CRMS Vegetation Analytical Team Framework: Methods for Collection, Development, and Use of Vegetation Response Variables

By Kari F. Cretini, Jenneke M. Visser, Ken W. Krauss, and Gregory D. Steyer

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Conversion Factors

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
meter (m)	1.094	yard (yd)
	Area	
square meter (m^2)	0.0002471	acre
hectare (ha)	2.471	acre
square centimeter (cm^2)	0.001076	square foot (ft^2)
square meter (m^2)	10.76	square foot (ft^2)
square centimeter (cm^2)	0.1550	square inch (ft^2)
hectare (ha)	0.003861	square mile (mi^2)

CRMS Vegetation Analytical Team Framework: Methods for Collection, Development, and Use of Vegetation Response Variables

By Kari F. Cretini,[1] Jenneke M. Visser,[2] Ken W. Krauss,[1] and Gregory D. Steyer[1]

Abstract

This document identifies the main objectives of the Coastwide Reference Monitoring System (CRMS) vegetation analytical team, which are to provide (1) collection and development methods for vegetation response variables and (2) the ways in which these response variables will be used to evaluate restoration project effectiveness. The vegetation parameters (that is, response variables) collected in CRMS and other coastal restoration projects funded under the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) are identified, and the field collection methods for these parameters are summarized. Existing knowledge on community and plant responses to changes in environmental drivers (for example, flooding and salinity) from published literature and from the CRMS and CWPPRA monitoring dataset are used to develop a suite of indices to assess wetland condition in coastal Louisiana. Two indices, the floristic quality index (FQI) and a productivity index, are described for herbaceous and forested vegetation. The FQI for herbaceous vegetation is tested with a long-term dataset from a CWPPRA marsh creation project. Example graphics for this index are provided and discussed. The other indices, an FQI for forest vegetation (that is, trees and shrubs) and productivity indices for herbaceous and forest vegetation, are proposed but not tested. New response variables may be added or current response variables removed as data become available and as our understanding of restoration success indicators develops.

Once indices are fully developed, each will be used by the vegetation analytical team to assess and evaluate CRMS/CWPPRA project and program effectiveness. The vegetation analytical teams plan to summarize their results in the form of written reports and/or graphics and present these items to CRMS Federal and State sponsors, restoration project managers, landowners, and other data users for their input.

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Introduction

In 2003 the Coastwide Reference Monitoring System (CRMS), a network of 392 monitoring sites along the coast of Louisiana, was implemented under the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA; Steyer and others, 2003, 2006). The CRMS monitoring sites characterize the Louisiana coastal wetland landscape as they are located within all marsh types (fig. 1). The CRMS network also represents the coastal Louisiana restoration project area as sites are located inside and outside of other CWPPRA projects (fig. 1). Sites located outside projects are used as references for project effectiveness to be assessed against. Comparisons at other spatial scales including marsh type and hydrologic basin are also possible through CRMS (Steyer and others, 2003, 2006).

To assess performance of restoration projects associated with CRMS it is important that we use existing knowledge to establish appropriate restoration targets (that is, goals). The existing knowledge includes descriptions of community and plant responses from published literature and the extensive dataset maintained by the CRMS analysis teams and their collaborators. These sources can help us define how a wetland community type is expected to respond to natural variations in major environmental drivers and help us develop a suite of indices to assess wetland condition. Individual indices for vegetation, hydrology and soils will be developed to assess the condition of these parameters at a CWPPRA project or group of projects. The indices along with other community response variables can be used to assess restoration project effectiveness.

In this document, we focus on emergent vegetation. Emergent vegetation, sampled within CRMS marsh and forested wetland sites, provides a description of the community types of coastal Louisiana over time (Folse and others, 2008). Several vegetation response (that is, performance) variables (table 1) are used to document subtle changes in vegetation assemblage associated with either natural degradation or restoration projects. A current conceptual model (fig. 2) of the environmental drivers of plant performance identifies flooding, salinity, and nutrient availability as the key components in coastal Louisiana ecology. The first two environmental drivers, flooding and salinity, are monitored through CRMS. The prevailing idea among project managers is that restoration projects can affect flooding and salinity by (1) altering the amount of water exchange between the project and surrounding area and/or (2) changing the project area elevation through sedimentation, nutrient gains, or nutrient deficits. Although nutrient availability is not currently monitored, it may have nutrient feedbacks that can indirectly alter wetland elevation gain (fig. 2; McKee and others, 2007).

