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Vegetation Classification and Mapping of Padre Island National Seashore

Final Project Report

Natural Resource Report NPS/GULN/NRR—2017/1499

ON THE COVER
Padre Island National Seashore
Photography by: Lee F. Elliott, MoRAP

Vegetation Classification and Mapping of Padre Island National Seashore

Final Project Report

Natural Resource Report NPS/GULN/NRR—2017/1449

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Executive Summary

Padre Island National Seashore (PAIS; Padre Island NS) circumscribes a section of Padre Island nearly 110 kilometers (68.3 miles [mi]) long and one to five kilometers (0.6 to 3.1 mi) wide. Padre Island is a barrier island along the Gulf of Mexico in southern Texas. The Gulf of Mexico forms one boundary to the east, and the Laguna Madre separates the western, landward side from mainland Texas. This report provides a map and analysis of vegetation of the seashore based on quantitative, plot-based field data collection and vegetation mapping.

Barrier dunes form inland from the gulf, and generally rise 4 to 7 meters (13.1 to 22.9 feet [ft]) in elevation, with some reaching 12 meters (39.3 ft). These dune fields are usually less than 200 meters (656.1 ft) wide, and narrow to 50 meters (164 ft) or fewer in the south. Flats, sometimes with shallow troughs, are characteristic of areas landward from the dunes. These rise to more than 2 meters (6.6 ft) elevation in the north, but are less than 1 meter (3.3 ft) in the south. Narrow dune ridges, usually reaching a little more than 3 meters (9.8 ft) elevation, occur in generally linear patches perpendicular to the length of the island in some areas.

A generalized vegetation transect perpendicular to the length of the island would intersect (1) unvegetated beach, (2) sparsely vegetated foredunes, (3) vegetated dune ridges and dune fields, (4) grasslands and herbaceous wetlands on broad flats and troughs that form the matrix of the back-side of the island in the north, and (5) irregularly shaped patches of tidally-influenced saline herbaceous vegetation on the Laguna Madre side of the island that form the back-side matrix in the south.

Dune and foredune communities together made up 9.37% of the vegetated area of PAIS. Grasslands made up 48.00%, and tidal saline vegetation 33.19%. Herbaceous wetlands made up 8.74% of the vegetation of PAIS. A few shrublands and woodlands accounted for less than 1% of the vegetation. Visually, these communities stood out in the otherwise herbaceous-dominated landscape, and added to local structural diversity of the vegetation.

Schizachyrium littorale (seacoast bluestem) and *Paspalum monostachyum* (gulfdune paspalum) were the most common dominant species of grasslands across large upland areas and stabilized dunes. *Spartina patens* (marshhay cordgrass) was the most common dominant of wetlands across a range of salinities and flooding regimes. Tidal saline, dune and foredune, and shrub-dominated areas each had their own unique flora.

A total of sixteen plant associations were identified during the classification phase of this study, primarily from analysis of 151 vegetation plots. A total of seventeen unique map classes were identified during the mapping phase. These did not entirely match with the plant association classification based on plots, because some classified associations could not be mapped, and several new associations were discovered and mapped after the plot data were collected. A map accuracy assessment showed 64.78% accuracy overall, corrected for area, and average by-class accuracy of 73.63% and reliability of 71.72%. (Appendix A)

Variation in seasonal and annual precipitation, wind-influenced high tides (especially on the Laguna Madre side), wildfires, and storm events all influence vegetation dynamics at Padre Island NS. Relative dominance might shift within a given area based on a single wet or dry season or year. Erosional cuts extending from the gulf to the Laguna Madre might form due to a single storm event. Hence, the landscape and vegetation of this barrier island are susceptible to significant change over short time periods.

Introduction

Padre Island National Seashore Vegetation Inventory Project

Padre Island National Seashore (PAIS) vegetation inventory was a cooperative project involving NPS staff and partners who separately completed (1) vegetation sampling, (2) vegetation classification, (3) vegetation mapping, (4) map accuracy assessment, (5) database preparation, and (6) report preparation. Staff from the Missouri Resource Assessment Partnership (MoRAP), University of Missouri, were responsible for mapping and were the lead authors for this report.

This project was initiated because accurate maps and descriptions of vegetation facilitate natural and cultural resource management and interpretation. Padre Island NS is the longest undeveloped segment of barrier island in the United States, and supports a suite of upland and wetland, mainly herbaceous, vegetation (National Park Service 1996). All aspects of this project conform to NPS Vegetation Inventory standards (see https://science.nature.nps.gov/im/inventory/veg/).

NPS Vegetation Inventory Program

The National Vegetation Mapping Inventory Program (VMI) was established to map, classify, and describe vegetation in national park units. It is administered by the NPS Biological Resources Management Division and provides baseline vegetation information to the NPS Natural Resource Inventory and Monitoring Division (I&M).

Vegetation Mapping Inventory Program scientists have developed procedures for classification, mapping, and accuracy assessment (Lea and Curtis 2010; Lea 2011). Use of the National Vegetation Classification System (NVCS) as the standard classification is central to fulfilling the goals of this national program. This system:

- Is vegetation based;
- Uses a systematic approach to classify a continuum;
- Emphasizes natural and existing vegetation;
- Uses a combined physiognomic-floristic hierarchy;
- Identifies vegetation units based on both qualitative and quantitative data; and
- Is appropriate for mapping at multiple scales.

The use of the NVCS and the establishment of classification and mapping standards facilitates effective resource stewardship by ensuring compatibility and widespread use of the information throughout the NPS as well as by other federal and state agencies. These vegetation maps and associated information support a wide variety of resource assessment, park management, and planning needs. In addition they can be used to provide a structure for framing and answering critical scientific questions about vegetation communities and their relationship to environmental conditions and ecological processes across the landscape.

Before 1994, NVCS development was led by The Nature Conservancy (TNC), and further development was then passed on to the newly formed NatureServe organization. A network of state

and regional ecologists involving dozens of individuals worked on the initial vegetation classification (TNC and ESRI 1994; Grossman et al. 1998). The NVCS is currently supported and endorsed by multiple federal agencies, the Federal Geographic Data Committee (FGDC 2008), NatureServe, state heritage and biodiversity database programs, and the Ecological Society of America. Refinements to the classification have occurred over the past decade, with funding from various federal and state agencies. A formal process for review of proposed additions and revisions is in place (see Jennings et al. 2009), and the most current NVCS is summarized at http://usnvc.org/.

Vegetation Mapping Program Standards

The NPS I&M Division established guidance and standards for all vegetation mapping projects in a series of documents.

Protocols

- Documenting a National Vegetation Classification System (TNC and ESRI 1994)
- Standards for field methods and mapping procedures (Jennings et al. 2009, Lea 2011)
- Producing rigorous and consistent accuracy assessment procedures (Lea and Curtis 2010)
- Establishing standards for using existing vegetation data (TNC 1996)

Standards

- National Vegetation Classification Standard (FGDC 2008)
- Spatial Data Transfer Standard (FGDC 1998)
- Content Standard for Digital Geospatial Metadata (FGDC 1998)
- United States National Map Accuracy Standards (USGS 1999)
- Integrated Taxonomic Information System (http://www.itis.gov/)
- Program-defined standards for map attribute accuracy and minimum mapping unit

A twelve-step guidance document provides details that cover the entire process with links to information extracted or summarized from publications described above (NPS 2011a), available at: http://science.nature.nps.gov/im/inventory/veg/docs/Veg_Inv_12step_Guidance_v1.1.pdf). Product specifications are also provided in a document (NPS 2011b).

Padre Island National Seashore

Padre Island National Seashore is a segment of Padre Island, which is a narrow barrier island located between the Gulf of Mexico and the Laguna Madre on the southern Texas coast (Figure 1). The seashore was established in 1962 to conserve the scenery, natural and historic objects, and wildlife of the park (National Park Service 1996). The length spans nearly 110 kilometers (68.3 mi), and the island is generally higher and wider (about 3 kilometers [1.9 mi]) in the north and lower and narrower (less than 2 kilometers [1.2 mi]) in the south. The Coastal Prairie is across the Laguna Madre on the mainland in the north, and the Coastal Sand Plain is landward for most of the length of the island. Overall, vegetation is most closely related to the Coastal Sand Plain (Diamond and Fulbright 1990 Judd et al. 1977).

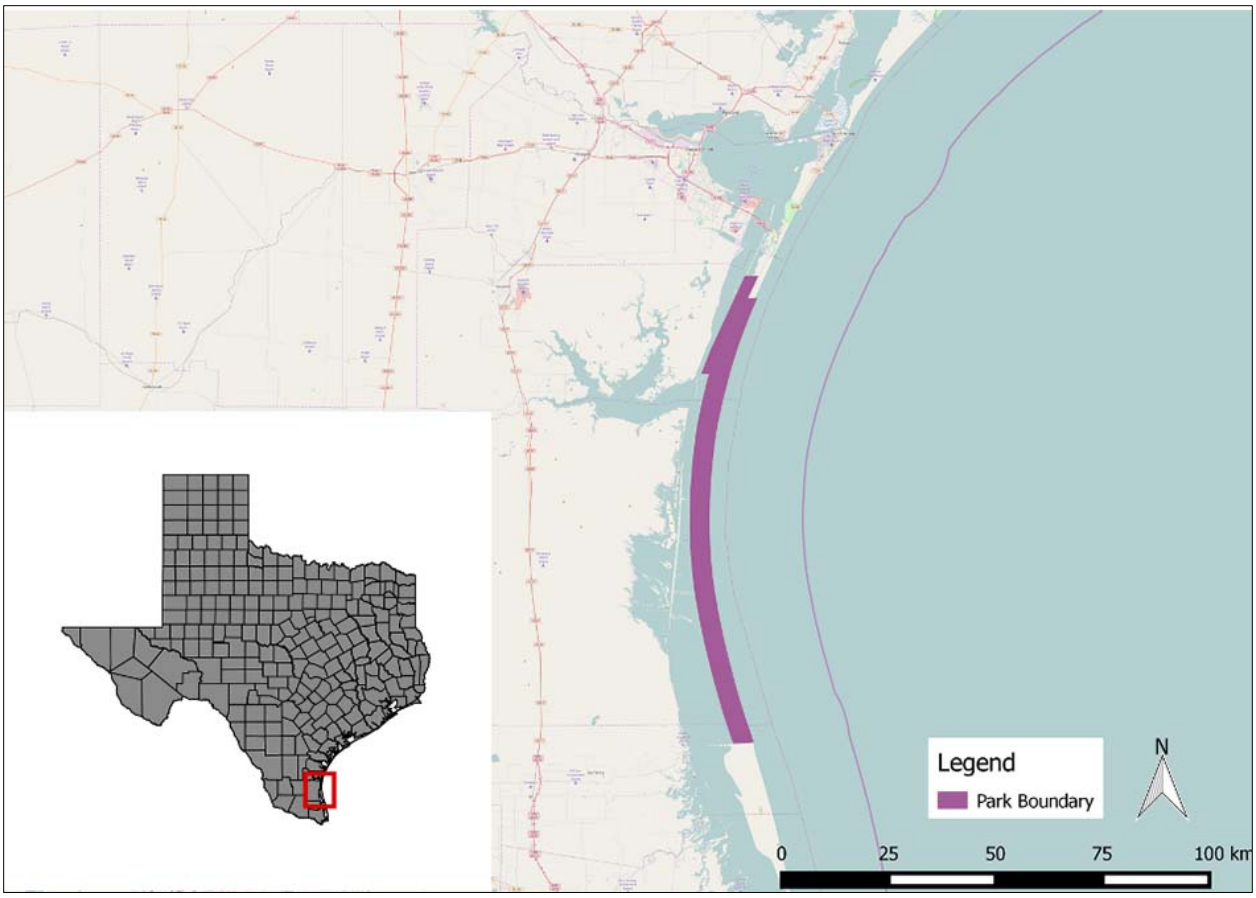

Figure 1. Location of Padre Island National Seashore.

Judd et al. (1977) sampled plant communities along three Gulf of Mexico to Laguna Madre transects on Padre Island south of the seashore. They identified topographic subdivisions including foreshore, backshore, primary dunes, secondary dunes and vegetation flats, and tidal flats. Vegetation was related to both topography and location of the three transects. Overall, *Schizachyrium littorale* was dominant on all three transects. They found that trees and shrubs were nearly absent from their study area. Nelson et al. (2000) sampled four transects in the north-central part of Padre Island NS and described four major vegetation types. From gulf toward the Laguna Madre, these included vegetated coppice dunes, foredunes and secondary dunes, barrier flats, and tidal flats. Dominants of the four communities included *Uniola paniculata* (seaoats) in the coppice dunes, *U. paniculata*, *Paspalum monostachyum*, and *Heterotheca subaxillaris* (camphorweed) in the foredunes and secondary dunes, *P. monostachyum*, *Schizachyrium littorale*, and *Spartina patens* in the barrier flats, and *Monathochloe littoralis* (shoregrass), *Salicornia virginica (depressa)* (Virginia glasswort), and *Sporobolus virginicus* (seashore dropseed) in the tidal flats.

Project Statistics

Field Work 2012–2016:

- Plot Sampling = 151
  - Plots sampled by the Lady Bird Johnson Wildflower Research, 2012 and 2013
- Accuracy Assessment Points = 309
  - Collected winter, 2015/2016, spring 2016, and summer 2016 by Texas Parks and Wildlife Department Staff

Classification:

- 23 National Vegetation Classification Plant Associations (16 from classification of plots)
- 17 Map Classes

GIS Database 2012–2014:

- Padre Island National Seashore = 20,212.01 hectare (49,944.96 acres [ac]) of vegetation mapped
- Base Imagery used for mapping (acquired by MoRAP)
- 2010, Kleberg and Kenedy Counties, TX, leaf-on, CIR, 1m
- Additional Imagery acquired and viewed by MoRAP:
- Lidar—2008—https://tnris.org/data-catalog/entry/usgs-2008-120cm
- Minimum Mapping Unit = 0.5 hectare (1.23 ac)
- Minimum Patch Size = 0.01 hectares (0.025 ac)
- Total Size = 14,854 polygons
- Average Polygon Size = 1.36 hectares (3.36 ac)
- Overall Thematic Accuracy = 64.78%
- Project Completion Date: 04/2017

Methods

General procedures for mapping of vegetation at Padre Island NS included (1) initial coordination and field sampling of plots, (2) classification of plot data, (3) generation of maps, (4) accuracy assessment, and (5) generation of final report and databases. Many areas of the seashore are difficult to access due to the length of the island and lack of improved roads. Walking is often slow and difficult in deep sand, and the lack of shade and high temperatures require adequate preparation in terms of human safety. Therefore, to reduce travel time and increase safety, both vegetation sampling plots and accuracy assessment plots were selected in a stratified random design, with clustering of potential samples rather than in a completely random design.

Field Data Collection

Field plot data collection was completed by NPS staff in coordination with staff from the Lady Bird Johnson Wildflower Research Center and the University of Texas, Austin. General methods followed those outlined by the NPS Vegetation Mapping Inventory Program (see Jennings et al. 2009, Lea 2011). Literature review, examination of two dates of air photos, and consultation with park staff helped establish the potential number of plant associations and their likely general location and relative extent in the park. This information informed the number and location of plots selected for sampling, with the goal of generating enough samples to adequately represent all associations (Figure 2).

Most of the vegetation of the park was herbaceous, and some communities were sparse. However, the density of vegetation, and even the presence or absence of shrubs and small trees, was not always apparent from available air photos. Homogeneous vegetation patches at PAIS were often small and irregularly shaped. Hence, appropriate plot size, and less often plot shape, were established at each plot location based on the vegetation at the plot. Of 151 sampled, 125 (82.78%) were standard, 50 square meters (5 × 10 meter [16.4 × 32.8 ft]), rectangular plots, taken in dense herbaceous vegetation. Twelve were 200 square meter (10 × 20 meter [32.8 × 65.6 ft]) rectangular plots, mostly within areas that had scattered shrubs; and six were 400 square meters (20 × 20 meter [65.6 × 65.6 ft]), mainly in areas with sparse vegetation. Seven plots were 100 square meters (328 ft^2) in areas where plots were adjusted to conform with vegetation patches (5 × 20 meter [16.4 × 65.6 ft]; 10 × 10 meter [32.8 × 32.8 ft]). One plot was 40 square meters (4 × 10 meter [13.1 ×32.8 ft]), designed to fit within a small, homogeneous vegetation patch.

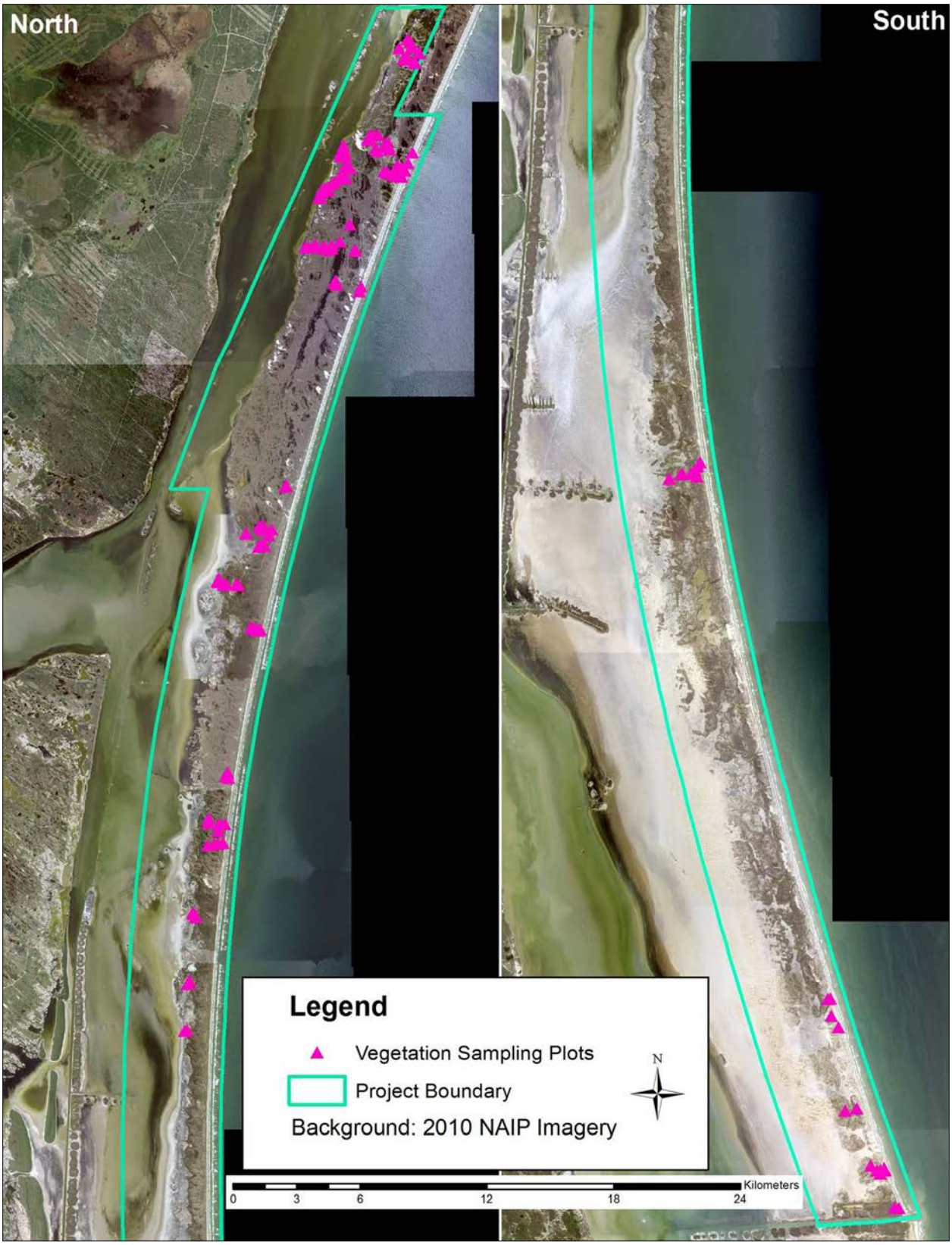

Figure 2. Location of 151 vegetation sampling plots on the north end (left) and south end (right) of Padre Island National Seashore.

All plot data were collected using a standard NPS plot data form (Appendix B). Presence and cover by cover class of all species were recorded at each plot (Table 1).

Table 1. Cover classes for vegetation plot sampling.

Cover Class	Range	Mid-point
1	Trace	0.1
2	0.1–1	0.5
3	1–2	1.5
4	2–4	2.5
5	5–10	7.5
6	10–25	17.5
7	25–50	37.5
8	50–75	62.5
9	75–95	85
10	>= 95	97.5

Vegetation Classification

Vegetation classification was completed by NPS staff in coordination with staff from NatureServe (NatureServe 2014). All vegetation data were entered into the PLOTS 4.0 relational data base (https://science.nature.nps.gov/im/inventory/veg/plots.cfm). The PLOTS database was developed for the NPS National Vegetation Inventory Program so that data entry fields mirror the standard field form. Data entry was facilitated by assigning each plant taxon a unique, standardized code and name based on the PLANTS database developed by Natural Resources Conservation Service in cooperation with the Biota of North America Program (USDA and NRCS 2009, available at: https://science.nature.nps.gov/im/inventory/veg/plots.cfm).

Plot data were analyzed using cluster analysis. Results from quantitative analyses were passed from NPS staff to staff with expertise on plant association classification at NatureServe. Successive refinements were made by iteratively eliminating some plots and some species from the analyses. In this way, plots were binned into groups that formed plant associations (NVC, http://usnvc.org/).

Development of Map

ECognition software (http://www.ecognition.com/) was used to circumscribe visually homogeneous polygons. Multiresolution segmentation (Scale parameter: 25, Shape: 0.2, Compactness: 0.2) was applied to four bands of 1 meter (3.3 ft) National Agricultural Imagery Program (NAIP) imagery and normalized difference vegetation index (NDVI) derived from the imagery. We used eCongition to calculate eighty-one variables and attributed the variables to the polygons. These variables summarized attributes of the topographic relationships of the polygons, reflectance values derived from aerial photography, surficial geologic composition, and vegetation height.

