).
Quincula lobata (Torr.) Raf. Tabasco (588).
Solanum carolinense L. Alamo (1122).
Solanum eleagnifolium Cav. Alamo (264).
Solanum nigrum L. Alamo (917).
Solanum rostratum Dunal. Roma (503).
Solanum triquetrum Cav. San Benito (616).

SCROPHULARIACEAE

Agalinis heterophylla (Nutt.) Small. Boca Chica (1252).
Calceolaria verticillata (Ortega) Kuntze, Clark Island (723).
Leucophyllum minus Gray. San Benito (1746).
Leucophyllum texanum Benth. La Joya (81).
Leucophyllum texanum Benth. Forma albiflorum (ined.)
Linaria canadensis texana Scheele. Mission (1787).
Scutellaria Drummondii Benth. Mission (591).
Stemodia lanata Ruiz & Pavon. Clark Island (747).
Sphaeralcea Lindheimeri Gray. Tabasco (1842).
Sphaeralcea pedatifida Gray. E. Starr Co. (657).

MARTYNIACEAE

Martynia fragrans Lindl. Roma (120).

LENTIBULARIACEAE

Utricularia subulata L. Rio Hondo (1748).

ACANTHACEAE

Justicia Runyonii Small. Brownsville (1233).
Carlowrightia glabrata Mission (1066).
Ruellia intermedia Leonard. La Joya (118).
Ruellia noctiflora (Nees) A. Gray. Roma (1389).

Ruellia tuberosa L. Tabasco (92).
Siphonoglossa dipteranantha (Nees) Heller (1911).
Tubiflora acuminata Small. E. Starr Co. (652).

PLANTAGINACEAE

Plantago lanatifolia (Coult. & Fish.) Small. Zapata (1922).
Plantago rhodosperma Decne. Clark Island (1921).
Plantago virginica L. Var longifolia Gray. Tabasco (675).

RUBIACEAE

Galium Aparine L. Palm Grove (1703).
Macrosiphonia macrosiphon (Torr.) Heller. La Joya (554).
Randia aculeata L. Mission (1065).
Richardia brasiliensis (Moq.) Gomez. Santa Elena Ranch (1109).

CUCURBITACEAE

Cummumis anguria L. La Joya (1897).
Cucurbita foetidissima H. B. K. Tabasco (1505).
Ibervillea Lindheimeri (Gray) Greene. Alamo (1919).
Melothria pendula L. Alamo (1417).

CAMPANULACEAE

Lobelia brachypoda A. DC. Rio Grande City (908).
Lobelia Cliffortiana L. Rio Hondo (615).
Lobelia Feayana A. Gray. Los Fresnos (1729).

LYTHRACEAE

Ammannia coccinea Rottb. Palm Grove (1523)
Heimia salicifolia Link. Havana (1126).
Lythrum alatum Pursh. Mercedes (287).

COMPOSITAE

Actinea linearifolia (Hook.) Greene ? Zapata (692).
Actinea odorata (DC.) Kuntze Zapata (1693).
Amblyolepis setigera DC. Rio Grande City (1832).
Ambrosia elatior L. Mission (167).
Ambrosia psilostachya DC. Mission (160).

Aphanostephus ramosissimus DC. Raymondville (1210).
Aphanostephus skirrhobasis (DC.) Trel. Clark Island (765).
Aphanostephus skirrhobasis var. Hallii (Gray) Blake. Linn. (810).
Aplopappus Drummondii (T. & G.) Blake. Los Frenos
Aplopappus phyllocephalus DC. Boca Chica (1732).
Arctium Lappa L. Roma (1940).
Aster exilis Ell. San Juan (441).
Aster palmeri Gray.-Rio Grande City (1380).
Aster spinosus Benth. Pharr (789).
Baccharis glutinosa Pers. Boca Chica (399).
Baccharis texana (T. & G.) Gray. Clark Island (1726).
Bahia absinthifolia Benth. Rio Grande City (1359).
Borrichia frutescens (L.) DC. Clark Island (330).
Calyptocarpus vialis Less. Mission (170).
Centaurea americana Nutt.
Cirsium undulatum Nutt. San Benito (627).
Clappia suaedaefolia Gray. Mercedes (619).
Conyza Coulteri Gray. Camp Perry (1757).
Coreopsis cardaminefolia (DC.) T. & G. Clark Island (571).
Dyssodia Berlandieri (DC.) Blake. Zapata (1827).
Dyssodia tephroleuca Blake. (New species) Rio Grande
Eclipta alba (L.) Hssk. Alamo (873). City (1825).
Erigeron canadensis L. Havana (1131).
Erigeron repens Gray. Boca Chica (713).
Erigeron tenuis T. & G. Palm Grove (1834).
Eupatorium ageratifolium DC. Barreda (1647).
Eupatorium azureum DC. Barreda (1740).
Eupatorium odoratum L. Palm Grove (1835).
Evax multicaulis DC. E. Zapata Co. (1864).
Florestina tripteris DC. San Juan (468).
Franseria confertiflora (DC.) Rydb. Zapata (690).
Gaillardia pulchella Foug. Chihuahua (193).
Gnaphalium spathulatum Lam. Rio Hondo (1044).
Gochnatia hypoleuca (DC.) Gray. San Ignacio (934).
Grindelia colepsis Blake. (Not collected).
Gutierrezia eriocarpa Gray. Boca Chica (389).
Helenium linifolium Rydb. Raymondville (1769).
Helenium microcephalum DC. Mission (163).
Helenium quadridentatum Labill. Alamo (906).
Helianthus annuus L. Zapata (1828).
Helianthus cucumerifolius T. & G. Raymondville (1200).
Heterotheca subaxillaris (Lam.) Britton & Rusby. Combes (1765).
Iva angustifolia Nutt. Boca Chica (328).
Iva ciliata Willd. Tabasco (213).
Lepachys columnaris var. pulcherrima (D. Don) T. & G. Mission (110).