The purpose of this document is to provide to those associated with CRMS (that is, Federal and State sponsors, project managers, landowners, data users etc.) with the following: (1) the collection and development methods for the vegetation response variables and (2) the ways in which these response variables will be used to evaluate CRMS project and program effectiveness. New response variables may be added, or current response variables may be removed, as data become available and as our understanding of restoration success indicators develops.

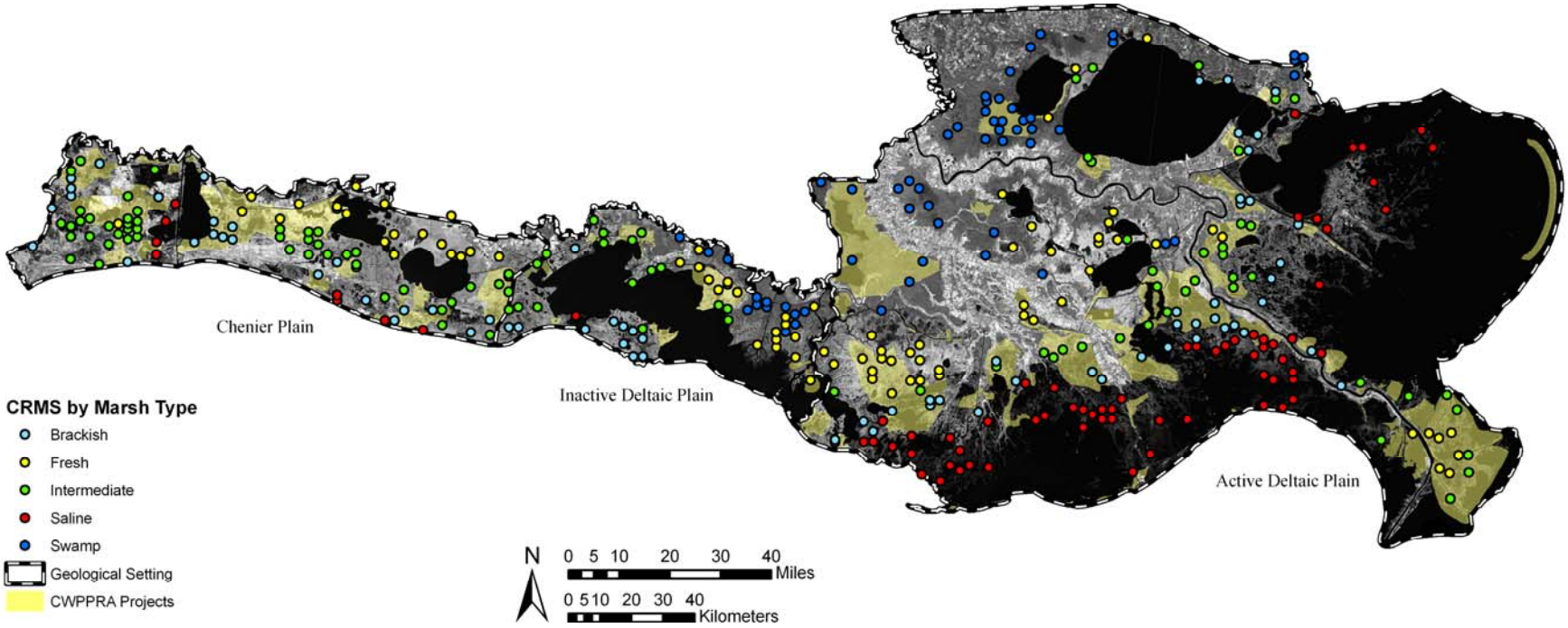

Figure 1. Louisiana coastal area with Coastwide Reference Monitoring System (CRMS) sites and Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) project areas depicted. CRMS sites are displayed according to the 2008 marsh type.

Table 1. Overview of vegetation response variables and applicable wetland type for Coastwide Reference Monitoring System assessment.