- Border Index—an index describing how jagged an image object is
- Compactness—product of the length and the width, divided by the number of pixels

- Elliptic Fit—how well an image object fits into an ellipse of similar size and proportion
- Roundness—measures the difference between an enclosed ellipse and an enclosing ellipse relative to an image object
- Shape Index—provides a measure of the smoothness of an image object border.
- NAIP bands one through four and NDVI (all dir.): gray level co-occurrence matrix (GLCM) after Haralick and gray-level difference vector (GLDV) variables (imagery consisted of 4-band uncompressed GeoTiff files with 1 m (3.3 ft) resolution acquired during 2010, https://tnris.org/data-catalog/entry/national-agriculture-imagery-program-naip-2010-1m-nc-cir/)
    - GLMC Contrast
    - GLCM Correlation
    - GLCM Dissimilarity
    - GLCM Entropy
    - GLCM Homogeneity
    - GLCM Mean
    - GLCM Angular Second Moment
    - GLDV Angular Second Moment
    - GLDV Contrast
        - GLDV Entropy
        - GLDV Mean
- From DEM (developed from LiDAR flown in 2008 https://tnris.org/data-catalog/entry/usgs-2008-120cm/ sampled to 2 meter [6.6 ft]):
    - Elevation—Maximum within object
    - Elevation—Minimum within object
    - Elevation—Mean within object
    - Elevation—Range within object
    - Range within 30 meter [98.4 ft] neighborhood—mean for object
    - Sink—mean of Fill minus Elevation within object
    - Sink—minimum of Fill minus Elevation within object
    - Slope—mean of percent slope within object
    - Topographic Wetness Index—(produced from SAGA = ln(a/tan B) where “a” is the upstream contributing area and “B” is the slope)—mean of values with within object
- From Lidar (developed from LiDAR flown in 2008 https://tnris.org/data-catalog/entry/usgs-2008-120cm/ sampled to 2 meter [6.6 ft]):
    - Vegetation Height, mean—mean nDSM for object
    - Vegetation Height, maximum—maximum nDSM for object

  - Vegetation Height, range—range of nDSM for object
- Distance to Bay Margin
- Direction to Bay Margin
- Distance to Gulf
- Geology Majority—surficial geology treated as a categorical raster with 28 types. Type making up the majority of the object was assigned to the object (layer from https://irma.nps.gov/DataStore/Reference/Profile/2184314)
- Length to area ratio—length (polygon perimeter)/area
- From four band NAIP:
  - NDVI = (near infrared—red) / (near infrared + red)—Mean within object
  - Principal components analysis of four bands, mean of three components, PCA1, PCA2, PCA3

The objects were classified using the random forest library of the R statistical software (https://cran.r-project.org/package=randomForest). The classification targeted twelve classes: (1) unvegetated sand, (2) active sand dune (unvegetated), (3) algal flat, (4) brackish/fresh herbaceous vegetation, (5) dune herbaceous vegetation, (6) foredune and vegetated backshore herbaceous vegetation, (7) submerged sand (unvegetated), (8) tidal saline herbaceous vegetation, (9) black willow woodland and shrubland, (10) tidal sparse saline herbaceous vegetation, (11) seacoast bluestem—gulfdune paspalum grassland, and (12) gulf cordgrass grassland. Of these twelve, unvegetated sands (three classes) and algal flat (one class) were not mapping targets, but were included to differentiate them from mapping targets.

Training objects were selected on the basis of plot data (from the plots used to identify associations on the park), field assessment, and photo interpretation. The classification was run and reviewed on screen numerous times until obvious errors were eliminated. Training data was revised between runs to include or exclude known areas of a given type or to correct obvious incorrect distributions of types. For the final analysis, an average of 1372 objects from each of the classes was selected as training data (from a low of 136 objects for gulf cordgrass grassland, to a maximum of 2604 objects for seacoast bluestem—gulfdune paspalum grassland). The out-of-bag estimate of error rate resulting from the randomForest classification was 4.08%.

Additional types were mapped that were not included in the random forest classification. These included Honey Mesquite Woodland and Shrubland, Live Oak Woodland, Common Reed Herbaceous Wetland, Seashore Paspalum Herbaceous Wetland, Jamaica Sawgrass Herbaceous Vegetation, Wax Myrtle Shrubland, Saltcedar Shrubland and Woodland, Beach Sheoak Woodland and Popinac Woodland and Shrubland. These types occurred in restricted areas and objects circumscribing the types were attributed by hand. Three of these (Saltcedar Shrubland and Woodland, Beach Sheoak Woodland, and Popinac Woodland and Shrubland) were found entirely on small remote islands along the Gulf Intracoastal Waterway (GIWW) within the Laguna Madre and were only mapped where occurrences were reported during colonial waterbird surveys (Chaney and

Blacklock 2003). These types and other vegetation on the GIWW islands were excluded from the accuracy assessment and are provided as data of unknown accuracy, but that might prove useful for management considerations. Likewise, algal flat, which consisted of sand encrusted with the alga *Lyngbya confervoides* on wind-tidal flats, was also mapped and not included as a vegetation type. Open water and impervious surfaces (cultural) were also mapped.

Accuracy Assessment

An accuracy assessment (AA) of the final map classes was conducted by staff of the Texas Parks & Wildlife Department (Treuer-Kuehn and Singhurst 2016). Researchers followed guidelines as described in Lea and Curtis (2010).

Sampling Design

A subset of polygons was selected in a random, stratified approach to ensure verification of all map classes across the study area. Sample sizes for each evaluated map class were selected using the USGS-NPS Vegetation Characterization Program guidelines (Table 2) (The Nature Conservancy et al. 1994). Actual AA point locations were determined by MoRAP staff and points were often clustered due to limited access to roads and harsh field conditions. Accuracy assessment field sites were identified as points within the center of the AA sample polygon.

Table 2. Number of original plots by map class. Species scientific names appear in the Description of Map Classes section.

Map Class	Total Number of Plots
Black Willow Woodland and Shrubland	30
Brackish/Fresh Herbaceous Wetland	30
Common Reed Herbaceous Wetland	9
Dune Herbaceous Vegetation	31
Foredune and Vegetated Backshore Herbaceous Vegetation	30
Gulf Cordgrass Grassland	29
Honey Mesquite Woodland and Shrubland	2
Jamaica Sawgrass Herbaceous Vegetation	6
Live Oak Woodland	4
Seacoast Bluestem—Gulfdune Paspalum Grassland	30
Seashore Paspalum Herbaceous Wetland	14
Tidal Saline Herbaceous Vegetation	30
Tidal Sparse Saline Herbaceous Vegetation	30
Wax Myrtle Shrubland	9

AA Field Data Collection

Accuracy assessment data were collected at the seashore during the winter of 2015–2016 and the spring and summer of 2016. Field crews used GPS units and NAIP aerial imagery to navigate to point locations (Figure 3). Twenty-five plots in addition to those cited in Table 2 were selected for sampling when a plot appeared to fall on the edge of two different vegetation types, so 309 plots were sampled. Two field crews collected data either using an ArcMap 10.2 data form or a paper data form (Appendix D). The plot size was 0.25 hectare (3.6 ac), or a circle with radius 28 meter (91.8 ft). Linear plots were collected in linear patches of herbaceous vegetation, especially the Foredune and Vegetated Backshore Herbaceous Vegetation map class

A dichotomous map class key was used to identify map class (Appendix C). Species and cover data were collected on the top three (woody) and top five (herbaceous) dominant species. Indicator species were also noted in all strata of the vegetation community; trees, shrubs, and herbs. Percent cover was collected and estimated in increments of 1% up to 10% and then in increments of ten up to 100%. All NVC plant associations noted in the plot were recorded.

Figure 3. Location of 309 accuracy assessment plots on the north end (left) and south end (right) of Padre Island National Seashore.

Results

Vegetation Classification

A total of sixteen plant associations were recognized at Padre Island NS during the classification phase of the project (Table 3; NatureServe 2014). Only one forest association was identified, the *Salix nigra* (black willow) Dune Swale Association, and only two shrub associations, the *Morella cerifera* (waxmyrtle) / *Paspalum monostachyum—Andropogon glomeratus* (bushy bluestem—*Schizachyrium littorale* type and the *Prosopis glandulosa* var *glandulosa* (honey mesquite)—*Opuntia engelmannii var lindheirmeri* (Texas pricklypear)—*Borrichia frutescens* (bushy seaoxeye) Shrubland. Of the remaining fourteen associations, eight were wetlands. Of these, five were saline, and placed within the North American Atlantic & Gulf Coast Salt Marsh Macrogroup of the NVC.

Table 3. Plant associations identified by the classification phase of the PAIS vegetation mapping project.

National Vegetation Classification Association Concepts	NVC Group	NVC Alliance	NVC Association
Batis maritima—Sarcocornia pacifica Dwarf Shrubland	G123	A3955	CEGL003956
Borrichia frutescens / (*Spartina patens*, *Juncus roemerianus*) Shrubland	G121	A1026	CEGL003924
Ipomoea pes-caprae—Ipomoea imperati—(*Cakile geniculata*) Herbaceous Vegetation	G661	A3683	CEGL004402
Monanthochloe littoralis Herbaceous Vegetation	G123	A3957	CEGL003991
Morella cerifera / *Paspalum monostachyum—Andropogon glomeratus—Schizachyrium littorale* Vegetation	G494	A3690	CEGL007223
Paspalum monostachyum—Andropogon glomeratus—Schizachyrium littorale—Iva texensis Herbaceous Vegetation	G494	A1200	CEGL007222
Phragmites australis Eastern North America Temperate Ruderal Herbaceous Alliance	G556	A1431	CEGL004141
Prosopis glandulosa var *glandulosa—Opuntia engelmannii* var *lindheimeri—Borrichia frutescens* Shrubland	G494	A4061	CEGL007790
Salix nigra Dune Swale Vegetation	G759	A1914	CEGL007242
Schizachyrium littorale—Paspalum monostachyum Herbaceous Vegetation	G494	A1200	CEGL002207
Schoenoplectus pungens—Conoclinium betonicifolium—Setaria parviflora—Flaveria brownii Coastal Marsh Vegetation	G777	A1372	CEGL007234
Sesuvium verrucosum—Suaeda linearis—Iva texensis Sparse Saline Flat	G123	A3855	CEGL005464
Spartina patens—Fimbristylis (caroliniana, castanea)—(Panicum virgatum) Herbaceous Vegetation	G777	A3692	CEGL007836
Spartina spartinae Herbaceous Vegetation	G494	A4061	CEGL004608
Sporobolus virginicus—Distichlis spicata Herbaceous Vegetation	G123	A39556	CEGL007663
Uniola paniculata—(*Panicum amarum*)—*Croton punctatus* Herbaceous Vegetation	G494	A1199	CEGL002218

Vegetation Map

Seventeen natural and semi-natural vegetation map classes were mapped (Table 4; Figure 4). Together, these types comprised 20,212 hectares (49,944.94 ac). Cultural areas made up 62.1 hectares (153.4 ac) and active sand dunes made up 233.23 hectares (576.32 ac).

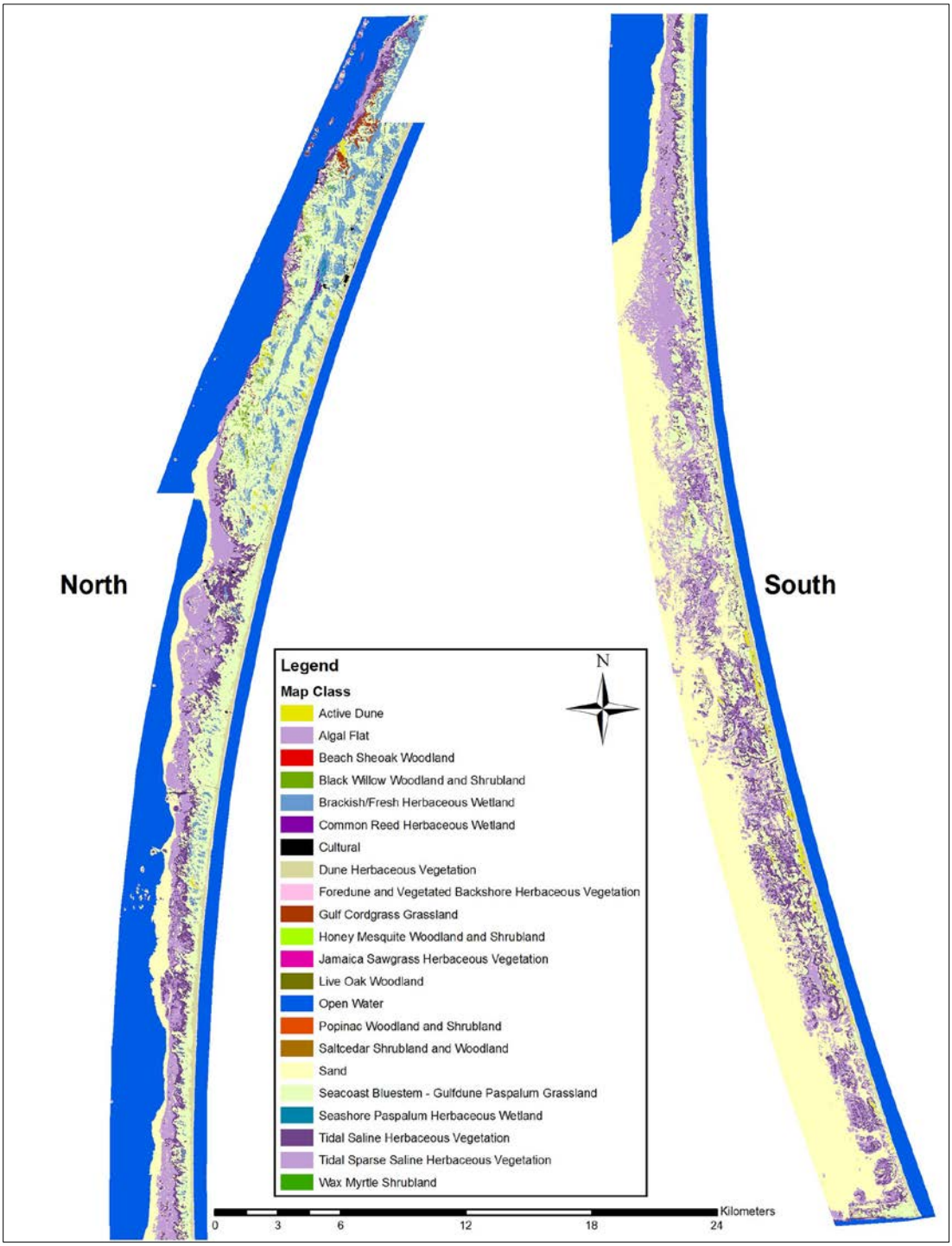

Figure 4. Vegetation map for Padre Island National Seashore. The northern end (right) is higher and wider than the southern end (left).

Table 4. Area and percenate of vegetated area by map class for PAIS vegetation map.

Map Class	Area (hectares)	Percent
Beach Sheoak Woodland	0.05	0.0002%
Black Willow Woodland and Shrubland	105.45	0.5217%
Brackish/Fresh Herbaceous Wetland	1,752.51	8.6706%
Common Reed Herbaceous Wetland	16.09	0.0796%
Dune Herbaceous Vegetation	1,662.30	8.2243%
Foredune and Vegetated Backshore Herbaceous Vegetation	232.29	1.1493%
Gulf Cordgrass Grassland	127.33	0.6300%
Honey Mesquite Woodland and Shrubland	4.15	0.0205%
Jamaica Sawgrass Herbaceous Vegetation	0.26	0.0013%
Live Oak Woodland	0.22	0.0011%
Popinac Woodland and Shrubland	0.25	0.0012%
Saltcedar Shrubland and Woodland	0.82	0.0040%
Seacoast Bluestem—Gulfdune Paspalum Grassland	9,575.69	47.3762%
Seashore Paspalum Herbaceous Wetland	23.00	0.1138%
Tidal Saline Herbaceous Vegetation	4,000.85	19.7944%
Tidal Sparse Saline Herbaceous Vegetation	2,708.02	13.3981%
Wax Myrtle Shrubland	2.73	0.0135%
TOTAL	20,212.01	100%

The most abundant map class was Seacoast Bluestem—Gulfdune Paspalum Grassland, which made up 47.37% of the vegetated portion of the seashore. This type formed the matrix of broad, relatively elevated areas on the northern, wider, relatively higher end of the island. Tidal Saline Herbaceous Vegetation and Tidal Sparse Saline Vegetation made up 19.79% and 13.13% of the vegetated area, respectively. These two types were most abundant toward the Laguna Madre side of the island, and became the most common map classes landward of barrier dunes on the southern, less elevated, narrower end of the park.

Brackish/Fresh Herbaceous Wetland made up 8.67% of the vegetated area of Padre Island NS, and was most common in the central (middle) part of the northern end of the island, where broad troughs ran parallel to the coast. The Dune Herbaceous Vegetation type made up 8.22% of the area, and occurred mainly just inland of the Foredune and Vegetated Backshore Herbaceous Vegetation type, which comprised 1.14% of the area. All other types made up less than 1% of the vegetated area each, with several making up less than 0.1%. These types added important local variation to what was generally a landscape with a uniform, herbaceous aspect.

The Beach Sheoak Woodland, Popinac Woodland and Shrubland, and Saltcedar Shrubland and Woodland were on remote spoil islands in the Laguna Madre associated with the Gulf Intracoastal Waterway near the northwest border of the seashore. They were recognized based on information found in Chaney and Blacklock (2003; see http://www.cbbep.org/) together with photo interpretation. These types combined made up a little more than 1 hectare (2.4 ac) in area, but may be of

management concern because the dominant species are non-native, and the islands provide habitat for biota, including nesting waterbirds.

Algal flats along the Laguna Madre made up 15,697.38 hectares (38,789.07 ac), but were not considered a classification target for this project, since they were not dominated by vascular plants. These areas, dominated by the alga *Lyngbya confervoides*, are important to various biota, including foraging shorebirds. They are sensitive to disturbance by vehicular traffic and alterations to hydrology (e.g. slight depressions). Thus, some knowledge of the extent and distribution of this class may prove useful.

Map Accuracy Assessment

The accuracy assessment for Padre Island NS included about 20,012 hectares (49,450.7 ac) of vegetated area, exclusive of cultural types, water, and other non-vegetated types. In addition, no attempt was made to access islands within the Laguna Madre, which supported about 103 hectares (254.5 ac) of vegetation within six mapped types.

A total of 309 sample plots were recorded. Overall map producer's accuracy was 71.63% and average reliability was 71.72%. User's accuracy was 64.78% corrected for area of map class, with 90% confidence lower limit of 58.42% and upper limit of 71.14%. Small map classes with six or fewer sample plots were all mapped with 100% reliability (Table 5) (Appendix A). Reliability was greater than 60% for all map classes except Tidal Saline Herbaceous Vegetation (12.12%) and Gulf Cordgrass Grassland (0.0%). The former was most often confused with the Brackish/Fresh Herbaceous Wetland map class, which tended to reduce the accuracy of the Brackish/Fresh Wetland map class by creating errors of omission. The Gulf Cordgrass Grassland map class was equally confused with the Brackish/Fresh Herbaceous Wetland and Seacoast Bluestem/Gulfdune Paspalum Grassland map classes. For this reason, the accuracy numbers for the Brackish/Fresh Herbaceous Wetland and Seacoast Bluestem—Gulfdune Paspalum types were reduced by the inaccuracy of mapping for the Gulf Cordgrass Grassland map class via creating errors of omission (see Appendix A).

A total of 36 new plant species were found during the AA process and these were added to the PAIS plant list (compiled by Jason Singhurst) (Appendix E). Plant associations recognized during the AA are reflected in the description of map classes section that follows.

Table 5. User's accuracy and reliability for 14 map classes sampled at PAIS.

Map Class	Accuracy	Reliability
Black Willow Woodland and Shrubland	100.00	63.33
Brackish/Fresh Herbaceous Wetland	36.49	87.10
Common Reed Herbaceous Wetland	100.00	88.89
Dune Herbaceous Vegetation	62.22	65.12
Foredune and Vegetated Backshore Herbaceous Vegetation	86.21	65.79
Gulf Cordgrass Grassland	0.00	0.00
Honey Mesquite Woodland and Shrubland	100.00	100.00
Jamaica Sawgrass Herbaceous Vegetation	100.00	83.33
Live Oak Woodland	100.00	100.00
Seacoast Bluestem—Gulfdune Paspalum Grassland	38.10	80.00
Seashore Paspalum Herbaceous Wetland	100.00	92.86
Tidal Saline Herbaceous Vegetation	50.00	12.12
Tidal Sparse Saline Herbaceous Vegetation	85.19	76.67
Wax Myrtle Shrubland	72.73	88.89

Description of Vegetation Map Classes

The overall dominant species and characteristic plant associations for each map class are presented below. Plant associations are those recognized based on classification of sampled vegetation plots, plus seven additional associations recognized based on field reconisance after plot data collection, during the accuracy assessment process, or during the map production phase of the project (NatureServe 2014, NatureServe Explorer at http://explorer.natureserve.org/) (Appendix F).

Beach Sheoak Woodland Map Class

This map class was the smallest recognized at PAIS, and covered 0.50 hectares (1.2 ac). The type was not represented by plots, but was described based on photo interpretation and work by Chaney and Blacklock (2003; see http://www.cbbep.org/). The isolated spoil island that supports this type was important for nesting birds. *Casuarina equisetifolia* (Beach sheoak) was often monodominant, with *Condalia hookeri* (Brazilian bluewood) present.

Associations:
Association Code: CEGL004830 (recognized by reference to literature)
Common Name: (River She-oak, Beach She-oak, Gray She-oak) Ruderal Forest
Scientific Name: *Casuarina (cunninghamiana, equisetifolia, glauca)* Ruderal Forest

Black Willow Woodland and Shrubland Map Class

This map class was confined to the northern end of the island and covered 105.45 hectares (0.52% of the vegetation; 3.7 ac). The type was characterized by dunes with usually sparse or patchy cover of *Salix nigra* interspersed with bare sand dunes and herbaceous vegetation, especially Brackish/Fresh Herbaceous Wetland and Seacoast Bluestem-Gulfdune Paspalum Grassland (Figure 5).

Associations:
Association Code: CEGL007242
Common Name: Black Willow Dune Swale Vegetation
Scientific Name*: Salix nigra* Dune Swale Vegetation

Figure 5. The Black Willow Woodland and Shrubland map class was found mainly on the north end of Padre Island National Seashore.

Brackish/Fresh Herbaceous Wetland Map Class

A total of 1752.51 hectares (8.67% of the vegetation; 4330.54 ac) of this type were mapped (Figure 6). Two associations appeared in plots, and one other association was noted as present from field surveys and the accuracy assessment. *Schoenoplectus pungens* (common threesquare) dominated one association and *Spartina patens* the other found in plots. *Fuirena* spp. (umbrella sedge species) dominated the third association. The largest patches of this type were found on the northern end of the island, in irregular troughs and in coastward-trending linear strips of lower elevation within broad flats.

Associations:
Association Code: CEGL007234
Common Name: Common Threesquare—Betonyleaf Thoroughwort—Knotroot Bristlegrass—Brown's Yellowtops Coastal Marsh Vegetation

Scientific Name*: Schoenoplectus pungens—Conoclinium betonicifolium—Setaria parviflora—Flaveria brownii* Coastal Marsh Vegetation

Association Code: CEGL007836
Common Name: Texas Coastal Bend Interdune Swale Grassland
Scientific Name: *Spartina patens—Fimbristylis (caroliniana, castanea)—(Panicum virgatum)* Herbaceous Vegetation

Association Code: CEGL004952 (not recognized by plot classification)
Common Name: Southern Umbrella-sedge—Coastal Plain Umbrella-sedge—Southern Beaksedge—Spreading Beaksedge Herbaceous Vegetation
Scientific Name: *Fuirena scirpoidea—Fuirena longa—Rhynchospora microcarpa—Rhynchospora divergens* Herbaceous Vegetation

Figure 6. The Brackish/Fresh Herbaceous Wetland map class was most common on the northern end of Padre Island National Seashore.

Common Reed Herbaceous Wetland Map Class

A total of 16 hectares (39.5 ac) of this type were mapped within distinct, nearly mono-culture stands of *Phragmites australis* (common reed) (Figure 7). Patches were concentrated near the edge of an alternately wet and dry lake on the northern end of the island.