Lygodesmia texana (T. & G.) Greene. No. Hidalgo Co. (824).
Melampodium cinereum DC. E. Starr Co. (653).
Othake robustum Rydb. Clark Island (733).
Othake texanum (Hook.) Bush. Tabasco (93).
Parthenium hysterophorus L. Mission (114).
Perezia runcinata Lag. Barreda (1622).
Perityle microglossa Benth. Rio Hondo (1742).
Psilostrophe gnaphalodes DC. San Ignacio (1689).
Pulchea camphorata (L.) DC. Boca Chica (367).
Rudbeckia bicolor Nutt. San Manuel Ranch (809).
Salloa glutinosa Spreng. Los Fresnos (1731B).
Senecio ampullaceus Hook. Palm Grove (1833).
Senecio glabellus Poir. Brownsville (1644).
Simsia calva (Gray & Engelm.) Gray. Rio Grande City (1355)
Sitilias grandiflora (DC.) Greene. San Benito (1928).
Sitilias multicaulis (DC.) Greene. Port Isabel (1649).
Sonchus oleraceus L. San Juan (445).
Trichocoronis Wrightii (T. & G.) Gray. Alamo (876).
Trixis radialis (L.) Kuntze Alamo (1428).
Varilla texana Gray. Roma (1351).
Viguiera stenoloba Blake. Mission (173).
Xanthium speciosum Kearney. Roma (500).
Verbesina encelioides (Cav.) Benth. & Hook. Tabasco (172).
Verbesina virginica L. Olmito (1645).
Zexmenia breviofolia Gray. Tabasco (90).
Zexmenia hispida (H. B. K.) Gray. Rio Grande City (1673).
Zinnia pumila Gray. Rio Grande City (479).

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EXPLANATION OF PLATE I.

1. Arroyo el Burro, near San Ignacio, Zapata County. This arroyo is usually dry, but during infrequent down pours becomes an impassable torrent.

2. The Arroyo Colorado is a distributary of the Rio Grande which flows north-east and empties into Laguna Madre. Its bed is cut below sea-level and consequently the water is salty for some distance inland.

PLATE I



- 1 -



- 2 -

EXPLANATION OF PLATE II.

1. Near San Ignacio in Zapata County the Rio Grande flows along steep bluffs. This hilly area broken by arroyos is known as the "Breaks of the Rio Grande".

2. A resaca dominated by Ipomoea fistulosa Mart. This plant is Brazilian and often escapes cultivation.

PLATE II



- 1 -



- 2 -

EXPLANATION OF PLATE XII.

1. Yucca tenuistyla Trelease (in the foreground) growing in open brush-land. This plant is abundant in the vicinity of San Ignacio.

2. A mesquite tree near Zapata badly infected with mistletoe, (Phoradendron flavescens Nutt.).

PLATE III



- 1 -



- 2 -

EXPLANATION OF PLATE IV.

1. Opuntia Lindheimeri Engelm. invading land recently cleared. The Opuntia is difficult to eradicate. Joints are capable of growth after lying in the hot sun for months.

2. Sal del Rey is a salt depression in Hidalgo County. The salt is supplied by water blowing inland from the Gulf of Mexico during storms. A mesquite woods surrounds the depression and typical coast plants grow near its margin.

PLATE XV



-1-



-2-

EXPLANATION OF PLATE V.

1. Chaparral vegetation covering a "clay dune" near the coast. The dominant shrub with dark foliage is Sideroxarpos flexicaulis (Benth.) Small. Note the difference in the size of this shrub and the same species growing near the Rio Grande at Alamo (Plate X, No. 2).

2. Transition zone between the coastal prairie and the mesquital = chaparral. The mesquite exists but does not thrive in this area.

PLATE V.



-1-



-2-

EXPLANATION OF PLATE VI.

1. The *cenizal* - *chaparral* near Roma, Starr County. The light areas are dominated by *Leucophyllum texanum* Benth. (commonly called "purple sage"); the dark areas are dominated by *Acacia amentacea* DC. (black chaparral).