Vegetation response variables	Marsh or forested wetland
Percent total cover of herbaceous vegetation	Both
Height of dominant herbaceous vegetation	Both
Floristic quality index (FQI)	Both
Productivity index	Both
Diameter at breast height (DBH)	Forested wetland
Basal area	Forested wetland
Basal area increment (BAI)	Forested wetland

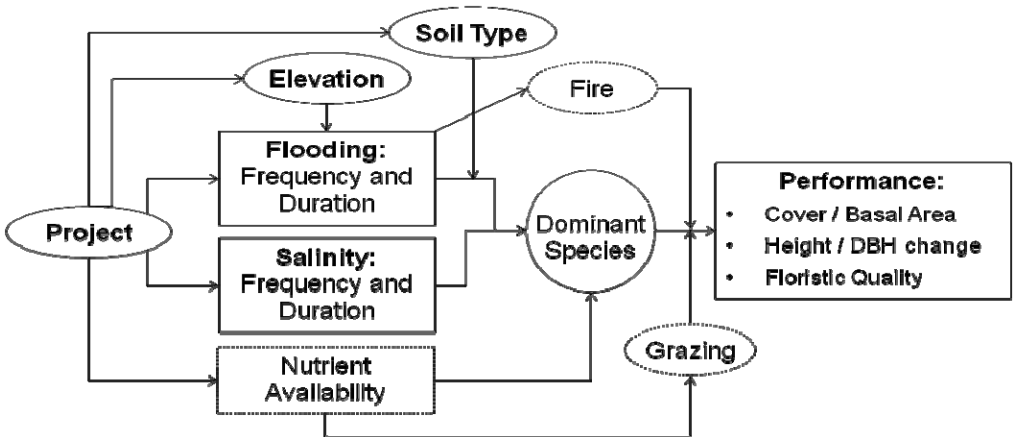

Figure 2. Conceptual model of environmental drivers of vegetation performance.

Vegetation Data Collection from CRMS Sites

A complete description of the methods and sampling design for collecting vegetation data in emergent marsh and forested wetlands can be found in Folse and others (2008). Summaries of these methods and designs for emergent marsh and forested wetland sites are given below.

Marsh Sites

Sampling is conducted within ten 2 m × 2-m vegetation stations along a 282.8-m transect within each 200 m × 200-m CRMS site (Folse and others, 2008). The same stations are sampled on repeat visits unless the station is lost or destroyed by a natural or human disturbance. Within each vegetation station the cover of each plant species is visually estimated near the end of the growing season (August 1 to September 30) by following the Braun-Blanquet cover scale (table 2). Total vegetation cover of each station and cover of each layer (that is, tree, shrub, herbaceous, carpet) is estimated between 0 and 100 percent (Folse and others, 2008). The sum of each vegetation layer

may exceed 100 percent because of overlapping canopies. The average height of the dominant (that is, greatest percent cover) species is measured in each vegetation station. Plant species nomenclature follows the U.S. Department of Agriculture's (USDA) PLANTS Database (USDA, NRCS, 2008).

Table 2. Vegetative cover values for the Braun-Blanquet method (reproduced from Folse and others, 2008).

Cover range (%)	Braun-Blanquet
Solitary	R
<1	+
1–5	1
6–25	2
26–50	3
51–75	4
76–100	5

Forested Wetland Sites

Sampling within forested wetland sites is conducted within three 20 m × 20-m forest stations along a 282.8-m transect within each 200 m × 200-m CRMS site (Folse and others, 2008). Within each station the herbaceous, understory, and canopy layers are sampled during the fall (August 1 to October 31) by using a nested sampling design (Folse and others, 2008). In each forest station there are three 6 m × 6-m understory stations, each of which contains one 2 m × 2-m herbaceous station. Canopy and understory layers are sampled every 3 years while herbaceous species layers are sampled each year. Vegetation sampling within the nine herbaceous stations is identical to the sampling procedure within marsh sites (see previous section). For understory layers, the number and height of all woody shrubs and trees <5 cm diameter at breast height (DBH) within each of the nine understory stations are recorded. For canopy layers, tree species >5 cm DBH are identified and the DBH (137 cm above the forest floor) is measured within each of the three canopy (that is, forest) stations. Canopy cover is also collected with a spherical densiometer by averaging cover in the four cardinal directions at the center of each CRMS plot. Hemispherical photography will also be used beginning in spring 2009 to provide data on percent cover and structure of overstory vegetation.