Associations:
Association Code: CEGL004141 (not recognized by plot classification)
Common Name: Common Reed Marsh
Scientific Name: *Phragmites australis* Eastern North America Temperate Ruderal Herbaceous Vegetation

Figure 7. The Common Reed Herbaceous Wetland map class was small at Padre Island National Seashore, and often consisted of mono-culture stands.

Dune Herbaceous Vegetation Map Class

A total of 1622.30 hectares (8.22% of the vegetation; 4008.79 ac) of this type were mapped (Figure 8). Narrow strips of this map class face coastward on the gulf side of the island. Moist swales were sometimes interspersed with drier dunes that usually reach 4 to 7 meters, but sometimes over 10 meters elevation. Common dominant species included *Paspalum monostachyum* and *Schizachyrium littorale*, which are also dominate within the Seacoast Bluestem—Gulfdune Paspalum Grassland map class. Several species that were not abundant in areas without dunes were characteristic, and included *Uniola paniculata*, *Heterotheca subaxillaris*, *Croton punctatus* (wooly croton) and *Chamaecrista fasciculata* (partridge pea).

Associations:
Association Code: CEGL002218

Common Name: Seaoats—(Bitter Panicgrass)—Wooly Croton Herbaceous Vegetation
Scientific Name: *Uniola paniculata—(Panicum amarum)—Croton punctatus* Herbaceous Vegetation

Figure 8. The Dune Herbaceous Vegetation map class formed a nearly continuous linear strip inland from the Gulf of Mexico.

Foredune and Vegetated Backshore Herbaceous Vegetation Map Class

A total of 232.29 hectares (1.15% of the vegetation; 574 ac) of this type were mapped. Narrow, gulf-facing strips, usually not more than 50 m (164 ac) wide, characterized this map class (Figure 9). The community was open with bare sand interspersed with pioneer vegetation. *Ipomoea imperati* (beach morningglory) and *I. pres-caprae* (bayhops) were visually conspicuous components. Other species included *Amaranthus greggii* (Gregg's amaranth), *Cakile geniculata* (gulf searocket*), Croton punctatus, Uniola paniculata, Heterotheca subaxillaris, Oenothera drummondii* (beach eveningprimrose), and *Sesuvium portulacastrum* (shoreline seapurslane). Vehicular traffic, where permitted, may limit the development and stability of this vegetation.

<u>Associations:</u>
Association Code: CEGL004402
Common Name: West Gulf Coastal Plain Ocean Strand
Scientific Name: *Ipomoea pes-caprae—Ipomoea imperati—(Cakile geniculata)* Herbaceous Vegetation

Figure 9. The Foredune and Vegetated Backshore Herbaceous Vegetation map class represented the first vegetated zone inland from the Gulf of Mexico.

Gulf Cordgrass Grassland Map Class

A total of 127.33 hectares (0.63%; 314.64 ac) of this type were mapped (Figure 10). The mapped type was found only on the northerner end of the island, and was not represented by plots. It was mapped based on field survey observations. *Spartina spartinae* was the conspicuous dominant in patches. *Spartina patens*, *Setaria parviflora* (knotroot bristlegrass) and *Andropogon glomeratus* were also components. Other herbaceous types, including Brackish/Fresh Herbaceous Wetland and Seacoast Bluestem—Gulfdune Paspalum Grassland, were interspersed with this map class.

Associations:

Association Code: CEGL004608 (not recognized by plot classification)
Common Name: Gulf Cordgrass Herbaceous Vegetation
Scientific Name: *Spartina spartinae* Herbaceous Vegetation

Figure 10. The Gulf Cordgrass Grassland map class was found on the northern end of Padre Island National Seashore.

Honey Mesquite Woodland and Shrubland Map Class

A total of 4.15 hectares (0.027%; 10.25 ac) of this type were mapped on the Laguna Madre side of the island (Figure 11). It was not represented by plots, but was recognized based on field observations and photo interpretation. The community was in a slightly elevated land position, and lower surrounding areas graded into herbaceous associations. *Prosopis glandulosa* var. *glandulosa* was the visual dominant, and *Celtis ehrenbergiana* (spiny hackberry*), Lycium carolinianum* (Carolina wolfberry), *Opuntia engelmannii*, *Borrichia frutescens*, and *Ambrosia psilostachya* (western ragweed) were components.

<u>Associations:</u>
Association Code: CEGL007790 (not recognized by plot classification)
Common Name: Honey Mesquite—Texas Pricklypear—Brushy Seaoxeye Shrubland
Scientific Name: *Prosopis glandulosa* var. *glandulosa—Opuntia engelmannii* var. *lindheimeri—Borrichia frutescens* Shrubland

Figure 11. The Honey Mesquite Woodland and Shrubland map class was small, and occurred on patches of less sandy soil on the Laguna Madre side of Padre Island National Seashore.

Jamaica Sawgrass Herbaceous Vegetation Map Class

A total of 0.26 hectares (0.64 ac) of this map class occurred in small patches, mainly associated with an alternately wet and dry shallow, linear lake on the north end of the island. Stands were dominated by *Cladium mariscus* ssp. *jamaicense* (Jamaica sawgrass) and were nearly monodominant (Figure 12).

<u>Associations:</u>
Association Code: CEGL003940 (not recognized by plot classification)
Common Name: Jamaica Sawgrass Marsh
Scientific Name: *Cladium mariscus* ssp. *jamaicense* Marsh

Figure 12. The Jamaica Sawgrass Herbaceous Vegetation map class was in small, nearly mono-culture patches.

Live Oak Woodland Map Class

A total of 0.22 hectares (0.54 ac) of this type were mapped within four patches. No plot data represented this type but it was mapped based on field observations and air photo interpretation. The small mottes were dominated by *Quercus fusiformis* (Texas live oak) in nearly monodominant stands (Figure 13).

Associations:
Association Code: CEGL002117 (not recognized by plot classification)
Common Name: Texas Live Oak—Redbay Forest
Scientific Name: *Quercus fusiformis—Persea borbonia* Forest

Figure 13. The Live Oak Woodland map class occurred as small, dense patches of low trees or shrubs that stood out in the otherwise herbaceous-dominated landscape.

Popinac Woodland and Shrubland Map Class

A total of 0.25 hectares (0.62 ac) of this type were mapped. The map class was not represented by plots, but was described based on photo interpretation and work by Chaney and Blacklock (2003; see http://www.cbbep.org/). *Leucaena leucocephala* (popinac) was often monodominant, and *Opuntia engelmannii* var. *lindheimeri* was present. It occurred on spoil islands within the Laguna Madre near the northwest boundary of PAIS. The association most closely resembles one currently attributed only to Hawaii, though the dominant woody species is non-native in both regions.

Associations:

Association Code: CEGL005404 (recognized by reference to literature)
Common Name: Popinac—Guineagrass Ruderal Shrubland
Scientific Name: *Leucaena leucocephala—Urochloa maxima* Ruderal Shrubland

Saltcedar Shrubland and Woodland Map Class

A total of 0.82 hectares (2.03 ac) of this type were mapped. The type was not represented by plots, but was described based on photo interpretation and work by Chaney and Blacklock (2003; see http://www.cbbep.org/). *Tamarix* spp. (saltcedar) was often monodominant, with *Nerium oleander*

(oleander), *Opuntia engelmannii* var. *lindheimeri*, and *Condalia hookeri* present. It occurred on spoil islands in the Laguna Madre near the northwest boundary of PAIS.

Associations:
Association Code: CEGL003114 (recognized by reference to literature)
Common Name: Saltcedar Ruderal Riparian Shrubland
Scientific Name: *Tamarix* spp. Ruderal Riparian Shrubland

Seacoast Bluestem—Gulfdune Paspalum Grassland Map Class

This map class was the largest at PAIS, and covered a total of 9,575.69 hectares (23,662.04 ac), or 47.37% of the vegetated area (Figure 14). It covered more than twice as much area as the next most common type, and almost as much area as the next four most abundant map classes. This map class formed the matrix of slightly more elevated, flat to rolling portions of PAIS. It was most common on the northern, slightly more elevated end of the island. Patches of other herbaceous types, especially Brackish/Fresh Herbaceous Wetland, were interspersed with grasslands within this map class. *Schizachyrium littorale* or *Paspalum monostachyum* were dominant. Grasslands within the map class were fairly diverse, with species such as *Andropogon glomeratus*, *Spartina patens*, *Baptisia bracteata* var. *leucophaea* (longbract wild indigo), *Indigofera miniata* (western indigo), *Croton glandulosus* (vente conmigo), *Iva texensis* (Texas marshelder), *Dichanthelium* spp., *Galactica canescens* (hoary milkpea) and *Heterotheca subaxillaris* present.

Associations:
Association Code: CEGL002207
Common Name: Seacoast Bluestem—Gulfdune Paspalum Herbaceous Vegetation
Scientific Name: *Schizachyrium littorale—Paspalum monostachyum* Herbaceous Vegetation

Association Code: CEGL007222
Common Name: Gulfdune Paspalum—Bushy Bluestem—Seashore Bluestem—Texas Marshelder Herbaceous Vegetation
Scientific Name: *Paspalum monostachyum—Andropogon glomeratus—Schizachyrium littorale—Iva texensis* Herbaceous Vegetation

Figure 14. The Seacoast Bluestem—Gulfdune Paspalum map class covered more area than any other type at Padre Island National Seashore.

Seashore Paspalum Herbaceous Wetland Map Class

A total of 23.00 hectares (0.11%; 56.83 ac) of this type were mapped within a linear, alternately wet and dry trough on the northern end of PAIS. The map class was nearly centered between the Gulf and the Laguna Madre. *Paspalum vaginatum* was monodominant across most of the area. *Typha domingensis* (southern cattail), *Eleocharis montevidensis* (sand spikerush), and *Schoenoplectus pungens* var. *longispicatus* were sometimes present (Figure 15).

<u>Associations:</u>
Association Code: CEGL004114 (not recognized by plot classification)
Common Name: Seashore Paspalum Interdune Swale
Scientific Name: *Paspalum vaginatum* Herbaceous Vegetation

Figure 15. The Seashore Bluestem Herbaceous Wetland map class was associated with a narrow, ephemeral lake on the north end of Padre Island National Seashore.

Tidal Saline Herbaceous Vegetation Map Class

This was the second most abundant map class at PAIS, and it covered a total of 4,000.85 hectares (9886.32 ac), or 19.79% of the vegetation (Figure 16). It was the most common type on the relatively low, southern end of PAIS and on the Laguna Madre side. This type was variable across small areas due to differences in flooding frequency and salinity. *Borrichia frutescens* was a conspicuous component, with species such as *Iva texensis*, *Spartina patens*, *Rayjacksonia phyllocephala* (camphor daisy), *Sporobolus virginicus* (seashore dropseed), *Distichlis spicata* (saltgrass), and *Juncus roemerianus* (needlegrass rush) often present Vegetation within this map class tended to interdigitate with, and circumscribe patches of, Brackish/Fresh Herbaceous Wetland and Seacoast Bluestem—Gulfdune Paspalum Grassland.

<u>Associations:</u>
Association Code: CEGL003924
Common Name: Bushy Seaoxeye Tidal Shrub Flat
Scientific Name: *Borrichia frutescens / (Spartina patens, Juncus roemerianus)* Shrubland

Association Code: CEGL007663

Common Name: Seashore Dropseed—Saltgrass Herbaceous Vegetation
Scientific Name: *Sporobolus virginicus—Distichlis spicata* Herbaceous Vegetation

Figure 16. The Tidal Saline Herbaceous Vegetation map class covered much of the area on the Laguna Madre side and on the southern end of Padre Island National Seashore.

Tidal Sparse Saline Herbaceous Vegetation Map Class

A total of 2708.00 hectares (13.40%; 6691.61 ac) of this type were mapped (Figure 17). It was most abundant on the slightly lower, southern end of the island, and on the Laguna Madre side. It often formed irregular patches in low lying, relatively flat, frequently flooded areas. The vegetation within this map class varied across small areas due to minor differences in the frequency and timing of flooding and salinity. Easily recognized vegetation zonation of simple plant communities allowed for identification of several plant associations. Common components included *Batis maritima* (turtleweed), *Sarcocornia pacifica* (Pacific swampfire), *Sesuvium verrucosum* (sea purslane), *Suaeda linearis* (annual seepweed) and *Monanthochloe littoralis*.

<u>Associations:</u>
Association Code: CEGL003956
Common Name: Turtleweed—Pacific Swampfire Dwarf-shrubland
Scientific Name: *Batis maritima—Sarcocornia pacifica* Dwarf Shrubland

Association Code: CEGL005464
Common Name: Sea Purslane—Annual Seepweed—Texas Marshelder Sparse Saline Flat
Scientific Name: *Sesuvium verrucosum—Suaeda linearis—Iva texensis* Sparse Saline Flat

Association Code: CEGL003991
Common Name: Shoregrass Herbaceous Vegetation
Scientific Name: *Monanthochloe littoralis* Herbaceous Vegetation

Figure 17. The Tidal Sparse Saline Herbaceous Vegetation map class was common in low areas on the Laguna Madre side of Padre Island National Seashore.

Wax Myrtle Shrubland Map Class

A total of 2.73 hectares (6.74 ac) of this type were mapped. It was found on the north end of the island in relatively small patches that were interspersed with herbaceous vegetation, primarily Seacoast Bluestem—Gulfdune Paspalum Grassland (Figure 18). *Morella cerifera* formed a conspicuous shrubby component, and a variety of herbaceous species were present, including *Schizachyrium littorale*, *Paspalum monostachyum*, *Spartina patens*, and *Andropogon glomeratus*.

Associations:
Association Code: CEGL007223
Common Name: Wax Myrtle / Gulfdune Paspalum—Bushy Bluestem—Seashore Bluestem Vegetation
Scientific Name: *Morella cerifera / Paspalum monostachyum—Andropogon glomeratus—Schizachyrium littorale* Vegetation

Figure 18. The Wax Myrtle Shrubland map class occurred in small patches on the northern end of Padre Island National Seashore.

Discussion

Despite a fairly flat topography and little structural diversity in vegetation, the accessibility of much of the area of Padre Island NS was limited due to deep, sandy soils and a lack of improved roads. Plot locations for both plant community data collection and accuracy assessment were clustered due to inaccessibility. Variation in weather and precipitation hamper movement more during some seasons and some years than others. As a result, three new map classes were found during field trips in preparation for map production, and additional plant associations were found during the accuracy assessment.

Map production at the seashore was challenging because most of the communities were herbaceous and many were not apparent based on viewing of aerial photography. Digital elevation models were an aid in mapping insofar as vegetation patterns were associated with elevation. Some vegetation mosaics were visually evident to a ground observer but patches of different plant associations were too small to map. For example, on the Laguna Madre side of the seashore, small differences in elevation sometimes resulted in patches or zones of differnet plant associations across a few square meters of space.

Schizachyrium litterole and *Paspalum monostachyum*, dominants of the Seacoast Bluestem—Gulfdune Paspalum map class, were among the domiants of the herbaceous vegetation layer in three additional map classes. The Black Willow Woodland and Shrubland and Wax Myrtle Shrubland map classes were distinguished based on the presence of shrubs or trees, often interspersed within a matrix of herbaceous vegetation. The Dune Herbaceous Vegetation map class was distinguished based on local topography and the presence of a suite of characteristic herbaceous species, even though *Schizachyrium littorale* or *Paspalum monostachyum*, or both, were often among the dominants. Thus, *Schizachyrium littorale* and *Paspalum monostachyium* in combination were among the dominant species of map classes that circumscribed 56.12% of the vegetated portion of Padre Island NS.

Seasonal and annual variation in precipitation and weather may influence vegetation patterns across short time periods at the seashore (Nelson et al. 2000). For example, annual precipitation during the four-year period of this study ranged from a low of 47.80 centimeters (18.82 inches [in]) in 2012 to a high of 83.13 centimeters (32.73 in) in 2016, a 73.91% difference. Differences in plant communities may manifest as aspect variation in terms of which species are producing the highest volume of above ground biomass in a given season or year, or as differences in species composition due to mortality or colonization of sites. All map classes at PAIS, whether common or uncommon, may show these types of variations due to weather patterns. Storms, including hurricanes, can cause large changes to the geomorphology and plant communities of barrier islands. Therefore, the current map of vegetation for the seashore represents only one slice in time, and vegetation may change over the course of a single year, and almost certainly will change over the course of the next decade.

The vegetation of the area inland from gulf-facing barrier dunes was higher and drier on the north end and lower and wetter on the south end of the seashore. Tidally flooded areas were common on the Laguna Madre side of the island. These extended across the bulk of the width of the island from

the Laguna Madre toward the gulf in the south. Most of the vegetation of the flats landward from coastal dunes fell within the Seacoast Bluestem—Gulfdune Paspalum Grassland map class to the north and within the Tidal Saline Herbaceous Vegetation or Tidal Sparse Saline Herbaceous Vegetation map class to the south. Less saline, and less tidally influenced, wetlands were most common to the north.

Subjective terms used such as foredunes, dunes, and tidal flats have been applied in different ways by different workers (Judd et al. 1977; Nelson et al. 2000; Gibeaut and Caudle 2009). Many of the plant associations and map classes were similar in composition at PAIS. These two characteristics made distinguishing among vegetation types based either on landform or plant community compostion relatively difficult at PAIS.

Non-native or native, potentially invasive species were dominant within several map classes at Padre Island NS, including the beach sheoak woodland, popinac woodland and shrubland, saltcedar shrubland and woodland, jamaica sawgrass herbaceous vegetation, and common reed herbaceous wetland types. The first three were found only on spoil islands associated with maintenance of the Gulf Intracoastal Waterway within the Laguna Madre near the northwest boundary of the seashore. The last two were associated with an essentially continuous, linear, ephemeral lake on the northern end of PAIS. The component plant species within these map classes may prove to be of management concern in the future.

The foredune and vegetated backshore herbaceous vegetation map class formed narrow bands just inland from bare, sandy, beach. Lonard et al. (1999) found that this vegetation zone had been reduced in extent due to vehicular traffic from 1977 to 1999 on Padre Island to the south of the seashore property line. McAtee and Drawe (1980) found negative impacts to vegetation from vehicular and pedestrian traffic at PAIS and at Nueces County Park. Nelson et al. (2000) noted that coppice dunes, the first vegetated community inland from the gulf, had been heavily impacted by human disturbance near Big Ball Hill at PAIS. The influence of vehicular and pedestrian traffic on the vegetation at PAIS was not addressed by the current report.

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Appendix A. Contingency Table for Mapping of Padre Island National Seashore

Classification	Black Willow Woodland and Shrubland	Brackish/Fresh Herbaceous Wetland	Common Reed Herbaceous Wetland	Dune Herbaceous Vegetation	Foredune and Vegetated Backshore	Gulf Cordgrass Grassland	Honey Mesquite Woodland and Shrubland	Jamaica Sawgrass Herbaceous Vegetation	Live Oak Woodland	Seacoast Bluestem - Gulfdune	Seashore Paspalum Herbaceous	Tidal Saline Herbaceous Vegetation	Tidal Sparse Saline Herbaceous Vegetation	Wax Myrtle Shrubland	Total Count	Reliability
Black Willow Woodland and Shrubland	19	4								4				3	30	63.3
Brackish/Fresh Herbaceous Wetland		27								4					31	87.1
Common Reed Herbaceous Wetland		1	8												9	88.9
Dune Herbaceous Vegetation		1		28	4					10					43	65.1
Foredune Herbaceous Vegetation				13	25										38	65.8
Gulf Cordgrass Grassland		14				0				15		1			30	0
Honey Mesquite Woodland and Shrubland							2								2	100
Jamaica Sawgrass Herbaceous Vegetation		1						5							6	83.3
Live Oak Woodland									4						4	100
Seacoast Bluestem - Gulfdune Paspalum Grassland		3		3						24					30	80
Seashore Paspalum Herbaceous Wetland		1									13				14	92.9
Tidal Saline Herbaceous Vegetation		18		1		1				5		4	4		33	12.1
Tidal Sparse Saline Herbaceous Vegetation		3								1		3	23		30	76.7
Wax Myrtle Shrubland		1												8	9	88.9
Total	19	74	8	45	29	1	2	5	4	63	13	8	27	11		
Accuracy	100	36.486	100	62.222	86.207	0	100	100	100	38.095	100	50	85.185	72.73		
Expected Accuracy	1.84	7.42	0.23	6.26	3.57	0.10	0.01	0.10	0.05	6.12	0.59	0.85	2.62	0.32		

Appendix B: Example of Plot Survey Form

NPS VEGETATION MAPPING PROGRAM – PLOT SURVEY FORM PLOT LOCATION AND DESCRIPTION

Plot Code _____ Surveyors _____
Date _____

Plot Directions

_____

Plot Dimensions _____ by _____ m Photos (y/n) _____
Provisional Community Name

_____

Relative Stand Size extensive (>100x plot), large (>10-100x plot), small (3-10x plot), very small (1-3x plot), unknown
Representativeness

_____
_____
_____

Landform (circle) interfluve, gap/saddle, side slope, terrace/bench flat plain

Topographic Position (circle) crest, upper slope, middle slope, lower slope, toe slope, plain/level/bottom, basin/depression

Hydrologic Regime ___Upland ___Permanently flooded ___Semipermanently flooded ___Seasonally/Temporarily flooded ___Unknown

Plot Shape (circle) concave convex flat irregular
General Comments

_____
_____
_____

Figure B-1. Example Plot Survey Form, page 1 of 3.

Plot Code _____

NPS VEGETATION MAPPING PROGRAM – PLOT SURVEY FORM

VEGETATION SAMPLING

Leaf Phenology	Leaf type	Physiognomic Class
____Deciduous (<25% evergreen)	____Broadleaf	____Forest
____Evergreen (<25% deciduous)	____Needleleaf	____Woodland
____Mixed deciduous/evergreen	____Mixed	____Sparse woodland
____Perennial graminoid	____Graminoid	____Shrubland
____Perennial forb	____Forb	____Sparse shrubland
____Perennial mixed	____Pteridophyte	____Herbaceous
____Annual herbaceous	____Non-vascular	____Sparse vegetation

Strata	%Cover (1=<1%, 2=1-5%, 3=5-25%, 4=25-50%, 5=50-75%, 6=75-95%, 7=95-100%)
T1 Emergent >30m	_____
T2 Tree Canopy 20-30m	_____
T3 Tree Subcanopy 5-20m	_____
S1 Tall Shrub 1-5m	_____
S2 Short Shrub <1m	_____
H Herbaceous	_____

SPECIES COMPOSITION AND COVER CLASS BY STRATUM

%Cover (1=<1%, 2=1-5%, 3=5-25%, 4=25-50%, 5=50-75%, 6=75-95%, 7=95-100%)

T1	T2	T3	S1	S2	H	Species	Comments

Figure B-2. Example Plot Survey Form, page 2 of 3.

Plot Code __________

T1	T2	T3	S1	S2	H	Species	Comments

Figure B-3. Example Plot Survey Form, page 3 of 3.