2. A limestone outcrop. *Mortonia Greggii* A. Gray (foreground) is dominant, with *Leucophyllum texanum* Benth., *Cordia Boissieri* DC., and *Acacia Berlandieri* Benth. sub-dominants.

PLATE VI.



- 1 -



- 2 -

EXPLANATION OF PLATE VII.

1. Lake La Joya bordered by a dense growth of Gaetela Nicholsonii Hook. This society is known as an amargosal. The shrub is reputed to have medicinal properties and is used by the Mexican people for various ailments.

2. A society of Cordia Boissieri DC. The plants nearest the fence are Lippia lingustrina Britton.

PLATE VII



- 1 -



- 2 -

EXPLANATION OF PLATE VIII.

1. Acanthocereus pentagonus (L.) Br. & Rose. This cactus requires much more water than most cacti. It extends over an area of several square miles east of Rio Hondo and often stands in water ~~for weeks~~ after a gulf storm without serious injury.

2. A huisachal. Acacia Farnesiana (L.) Willd. growing in a depression which is filled with water when Lake La Joya overflows.

PLATE VIII



- 1 -



- 2 -

EXPLANATION OF PLATE IX.

1. A shallow resaca near Alamo. Scirpus Hallii Vasey and Castalia elegans Greene are shown here with Parkinsonia aculeata L. in the background.

2. A canal near Rio Hondo filled with Piaropus crassipes Mart. Britton.

PLATE IX



- 1 -



- 2 -

EXPLANATION OF PLATE X.

1. Wooded area near the Rio Grande, Alamo. The large tree is Sapindus Drummondii Hook. & Arn.

2. Siderocarpos flexicaulis (Benth.) Small in woods near the Rio Grande, Alamo. This same species is a small shrub in dry areas.

PLATE X



-1-



-2-

EXPLANATION OF PLATE XI.

1. A society of Monarda dispersa Small in a mesquite wood, Havana.

2. A dense growth of Baccharis in sandy soil on the banks of the Rio Grande, Roma.

PLATE XI



- 1 -



- 2 -

EXPLANATION OF PLATE XII.

1. Chaparral between Zapata and San Ignacio. This association is miles in extent and dominance varies with the locality. Lycium Berlandieri Dunal and Cercidium texanum A. Gray are in the foreground.

2. A society of Opuntia Lindheimeri Engelm. in a chaparral association between San Ignacio and Laredo.

PLATE XII



- 1 -



- 2 -

EXPLANATION OF PLATE XIII,

1. Heliotta parvifolia Benth. on a low hill east of Rio Grande City.

2. A society of Hechtia texensis Watson near an arroyo between Roma and Zapata.

PLATE XIII



- 1 -



- 2 -

EXPLANATION OF PLATE XIV.

1. Agave americana L. in flower. This society occurs in a mixed chaparral near Zapata.

2. Lophophora Williamsii (Lemaire) Coulter growing on the Bordas Scarp eight miles north of Rio Grande City, Starr County. This is the cactus used for religious purposes by the Indians.

PLATE XIV





EXPLANATION OF PLATE XV.

1. A costillal. Microrhamnus ericoides Gray is dominant, and sometimes the growth is so dense that most other species are crowded out.

2. A water-hole, Arroyo Veleño, with Acacia Farnesiana Willd. growing at its margin.

PLATE IV



-1-



-2-

EXPLANATION OF PLATE XVI.

1. Ferocactus hamatacanthus (Muhlenpfordt) Br. & Rose. This cactus is fairly abundant along the Rio Grande near Zapata.

2. Ferocactus hamatacanthus (Muhlenpfordt) Br. & Rose which has produced flowers and fruit for at least four years since all soil was washed away from its base. Arroyo Loma Blanco, Zapata County.

PLATE XVI



- 1 -



- 2 -

EXPLANATION OF PLATE XVII.

1. *Yucca* sp. in *chaparral* east of Rio Grande City. This species seldom forms societies, but individuals are scattered in the vegetation throughout the Rio Grande Valley.

2. *Ipomoea Pes-Caprae* Sweet on dunes at Boca Chica. The grass on dunes near the water's edge is *Uniola paniculata* L.

PLATE XVII



- 1 -



- 2 -

EXPLANATION OF PLATE XVIII.

1. Avicennia nitida Jacq. (black mangrove) at the water's edge, Clark Island.

2. The manahuistal is composed largely of Spartina spartinae (background) with a few yuccas scattered through it. The grass in the foreground is Sporobolus Wrightii (Hess) Kunth.

PLATE XVIII



-1-



-2-

EXPLANATION OF PLATE XIX.

1. This "forest" of Yucca Treculeana Carr grew in the sacahuistal near Boca Chica. The picture was taken in August, 1932.

2. The same location as No. 1 (this plate) after the hurricane in September, 1934. The picture was taken in January, 1935.

PLATE XIX





EXPLANATION OF PLATE XX.

1. Inodes texana O. F. Cook. This palm extends over approximately one hundred acres along the Rio Grande below Brownsville.

2. Cordia Boissieri A. DC. When land is cleared native trees are sometimes allowed to remain.

PLATE XX



-1-



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