Index Development

Index Background

The Floristic Quality Index (FQI) was first developed by Swink and Wilhelm (1979) as a way to quantitatively measure habitat condition based on plant species composition. The FQI is based on a coefficient of conservatism (CC), a score from 0 to 10 that is applied to each plant species in a local flora by local plant experts. Species are scored according to their tolerance to disturbance and conservatism to a particular habitat type relative to all other plant species in the area of geographical interest. Species that are not found in specific habitat types or that are common in disturbed areas (for example, *Amaranthus australis*) are given low CC scores, while habitat-specific species

(for example, *Spartina alterniflora*) are given high CC scores. The FQI is then calculated by using the following equation:

$$FQI = \left(\frac{\sum (CCi)}{\sqrt{N}} \right), \quad (1)$$

where CCi is the coefficient of conservatism for species i, and N is the total number of native species at the area of interest.

The FQI has been developed for several regions (Ohio: Andreas and Lichvar, 1995; Andreas and others, 2004; Florida: Cohen and others, 2004; Mississippi: Herman 2005; Wisconsin and Michigan: Bourdaghs and others, 2006). It has been modified to include nonnative species (Andreas and others, 2004; Cohen and others, 2004) and measures of abundance (Poling and others, 2003). The FQI has also been used to determine the level of disturbance in a wetland site, based on the presence of invasive and disturbance-prone species and species indicative of highly disturbed sites (Lopez and Fennessy, 2002; Ervin and others, 2006; Miller and Wardrop, 2006). An FQI for coastal Louisiana was developed to track even subtle changes in Louisiana wetland condition.

Floristic Quality Index for Coastal Louisiana

Assignment of CC Scores

We provided a list of 809 plant species occurring in Louisiana coastal wetlands and a list of CC score descriptions for coastal Louisiana (table 3) to 40 Louisiana coastal vegetation experts. These experts were asked to assign CC scores to species across community types (Andreas and Lichvar, 1995) by using the descriptions in table 3. Twenty-four responses were received. A panel of seven individuals (table 4), consisting of authors of this report and experts from the larger group, met to review the responses and establish a final score by concensus. For most species, the median of the response scores was selected as the final score. For some species, the panel felt that the median of the response scores did not adequately reflect the disturbance tolerance and/or conservatism of the species. The panel discussed and revised the score according to their experience with the species in coastal Louisiana (see appendix table for all CC scores).

Although a deviation of the standard assignment method (Andreas and Lichvar, 1995), one species, *Distichlis spicata*, was assigned community-specific CC scores. Since this species is a codominant in healthy brackish and salt marshes, it was assigned a high CC score in those habitats. It is indicative of a disturbance, however, when it occurs in fresh and intermediate marshes, so it receives a low CC score in those communities. Scores for each habitat type are available in the appendix table.

The panel did not assign CC scores to (1) submerged aquatic vegetation, (2) parasitic species, (3) plants that were identified only to genus or family, or (4) unidentifiable plants (unknowns). For those plants identified only to genus, we assigned the species value to the genus if that genus had only one species on the list. If more than one species for the genus was listed and those species CC scores were within a 3-point

range, the mode of the species scores was assigned to the genus. If the CC scores for the species within the genus had a wider range than 3 points, no CC score was assigned.

The panel decided that nonnative species (USDA, NRCS, 2008) would automatically be assigned a zero CC score and would be included in the FQI calculation as these species are indicators of anthropogenic disturbance (Cohen and others, 2004; Allain and others, 2006; Bourdaghs and others, 2006) or some other stress on the site.

Table 3. Assignment of coefficient of conservatism (CC) scores to different plant species for coastal Louisiana (modified from Cohen and others, 2004).

CC score	Louisiana description
0	Invasive plant species
1–3	Plants that are opportunistic users of disturbed sites
4–6	Plants that occur primarily in less vigorous coastal wetland communities
7–8	Plants that are common in vigorous coastal wetland communities
9–10	Plants that are dominants in vigorous coastal wetland communities

Table 4. Louisiana coastal vegetation expert panel.