Appendix C: Padre Island National Seashore Dichotomous Key to Mapped Current Vegetation Types

1a. Tidally-influenced vegetation dominated by salt-tolerant species such as *Borrichia frutescens*, *Batis maritima*, *Sarcocornia* spp., *Distichlis spicata*, *Rayjacksonia phyllocephala*, *Limonium carolinianum*, *Sesuvium portulacastrum*, *Suaeda linearis*, *Spartina spartinae*, and/or *Monanthochloe littoralis* **2**

2a. Vegetation sparse with total canopy cover < 40%. Areas often adjacent to barren soils or algal flats of the Laguna Madre, with species such as *Batis maritima*, *Monanthochloe littoralis*, *Sarcocornia* spp., *Sesuvium* spp., and/or *Suaeda linearis*. ..... **Tidal Sparse Saline Herbaceous Vegetation**

2b. Vegetation with total canopy > 40% **3**

3a. Vegetation strongly dominated by *Spartina spartinae* ..... **Gulf Cordgrass Grassland**

3b. Vegetation not strongly dominated by *Spartina spartinae*, but instead characterized by salt-tolerant species such as *Borrichia frutescens*, *Rayjacksonia phyllocephala*, *Distichlis spicata*, or other salt-tolerant species ..... **Tidal Saline Herbaceous Vegetation**

1b. Vegetation not tidally-influenced, or at least without a preponderance of the species listed above **4**

4a. Vegetation of unstable foredunes and backshore areas. Species such as *Ipomoea pes-caprae*, *Ipomoea imperati*, *Cakile geniculate*, *Croton punctatus*, *Oenothera drummondii*, *Panicum amarum*, and/or *Sesuvium portulacastrum* are present and dominant at least in patches..... **Foredune and Vegetated Backshore Herbaceous Vegetation**

4b. Vegetation of uplands or wetlands, not of unstable foredunes and backshore **5**

5a. Vegetation characterized by a conspicuous woody canopy of species other than Sesbania spp. greater than 1 m in height which makes up > 40% of the total relative cover **6**

6a. Woody canopy dominated by *Prosopis glandulosa* ..... **Honey Mesquite Woodland and Shrubland**

6b. Woody canopy not dominated by *Prosopis glandulosa* 7

7a. Woody canopy dominated by *Salix nigra* ..... **Black Willow Woodland and Shrubland**

7b. Woody canopy not dominated by *Salix nigra* **8**

8a. Woody canopy dominated by *Morella cerifera* ..... **Wax Myrtle Shrubland**

8b. Woody canopy not dominated by *Morella cerifera* **9**

9a. Woody canopy dominated by *Quercus fusiformis* ..... **Live Oak Woodland**

9b. Woody canopy not dominated by *Quercus fusiformis*..... **10**

10a. Woody canopy dominated by *Tamarix* spp. ..... **Saltcedar Shrubland and Woodland**

10b. Woody canopy not dominated by *Tamarix* spp. **11**

11a. Woody canopy dominated by *Casuarina* spp. ..... **Beach Sheoak Woodland**

11b. Woody canopy dominated by *Leucaena leucoephala* ..... **Popinac Woodland and Shrubland**

5b. Vegetation dominated by herbaceous vegetation with < 40% woody cover **12**

12a. Vegetation of dunes, rolling uplands, and flats dominated by species such as *Schizachyrium littorale, Paspalum monostachyum, Heterotheca subaxillaris, Uniola paniculata, Chamaecrista fasciculata*, and/or *Croton punctatus* **13**

13a. Vegetation of dunes and adjacent slopes and swales with > 2 m local relief (within 30 m radius), with species such as *Uniola paniculata, Heterotheca subaxillaris, Chamaecrista fasciculata, Panicum amarum*, and/or *Croton punctatus* conspicuous and dominant in patches (*Schizachyrium littorale* and *Paspalum monostachyum* are also common components and may be dominant) .....**Dune Herbaceous Vegetation**

13b. Vegetation of rolling uplands and flats with < 2 m local relief, with species such as *Schizachyrium littorale* and Paspalum monostachyum dominant ..... **Seacoast Bluestem - Gulfdune Paspalum Grassland**

12b. Vegetation of wetlands, including broad, low flats only slightly lower than surrounding uplands. Species such as *Paspalum monostachyum* and *Schizachyrium littorale* may be present, but are not dominant **14**

14a. Vegetation dominated by species such as *Spartina patens, Schoenoplectus pungens, Fimbristylis* spp., *Rhynchospora* spp., *Andropogon glomeratus, Sporobolus virginicus, Flaveria brownii, Setaria, parviflora, Conoclinium betonicifolium*, and/or *Eleocharis* spp. ....**Brackish/Fresh Herbaceous Wetland**

14b. Vegetation not dominated by the above suite of species; communities often nearly mono-dominant or at least not diverse **15**

15a. Vegetation dominated by *Phragmites australis* .... **Common Reed Herbaceous Wetland**

15b. Vegetation not dominated by *Phragmites austrialis*.....**16**

16a. Vegetation dominated by *Cladium mariscus* var. *jamaicense* ....**Jamaica Sawgrass Herbaceous Vegetation**

16b. Vegetation not dominated by *Cladium mariscus* var. *jamaicense* **17**

17a. Vegetation dominated by *Spartina spartinae* .... **Gulf Cordgrass Grassland**

17b. Vegetation dominated by *Paspalum vaginatum* ....**Seashore Paspalum Herbaceous Wetland**

Appendix D: Example of Accuracy Assessment Form

Park _PAIS

Survey Date _____ Time _____ Observers:

Target Point Name _____

X: _____ Y: _____ Elev _____ m UTM NAD83 zone 15

GPS Unit _____ PDOP _____ # Satellites _____ Average ≥ 5 seconds

Photo number _____

Is the veg type uniform for 1 mmu around point? Y N

Shape and Size of Observation Area if not a 28m radius circle (explain):

Observation Area Comments (disturbance? mosaic of types?)

Circle one: Woodland, Shrubland, Grassland, Herbaceous Wetland, Shrub Wetland, Barren, Open Water

List cover of dominant/characteristic species to the closest 10% (or actual % if < 5%,)

Trees	% Cover	Shrubs	% Cover
Herbs	% Cover	Herbs	% Cover

Mapped Type
Name

Veg Key Fit: **H M L** Fit of plants to type description: **H M L**

Veg Type Comment

Figure D-1. Example Accuracy Assessment Form, page 1 of 2.

NVC
Name

NVC
Name

NVC
Name

Figure D-2. Example Accuracy Assessment Form, page 2 of 2.

Appendix E: Species List for Padre Island National Seashore

Table E-1. Species list for Padre Island National Seashore.

FAMILY	Scientific Name
AGAVACEAE	*Yucca constricta* Buckley
	Yucca treculeana Carr
AIZOACEAE	*Sesuvium maritimum* (Walt.) Britton, Stems, & Poggenb.
	Sesuvium portulacastrum (L.) L.
	Sesuvium trianthemoides Correll
	Sesuvium verrucosum Raf.
	Trianthema portulacastrum L.
	Mollugo verticillata L.
ALISMATACEAE	*Echinodorus beteroi* (Spreng.) Fassett
AMARANTHACEAE	*Amaranthus arenicola* I. M. Johnst.
	Amaranthus blitum L.
	Amaranthus greggii S. Watson
	Amaranthus polygonoides L.
	Celosia nitida Vahl.
	Froelichia drummondii Moq.
	Froelichia floridana (Nutt.) Moq. var.floridana
	Blutaparon vermiculare (L.) Mears
	Gomphrena nealleyi
	Tidestromia lanuginosa (Nutt.) StandI.var. lanuginose
ANACARDIACEAE	*Schinus terebinthifolius* Raddi
APIACEAE	*Centella asiatica* (L.) Urb.
	Hydrocotyle bonariensis Commers. ex Lam.
	Hydrocotyle umbellata L., Ombligo de Venus
ASCLEPIDACEAE	*Asclepias emoryi* (Greene) Vail
	Asclepias oenotheroides Cham.&SchltdI.
	Asclepias viridiflora Raf.
	Cynanchum angustifolium Pers.
	Funastrum cynanchoides (Decne.) Schltr. subsp. *cynanchoides*
ASTERACEAE	*Ambrosia artemisiifolia* L.
	Ambrosia psilostachya DC.
	Aphanostephus skirrhobasis (DC.) TreI. var. *thalassius* Shinners
	Amphiachyris dracunculoides (DC.) Nutt.
	Baccharis neglecta Britton
	Baccharis salicina Torr. & A. Gray
	Borrichia frutescens (L.) DC.
	Centaurea americana Nutt.

FAMILY	Scientific Name
	Chrysopsis pilosa Nutt.
	Cirsium horridulum Michx. var. *elliottii*
	Cirsium texanum Buckley
	Conoclinium betonicifolium (Mill.) King & Rob.
	Conyza canadensis (L.) Cronquist
	Conyza ramosissima Cronquist
	Coreopsis tinctoria Nutt.
	Croptilon divaricatum (Nutt.) Raf.
	Croptilon rigidifolium (E. B. Sm.) E. B. Sm.
	Dyssodia pentachaeta (DC.) Robins. var.*pentachaeta*
	Dyssodia tenuiloba (DC.) Robins.
	Eclipta prostrata (L.) L.
	Erechtites hieraciifolius (L.) Raf. ex DC.
	Erigeron procumbens (Houst. ex Mill.) Nesom
	Eupatorium compositifolium Walter
	Euthamia leptocephala (Torr. & A. Gray) Greene
	Euthamia gymnospermoides Greene
	Evax verna Raf.
	Flaveria brownii Powell
	Fleischmannia incarnata (Walter) R.M. King & H. Rob.
	Gaillardia pulchella Foug.
	Gamochaeta falcata (Lam.) Cabrera
	Gamochaeta pensylvanica (Willd.) Cabrera
	Helenium amarum (Raf.) H. Rock var. *amarum*
	Helianthus annuus L.
	Helianthus argophyllus Torr. & A. Gray
	Helianthus debilis Nutt. subsp. *cucumerifolius* (Torr. & A. Gray) Heiser
	Helianthus praecox Engelm. & A. Gray subsp. *runyonii* (Heiser) Heiser
	Heterotheca subaxillaris (Lam.) Britton & Rusby
	Iva annua L.
	Iva imbricata Walter
	Iva texensis R. R. Johnson
	Krigia occidentalis Nutt.
	Liatris carizzana
	Rayjacksonia phyllocephala Machaeranthera phyllocephala (DC.) Shinners
	Palafoxia hookeriana Torr. & A. Gray
	Palafoxia rosea (Bush) Cory var. *rosea*
	Palafoxia texana DC. var. *ambigua* (Shinners)B. L. Turner & M.I. Morris
	Pityopsis graminifolia
	Pluchea odorata (L.) Cass.
	Pluchea purpurascens (Sw.) DC., Canela.

FAMILY	Scientific Name
	Ratibida peduncularis (Torr. & A. Gray) Barnh. var. *peduncularis*
	Rudbeckia hirta L. var. *angustifolia* (Moore) Perdue
	Senecio riddellii Torr. & A. Gray
	Solidago odora Aiton var. *odorata*
	Solidago sempervirens L.
	Sonchus asper (L.) Hill
	Sonchus oleraceus L.
	Symphyotrichum divaricatum (Nutt.) Nesom
	Tetragonotheca repanda (Buckley) Small
	Thelesperma filifolium (Hook.) A. Gray
	Thelesperma nuecense B. L. Turner
	Verbesina encelioides (Cav.) Benth. & Hook. ex A. Gray
	Xanthium strumarium L., Abrojo.
BORAGINACEAE	*Heliotropium convolvulaceum* (Nutt.) A. Gray
BRASSICACEAE	*Cakile geniculata* (Robins.) Millsp.
	Lepidium lasiocarpum T. Nutt. ex Torr. & A. Gray var. *wrightii* (A. Gray) C. L. Hitchc.
	Lepidium virginicum L.
	Rorippa nasturtium-aquaticum (L.) Hayek
BUDDLEJACEAE	*Polypremum procumbens* L.
CACTACEAE	*Opuntia engelmannii* Salm-Dyck var. *lindheimeri* (Engelm.) B. D. Parfitt & Pinkava
	Opuntia humifusa (Raf.) Raf. var. *humifusa*
	Opuntia macrorhiza Engelm. var. *macrorhiza*
	Opuntia stricta (Haw.) Haw.
CAMPANULACEAE	*Triodanis perfoliata* (L.) Nieuwl.
	Lobelia puberula
CAPPARIDACEAE	*Polanisia erosa* (Nutt.) H. H. Iltis subsp. *breviglandulosa* H. H. Iltis
CARYOPHYLLACEAE	*Silene antirrhina* L.
	Spergularia marina (L.) Griseb.
CHENOPODIACEAE	*Atriplex matamorensis* A. Nels.
	Atriplex texana S. Watson
	Atriplex pentandra (Jacq.) Standl.
	Chenopodium album L.
	Chenopodium ambrosioides L. var. *ambrosioides*
	Chenopodium berlandieri Moq.
	Suaeda conferta (Small) I. M. Johnst.
	Suaeda linearis (Ell.) Moq.
	Suaeda tampicensis (Standl.) Standl.
CISTACEAE	*Helianthemum georgianum* Chapm.
	Lechea mucronata Raf.
CLUSIACEAE	*Hypericum drummondii* (Grev. & Hook.) Torr. & A. Gray
	Hypercium hypericoides (L.) Crantz subsp. *hypericoides*

FAMILY	Scientific Name
	Hypericum gentianoides (L.) Britton, Stems, & Poggenb.
	Hypericum pauciflorum Kunth
COMMELINACEAE	*Commelina erecta* L. var. *angustifolia* (Michx.) Fern.
	Commelina erecta L. var. *erecta*, Hierba del pollo.
	Tradescantia humilis Rose
CONVOLVULACEAE	*Ipomoea cordatotriloba* Dennst.
	Ipomoea imperati (Vahl) Griseb.
	Ipomoea pes-caprae (L.) R. Brown subsp. *brasiliensis* (L.) v. Ooststr.
	Ipomoea sagittata Poir.
CUCURBITACEAE	*Citrullus lanatus* (Thunb.) Matsum. & Nakai var. *citroides* (L. H. Bailey) Mansf.
	Cucumis melo L. var. *melo*
	Cucurbita foetidissima Kunth
	Ibervillea lindheimeri (A. Gray) Greene
	Melothria pendula L. var. *pendula*
CUSCUTACEAE	*Cuscuta indecora* Choisy
	Cuscuta pentagona Engelm.
CYMODOCEACEAE	*Cymodocea filiformis* (Kutz.) Correll
	Halodule beaudettei (den Hartog) den Hartog
CYPERACEAE	*Cladium mariscus* (L.) Pohl subsp. *jamaicense* (Crantz) Kük.
	Cyperus acuminatus
	Cyperus croceus YaW
	Cyperus echinatus (L.) A. W. Wood
	Cyperus filicinus Vahl
	Cyperus flavescens
	Cyperus haspan L.
	Cyperus polystachyos Rottb.
	Cyperus pseudothyrsiflorus (Ktikenth.) R. Carter & S. D. Jones
	Cyperus retroflexus Buckley var. *retroflexus*
	Cyperus retrorsus Chapm.
	Cyperus rotundus L., Nut-grass
	Cyperus squarrosus L. var. *squarrosus*
	Cyperus surinamensis Rottb.
	Eleocharis albida Torr.
	Eleocharis atropurpurea (Retz.) J. & c. Presl
	Eleocharis cellulosa Torr.
	Eleocharis geniculata (L.) J. J. Roem. & Schult., Spikerush.
	Eleocharis interstincta (VaW)Roem. & Schult.
	Eleocharis minima Kunth var. *minima*
	Eleocharis montevidensis K. Kunth
	Eleocharis obtuse

FAMILY	Scientific Name
	Eleocharis parvula (Roem. & Schult.) Link ex Bluff, Nees & Schauer var. *anachaeta* (Torr.) Svenson
	Eleocharis flavescens (Poir.) Urb. var.*flavescens*
	Eleocharis tortilis (Link) Schult.
	Eleocharis sp.
	Fimbristylis caroliniana (Lam.) Fern.
	Fimbristylis castanea (Michx.) Vahl
	Fuirena scirpoidea Michx.
	Fuirena simplex
	Lipocarpha micrantha (VaW.)G. C. Tucker
	Rhynchospora colorata (L.) H. Pfeiff.
	Rhynchospora divergens
	Rhynchospora nitens
	Rhynchospora perplexa
	Schoenoplectus erectus (Poir.) Palla ex J. Raynal
	Schoenoplectus pungens (vaW) Palla var. *longespicatus* (Britton)S. G. Sm.
	Schoenoplectus saximontanus
DROSERACEAE	*Drosera brevifolia* Pursh
ELATINACEAE	*Elatine triandra* Schkuhr.
EUPHORBIACEAE	*Acalypha radians* Torr.
	Cnidoscolus texanus (Miill. Arg.) Small
	Croton argyranthemus Michx.
	Croton capitatus Michx. var. *lindheimeri* (Engelm. & A. Gray)MUll. Arg.
	Croton coryi Croizat
	Croton glandulosus L. var. *pubentissimus* Croizat
	Croton glandulosus L. var. *septentrionalis* Miill. Arg.
	Croton glandulosus L. var.*lindheimeri* MUll.Arg.
	Croton monanthogynus Croton. Michx.
	Croton parksii Croizat
	Croton punctatus Jacq.
	Euphorbia bombensis Jacq.
	Euphorbia cordifolia Elliott, Spurge.
	Euphorbia corollata L.
	Euphorbia innocua Wheeler, Spurge.
	Euphorbia maculata L., Spurge.
	Euphorbia serpens Kunth
	Phyllanthus abnormis Baill. var. *abnormis*
	Phyllanthus polygonoides Nutt. ex Spreng.
	Phyllanthus pudens Wheeler
	Stillingia sylvatica Garden ex L. subsp. *sylvatica*
FABACEAE	*Acacia farnesiana* (Vachellia farnesiana)

FAMILY	Scientific Name
	Acacia minuata (M. E. Jones) Beauch. subsp. *miniata*
	Aeschynomene viscidula Michx.
	Astragalus brazoensis Buckley
	Astragalus leptocarpus Torr. & A. Gray
	Baptisia bracteata Muhl. ex Elliott var. *laevicaulis*(A. Gray ex Canby) Isley
	Baptisia bracteata Nutt. var.*leucophaea* (Nutt.) Kartesz & Gandhi
	Canavalia rosea (Sw.) DC.
	Centrosema virginianum (L.) Benth.
	Chamaecrista fasciculata (Michx) Greene
	Clitoria mariana L.
	Crotalaria sagittalis L.
	Dalea emarginata (Torr.& A. Gray) Shinners
	Dalea lanata Spreng.
	Dalea obovata (Torr. & A. Gray) Shinners
	Dalea pogonathera A. Gray
	Desmanthus virgatus (L.) Willd. var. *depressus* (Humb. & Bonpl. ex Willd.) B. L. Turner
	Erythrina herbacea L.
	Galactia canescens Benth., Hoary milkpea. PINS,
	Galactia marginalis Benth.
	Glottidium vesicaria (Jacq.) R. M. Harper
	Indigofera miniata Ortega var. *leptosepala* (Nutt. ex Torr. & A. Gray) B. L. Turner
	Indigofera miniata Ortega var. *miniata*
	Indigofera suffruticosa Mill.
	Leucaena leucocephala (Lam.) de Wit
	Medicago polymorpha L.
	Melilotus albus Medik.
	Melilotus indicus (L.) C. All.
	Mimosa latidens (Small) B. L. Turner
	Mimosa strigillosa Torr. & A. Gray
	Neptunia lutea (Leavenw.) Benth.
	Neptunia pubescens Benth. var. *pubescens*
	Parkinsonia aculeata L., Retama
	Pediomelum rhombifolium (Torr. & A. Gray) Rydb.
	Prosopis glandulosa Torr. var. *glandulosa*
	Rhynchosia americana (Housl. ex Mill.) Metz
	Rhynchosia minima (L.) DC.
	Rhynchosia reniformis (Pursh) DC.
	Rhynchosia senna Gillies ex Hook. var. *texana*
	Sesbania drummondii (Rydb.) Cory
	Sesbania exaltata (Raf.) Rydb. ex A. Hill
	Sophora tomentosa L. var. *occidentalis* (L.) Isely

FAMILY	Scientific Name
	Strophostyles helvula (L.) Elliot
	Strophostyles leiosperma (Torr. & A. Gray) Piper
	Stylosanthes viscosa Sw.
	Vigna luteola (Jacq.) Benth.
	Zornia bracteata J. F. Gmel.
	Quercus minima (Sarg.) Small.
	Quercus virginiana Mill. var. *virginiana*
	Quercus virginiana Mill. var.*fusiformis* (Small) Sarg.
FUMARIACEAE	*Corydalis micrantha* (Engelm. ex A. Gray) A. Gray subsp. *texensis* G. Ownbey
GENTIANACEAE	*Eustoma exaltatum* (L.) Salisb. ex G. Don
	Sabatia arenicola Greenm.
GOODENIACEAE	*Scaevola plumieri* (L.) Vahl
HYDROPHYLLACEAE	*Nama hispidum* A. Gray
	Phacelia patuliflora (Engelm. & A. Gray) A. Gray
IRIDACEAE	*Sisyrinchium biforme* E. P. Bicknell
	Sisyrinchium sagittiferum E. P. Bicknell
JUNCACEAE	*Juncus acuminatus* Michx.
	Juncus brachycarpus Engelm.
	Juncus bufonius L. var. *bufonius*
	Juncus marginatus Rostk.
	Juncus megacephalus M. A. Curtis
	Juncus roemerianus Scheele
	Juncus scirpoides Lam.
	Juncus validus Coville var.*fascinatus* M. C. Johnst.
LAMIACEAE	*Monarda punctata* L. var. lasiodonta A. Gray
	Scutellaria drummondii Benth.
	Scutellaria muriculata Epl.
	Teucrium cubense Jacq. var. *cubense*
LAURACEAE	*Persea borbonia* (L.) K. Spreng.
LENTIBIULARIACEAE	*Utricularia gibba* L.
	Utricularia subulata L., Bladderwort
LILIACEAE	*Cooperia drummondii* Herb.
	Nothoscordum bivalve (L.) Britton
	Linum alatum (Small) H. K. A. Winkl.
	Linum aristatum Engelm., Flax. NSA;
	Linum imbricatum (Raf.) Shinners
LOASACEAE	*Mentzelia oligosperma* Nutt. ex Sims
LYCOPODIACEAE	*Lycopodiella alopecuroides* (L.) Cranfill
LYTHRACEAE	*Ammannia latifolia* L.
	Lythrum alatum
	Lythrum califomicum Torr. & A. Gray

FAMILY	Scientific Name
	Rotala ramosior (L.) Koehne
MALVACEAE	*Abutilon fruticosum* Guill. & Perr.
	Kosteletzkya virginica (L.) K. Presl ex A. Gray
	Malvastrum americanum (L.) Torr.
	Malvastrum coromandelianum (L.) Garcke
	Sida ciliaris L.
	Sida cordifolia L., NSA;
	Sida lindheimeri Engelm. & A. Gray
	Sphaeralcea lindheimeri A. Gray
MYRICACEAE	*Morella cerifera* (L.) Small
NAJADACEAE	*Najas guadalupensis* (Spreng.) Magnus
NYCTAGINACEAE	*Acleisanthes obtusa* (Choisy) Standl.
	Boerhavia coccinea Mil.
	Mirabilis albida (Walter) Heimer
ONAGRACEAE	*Calylophus berlandieri* Spach subsp.*pinifolius* (Engelm. ex A. Gray) Towner
	Gaura longiflora Spach
	Gaura parviflora Douglas ex Lehm.
	Ludwigia glandulosa Walter
	Ludwigia linearis
	Oenothera drummondii Hook. subsp. *drummondii*
	Oenothera grandis (Britton)Smyth
	Oenothera laciniata Hill
	Oenothera speciosa Nutt.
ORCHIDACEAE	*Spiranthes vernalis* Engelm. & A. Gray
OROBANCHACEAE	*Orobanche ludoviciana* Nutt. subsp. *multiflora* (Nutt.) Collins
OXALIDACEAE	*Oxalis dillenii* Jacg. subsp. dillenii
	Oxalis drummondii A. Gray
PAPAVERACEAE	*Argemone albiflora* Hornem. subsp. *texana* G. B. Ownbey
	Argemone sanguinea Greene
PASSIFLORACEAE	*Passiflora foetida* L.
PHYTOLACCACEAE	*Phytolacca americana* L. var. *americana*
PLANTAGINACEAE	*Plantago heterophylla* Nutt.
	Plantago virginica L.
POACEAE	*Agrostis hyemalis*
	Andropogon gerardii Vitman
	Andropogon glomeratus (Walter) Britton, Sterns & Poggenb.
	Andropogon ternarius Michaux var. *ternarius*
	Andropogon virginicus L.
	Aristida oligantha Michx.
	Aristida purpurea Nutt. var. *purpurea*
	Arundo donax L.

FAMILY	Scientific Name
	Avena fatua L.
	Bothriochloa barbinodis (Lag.) Herter var. *barbinodis*
	Bothriochloa ischaemum L. var. *songarica* (Fisch. and C. A. Mey.) Celarier & Harlan
	Bothriochloa laguroides (DC.) Herter subsp. torreyana (Steud.) Hack.
	Bromus catharticus Vahl
	Cenchrus echinatus L., Cadillo.
	Cenchrus spinifex Cav.
	Chloris andropogonoides Fourn.
	Chloris canterai Arech. var. *canterai*
	Chloris cucullata Bisch.
	Chloris gayana Kunth
	Chloris verticillata Nutt.
	Cynodon dactylon (L.) Pers. var. *dactylon*
	Dactyloctenium aegyptium (L.)Beauv.,Crowfoot. NSA;
	Dichanthium annulatum (Forssk.) Stapf var. annulatum
	Dichanthium aristatum (Poir.) C. E. Hubb.
	Digitaria arenicola (Swall.) A. Beetle
	Digitaria bicornis (Lam.) Roem. & Schult.
	Digitaria cognata (Schult.) Pilg.
	Digitaria sanguinalis (L.) Scop.
	Digitaria texana Hitchc.
	Distichlis spicata (L.) Greene
	Echinochloa crus-galli (L.) Beauv. var. *crus-galli*
	Echinochloa crus-pavonis (Kunth) Schult.
	Echinochloa walteri (Pursh.) A. Heller
	Eragrostis barrelieri Daveau
	Eragrostis capillaris (L.) Nees.
	Eragrostis curtipedicellata Buckley
	Eragrostis intermedia Hitchc. var. *intermedia*
	Eragrostis lugens Nees.
	Eragrostis pectinacea (Michx.) Nees.
	Eragrostis secundiflora J. Presl subsp. *oxylepis* (Torr.) S. D. Koch
	Eragrostis sessilispica Buckley
	Eragrostis spectabilis (Pursh) Steud.,
	Eustachys petraea (Sw.) Desv.
	Leersia hexandra Sw.
	Leptochloa dubia (Kunth) Nees.
	Leptochloa mucronata (Michx) Kunth
	Leptochloa fascicularis (Lam.) A. Gray var. *fasicularis*
	Lolium perenne L.
	Muhlenbergia capillaris (Lam.) Trin.

FAMILY	Scientific Name
	Nassella leucotricha (Trin. & Rupr.) R. Pohl
	Panicum aciculare Desv. ex Poir. var. *angustiflium* (Elliot)Wipff and S. D. Jones
	Panicum acuminatum Sw.
	Panicum amarum Elliot var. *amarulum* (A. Hitchc. & Chase) P. Palmer
	Panicum amarum Elliot var. *amarum*
	Panicum capillarioides Vasey
	Panicum nodatum Hitchc. & Chase
	Panicum oligosanthes Schult.
	Panicum portoricense Desv. ex W. Hamilt.
	Panicum sphaerocarpon Elliott
	Panicum virgatum L.
	Parapholis incurva (L.) C. E. Hubb.
	Paspalum langei (Fourn.) Nash
	Paspalum monostachyum Vasey
	Paspalum plicatulum Michx. var.*plicatum*
	Paspalum setaceum Michx.
	Paspalum vaginatum Sw.
	Pennisetum ciliare (L.) Link var. *ciliare*
	Pennisetum glaucum (L.) R. Br.
	Phragmites australis (Cav.) Trin. ex Steud. subsp. *australis*
	Schedonnardus paniculatus (Nutt.) W. Trel.
	Schizachyrium scoparium (Michx.) Nash var. *littorale* (Nash) Gould
	Setaria leucopila (Scribn. & Merr.) K. Schum.
	Setaria macrostachya Kunth.
	Setaria magna Griseb.
	Setaria parviflora (Poir.) Kerguelen
	Sorghastrum nutans (L.) Nash
	Sorghum halepense (L.) R. Br.
	Spartina alterniflora Lois. var. *glabra* (Bigel.) Fern.
	Spartina patens (Ait.) Muhl.
	Spartina spartinae (Trin.) Merr. ex Hitchc.
	Sphenopholis obtusata (Michx) F. Lamson.
	Sporobolus airoides (Torr.) Torr. subsp. *airoides*
	Sporobolus cryptandrus (Torr.) A. Gray
	Sporobolus pyramidatus (Lam.) Hitchc.
	Sporobolus tharpii Hitchc.*
	Sporobolus virginicus (L.) Kunth
	Trichloris pluriflora Fourn., NSA;
	Trichoneura elegans Swall.
	Tridens congestus (L. H. Dewey) Nash
	Triplasis purpurea (Walter) Chapm. var. *purpurea*

FAMILY	Scientific Name
	Uniola paniculata L.
	Urochloa ciliatissima (Buckley) R. D. Webster
	Urochloa texana (Buckley) R. D. Webster
	Vaseyochloa multinervosa (Vasey) Hitchc.
	Vulpia octoflora (Walter) Rydb.
POLEMONIACEAE	*Phlox drummondii* Hook.
	Phlox glabriflora (Brand) Whitehouse subsp. *glabriflora*
	Phlox glabriflora (Brand) Whitehouse subsp. *littoralis* (Cory) Wherry
POLYGALACEAE	*Polygala alba* Nutt.
	Polygala incarnata L.
	Polygala verticillata L.
	Eriogonum longifolium Nutt. var. *longifolium*
	Eriogonum multiflorum Benth.
	Polygonella polygama (Vent.) Engelm. & A. Gray
	Polygonum hydropiperoides Michx.
PORTULACACEAE	*Portulaca oleracea* L. subsp. *oleracea*
	Portulaca pilosa L., Chisme
	Talinum parviflorum Nutt.
PRIMULACEAE	*Anagallis arvensis* L.
	Anagallis minima L.
	Samolus ebracteatus Kunth
RUBIACEAE	*Cephalanthus occidentalis* L. var. *califomicus* Benth.
	Diodia teres Walter var. *teres*
	Hedyotis nigricans (Lam.) Fosberg, Bluets.
	Houstonia subviscosa (c. Wright ex A. Gray) A. Gray
	Oldenlandia boscii (DC.) Chapm.
	Oldenlandia uniflora L.
	Richardia brasiliensis Gomes B427
RUPPIACEAE	*Ruppia maritima* L.
RUTACEAE	*Zanthoxylum clava*-herculis L., Pepperbark
	Zanthoxylum hirsutum Buckley
SALICACEAE	*Salix nigra* Marshall, Black willow, Sauz.
SAXIFRAGACEAE	*Lepuropetalon spathulatum* Elliott
SCROPHULARIACEAE	*Agalinis heterophylla* (Nutt.) Small ex Britton, Prairie agalinis.
	Agalinis maritima (Raf.) Raf. var. glandiflora (Benth.) Shinners
	Agalinis strictifolia (Benth.) Pennell
	Agalinis fasciculata(Elliott) Raf.
	Bacopa caroliniana (Walter) Robins.
	Bacopa monnieri (L.) Pennell
	Bacopa rotundifolia (Michx.) Wettst.
	Buchnera americana L.

FAMILY	Scientific Name
	Castilleja indivisa Engelm.
	Lindernia dubia (L.) Pennell var. *anagallidea* (Michx.) Cooperr.
	Maurandya antirrhiniflora Humb. & Bonpl. ex Willd. subsp. *antirrhiniflora*,
	Nuttallanthus texanus (Scheele) D. A. Sutton
	*Stemodia lanata*Ses.& Moc.ex Benth.
SOLANACEAE	*Capsicum annuum* L. var. *aviculare* (Dierb.) D' Arcy & Eshbaugh,
	Nicotiana glauca Grah.
	Physalis cinerascens (Dunal) Hitchc. var. *cinerascens*
	Physalis cinerascens (Dunal) Hitchc. var. *spathulifolia*
	Solanum americanum Mill.
	Solanum rostratum Dunal
TAMARICACEAE	*Tamarix aphylla* (L.) Karst.
	Tamarix canariensis Willd.
	Tamarix chinensis Lour.
	Tamarix gallica L.
	Tamarix ramosissima Ledeb.
TYPHACEAE	*Typha domingensis* Pers.
	Typha latifolia L.
URTICACEAE	*Parietaria pensylvanica* Muhl. ex Willd. var. *obtusa* (Rydb. ex Small) Shinners
	Parietaria floridana Nutt.
	Urtica chamaedryoides Pursh
VERBENACEAE	*Avicennia germinans* (L.) L.
	Glandularia bipinnatifida (Nutt.) Nutt. var. *bipinnatifida*
	Lantana camara L.,
	Lantana urticoides Hayek
	Phyla lanceolata (Michx.) Greene
	Phyla nodiflora (L.) Greene
	Verbena halei Small
VITACEAE	*Cissus incisa* Des Moul.
XYRIDACEAE	*Xyris jupicai* Rich.
ZYGOPHYLLACEAE	*Kallstroemia hirsutissima* Vail ex Small
	Tribulus terrestris L.

Appendix F: National Vegetation Classification Summary for Plant Associations at Padre Island National Seashore

U.S. National Vegetation Classification Associations of Padre Island National Seashore

9 October 2014

by

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This subset of the International Ecological Classification Standard covers vegetation associations attributed to Padre Island National Seashore. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Judy Teague, Senior Regional Ecologist, Durham, NC <judy_teague@natureserve.org>.

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[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

United States

Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program,

Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada

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Latin American and Caribbean

Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

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1. Forest & Woodland

1.B.3. Temperate Flooded & Swamp Forest

1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

M031. Southern Coastal Plain Floodplain Forest

G759. Southern Ash - Elm - Willow Floodplain Forest

Black Willow Dune Swale Vegetation
Salix nigra Dune Swale Vegetation

Identifier: CEGL007242

USNVC CLASSIFICATION

Division Southeastern North American Flooded & Swamp Forest (1.B.3.Nb)

Macrogroup Southern Coastal Plain Floodplain Forest (M031)

Group Southern Ash - Elm - Willow Floodplain Forest (G759)

Association Black Willow Dune Swale Vegetation

ELEMENT CONCEPT

Global Summary: This provisional community is characterized by high cover of *Salix nigra*. It occurs in a variety of landscape positions, including depressions and other low areas, and on low dunes at Padre Island, Texas. Associated species include *Borrichia frutescens, Conoclinium betonicifolium, Morella cerifera, Phyla nodiflora, Schizachyrium littorale, Schoenoplectus pungens var. longispicatus, Sesbania herbacea*, and *Spartina patens*. Its concept was developed from limited information from Padre Island National Seashore of southern Texas.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This vegetation occurs in a variety of landscape positions, including depressions and other low areas (blowout ponds and depressions), and on low dunes at Padre Island, Texas.

Global Environment: This vegetation occurs in lower, wetter areas (blowout ponds and depressions) on the barrier flat.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This provisional community is characterized by high cover of *Salix nigra*. Associated species include *Borrichia frutescens, Conoclinium betonicifolium, Morella cerifera, Phyla nodiflora, Schizachyrium littorale, Schoenoplectus pungens var. longispicatus, Sesbania herbacea*, and *Spartina patens*.

Global Vegetation: This provisional community is characterized by high cover of *Salix nigra*. Associated species include *Borrichia frutescens, Conoclinium betonicifolium, Morella cerifera, Phyla nodiflora, Schizachyrium littorale, Schoenoplectus pungens var. longispicatus, Sesbania herbacea*, and *Spartina patens*.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Tall shrub/sapling	Broad-leaved deciduous shrub	*Salix nigra*
Global	Tall shrub/sapling	Broad-leaved deciduous shrub	*Salix nigra*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Salix nigra*

Global: *Salix nigra*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (13-May-2014).

CLASSIFICATION

Status: Provisional

Padre Island National Seashore Comments: This provisional community was developed from limited information from Padre Island National Seashore of southern Texas. It includes areas dominated by *Salix nigra*. Scattered individuals of *Salix nigra* are also present with the matrix grassland communities of the barrier flat. That vegetation is classified with the grassland communities.

Global Comments: This provisional community was developed from limited information from Padre Island National Seashore of southern Texas.

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This vegetation occurs in a variety of landscape positions, including depressions and other low areas (blowout ponds and depressions), and on low dunes.

Global Range: This vegetation occurs on barrier islands along the central and southern coast of Texas.

Nations: US

States/Provinces: TX

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 255Dc:CCC

Federal Lands: NPS (Padre Island)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation was documented with a single plot and some field notes of observations by NPS.

Padre Island National Seashore Plots and Observation Points: PAIS630.

Local Description Authors: J. Teague

Global Description Authors: J. Teague

References: Southeastern Ecology Working Group n.d.

2. Shrub & Herb Vegetation

2.B.4. Temperate to Polar Scrub & Herb Coastal Vegetation

2.B.4.Na. Eastern North American Coast Scrub & Herb Vegetation

M060. Eastern North American Coastal Beach

G661. South Atlantic & Gulf Coastal Beach

West Gulf Coastal Plain Ocean Strand
Ipomoea pes-caprae - Ipomoea imperati - (Cakile geniculata) Herbaceous Vegetation
Railroad-vine - Beach Morning-glory - (Gulf Searocket) Herbaceous Vegetation

Identifier: CEGL004402

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Coastal Beach (M060)

Group South Atlantic & Gulf Coastal Beach (G661)

Association West Gulf Coastal Plain Ocean Strand

ELEMENT CONCEPT

Global Summary: This association is a characteristic back-beach community of ocean beaches of the West Gulf Coast Prairies and Marshes, west of the Mississippi River to Texas and adjacent Mexico. *Ipomoea pes-caprae* and *Ipomoea imperati (= Ipomoea stolonifera)* dominate as sparse to moderately dense trailing vines. Other species that may be present as scattered individuals include *Cakile geniculata, Croton punctatus, Erigeron procumbens (= Erigeron myrionactis), Heliotropium curassavicum, Heterotheca subaxillaris, Oenothera drummondii, Physalis viscosa, Sesuvium portulacastrum, Spartina patens, Tidestromia lanuginosa*, and *Uniola paniculata*.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This is the back-beach community at Padre Island National Seashore.

Global Environment: This vegetation occurs along the harsh back beaches of barrier islands of Texas and adjacent Louisiana and Mexico.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: Vegetation tends to be sparse and characterized by *Amaranthus greggii, Cakile geniculata, Croton punctatus, Heterotheca subaxillaris, Ipomoea imperati, Ipomoea pes-caprae, Oenothera drummondii*, and *Sesuvium portulacastrum*.

Global Vegetation: Characteristic species of this community include *Cakile geniculata, Croton punctatus, Erigeron procumbens (= Erigeron myrionactis), Heliotropium curassavicum, Heterotheca subaxillaris, Ipomoea imperati, Ipomoea pes-caprae, Oenothera drummondii, Physalis viscosa, Sesuvium portulacastrum, Spartina patens*, and *Tidestromia lanuginosa*.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Forb	*Cakile geniculata*, *Ipomoea imperati*, *Oenothera drummondii*, *Sesuvium portulacastrum*
Global	Herb (field)	Forb	*Cakile geniculata*, *Ipomoea imperati*, *Oenothera drummondii*, *Sesuvium portulacastrum*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Cakile geniculata, Ipomoea imperati, Oenothera drummondii, Sesuvium portulacastrum*

Global: *Cakile geniculata, Ipomoea imperati, Oenothera drummondii, Sesuvium portulacastrum*

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (14-Aug-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: *Cakile geniculata* is included as a geographic indicator.

Global Similar Associations:

- *Ipomoea imperati - Cakile edentula ssp. harperi* Herbaceous Vegetation (CEGL007009)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This is the back-beach community at Padre Island National Seashore.

Global Range: This association is a characteristic back-beach community of ocean beaches of the West Gulf Coast Prairies and Marshes, west of the Mississippi River to Texas and adjacent Mexico.

Nations: MX, US

States/Provinces: LA, MXTM, TX

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 231Fb:CCC, 232Eb:CPP, 255Dc:CCC

Federal Lands: NPS (Padre Island); USFWS (Matagorda Island)

ELEMENT SOURCES

Padre Island National Seashore Plots and Observation Points: PAIS502, PAIS612, PAIS709, PAIS710, PAIS718.

Local Description Authors: J. Teague

Global Description Authors: A.S. Weakley, mod. J. Teague

References: LNHP 2009, McAlister and McAlister 1993, Smith 1996a, Southeastern Ecology Working Group n.d.

M057. Eastern North American Dune & Coastal Grassland & Shrubland

G494. South Atlantic & Gulf Shrub & Grass Coast & Dune

Wax-myrtle / Gulfdune Crowngrass - Bushy Bluestem - Shore Little Bluestem Vegetation
Morella cerifera / Paspalum monostachyum - Andropogon glomeratus - Schizachyrium littorale Vegetation

Identifier: CEGL007223

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Dune & Coastal Grassland & Shrubland (M057)

Group South Atlantic & Gulf Shrub & Grass Coast & Dune (G494)

Association Wax-myrtle / Gulfdune Crowngrass - Bushy Bluestem - Shore Little Bluestem Vegetation

ELEMENT CONCEPT

Global Summary: This community represents vegetation dominated or codominated by *Morella cerifera* occurring on the barrier flat of barrier islands along the central and south Texas coast. It may occur in small patches or as a shrub savanna, and sometimes occupies lower areas within a matrix of the barrier flat and secondary dune grassland communities. Codominants may include *Schizachyrium littorale, Paspalum monostachyum*, and *Andropogon glomeratus*. Fire, washovers, shifting sands, and other disturbances shape the extent and expression of this community. This provisional community is described from very limited plot data and other observations from Padre Island National Seashore. Related vegetation has been described from other barrier islands along the Gulf and Atlantic coasts.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community is found in small patches or as a shrub savanna, and sometimes occupies lower areas within a matrix of the barrier flat and secondary dune grassland communities. Fire, washovers, shifting sands, and other disturbances shape the extent and expression of this community.

Global Environment: This community is found in small patches or as a shrub savanna, and sometimes occupies lower areas within a matrix of the barrier flat and secondary dune grassland communities. Fire, washovers, shifting sands, and other disturbances shape the extent and expression of this community.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This community represents barrier flat vegetation dominated or codominated by *Morella cerifera*. Codominants may include *Schizachyrium littorale, Paspalum monostachyum*, and *Andropogon glomeratus*. It may exhibit patchiness or low cover (>10-20%) of scattered individuals of *Morella cerifera* within grassland. Even lower cover (<10-20%) of

scattered individuals of *Morella cerifera* within grassland should be included as components of the relevant grassland community.

Global Vegetation: This community represents barrier flat vegetation dominated or codominated by *Morella cerifera*. Codominants may include *Schizachyrium littorale, Paspalum monostachyum*, and *Andropogon glomeratus*. It may exhibit patchiness or low cover (>10-20%) of scattered individuals of *Morella cerifera* within grassland. Even lower cover (<10-20%) of scattered individuals of *Morella cerifera* within grassland should be included as components of the relevant grassland community.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Short shrub/sapling	Broad-leaved evergreen shrub	*Morella cerifera*
	Herb (field)	Graminoid	*Andropogon glomeratus*, *Paspalum monostachyum*, *Schizachyrium littorale*
Global	Short shrub/sapling	Broad-leaved evergreen shrub	*Morella cerifera*
	Herb (field)	Graminoid	*Andropogon glomeratus*, *Paspalum monostachyum*, *Schizachyrium littorale*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Andropogon glomeratus, Morella cerifera, Paspalum monostachyum, Schizachyrium littorale*

Global: *Andropogon glomeratus, Morella cerifera, Paspalum monostachyum, Schizachyrium littorale*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (9-May-2014).

CLASSIFICATION

Status: Provisional

Padre Island National Seashore Comments: This provisional community is described from very limited plot data and other observations from Padre Island National Seashore. Related vegetation has been described from other barrier islands along the Gulf and Atlantic coasts (Godfrey and Godfrey 1976, Faber-Langendoen et al. 2014).

Global Comments: This provisional community is described from very limited plot data and other observations from Padre Island National Seashore. Related vegetation has been described from other barrier islands along the Gulf and Atlantic coasts (Godfrey and Godfrey 1976, USNVC 2014).

Global Similar Associations:

- *Morella cerifera - Vaccinium corymbosum* Shrubland (CEGL003906)
- *Morella cerifera / Spartina patens* Shrubland (CEGL003839)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community is found in small patches or as a shrub savanna, and sometimes occupies lower areas within a matrix of the barrier flat and secondary dune grassland communities. Fire, washovers, shifting sands, and other disturbances shape the extent and expression of this community.

Global Range: This provisional community is described from very limited plot data and other observations at Padre Island National Seashore, Texas. It may extend north to other barrier islands along the Gulf Coast.

Nations: US

States/Provinces: TX

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 255Dc:CCC

Federal Lands: NPS (Padre Island)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation is described from one plot and ancillary observations at Padre Island National Seashore.

Padre Island National Seashore Plots and Observation Points: PAIS622.

Local Description Authors: J. Teague

Global Description Authors:

References: Godfrey and Godfrey 1976, Southeastern Ecology Working Group n.d.