Name	Affiliation
Larry K. Allain	U.S. Geological Survey
Ken W. Krauss	U.S. Geological Survey
Mike Materne	Louisiana State University
Charles E. Sasser	Louisiana State University
Gary P. Shaffer	Southeastern Louisiana University
Gregory D. Steyer	U.S. Geological Survey
Jenneke M. Visser	University of Louisiana at Lafayette

FQI Equation

The FQI equation developed by Swink and Wilhelm (1979) was modified for coastal Louisiana wetlands by (1) including nonnative species, (2) including measures of abundance, and (3) scaling the score from 0 to 100. Separate indices were developed for herbaceous marshes and forested wetlands and are described in the next section. The herbaceous and forested FQIs will be calculated annually for all CRMS and CWPPRA stations with available data. We began using the herbaceous marsh FQI in 2008. It has been calculated by vegetation station for each year where the data are available. The forested wetland FQI will be calculated by station for all years with available data starting in 2009.

Herbaceous Vegetation

Marsh sites throughout the CRMS network are predominately herbaceous although forested wetland vegetation can colonize marsh sites coincident with change.

For the herbaceous vegetation on all CRMS sites, the FQI is calculated first at the vegetation station level by using one of the two following equations.

If the sum of species cover at a CRMS vegetation station at time t is less than or equal to 100, we use the following formula:

$$FQI_t = \left(\frac{\sum \left(COVER_{it} \times CC_i \right)}{100} \right) \times 10, \qquad (2)$$

where COVERit is the percent cover for species i at a vegetation station within a CRMS site at time t, and CCi is coefficient of conservatism for species i. This equation allows for a low FQI when the species composition of the site consists of species found in vigorous wetlands (high CC score), but the biomass (as estimated through cover) is low because of environmental stressors.

Where the sum of species cover at a CRMS vegetation station at time t is greater than 100 (overlapping canopies), we use the following formula:

$$FQI_t = \left(\frac{\sum \left(COVER_{it} \times CC_i \right)}{\sum \left(TOTAL\ \ COVER_t \right)} \right) \times 10, \qquad (3)$$

where TOTAL $COVER_t$ refers to the cumulative species cover of the vegetation station (that is, > 100%).

FQI scores for individual stations are averaged to obtain the site-level FQI score and reported with ± 1 standard error of the mean (SE). Collectively, these two formulas are robust to all types of herbaceous plot data.

Forested Wetland Vegetation

CRMS sites in forested wetlands have at least three canopy layers to be considered: (1) herbaceous layer, (2) understory layer, and (3) canopy layer. Data from herbaceous vegetation stations associated with CRMS forested wetland sites will be treated identically to marsh sites. Consistency with sampling of the herbaceous layer will be critical for comparisons with marsh data. Understory data will not be available until after the 2009 sampling period and so will not be discussed here. The herbaceous and canopy layers will be sampled in 2009 and are important in representing different resolutions for temporal change. We suspect that the herbaceous community will be the first to change in response to environmental change; however, there will be a number of instances where both layers will need to be considered together. For example, pristine forested wetlands with floating aquatic vegetation in the understory (that is, CCi = 0) will have very low FQI ratings because of the herbaceous layer, but these same sites will have very high FQI ratings for the canopy, reflecting a target condition of restoration.

For canopy FQI determinations, we will use one of the two following equations. The 80 m^2/ha basal area is the total basal area that occurs in a healthy swamp based on the authors' research experience. Where the sum of basal areas of species at a station within a CRMS site at time t is less than or equal to 80 m^2/ha, we will use the following formula:

$$FQI_t = \left(\frac{\sum \left(BASAL\ \ AREA_{it} \times CC_i \right)}{80} \right) \times 10, \qquad (4)$$

where BASAL AREAit is the average basal area for species i at a vegetation station within a CRMS site at time t, and CCi is coefficient of conservatism for species i. This formula allows for swamps with sparse trees with high CC scores (for example, Taxodium distichum) to receive a lower score.

Where the sum of basal areas of species at a station within a CRMS site at time t is greater than 80 m^2/ha, we will use the following formula:

$$FQI_t = \frac{\sum \left(BASAL\ \ AREA_{it} \times CC_i \right)}{\sum \left(TOTAL\ \ BASAL\ \ AREA_t \right)} \times 10, \qquad (5)$$

where TOTAL BASAL AREAt represents the total inventory of trees in the same size class for a particular site at time t.