Gulfdune Crowngrass - Bushy Bluestem - Shore Little Bluestem - Texas Marsh-elder Herbaceous Vegetation
Paspalum monostachyum - Andropogon glomeratus - Schizachyrium littorale - Iva texensis Herbaceous Vegetation

Identifier: CEGL007222

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Dune & Coastal Grassland & Shrubland (M057)

Group South Atlantic & Gulf Shrub & Grass Coast & Dune (G494)

Association Gulfdune Crowngrass - Bushy Bluestem - Shore Little Bluestem - Texas Marsh-elder Herbaceous

Vegetation

ELEMENT CONCEPT

Global Summary: This community is described from Padre Island, Texas. It represents grasslands dominated or codominated by *Paspalum monostachyum* that occupy slightly lower parts of barrier flats. Other herbaceous species that may be present in high cover and occasionally codominating include *Schizachyrium littorale, Andropogon glomeratus*, and *Iva texensis*. Associated species include wetland herbs such as *Hydrocotyle bonariensis, Conoclinium betonicifolium*, and *Spartina patens*. It grades into and may be hard to distinguish from *Schizachyrium littorale - Paspalum monostachyum* Herbaceous Vegetation (CEGL002207) which occupies slightly higher and drier positions on the barrier flat.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community appears to occur in the slightly moister areas of the barrier flat.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This community is characterized and often dominated by *Paspalum monostachyum*. Some occurrences may be codominated by *Schizachyrium littorale, Andropogon glomeratus*, and *Iva texensis*. Associated species include wetland herbs such as *Hydrocotyle bonariensis, Conoclinium betonicifolium*, and *Spartina patens*.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Forb	*Eupatorium betonicifolium*, *Hydrocotyle bonariensis*, *Iva texensis*
	Herb (field)	Graminoid	*Andropogon glomeratus*, *Paspalum monostachyum*, *Schizachyrium littorale*, *Spartina patens*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Eupatorium betonicifolium, Hydrocotyle bonariensis, Iva texensis, Paspalum monostachyum, Spartina patens*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (9-May-2014).

CLASSIFICATION

Status: Provisional

Padre Island National Seashore Comments: This vegetation was identified as a fairly distinctive type in cluster analysis, though homoteneity and Bray-Curtis Similarity were moderately low within the group of plots. The species in this community are shared with and sometimes codominant in other communities at Padre Island, but the combination of species and environmental setting seem to support description of this community as a separate type.

Global Similar Associations:

- *Schizachyrium littorale - Paspalum monostachyum* Herbaceous Vegetation (CEGL002207)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community appears to occur in the slightly moister areas of the barrier flat. It grades into and may be hard to distinguish from *Schizachyrium littorale - Paspalum monostachyum* Herbaceous Vegetation (CEGL002207) which occupies slightly higher and drier positions on the barrier flat.

Global Range: As currently described, this community is only known from Padre Island, Texas. It potentially ranges farther north along the Texas coast, along the coast of Florida and farther south on barrier islands along the coast of Mexico.

Nations: MX?, US

States/Provinces: FL?, TX

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 255Dc:CCC

Federal Lands: NPS (Padre Island)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation was identified as a fairly distinctive type in cluster analysis, though homoteneity and Bray-Curtis Similarity were moderately low within the group of plots. The species in this community are shared with and sometimes codominant in other communities at Padre Island, but the combination of species and environmental setting seem to support description of this community as a separate type.

Padre Island National Seashore Plots and Observation Points: PAIS113, PAIS12, PAIS120, PAIS18, PAIS2, PAIS505, PAIS510, PAIS513, PAIS515, PAIS521, PAIS537, PAIS558, PAIS566, PAIS635, PAIS676, PAIS678, PAIS681, PAIS682, PAIS684, PAIS686, PAIS7, PAIS706, PAIS73, PAIS97.

Local Description Authors: J. Teague

Global Description Authors: J. Teague

References: Southeastern Ecology Working Group n.d.

Seaside Bluestem - Gulfdune Crowngrass Tallgrass Prairie

Schizachyrium littorale - Paspalum monostachyum Herbaceous Vegetation

Shore Little Bluestem - Gulfdune Crowngrass Herbaceous Vegetation

Identifier: CEGL002207

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Dune & Coastal Grassland & Shrubland (M057)

Group South Atlantic & Gulf Shrub & Grass Coast & Dune (G494)

Association Seaside Bluestem - Gulfdune Crowngrass Tallgrass Prairie

ELEMENT CONCEPT

Global Summary: This association is the predominant grassland on the Ingleside barrier-strandplain and barrier islands of the Texas Coastal Bend. It also occurs on the upper Texas coast (Follets Island). In addition to *Schizachyrium littorale* and *Paspalum monostachyum*, common components include *Heteropogon contortus, Paspalum plicatulum, Trichoneura elegans, Andropogon gerardii, Sorghastrum nutans, Bothriochloa saccharoides, Muhlenbergia capillaris, Dichanthelium* spp., and *Elionurus tripsacoides*. Minor changes in drainage can cause differences in species composition. On the Ingleside barrier-strandplain, while *Paspalum monostachyum* may dominate slightly lower areas [see *Paspalum monostachyum - Andropogon glomeratus - Schizachyrium littorale - Iva texensis* Herbaceous Vegetation (CEGL007222)], deeper swales are typically dominated by *Panicum virgatum* and *Spartina patens* and are classified as *Spartina patens - Fimbristylis (caroliniana, castanea) - (Panicum virgatum)* Herbaceous Vegetation (CEGL007836). In this area, these grasslands occur intermixed with *Quercus fusiformis - Persea borbonia* Forest (CEGL002117). Other components on the barrier-strandplain include *Baptisia bracteata var. leucophaea, Dichanthelium acuminatum var. fasciculatum (= Dichanthelium lanuginosum), Phlox drummondii, Rhynchosia americana, Sida lindheimeri, Stemodia lanata*, and *Stylisma villosa*. In addition to the nominals, barrier flat communities include *Spartina patens, Trachypogon spicatus (= Trachypogon secundus), Muhlenbergia capillaris, Rhynchosia americana, Galactia canescens, Helianthus argophyllus*, and *Physalis walteri*. Here, poorly drained areas may support inclusions of *Spartina spartinae* or *Spartina patens*.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community represents matrix grasslands that occupy higher parts of the barrier flat.

Global Environment: This association is the predominant grassland on the Ingleside barrier-strandplain of the Texas Coastal Bend and barrier flats of barrier islands off the central and upper coast of Texas.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: Though dominated by *Schizachyrium littorale* with *Paspalum monostachyum* as a strong associate, species composition is otherwise variable with over 75 species recorded in 35 plots. Associated species include *Baptisia bracteata var. leucophaea, Chamaecrista fasciculata var. fasciculata, Commelina erecta var. angustifolia, Dichanthelium sphaerocarpon, Eragrostis secundiflora ssp. oxylepis, Galactia canescens, Paspalum setaceum, Polygala alba*, and many others. This vegetation is typically dense with high cover of *Schizachyrium littorale* and *Paspalum monostachyum*, other graminoids and forbs, but a sparse subtype has also been identified. The sparse subtype may be related to impacts of fire or substrate changes, such as coppice dunes. *Chamaecrista fasciculata var. fasciculata* and/or *Baptisia bracteata var. leucophaea* maybe the aspect dominant(s) in some examples. There also appears to be a slightly wetter subtype characterized by higher cover of *Spartina patens* and scattered *Morella cerifera* and *Salix nigra*, but significant cover of either of these species is covered in separate associations, Wax-myrtle / Gulfdune Crowngrass - Bushy Bluestem - Shore Little Bluestem Vegetation (CEGL007223) and Black Willow Dune Swale Vegetation (CEGL007242), respectively.

Global Vegetation: In addition to *Schizachyrium littorale* and *Paspalum monostachyum*, common components include *Heteropogon contortus, Paspalum plicatulum, Trichoneura elegans, Andropogon gerardii, Sorghastrum nutans, Muhlenbergia capillaris, Dichanthelium* spp., and *Elionurus tripsacoides*. Minor changes in drainage can cause differences in species composition. Also noted in mainland occurrences are *Panicum hallii (= Panicum filipes), Leptochloa nealleyi*, and *Chloris cucullata*. On the Ingleside barrier-strandplain, while *Paspalum monostachyum* may dominate slightly lower areas [see *Paspalum monostachyum - Andropogon glomeratus - Schizachyrium littorale - Iva texensis* Herbaceous Vegetation (CEGL007222)], deeper swales are typically dominated by *Panicum virgatum* and *Spartina patens* and are classified as *Spartina patens - Fimbristylis (caroliniana, castanea) - (Panicum virgatum)* Herbaceous Vegetation (CEGL007836). In this area, these grasslands occur intermixed with *Quercus fusiformis - Persea borbonia* Forest (CEGL002117). In addition to the nominals, barrier flat communities include *Spartina patens, Trachypogon spicatus (= Trachypogon secundus), Muhlenbergia capillaris, Rhynchosia americana, Galactia canescens, Helianthus argophyllus*, and *Physalis viscosa*. Here, poorly drained areas may support inclusions of *Spartina spartinae* and/or *Spartina patens*.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Graminoid	*Paspalum monostachyum*, *Schizachyrium littorale*
Global	Herb (field)	Graminoid	*Schizachyrium littorale*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Baptisia bracteata* var. *leucophaea*, *Paspalum monostachyum*, *Schizachyrium littorale*

Global: *Paspalum monostachyum*, *Schizachyrium littorale*

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Euphorbia innocua* (G3), *Sporobolus tharpii* (G3), *Yucca tenuistyla* (G3); **Other**: *Cucurbita pepo* var. *texana* (G4G5T4?), *Dichanthelium nodatum* (G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (13-Jun-2001). This community is restricted in environmental setting and range to barrier islands and barrier-strandplains of the central and upper coast of Texas. Unprotected examples are threatened by coastal development and grazing pressures. The degree of uncertainty in the rank reflects the need for further inventory to assess the remaining number of occurrences of this type. The relationship of this community to similar communities needs clarification.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Padre Island National Seashore Comments: This vegetation was identified as a variable but distinctive group of plots in cluster analysis, though Homoteneity (0.469) and Bray-Curtis Similarity (0.233 - 0.515) were moderately low within the group. The species in this community are shared with and sometimes codominant in other communities at Padre Island, but the combination of species and environmental setting support description of this community as a separate type.

Global Comments: This vegetation is related to *Schizachyrium scoparium* - *Triplasis purpurea* - *Eriogonum multiflorum* - *Liatris elegans var. carizzana* Herbaceous Vegetation (CEGL008483), occurring on deep sandy ridges along the San Bernard and possibly other rivers as they flow through the Lissie Formation in the Upper Coastal Prairie. It is also similar to *Schizachyrium littorale* - *Paspalum plicatulum* Texas Sand Sheet Herbaceous Vegetation (CEGL007821) occurring on the South Texas Sand Sheet. All of these communities occur over deep sandy strata. These communities share many taxa, but each seems to have a suite of unique species not found in the others. More information is needed to fully describe these differences. The taxonomy of the nominal species of *Schizachyrium* is in question for some occurrences. This type originally described vegetation of the South Texas Sand Sheet, the Ingleside barrier-strandplain and barrier islands in Texas. The sand sheet vegetation is now classified as *Schizachyrium littorale* - *Paspalum plicatulum* Texas Sand Sheet Herbaceous Vegetation (CEGL007821).

Global Similar Associations:

- *Paspalum monostachyum - Andropogon glomeratus - Schizachyrium littorale - Iva texensis* Herbaceous Vegetation (CEGL007222)
- *Schizachyrium littorale - Paspalum plicatulum* Texas Sand Sheet Herbaceous Vegetation (CEGL007821)
- *Schizachyrium scoparium - Triplasis purpurea - Eriogonum multiflorum - Liatris elegans var. carizzana* Herbaceous Vegetation (CEGL008483)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community represents matrix grasslands that occupy higher areas of the barrier flat.

Global Range: This community is known only from the central and upper coast of Texas.

Nations: US

States/Provinces: TX:S3

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 255Dc:CCC

Federal Lands: NPS (Padre Island); USFWS (Aransas, Matagorda Island)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation was identified as a variable but distinctive group of plots in cluster analysis, though Homoteneity (0.469) and Bray-Curtis Similarity (0.233 - 0.515) were moderately low within the group. The species in this community are shared with and sometimes codominant in other communities at Padre Island, but the combination of species and environmental setting support description of this community as a separate type.

Padre Island National Seashore Plots and Observation Points: PAIS114, PAIS121, PAIS122, PAIS141, PAIS154b, PAIS16, PAIS17, PAIS511, PAIS514, PAIS516, PAIS517, PAIS520, PAIS529, PAIS532, PAIS535, PAIS541, PAIS544, PAIS548, PAIS554, PAIS562, PAIS608, PAIS666, PAIS668, PAIS687, PAIS690, PAIS708, PAIS715, PAIS716, PAIS72, PAIS74, PAIS75, PAIS76, PAIS93, PAIS95, PAIS96.

Local Description Authors: J. Teague

Global Description Authors: D. Diamond

References: Diamond 1993, McAlister and McAlister 1993, McAlister and McAlister 1995, Southeastern Ecology Working Group n.d.

Honey Mesquite - Texas Prickly-pear - Bushy Seaside-tansy Shrubland

Prosopis glandulosa var. glandulosa - Opuntia engelmannii var. lindheimeri - Borrichia frutescens Shrubland

Identifier: CEGL007790

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Dune & Coastal Grassland & Shrubland (M057)

Group South Atlantic & Gulf Shrub & Grass Coast & Dune (G494)

Association Honey Mesquite - Texas Prickly-pear - Bushy Seaside-tansy Shrubland

ELEMENT CONCEPT

Global Summary: This shrubland occurs on alkaline saline clay loams a few feet above the tidal flat, along the southern Gulf of Mexico of Texas and Tamaulipas. Due probably to the shallow depth to the saline water table, *Prosopis glandulosa var. glandulosa* is generally stunted, seldom exceeding 5 m in height, and rather scattered, seldom occupying more than 25% cover. Lower shrubs or suffrutescent perennials are more common, including *Opuntia engelmannii var. lindheimeri, Borrichia frutescens, Isocoma drummondii, Maytenus phyllanthoides (= Maytenus texana)*, and *Prosopis reptans*; such cover is often nearly continuous. Important herb species include *Monanthochloe littoralis, Buchloe dactyloides, Setaria leucopila, Spartina spartinae, Billieturnera helleri*, and *Pappophorum vaginatum*. *Lenophyllum texanum*, a Tamaulipan Thornscrub endemic, is sometimes found in this community. This community often intermingles with grasslands dominated by *Spartina spartinae*.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This association is reported from along the edge of Laguna Madre on Padre Island National Seashore.

Global Environment: This shrubland occurs on alkaline saline clay loams a few feet above the tidal flat, along the southern Gulf of Mexico of Texas and Tamaulipas, Mexico.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This vegetation includes dense stands (>75% cover) of small, stunted (3 m height) *Prosopis glandulosa var. glandulosa* with *Opuntia engelmannii var. lindheimeri*. Dense patches of *Borrichia frutescens* occur along the edge of stands and may intermix with the mesquite. *Celtis pallida* may occur as a minor component.

Global Vegetation: This community is dominated by scattered, stunted *Prosopis glandulosa*. Lower shrubs or suffrutescent perennials are more common, including *Opuntia engelmannii var. lindheimeri, Borrichia frutescens, Isocoma drummondii, Maytenus phyllanthoides (= Maytenus texana)*, and *Prosopis reptans*; such cover is often nearly continuous. Important herb species include *Monanthochloe littoralis, Buchloe dactyloides, Setaria leucopila, Spartina spartinae, Billieturnera*

helleri, and *Pappophorum vaginatum*. *Lenophyllum texanum*, a Tamaulipan Thornscrub endemic, is sometimes found in this community. This community often intermingles with grasslands dominated by *Spartina spartinae*, *Spartina spartinae* Herbaceous Vegetation (CEGL004608) or *Prosopis glandulosa var. glandulosa / Spartina spartinae* Shrubland (CEGL007761).

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Tall shrub/sapling	Broad-leaved deciduous shrub	*Prosopis glandulosa* var. *glandulosa*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Prosopis glandulosa* var. *glandulosa*

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Lenophyllum texanum* (G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (12-Jun-2001). This community is naturally restricted in range and habitat to the Gulf Coast of south Texas and possibly northern Mexico. The extent of this community in Mexico is unknown. The range in the rank reflects the need for further inventory and description of this community. Its relationship to similar communities needs clarification.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: The relationship between this community, *Prosopis glandulosa var. glandulosa - Opuntia engelmannii var. lindheimeri - Borrichia frutescens* Shrubland (CEGL007790), and *Prosopis glandulosa var. glandulosa / Spartina spartinae* Shrubland (CEGL007761) is unclear. A working hypothesis is that they separate out along salinity and hydrological gradients with the former community occurring in areas slightly lower on the landscape and possibly more saline. Perhaps these two communities belong together in an alliance (and group, macrogroup, etc.) that includes tidally influenced saline vegetation characterized by *Prosopis glandulosa var. glandulosa*.

Global Similar Associations:

- *Prosopis glandulosa var. glandulosa / Spartina spartinae* Shrubland (CEGL007761)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This association is reported from along the edge of Laguna Madre on Padre Island National Seashore.

Global Range: This community is known from the coast of south Texas. It may also range into the Mexican state of Tamaulipas.

Nations: MX, US

States/Provinces: MXTM, TX

TNC Ecoregions: 30:P, 31:C

USFS Ecoregions (1994/95): 255Dc:CCC, 315E:PP

Federal Lands: NPS (Padre Island); USFWS (Laguna Atascosa, Lower Rio Grande Valley)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: No plots were collected in this vegetation. It was identified and included in the subset for Padre Island National Seashore after field visits by NPS and MoRAP.

Local Description Authors: J. Teague

Global Description Authors: B. Carr

References: Southeastern Ecology Working Group n.d.

Salty Prairie

Spartina spartinae Herbaceous Vegetation

Gulf Cordgrass Herbaceous Vegetation

Identifier: CEGL004608

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Dune & Coastal Grassland & Shrubland (M057)

Group South Atlantic & Gulf Shrub & Grass Coast & Dune (G494)

Association Salty Prairie

ELEMENT CONCEPT

Global Summary: This community occurs on upland flats just above normal tidal reach. *Spartina spartinae* is typically monodominant, but *Setaria parviflora* is common and typical and *Spartina patens* may be locally codominant. Other species include *Andropogon glomeratus var. pumilus, Paspalum vaginatum, Spartina patens, Cyperus* spp., *Lythrum alatum var. lanceolatum, Solidago sempervirens*, and *Palafoxia texana var. ambigua*. Scattered shrubs, such as *Iva frutescens, Prosopis glandulosa var. glandulosa*, and *Baccharis halimifolia*, can occur, especially as invaders as the result of grazing and/or fire suppression. In parts of its range, this community covers large expanses, but it also can form a linear fringe above tidal flats and marshes.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community occurs on barrier flats above normal tidal reach.

Global Environment: This association is found on mainland shores in heavy saline soils (Natraqualfs) along the upland edges of coastal marshes and bays of the Gulf Coast of Texas. This or similar vegetation has also been identified from barrier islands along the south Texas coast. It may be saturated for much of the growing season.

VEGETATION DESCRIPTION

Global Vegetation: *Spartina spartinae* is monodominant, but *Setaria parviflora* is common and typical. Other species include *Andropogon glomeratus var. pumilus, Paspalum vaginatum, Spartina patens, Cyperus* spp., *Lythrum alatum var. lanceolatum, Solidago sempervirens*, and *Palafoxia texana var. ambigua*. Scattered shrubs, such as *Iva frutescens, Prosopis glandulosa var. glandulosa* and *Baccharis halimifolia*, can occur, especially as invaders as the result of grazing and/or fire suppression. *Spartina patens* may be locally codominant.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Graminoid	*Spartina spartinae*
Global	Herb (field)	Graminoid	*Spartina spartinae*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Spartina spartinae*

Global: *Spartina spartinae*

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (19-Jan-2000). This association is common within its naturally restricted range along the Gulf of Mexico. It is a matrix community in the Gulf Coastal Prairie of Texas where it occupies extensive upland flats above normal tidal reach. It occurs on soils of variable salinity that may be saturated for much of the growing season. In the absence of periodic fires, encroachment by woody shrubs such as *Baccharis halimifolia* can convert this association into a shrubland. On private property, this community is often threatened by overgrazing and fire suppression, but several large occurrences are known from National Wildlife Refuges along the Texas Coast.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Padre Island National Seashore Comments: This vegetation is reported from observations, but no plot data are available.

Global Similar Associations:

- *Spartina spartinae* - *Schizachyrium scoparium* Herbaceous Vegetation (CEGL002231)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community occurs on barrier flats above normal tidal reach.

Global Range: This alliance occurs in near-coastal areas along the Gulf Coast of Texas and possibly Louisiana and the Mexican state of Tamaulipas.

Nations: MX?, US

States/Provinces: LA?, MXTM?, TX:S4

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 231Fb:CCC, 232Eb:PPP, 255Dc:CCC

Federal Lands: NPS (Padre Island); USFWS (Anahuac, Aransas, Big Boggy, Brazoria, Laguna Atascosa, Matagorda Island, McFaddin, San Bernard, Texas Point)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation is reported from observations, but no plot data are available.

Padre Island National Seashore Plots and Observation Points: No data available.

Local Description Authors: J. Teague

Global Description Authors: A.S. Weakley, mod. J. Teague

References: Diamond 1993, McAlister and McAlister 1993, Southeastern Ecology Working Group n.d.

Sea-oats - Bitter Panicum Tallgrass Prairie

Uniola paniculata - (Panicum amarum) - Croton punctatus Herbaceous Vegetation

Sea-oats - (Bitter Panicgrass) - Gulf Croton Herbaceous Vegetation

Identifier: CEGL002218

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Dune & Coastal Grassland & Shrubland (M057)

Group South Atlantic & Gulf Shrub & Grass Coast & Dune (G494)

Association Sea-oats - Bitter Panicum Tallgrass Prairie

ELEMENT CONCEPT

Global Summary: This is a coastal beach or dune grassland community of the Gulf Coast of Texas. *Uniola paniculata* is typically dominant or codominant with *Croton punctatus, Heterotheca subaxillaris*, and *Ipomoea imperati (= Ipomoea stolonifera).* Associated species that may have high cover include *Chamaecrista fasciculata* and *Paspalum monostachyum*. This vegetation occupies excessively drained sands on partially stabilized dunes of the coastal barrier islands and patches of mainland Gulf shoreline. This vegetation grades into *Schizachyrium littorale (= Schizachyrium scoparium ssp. littorale) - Paspalum monostachyum*-dominated grasslands on the barrier flat.

ENVIRONMENTAL DESCRIPTION

Global Environment: This dune grassland community occurs almost exclusively on sandy, unstable, droughty substrates (Typic Quartzipsamments) with no soil profile development. Eolian processes cause active sand deposition and erosion. The sand substrate is usually visible, and litter accumulation from plant debris is nearly absent. This community generally occurs on foredunes that receive the force of wind and salt spray but is beyond the influence of most storm tides. The effects of nearly continuous salt spray exclude most other species and maintain the vegetation type. Barbour et al. (1987) found that soils associated with this type were finer-textured and much higher in cation exchange than related beaches in both southwest Florida and the panhandle region of Florida.

VEGETATION DESCRIPTION

Global Vegetation: This community of the Gulf Coast of Texas occurs west of the distribution of *Schizachyrium maritimum.* This vegetation is dominated by *Uniola paniculata*, along with *Croton punctatus* and *Ipomoea imperati (= Ipomoea stolonifera)* (Barbour et al. 1987). Other important species that may at times assume codominance in this vegetation type are *Chamaecrista fasciculata (= Cassia fasciculata), Heterotheca subaxillaris, Sesuvium portulacastrum, Ipomoea pes-caprae, Oenothera drummondii, Panicum amarum, Paspalum monostachyum,* and *Spartina patens.*

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Forb	*Heterotheca subaxillaris*

Level	Stratum	Lifeform	Species
	Herb (field)	Graminoid	*Uniola paniculata*
Global	Herb (field)	Forb	*Croton punctatus*, *Heterotheca subaxillaris*
	Herb (field)	Graminoid	*Uniola paniculata*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Uniola paniculata*

Global: *Croton punctatus, Uniola paniculata*

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (11-Dec-1998). This community is very similar to *Panicum amarum - Paspalum monostachyum* Herbaceous Vegetation (CEGL004970); the two types occupy essentially identical habitat, with *Panicum amarum - Paspalum monostachyum* Herbaceous Vegetation replacing *Uniola paniculata - (Panicum amarum) - Croton punctatus* Herbaceous Vegetation (CEGL002218) along the upper Texas coast. Additional research may be needed to pinpoint the distribution of this community in Texas and Mexico and to verify its current global rank.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Padre Island National Seashore Comments: This vegetation occurs on primary dunes along the Gulf of Mexico and may also occur on dune ridges that skirt the western side of the island along the Laguna Madre. South island plots are drier and sparser. This type includes some occurrences characterized by *Chamaecrista fasciculata*. Carls et al. (1991) found *Heterotheca subaxillaris* and *Chamaecrista fasciculata* to dominate the leeward slopes of primary dunes at North Padre Island.

Global Comments: In Texas, *Uniola paniculata* is described as the most important component of the Sea Oats-Bitter Panicum Series, but it is "replaced along the upper coast by *Panicum amarum*" (Diamond 1993). The lower-energy shoreline grasslands of Louisiana which lack a substantial component of *Uniola paniculata* are accommodated in *Panicum amarum - Paspalum monostachyum* Herbaceous Vegetation (CEGL004970) in the *Schizachyrium littorale - Paspalum monostachyum - Panicum amarum* Texas Coastal Herbaceous Alliance (A1200). L. Smith (pers. comm.) states that "very few if any dunes in Louisiana are dominated by, or even have, *Uniola paniculata*." Apparently this zone is occupied primarily by *Spartina patens, Panicum amarum, Paspalum vaginatum, (Schizachyrium maritimum),* and *Sporobolus virginicus*.

Global Similar Associations:

- *Panicum amarum - Paspalum monostachyum* Herbaceous Vegetation (CEGL004970)
- *Uniola paniculata - Hydrocotyle bonariensis* Herbaceous Vegetation (CEGL004040)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This vegetation occurs on primary dunes along the Gulf of Mexico and may also occur on dune ridges that skirt the western side of the island along the Laguna Madre.

Global Range: This association is restricted to coastal Texas.

Nations: US

States/Provinces: TX:S3

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 231Fb:CCC, 232Eb:CC?, 232Ed:CCC, 255Dc:CCC

Federal Lands: NPS (Padre Island); USFWS (Matagorda Island)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: The presence of *Uniola paniculata* may be the best indicator of this type. It includes vegetation that may be dominated or codominated by *Heterotheca subaxillaris*, *Paspalum monostachyum*, *Chamaecrista fasciculata var. fasciculata*, or *Schizachyrium littorale*.

Padre Island National Seashore Plots and Observation Points: PAIS124, PAIS3, PAIS4, PAIS503, PAIS504, PAIS508, PAIS509, PAIS533, PAIS542, PAIS543, PAIS77.

Local Description Authors: J. Teague

Global Description Authors: R.E. Evans, mod. J. Teague

References: Barbour et al. 1987, Carls et al. 1991, Diamond 1993, Smith, L. pers. comm., Southeastern Ecology Working Group n.d.

2.C.4. Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland

2.C.4.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh

M067. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh

G777. Atlantic & Gulf Coastal Interdunal Marsh & Prairie

Common Threesquare - Betonyleaf Thoroughwort - Marsh Bristlegrass - Brown's Yellowtops Coastal Marsh Vegetation

Schoenoplectus pungens - Conoclinium betonicifolium - Setaria parviflora - Flaveria brownii Coastal Marsh Vegetation

Identifier: CEGL007234

USNVC CLASSIFICATION

Division Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.4.Na)

Macrogroup Atlantic & Gulf Coastal Plain Wet Prairie & Marsh (M067)

Group Atlantic & Gulf Coastal Interdunal Marsh & Prairie (G777)

Association Common Threesquare - Betonyleaf Thoroughwort - Marsh Bristlegrass - Brown's Yellowtops Coastal

Marsh Vegetation

ELEMENT CONCEPT

Global Summary: This vegetation occurs in interdunal swales and other marshy areas on barrier islands along the south Texas coast. These wetlands are characterized (and may be dominated) by *Schoenoplectus pungens, Typha domingensis, Flaveria brownii, Bacopa monnieri, Centella erecta, Phyla nodiflora*, and/or *Sesbania herbacea*. Associated species may include *Conoclinium betonicifolium, Setaria parviflora, Andropogon glomeratus, Pluchea odorata var. odorata*, and *Iva texensis*. This provisional community is described from very limited plot data from Padre Island National Seashore, Texas. Some plots attributed to this type were dominated by annuals such as *Flaveria brownii* and *Sesbania herbacea*. Classification of these ephemeral ponds and depressions is difficult because of seasonal and weather-related shifts in species composition and dominance.

ENVIRONMENTAL DESCRIPTION

Global Environment: This vegetation occurs in interdunal swales and other marshy areas on barrier islands along the south Texas coast.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: These wetlands are characterized (and may be dominated) by *Schoenoplectus pungens, Typha domingensis, Flaveria brownii, Bacopa monnieri, Centella erecta, Phyla nodiflora*, and/or *Sesbania herbacea*. Associated species may include *Conoclinium betonicifolium, Setaria parviflora, Andropogon glomeratus, Pluchea odorata var. odorata*, and *Iva texensis*. This provisional community is described from very limited plot data from Padre Island National Seashore. Some plots attributed to this type were dominated by annuals such as

Flaveria brownii and *Sesbania herbacea*. Classification of these ephemeral ponds and depressions is difficult because of seasonal and weather-related shifts in species composition and dominance. The annual forb *Flaveria brownii* can tend to dominate ponds during a drought that might be dominated by different species (e.g., *Schoenoplectus pungens* or *Typha domingensis*) during wetter periods.

Global Vegetation: These wetlands are characterized (and may be dominated) by *Schoenoplectus pungens, Typha domingensis, Flaveria brownii, Bacopa monnieri, Centella erecta, Phyla nodiflora*, and/or *Sesbania herbacea*. Associated species may include *Conoclinium betonicifolium, Setaria parviflora, Andropogon glomeratus, Pluchea odorata var. odorata*, and *Iva texensis*. This provisional community is described from very limited plot data from Padre Island National Seashore, Texas. Some plots attributed to this type were dominated by annuals such as *Flaveria brownii* and *Sesbania herbacea*. Classification of these ephemeral ponds and depressions is difficult because of seasonal and weather-related shifts in species composition and dominance. The annual forb *Flaveria brownii* can tend to dominate ponds during a drought that might be dominated by different species (e.g., *Schoenoplectus pungens* or *Typha domingensis*) during wetter periods.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Forb	*Bacopa monnieri*, *Centella erecta*, *Flaveria brownii*, *Hydrocotyle bonariensis*, *Iva texensis*, *Phyla nodiflora*, *Pluchea odorata* var. *odorata*, *Sesbania herbacea*, *Sesuvium verrucosum*
	Herb (field)	Graminoid	*Andropogon glomeratus*, *Distichlis spicata*, *Schoenoplectus pungens* var. *longispicatus*, *Setaria parviflora*, *Typha domingensis*
Global	Herb (field)	Forb	*Bacopa monnieri*, *Centella erecta*, *Flaveria brownii*, *Hydrocotyle bonariensis*, *Iva texensis*, *Phyla nodiflora*, *Pluchea odorata* var. *odorata*, *Sesbania herbacea*, *Sesuvium verrucosum*
	Herb (field)	Graminoid	*Andropogon glomeratus*, *Distichlis spicata*, *Schoenoplectus pungens* var. *longispicatus*, *Setaria parviflora*, *Typha domingensis*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Andropogon glomeratus, Bacopa monnieri, Centella erecta, Distichlis spicata, Flaveria brownii, Hydrocotyle bonariensis, Iva texensis, Phyla nodiflora, Pluchea odorata* var. *odorata, Schoenoplectus pungens* var. *longispicatus, Sesbania herbacea, Sesuvium verrucosum, Setaria parviflora, Typha domingensis*

Global: *Andropogon glomeratus, Bacopa monnieri, Centella erecta, Distichlis spicata, Flaveria brownii, Hydrocotyle bonariensis, Iva texensis, Phyla nodiflora, Pluchea odorata* var. *odorata, Schoenoplectus pungens* var. *longispicatus, Sesbania herbacea, Sesuvium verrucosum, Setaria parviflora, Typha domingensis*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (9-May-2014).

CLASSIFICATION

Status: Provisional

Padre Island National Seashore Comments: This provisional community is described from very limited plot data from Padre Island National Seashore. Classification of these ephemeral ponds and depressions is difficult because of seasonal and weather-related shifts in species composition and dominance. This community was described from 12 plots at Padre Island National Seashore that loosely clustered together, but Homoteneity and Goodness of Fit were low. This community represents a diverse set of occurrences with seasonal and aspect dominance that differs among sites. They are tied together by their landscape setting and presence of freshwater to oligohaline species not necessarily by dominance patterns. Based on dominance patterns alone, each plot might represent a different type. For classification purposes, more weight was given to perennial species with greater biomass, such as *Schoenoplectus pungens* and *Typha domingensis* even though their cover was low in some plots. Future sampling might best be conducted by repeatedly sampling sites across seasons and years.

Global Comments: This community might warrant splitting into separate types but we were not able to discern clear ecological patterns from the cluster analysis. More data will be necessary to discern these patterns if they are relevant. Taken as a whole, these wetlands tend to share a suite of species, but individual occurrences may exhibit strong dominance by different species. Separate types, e.g., one dominated by *Schoenoplectus pungens* and one dominated by *Typha domingensis*, are supported by the classification results of other studies of Padre Island and other barrier islands along the Gulf of Mexico (Judd and Lonard 2009). This provisional community is described from very limited plot data from Padre Island National Seashore, Texas. Classification of these ephemeral ponds and depressions is difficult because of seasonal and weather-related shifts in species composition and dominance. This community was described from 12 plots at Padre Island National Seashore that loosely clustered together, but Homoteneity and Goodness of Fit were low. This community represents a diverse set of occurrences with seasonal and aspect dominance that differs among sites. They are tied together by their landscape setting and presence of freshwater to oligohaline species not necessarily by dominance patterns. Based on dominance patterns alone, each plot might represent a different type. For classification purposes, more weight was given to perennial species with greater biomass, such as *Schoenoplectus pungens* and *Typha domingensis* even though their cover was low in some plots. Future sampling might best be conducted by repeatedly sampling sites across seasons and years.

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This vegetation occurs in interdunal swales and blowout depressions.

Global Range: This vegetation occurs in interdunal swales and other marshy areas on barrier islands along the south Texas coast.

Nations: US

States/Provinces: TX

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 255Dc:CCC

Federal Lands: NPS (Padre Island)

ELEMENT SOURCES

Padre Island National Seashore Plots and Observation Points: PAIS501, PAIS506, PAIS507, PAIS546, PAIS568, PAIS613, PAIS620, PAIS643, PAIS669, PAIS698, PAIS84, PAIS92.

Local Description Authors: J. Teague

Global Description Authors: J. Teague

References: Judd and Lonard 2009, Southeastern Ecology Working Group n.d.

Texas Coastal Bend Interdune Swale Grassland

Spartina patens - Fimbristylis (caroliniana, castanea) - (Panicum virgatum) Herbaceous Vegetation

Saltmeadow Cordgrass - (Carolina Fimbry, Marsh Fimbry) - (Switchgrass) Herbaceous Vegetation

Identifier: CEGL007836

USNVC CLASSIFICATION

Division Eastern North American Coast Scrub & Herb Vegetation (2.B.4.Na)

Macrogroup Eastern North American Dune & Coastal Grassland & Shrubland (M057)

Group South Atlantic & Gulf Shrub & Grass Coast & Dune (G494)

Association Texas Coastal Bend Interdune Swale Grassland

ELEMENT CONCEPT

Global Summary: This non-tidal maritime grassland occurs in seasonally and periodically flooded to saturated interdune swales on barrier islands and the Ingleside barrier-strandplain in the Coastal Bend of Texas. It may also occur in Louisiana and Tamaulipas, Mexico. Dominant herbs can include *Spartina patens, Panicum virgatum, Fimbristylis caroliniana, Fimbristylis castanea*, and *Hydrocotyle bonariensis*. Other species include *Paspalum monostachyum, Andropogon glomeratus, Andropogon virginicus, Centella erecta, Rhynchospora colorata (= Dichromena colorata), Eragrostis* sp., *Juncus* sp., *Phyla nodiflora, Pluchea foetida, Rhynchospora* spp., and *Samolus ebracteatus*. On the Ingleside barrier-strandplain along the Coastal Bend of Texas, some occurrences lack *Spartina patens* and are dominated by *Panicum virgatum*. A sparse shrub layer dominated by *Morella cerifera* is sometimes present.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community occupies low barrier island flats and interdunal swales.

Global Environment: This non-tidal maritime grassland occurs in seasonally and periodically flooded to saturated interdune swales on barrier islands and the Ingleside barrier-strandplain in the Coastal Bend of Texas. This is a non-tidal community occurring in areas elevated above the normal reach of tides.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This community is dominated by *Spartina patens*. Associated species include *Paspalum monostachyum* (which may codominate some stands), *Cynanchum angustifolium, Samolus ebracteatus, Iva texensis*, and a variety of other graminoids and forbs; 46 species were recorded in this plot data. In some cases species composition can include a high percentage of salt-tolerant species, and tends more towards a brackish marsh.

Global Vegetation: Dominant herbs can include *Spartina patens, Panicum virgatum, Fimbristylis caroliniana, Fimbristylis castanea*, and *Hydrocotyle bonariensis*. Other species include *Paspalum monostachyum, Andropogon glomeratus, Andropogon virginicus, Centella erecta, Rhynchospora*

colorata (= Dichromena colorata), Eragrostis sp., *Juncus* sp., *Phyla nodiflora, Pluchea foetida, Rhynchospora* spp., and *Samolus ebracteatus*. On the Ingleside barrier-strandplain along the Coastal Bend of Texas, some occurrences lack *Spartina patens* and are dominated by *Panicum virgatum*. A sparse shrub layer dominated by *Morella cerifera* is sometimes present.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Graminoid	*Paspalum monostachyum*, *Spartina patens*
Global	Herb (field)	Graminoid	*Spartina patens*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Fimbristylis castanea, Spartina patens*

Global: *Fimbristylis caroliniana, Fimbristylis castanea, Hydrocotyle bonariensis, Spartina patens*

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (18-May-2001). This association is naturally restricted in range and environmental setting to the Gulf Coast of Texas and possibly Louisiana. Unprotected examples are threatened by coastal development and grazing pressures. It may also be somewhat ephemeral, being subject to destruction in major storm events. The range in the rank reflects the need for further inventory and description of this community.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community occupies low barrier island flats and interdunal swales.

Global Range: This community is known from barrier islands and the Ingleside barrier-strandplain in the Coastal Bend of Texas. It may also occur in Louisiana and Tamaulipas, Mexico.

Nations: MX?, US

States/Provinces: LA?, MXTM?, TX

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 231Fb:CCC, 255Dc:CCC

Federal Lands: NPS (Padre Island); USFWS (Aransas, Laguna Atascosa, Matagorda Island)

ELEMENT SOURCES

Padre Island National Seashore Plots and Observation Points: PAIS131, PAIS148, PAIS150, PAIS154, PAIS518, PAIS610, PAIS637, PAIS639, PAIS640, PAIS672, PAIS675, PAIS680, PAIS697, PAIS71, PAIS90.

Local Description Authors: J. Teague

Global Description Authors: A.S. Weakley, B. Carr, and L.M. Smith

References: LNHP 2009, McAlister and McAlister 1993, McAlister and McAlister 1995, Peet et al. unpubl. data, Smith 1996a, Southeastern Ecology Working Group n.d.

M303. Eastern North American Ruderal Wet Meadow & Marsh

G556. Northern & Central Ruderal Wet Meadow & Marsh

Eastern Reed Marsh

Phragmites australis Eastern North America Temperate Ruderal Herbaceous Vegetation

Common Reed Eastern North America Temperate Ruderal Herbaceous Vegetation

Identifier: CEGL004141

USNVC CLASSIFICATION

Division Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.4.Na)

Macrogroup Eastern North American Ruderal Wet Meadow & Marsh (M303)

Group Northern & Central Ruderal Wet Meadow & Marsh (G556)

Association Eastern Reed Marsh

ELEMENT CONCEPT

Global Summary: This reed marsh type is found across the east-temperate regions of the United States and Canada. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc., that have often been disturbed by human activity. The vegetation is variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community occurs in blowout ponds and depressions.

Global Environment: Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This vegetation is solely dominated by *Phragmites australis*.

Global Vegetation: The vegetation is often variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Graminoid	*Phragmites australis*
Global	Herb (field)	Graminoid	*Phragmites australis*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Phragmites australis*

Global: *Phragmites australis*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (23-Nov-1997). Although almost always occurring as a naturalized type that arises from human disturbance, some stands in northern Minnesota and further north in Canada may be native. If so, they should be tracked as a separate type.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Global Comments: This is not a native community but is the result of the invasion of alien *Phragmites australis* into natural or semi-natural vegetation. The vegetation has variable hydrology and, unless *Phragmites* is clearly dominant, is often treated as part of other marsh and meadow types. The geographic distribution of the type is arbitrarily limited to Bailey's Humid Temperate Domain in eastern North America (Bailey 1997, 1998). Stands in northern Minnesota and farther north in Canada may represent native stands. If so, they should be tracked as a different type. Tidal vegetation of the Gulf Coast of Louisiana and Texas dominated by *Phragmites australis* is classified in *Sagittaria lancifolia* Tidal Freshwater Marsh Alliance (A1987).

Global Similar Associations:

- *Phragmites australis* Tidal Herbaceous Vegetation (CEGL004187)
- *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: Based on plot data, it is only known from one location on the island. Other locations are possible.

Global Range: This reed marsh type is found across the east-temperate regions of the United States and Canada, ranging from Maine west to the eastern Dakotas and Manitoba, south to Texas and east to Florida.

Nations: CA, US

States/Provinces: AL, AR, CT, DE, FL, GA, IA, IN, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ:S5, NY, OH, ON, PA:S5, QC, RI, SC, TX, VA, VT, WI, WV

TNC Ecoregions: 31:C, 39:P, 40:C, 41:C, 42:C, 47:C, 48:C, 52:P, 53:C, 55:C, 56:C, 57:C, 59:C, 60:C, 61:C, 62:C

USFS Ecoregions (1994/95): 212C:CP, 212Fc:CCC, 212Ho:CCC, 212Hw:CCC, 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Da:CCC, 222Ic:CCC, 222Jj:CCC,

231Fb:CCC, 232Ab:CCC, 232Ac:CCC, 232Ch:CCC, 232Dc:CCC, 232E:CC, 232G:CC, 234A:PP, 255Dc:CCC, M212:C, M221:P

Federal Lands: NPS (Appalachian Trail [Central Appalachians], Appalachian Trail [Lower New England], Assateague Island, Boston Harbor Islands, Cape Cod, Cuyahoga Valley, Indiana Dunes, Minute Man, Mississippi, Padre Island, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFWS (Alligator River, Aransas, Bon Secour, Brazoria, Cape May, E.B. Forsythe, Great Dismal Swamp, Great Meadows, Great Swamp, Matagorda Island, Monomoy, Montezuma, Oxbow, Parker River, Prime Hook, Supawna Meadows)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This association is attributed to Padre Island National Seashore based on one plot and a relatively large marsh that it represented dominated by *Phragmites australis.*

Padre Island National Seashore Plots and Observation Points: PAIS641.

Local Description Authors: J. Teague

Global Description Authors: D. Faber-Langendoen

References: Bailey 1997, Bailey 1998, Bell et al. 2002, Brock et al. 2007, CDPNQ unpubl. data, Chapman et al. 1989, Clancy 1993b, Coxe 2009, Edinger et al. 2002, Edinger et al. 2007, Eichelberger 2011f, Faber-Langendoen 2001, Gawler et al. 2005, Harris et al. 1996, Homoya et al. 1988, Hop et al. 1999, Hop et al. 2009, INAI unpubl. data, Largay and Sneddon 2010, MNNHP 1993, Metzler and Barrett 1992, Metzler and Barrett 2001, Metzler and Barrett 2006, NRCS 2004a, NatureServe 2009, Nelson 1986, ONHD unpubl. data, Perles et al. 2008, Rawinski 1984a, Schafale and Weakley 1990, Schotz pers. comm., Sneddon et al. 2010, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, TNC 1995c, Zimmerman et al. 2012

2.C.5. Salt Marsh

2.C.5.Nb. Temperate & Boreal Atlantic Coastal Salt Marsh

M079. North American Atlantic & Gulf Coast Salt Marsh

G121. Atlantic & Gulf Coast High Salt Marsh

Seaside-tansy Tidal Shrub Flat

Borrichia frutescens / (Spartina patens, Juncus roemerianus) Shrubland

Bushy Seaside-tansy / (Saltmeadow Cordgrass, Black Needlerush) Shrubland

Identifier: CEGL003924

USNVC CLASSIFICATION

Division Temperate & Boreal Atlantic Coastal Salt Marsh (2.C.5.Nb)

Macrogroup North American Atlantic & Gulf Coast Salt Marsh (M079)

Group Atlantic & Gulf Coast High Salt Marsh (G121)

Association Seaside-tansy Tidal Shrub Flat

ELEMENT CONCEPT

Global Summary: This association includes upper marsh edges and flats strongly dominated by *Borrichia frutescens*, ranging in size from narrow bands to flats in excess of 500 ha. It is broadly described to include vegetation ranging from the Mid- and South Atlantic Coast to the West Gulf Coast of the United States.Other characteristic species may include *Spartina patens, Iva frutescens,* and *Limonium carolinianum*. In Texas, the composition of this low-diversity, irregularly tidally flooded shrubland is variable and can include *Distichlis spicata, Schoenoplectus robustus, Sporobolus virginicus, Monanthochloe littoralis, Atriplex matamorensis* (in south Texas), *Sarcocornia pacifica, Limonium carolinianum, Lycium carolinianum var. quadrifidum, Rayjacksonia phyllocephala, Prosopis reptans* (in south Texas), and *Batis maritima*. Here, this community often occurs just above the lower tidal flat communities *Batis maritima - Sarcocornia pacifica* Dwarf-shrubland (CEGL003956) or *Sarcocornia pacifica - (Batis maritima, Distichlis spicata)* Dwarf-shrubland (CEGL002278).

This shrubland usually occurs as a very narrow band adjacent and below tidal shrublands. Two large examples of this association at Fort Pulaski, Georgia, are extensive enough to map and occur on tidal flats adjacent the extensive salt marsh communities of eastern Cockspur Island. Typically this community is monospecific, being made up almost exclusively of *Borrichia frutescens*.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community typically occurs along the Laguna Madre and in the upper reaches of washover saline flats. One plot (545) is in an interior depression and apparently not tidal.