FQI scores for individual stations will be averaged to obtain the site-level FQI score and will be reported with ± 1 standard error of the mean (SE).

Productivity Index

Since aboveground biomass collection is not included in the CRMS sampling plan, we will estimate primary productivity in emergent marsh and forested wetlands by using a productivity index. In emergent marsh and forested wetland understory, the productivity index estimates primary productivity by multiplying the height of the dominant plant species by the total vegetation cover. For forested wetland canopy, the productivity index estimates productivity by using basal area increment (BAI) of standing trees. Basal area increment is the difference in basal area of individual trees between sampling times (for example, annually).

Herbaceous Vegetation

Nondestructive techniques have been used in wetlands to produce estimates of aboveground primary production similar to estimates produced from harvesting

(Hopkinson and others, 1980; Daoust and Childers, 1998). These techniques require measurements of phenometric variables and an estimation of the stem density. Through CRMS, the average height of the dominant species in each vegetation station is measured, and the total vegetation cover of the station is estimated. Multiplying height and cover gives an estimate of the volume of biomass at each station. Although not as intensive as measurements made in other studies, these data should provide an index of primary productivity that can be compared among CRMS sites. More intensive study of the relationship between this proposed productivity index and actual primary productivity is needed to validate this index.

Forested Wetland Vegetation

The productivity of forested wetland sites will be dominated by woody vegetation unless sites become so degraded that they convert to marsh. Hence, primary productivity of the understory layer will be assessed similarly to protocols established for herbaceous vegetation in marsh sites. Data from canopy species will be treated separately, however, with productivity being linked to measurements of basal area increment. At a CRMS site, BAI will be calculated for individual canopy stations (N = 3) and summed for the site. While basal area increment does not assess all aspects of forested wetland integrity and productivity (for comparison, see Megonigal and others, 1997), these data will provide reasonable estimates.

An example of basal-area-rated productivity versus an environmental driver within forested wetlands is provided in figure 3. In this example, Krauss and others (2009) calculated BAI for individual trees that were codominants of *Taxodium distichum* in Louisiana and South Carolina swamps. The BAI data were compared among multiple sites with different salinity regimes and were subjected to quantile regression to indicate different possible responses to salinity. Because habitats differ widely in their response to prolonged levels of stress, such as salinity and flooding, defining critical thresholds depends on whether vegetation in a particular habitat can, under any circumstances, grow adequately. In this example, the annual BAI of codominant trees was natural-log-transformed and was regressed against salinity, with the 5, 10, 25, 50, 75, 90, and 95-percent regression quantiles being depicted as lines along the ordinate. While the typical mean regression response is depicted by the 50 percent quantile, in figure 3 it becomes evident that by using basal area increment data that the 75 percent quantile is a better predictor (at $\alpha = 0.10$) for coastal forested wetland growth increment than is the 50 percent regression quantile. These analyses will be conducted with CRMS data the forested data to determine salinity and flooding duration/frequency thresholds necessary to achieve optimal productivity.