Global Environment: This association occurs along upper marsh edges and in tidal flats ranging in scale from narrow bands to hundreds of hectares. It is found along mainland shores and the bayside of barrier islands. In south Texas, it can also occur around the base of lomas.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This community is usually strongly dominated by *Borrichia frutescens*. Associated species are variable; some of the more common associates include *Limonium carolinianum, Sporobolus virginicus, Cynanchum angustifolium, Iva texensis, Blutaparon vermiculare*, and *Salicornia* sp. Plot data indicate that some interior depressions on the island may also support this and other high salt marsh or salt flat vegetation.

Global Vegetation: This community is strongly dominated by *Borrichia frutescens*. Other characteristic species may include *Spartina patens, Iva frutescens, Distichlis spicata, Schoenoplectus robustus, Sporobolus virginicus, Monanthochloe littoralis, Sarcocornia pacifica, Limonium carolinianum, Lycium carolinianum var. quadrifidum, Rayjacksonia phyllocephala*, and *Batis maritima*. In Texas, *Spartina patens* is a less important component of this community, but it often forms a fringe along the upper margin.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Forb	*Borrichia frutescens*
Global	Herb (field)	Forb	*Borrichia frutescens*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Borrichia frutescens*

Global: *Borrichia frutescens*

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Grus americana* (G1), *Sideroxylon tenax* (G3?)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (10-Oct-1997). This is a common tidal flat community along the Gulf and Middle and South Atlantic coasts of the United States.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Padre Island National Seashore Comments: This vegetation is typically strongly dominated by *Borrichia frutescens* (8 out of 9 plots). One plot that clustered with this group is dominated by *Salicornia* sp., one codominated by *Borrichia frutescens* and *Blutaparon vermiculare*, and one codominated by *Borrichia frutescens, Blutaparon vermiculare, Salicornia* sp., and *Suaeda linearis*. One plot each had high cover of *Batis maritima* and *Phyla nodiflora*.

Global Comments: The relationship between this community and similar *Borrichia frutescens / Spartina spartinae* Shrubland (CEGL004617) is poorly documented. The ranges of these two communities overlap along the middle and south Texas coast where *Borrichia frutescens / Spartina spartinae* Shrubland (CEGL004617) appears to dominate less saline, higher ground than this community (CEGL003924).

NatureServe identified the perennial glasswort plants at Fort Pulaski as *Sarcocornia pacifica* using the recent key in Weakley (2007), which follows Flora of North America (FNA Editorial Committee 2003). The perennial glassworts on the U.S. East Coast have been called *Sarcocornia perennis* in the past (Kartesz 1999), and their taxonomy remains unsettled. Kartesz refers to *Salicornia virginica* and *Sarcocornia perennis* as *Salicornia ambigua* and restricts *Sarcocornia pacifica* to the Pacific coast. For the time being, NatureServe will continue to follow the Kartesz (1999) nomenclature in our global descriptions and U.S. National Vegetation Classification association names.

Global Similar Associations:

- *Borrichia frutescens / Spartina spartinae* Shrubland (CEGL004617)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community typically occurs along the Laguna Madre and in the upper reaches of washover saline flats. One plot (545) is in an interior depression and apparently not tidal.

Global Range: This association is found in coastal areas from North Carolina to Texas.

Nations: US

States/Provinces: AL, FL, GA, LA?, MS, NC, SC, TX:S4

TNC Ecoregions: 31:C, 53:C, 55:C, 56:C, 57:C

USFS Ecoregions (1994/95): 231Fb:CCP, 232Cb:CCC, 232Ce:CCC, 232Ch:CCC, 232Ci:CCC, 232Dc:CCC, 232Eb:CCC, 232Gb:CCC, 255Dc:CPP

Federal Lands: NPS (Canaveral, Cape Lookout, Cumberland Island, Fort Pulaski, Padre Island, Timucuan?); USFS (Croatan); USFWS (Anahuac, Aransas, Big Boggy, Brazoria, Laguna Atascosa, Matagorda Island, McFaddin, Pea Island, San Bernard, Texas Point)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation was identified in a cluster of 9 plots from an analysis of 140 plots form Padre Island National Seashore. Composition is somewhat variable (Homoteneity (0.556) and Goodness of Fit (0.385)).

Padre Island National Seashore Plots and Observation Points: PAIS531, PAIS540, PAIS545, PAIS556, PAIS615, PAIS701, PAIS702, PAIS703, PAIS711.

Local Description Authors: J. Teague

Global Description Authors: A.S. Weakley

References: Diamond 1993, FNA Editorial Committee 2003, FNAI 1990, FNAI 1992a, FNAI 1997, Govus 1998, Kartesz 1999, McAlister and McAlister 1993, McAlister and McAlister 1995, Peet et al. unpubl. data, Schafale 2000, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Weakley 2007

G123. Atlantic & Gulf Coast Saline Flat & Panne

Turtleweed - Pacific Swampfire Dwarf-shrubland

Batis maritima - Sarcocornia pacifica Dwarf-shrubland

Identifier: CEGL003956

USNVC CLASSIFICATION

Division Temperate & Boreal Atlantic Coastal Salt Marsh (2.C.5.Nb)

Macrogroup North American Atlantic & Gulf Coast Salt Marsh (M079)

Group Atlantic & Gulf Coast Saline Flat & Panne (G123)

Association Turtleweed - Pacific Swampfire Dwarf-shrubland

ELEMENT CONCEPT

Global Summary: This association includes regularly to irregularly flooded tidal areas dominated (often with 95% or more cover) by *Batis maritima*. Other species can include *Sarcocornia pacifica, Sporobolus virginicus, Borrichia frutescens, Suaeda* sp., *Lycium carolinianum, Spartina spartinae, Monanthochloe littoralis, Sesuvium portulacastrum*, and *Blutaparon vermiculare*. This community generally lacks trees, though scattered individuals of *Avicennia germinans* can occur in Florida and southern Texas. It may occur as a narrow band or occupy areas up to at least 100 hectares. This is generally a subtropical community, which also ranges northwards into the warmest portions of the temperate southeastern United States.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community occurs in tidal flats along the edge of the Laguna Madre.

Global Environment: This association occurs in lower tidal flats and low areas of higher tidal flats, within the reach of regular high tides. It is regularly to irregularly flooded by shallow brackish waters. As these waters evaporate, high concentrations of salt accumulate, producing hypersaline conditions.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This community is strongly dominated by *Batis maritima*. Associated species include *Suaeda linearis, Monanthochloe littoralis*, and *Salicornia* sp.

Global Vegetation: This community is dominated by *Batis maritima* sometimes in association with *Sarcocornia pacifica, Sporobolus virginicus, Borrichia frutescens, Suaeda linearis, Suaeda conferta* (in southern Texas), *Lycium carolinianum, Spartina spartinae, Sesuvium portulacastrum*, and *Blutaparon vermiculare*. Algal mats of blue-green and sometimes green algae are characteristically present, visible even in densely vegetated pannes.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Short shrub/sapling	Dwarf-shrub	*Batis maritima*
Global	Short shrub/sapling	Dwarf-shrub	*Batis maritima*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Batis maritima*

Global: *Batis maritima*

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Grus americana* (G1)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (15-May-1995). This is a common tidal flat community along the Gulf Coast of Texas and Florida. It may occur as a narrow band or occupy areas up to at least 100 hectares.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This association is currently known only from Florida, Georgia and the southern coast of Texas and may be distinguished from *Sarcocornia pacifica - (Batis maritima, Distichlis spicata)* Dwarf-shrubland (CEGL002278) by the dominance of *Batis maritima*. *Sarcocornia pacifica - (Batis maritima, Distichlis spicata)* Dwarf-shrubland (CEGL002278) ranges along the Gulf Coast of the United States, and though *Batis maritima* is a component in this association, it is rarely dominant, and then only at small scales. These two associations can be difficult to distinguish along the middle and upper Texas coast where their ranges overlap.

NatureServe identified the perennial glasswort plants at Fort Pulaski as *Sarcocornia pacifica* using the recent key in Weakley (2007), which follows Flora of North America (FNA Editorial Committee 2003). The perennial glassworts on the U.S. East Coast have been called *Sarcocornia perennis* in the past (Kartesz 1999), and their taxonomy remains unsettled. Kartesz refers to *Salicornia virginica* and *Sarcocornia perennis* as *Salicornia ambigua* and restricts *Sarcocornia pacifica* to the Pacific coast. For the time being, NatureServe will continue to follow the Kartesz (1999) nomenclature in our global descriptions and U.S. National Vegetation Classification association names.

Global Similar Associations:

- *Salicornia (virginica, bigelovii, maritima) - Spartina alterniflora* Herbaceous Vegetation (CEGL004308)
- *Sarcocornia pacifica* - (*Batis maritima, Distichlis spicata*) Dwarf-shrubland (CEGL002278)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community occurs along the edge of the Laguna Madre.

Global Range: This association is currently only known from Texas, Georgia and Florida. It may also occur in Alabama, Mississippi, and Louisiana, and the Mexican state of Tamaulipas. It does not extend to South Carolina.

Nations: MX?, US

States/Provinces: AL?, FL, GA, LA?, MS?, MXTM?, TX:S4

TNC Ecoregions: 30:C, 31:C, 53:C, 54:C, 55:C, 56:C

USFS Ecoregions (1994/95): 231Fb:CCC, 232Ce:CCC, 232Da:CCC, 232Dc:CCC, 232De:CCC, 232Ed:CCC, 232Ee:CCC, 232Gb:CCC, 255Dc:CCC, 315F:CC, 411Ae:CCC, 411Af:CCC, 411Ag:CCC, M411:C

Federal Lands: NPS (Canaveral, Everglades, Fort Frederica?, Fort Matanzas, Fort Pulaski, Padre Island, Timucuan?); USFWS (Aransas, Big Boggy, Brazoria, Laguna Atascosa, Matagorda Island, San Bernard)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation was identified through cluster analysis of 140 plots. This group of three plots formed a tight cluster with high Homoteneity (0.917) and Goodness of Fit (0.884).

Padre Island National Seashore Plots and Observation Points: PAIS523, PAIS550, PAIS705.

Local Description Authors: J. Teague

Global Description Authors: A.S. Weakley and K.D. Patterson

References: Ball 2003a, Ball 2003b, Diamond 1993, FNA Editorial Committee 2003, FNAI 1992a, FNAI 1997, Govus 1998, Johnston 1952, Kartesz 1999, Kartesz 2013, McAlister and McAlister 1993, McAlister and McAlister 1995, Schotz pers. comm., Southeastern Ecology Working Group n.d., TNHS unpubl. data, Weakley 2007

Verrucose Sea-purslane - Annual Seepweed - Texas Marsh-elder Sparse Saline Flat

Sesuvium verrucosum - Suaeda linearis - Iva texensis Sparse Saline Flat

Identifier: CEGL005464

USNVC CLASSIFICATION

Division Temperate & Boreal Atlantic Coastal Salt Marsh (2.C.5.Nb)

Macrogroup North American Atlantic & Gulf Coast Salt Marsh (M079)

Group Atlantic & Gulf Coast Saline Flat & Panne (G123)

Association Verrucose Sea-purslane - Annual Seepweed - Texas Marsh-elder Sparse Saline Flat

ELEMENT CONCEPT

Global Summary: This community is located in high salt flat/pannes and is dominated by *Sesuvium verrucosum* and/or *Suaeda linearis*. Codominants include *Rayjacksonia phyllocephala* and *Iva texensis*. Other associated species include *Coreopsis tinctoria, Sporobolus virginicus*, and *Borrichia frutescens*, among others. *Sesuvium verrucosum* is the only constant species in the supporting plot data. This provisional community is described from very limited plot data from Padre Island National Seashore, Texas.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community is located in high salt flat/pannes.

Global Environment: This community is located in high salt flat/pannes on barrier islands.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This community is located in high salt flat/pannes and is dominated by *Sesuvium verrucosum* and/or *Suaeda linearis*. Codominants include *Rayjacksonia phyllocephala* and *Iva texensis*. Other associated species include *Coreopsis tinctoria, Sporobolus virginicus*, and *Borrichia frutescens* among others. *Sesuvium verrucosum* is the only constant species in the supporting plot data. This provisional community is described from very limited plot data from Padre Island National Seashore.

Global Vegetation: This community is located in high salt flat/pannes and is dominated by *Sesuvium verrucosum* and/or *Suaeda linearis*. Codominants include *Rayjacksonia phyllocephala* and *Iva texensis*. Other associated species include *Coreopsis tinctoria, Sporobolus virginicus*, and *Borrichia frutescens* among others. *Sesuvium verrucosum* is the only constant species in the supporting plot data. This provisional community is described from very limited plot data from Padre Island National Seashore.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Forb	*Sesuvium verrucosum*
Global	Herb (field)	Forb	*Sesuvium verrucosum*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Sesuvium verrucosum*

Global: *Sesuvium verrucosum*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (8-Oct-2014).

CLASSIFICATION

Status: Standard

Padre Island National Seashore Comments: PAIS plots (605, 606, 694, 717) are all in the very north end of the park. They cluster together in the Cover Class dendrogram, but all four have different dominants. These plots represent a limited sample of the vegetation (Plots 606 and 605 are 30 m apart; plots 694 and 717 are 15 m apart). They do all seem to be high salt marsh or salt flat vegetation. I lean toward Atlantic & Gulf Coast Saline Flat & Panne Group (G123) instead of Atlantic & Gulf Coast High Salt Marsh Group (G121), but they make a highly variable single association. They are in low tidal (irregularly flooded?) depressions/channels that connect to Laguna Madre. The relationship of this community with *Spartina spartinae* - *Monanthochloe littoralis* - *Suaeda linearis* Herbaceous Vegetation (CEGL004614) needs clarification.

Global Comments: There is some ambiguity about the taxonomic status of *Sarcocornia perennis* and *Salicornia virginica* and about which taxa are referenced in this type. Kartesz (1999) refers to *Salicornia virginica* and *Sarcocornia perennis* as *Salicornia ambigua* and restricts *Sarcocornia pacifica* to the Pacific coast.

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community is located in high salt flat/pannes.

Global Range: This community is located in high salt flat/pannes of barrier islands along the south Texas coast.

Nations: US

States/Provinces: TX

TNC Ecoregions: 31:C

USFS Ecoregions (1994/95): 255Dc:CCC

Federal Lands: NPS (Padre Island)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: More data are needed to better described this community.

Padre Island National Seashore Plots and Observation Points: PAIS605, PAIS606, PAIS694, PAIS717.

Local Description Authors: J. Teague

Global Description Authors: J. Teague

References: Southeastern Ecology Working Group n.d.

Seashore Dropseed - Saltgrass Herbaceous Vegetation

Sporobolus virginicus - Distichlis spicata Herbaceous Vegetation

Identifier: CEGL007663

USNVC CLASSIFICATION

Division Temperate & Boreal Atlantic Coastal Salt Marsh (2.C.5.Nb)

Macrogroup North American Atlantic & Gulf Coast Salt Marsh (M079)

Group Atlantic & Gulf Coast Saline Flat & Panne (G123)

Association Seashore Dropseed - Saltgrass Herbaceous Vegetation

ELEMENT CONCEPT

Global Summary: This association accommodates coastal tidally flooded grasslands of Florida, south Texas, and Cuba dominated by *Sporobolus virginicus*. This association also accommodates areas codominated by *Sporobolus virginicus* and *Distichlis spicata*. *Distichlis spicata* may dominate some examples in south Texas. Other species that may be present include *Eustachys petraea, Limonium carolinianum*, and *Sesuvium portulacastrum*. In addition, there may be a very sparse emergent layer of *Juniperus virginiana var. silicicola, Ilex vomitoria*, and *Iva frutescens*.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community typically occurs along the Laguna Madre and in the upper reaches of washover saline flats. Several occurrences were documented in interior depressions that may only be irregularly tidally flooded.

Global Environment: These coastal grasslands may be regularly or irregularly tidally flooded.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: Plot data indicate that most occurrences of this community at Padre Island National Seashore are strongly dominated by *Sporobolus virginicus*, though there is some concern that *Sporobolus virginicus* and *Distichlis spicata* may not have always been identified correctly in the data. One plot is dominated by *Distichlis spicata* with moderate cover of *Sporobolus virginicus*. Associated species include *Borrichia frutescens, Cynanchum angustifolium, Sesuvium verrucosum*, and *Iva texensis*. Occurrences in interior depressions have low cover of some species more indicative of a less saline environment, such as *Schoenoplectus pungens, Typha domingensis, Flaveria brownii, Pluchea odorata*, and *Bacopa monnieri*.

Global Vegetation: This community is dominated by *Sporobolus virginicus*, with other species including *Distichlis spicata, Limonium carolinianum*, and *Sesuvium portulacastrum*. *Distichlis spicata* may dominate or codominate some examples in south Texas.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Graminoid	*Distichlis spicata*, *Sporobolus virginicus*

Level	Stratum	Lifeform	Species
Global	Herb (field)	Graminoid	*Distichlis spicata*, *Sporobolus virginicus*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Distichlis spicata, Sporobolus virginicus*

Global: *Distichlis spicata, Sporobolus virginicus*

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (5-Nov-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Padre Island National Seashore Comments: More data are needed to elucidate the relationship between occurrences along the Laguna Madre and in the upper reaches of washover saline flats from those in interior depressions. It's possible that the two expressions might warrant separation into different communities. During droughts, blowout depressions share some vegetative similarity to high salt marsh/salt flats, but some species indicative of a fresh(er) water environment are still present at very low cover in these depressions.

Global Similar Associations:

- *Distichlis spicata - (Sporobolus virginicus)* Herbaceous Vegetation (CEGL007694)

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community typically occurs along the Laguna Madre and in the upper reaches of washover saline flats. Several occurrences were documented in interior depressions that may only be irregularly tidally flooded.

Global Range: This association occurs along coastal shores of Florida, Cuba and south Texas.

Nations: CU, US

States/Provinces: FL, TX

TNC Ecoregions: 31:C, 54:C, 55:C, 56:C

USFS Ecoregions (1994/95): 232Ce:CCC, 232Gb:CCC, 411A:CC, M411A:CC

Federal Lands: NPS (Canaveral, Padre Island, Timucuan)

ELEMENT SOURCES

Padre Island National Seashore Plots and Observation Points: PAIS564, PAIS604, PAIS619, PAIS621, PAIS634, PAIS665, PAIS85.

Local Description Authors: J. Teague

Global Description Authors: H. Summer, mod. J. Teague

References: Areces-Mallea et al. 1999, Southeastern Ecology Working Group n.d.

Shoregrass Herbaceous Vegetation

Monanthochloe littoralis Herbaceous Vegetation

Identifier: CEGL003991

USNVC CLASSIFICATION

Division Temperate & Boreal Atlantic Coastal Salt Marsh (2.C.5.Nb)

Macrogroup North American Atlantic & Gulf Coast Salt Marsh (M079)

Group Atlantic & Gulf Coast Saline Flat & Panne (G123)

Association Shoregrass Herbaceous Vegetation

ELEMENT CONCEPT

Global Summary: This association occurs in hypersaline areas on the upper reaches of the tidal flats or salt flats above the normal high tide and is usually only inundated by the highest lunar, wind or storm tides. It is strongly dominated by *Monanthochloe littoralis*, and may have scattered patches of *Sarcocornia pacifica, Sporobolus virginicus, Batis maritima*, and *Lycium carolinianum*. This community generally lacks mangroves, though widely scattered *Avicennia germinans* (and, less frequently, other mangroves) may occur in Florida and south Texas. In Florida, it grades downslope to *Avicennia germinans* shrubland and upslope to *Conocarpus erectus*.

ENVIRONMENTAL DESCRIPTION

Padre Island National Seashore Environment: This community is a salt flat/panne occurring along the upper tidal reaches of Laguna Madre.

Global Environment: This community occurs on exposed substrates such as limestone in Florida or saline mud in Texas. It is found in hypersaline areas on the upper reaches of the tidal flats or salt flats above the normal high tide and is usually only inundated by the highest lunar, wind or storm tides.

VEGETATION DESCRIPTION

Padre Island National Seashore Vegetation: This community is strongly dominated by *Monanthochloe littoralis*. Associated species include *Blutaparon vermiculare, Salicornia* spp., and *Suaeda linearis* and other salt-tolerant plants.

Global Vegetation: This community is strongly dominated by *Monanthochloe littoralis*, and may have scattered patches of *Sarcocornia pacifica, Sporobolus virginicus, Batis maritima*, and *Lycium carolinianum*.

MOST ABUNDANT SPECIES

Level	Stratum	Lifeform	Species
PAIS	Herb (field)	Graminoid	*Monanthochloe littoralis*
Global	Herb (field)	Graminoid	*Monanthochloe littoralis*

CHARACTERISTIC SPECIES

Padre Island National Seashore: *Monanthochloe littoralis*

Global: *Monanthochloe littoralis*

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (31-Dec-1997). Occurrences of this community are usually patchily distributed and the overall acreage of this community is probably small.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Padre Island National Seashore Comments: This vegetation was identified as a fairly distinctive type in cluster analysis, though Homoteneity (0.575) and Bray-Curtis Similarity (0.549) were moderate within the group of plots. Though dominated or codominated by a single species, *Monanthochloe littoralis*, the community may have scattered patches of species that are shared with and sometimes codominant in other communities at Padre Island.

Global Comments: There is some ambiguity about the taxonomic status of *Sarcocornia perennis* and *Salicornia virginica* and about which taxa are referenced in this type. Kartesz (1999) refers to *Salicornia virginica* and *Sarcocornia perennis* as *Salicornia ambigua* and restricts *Sarcocornia pacifica* to the Pacific coast.

ELEMENT DISTRIBUTION

Padre Island National Seashore Range: This community is a salt flat/panne occurring along the upper tidal reaches of Laguna Madre.

Global Range: This alliance is found in Florida, Texas, the Mexican state of Tamaulipas, and possibly elsewhere.

Nations: MX, US

States/Provinces: FL, MXTM, TX

TNC Ecoregions: 30:P, 31:C, 54:C

USFS Ecoregions (1994/95): 231Fb:CCC, 255Dc:CCC, 315:C, 411A:CC

Federal Lands: NPS (Padre Island); USFWS (Anahuac, Aransas, Big Boggy, Brazoria, Laguna Atascosa, Matagorda Island, National Key Deer, San Bernard, Texas Point)

ELEMENT SOURCES

Padre Island National Seashore Inventory Notes: This vegetation was identified as a fairly distinctive type in cluster analysis, though Homoteneity (0.575) and Bray-Curtis Similarity (0.549) were moderate within the group of plots. Though dominated or codominated by a single species, *Monanthochloe littoralis*, the community may have scattered patches of species that are shared with and sometimes codominant in other communities at Padre Island.

Padre Island National Seashore Plots and Observation Points: PAIS519, PAIS525, PAIS528, PAIS530, PAIS538, PAIS674, PAIS683, PAIS685, PAIS704, PAIS712.

Local Description Authors: J. Teague

Global Description Authors: A.S. Weakley and K.D. Patterson

References: Kartesz 1999, Southeastern Ecology Working Group n.d.

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