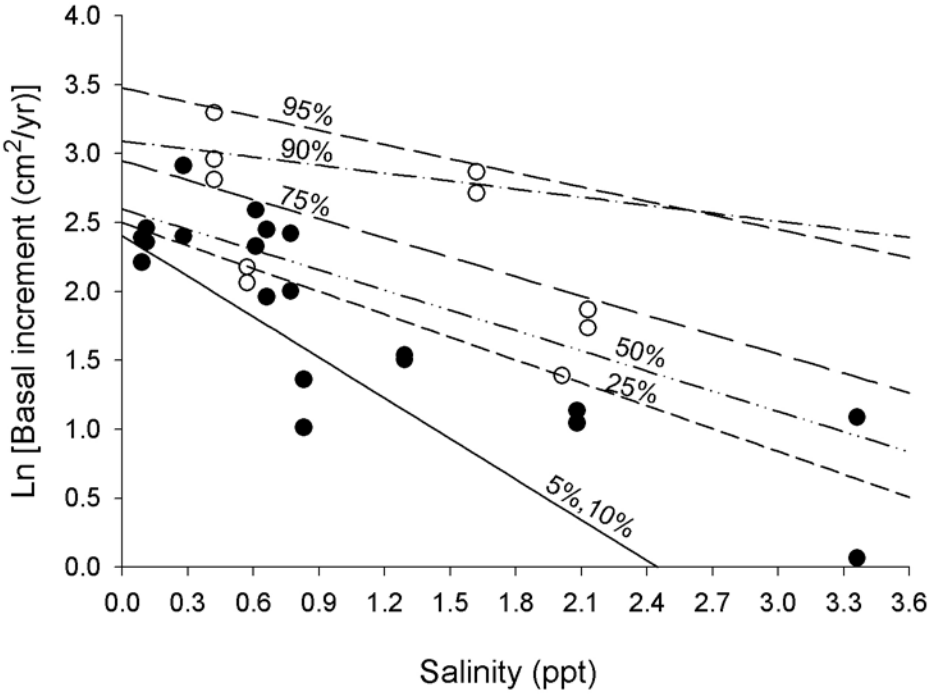

Figure 3. Relationship between site salinity and mean basal area increment (cm^2/yr) of *Taxodium distichum* codominant trees in Louisiana (open circle) and South Carolina (closed circle) swamps. The 75 percent quantile was the largest significant quantile (α = 0.10) (data after Krauss and others, 2009).

Evaluation of Project Effectiveness

Types of Comparisons

Project Status

With only 1 year of data, the status of a project relative to other projects and reference sites can be evaluated. Project status evaluation will consist of comparing the indices derived from the CRMS site(s) within a project to the distribution of the indices from the reference stations, other project stations, and to an ideal (target) range (fig. 4, table 5). Evaluation of project status will occur within the dominant habitat (swamp forest, fresh marsh, intermediate marsh, brackish marsh, or saline marsh; fig. 1) of the project within geological setting (active deltaic plain, inactive deltaic plain, or chenier plain; fig. 1) combination. The evaluation will take into consideration the time since project completion. Condition of project sites is expected to start lower on average than that of reference sites, as restoration projects generally addresses the areas with highest need.

Since we developed the vegetation indices for coastal Louisiana wetlands to evaluate restoration projects in coastal Louisiana, we determined the ideal ranges using our best professional judgment. The ranges were based on the index scores calculated for coastal Louisiana marshes with available CWPPRA and CRMS data (table 5). Marshes in the active deltaic region, for example, are in a state of primary succession and thus contain a larger number of disturbance species (that is, lower CC score) and as a result they have a lower FQI score compared to marshes in other coastal regions. The ideal ranges in these marshes are thus lower because of the plant species that are found there. Ideal ranges may need to be adaptively adjusted as more information from CRMS sites becomes available.

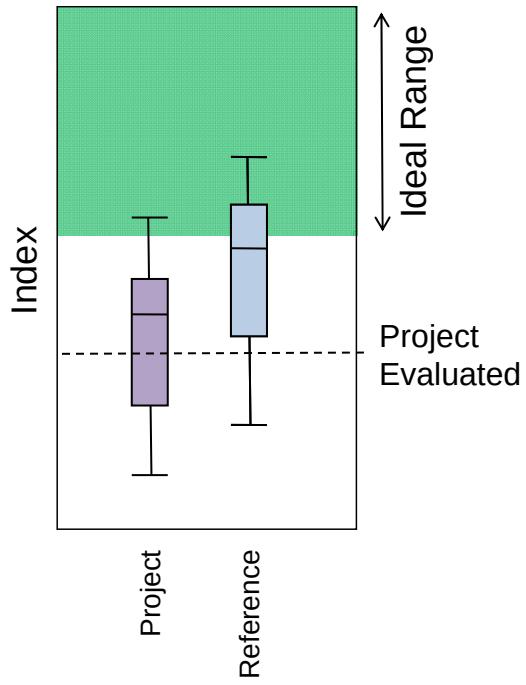

Figure 4. Example of graphing Coastwide Reference Monitoring System information used to evaluate a project's condition. The dashed line indicates the index score (0–100) for the project being evaluated. Data used to generate these graphs will include only data from those CRMS sites that are within the same wetland type and geological setting.

Table 5. Ideal range for vegetation indices based on the vegetation anlaysis team's best professional judgment. As more field data are collected through the Coastwide Reference Monitoring System and other research projects, these ranges may need to be adjusted to reflect the best available data.

[FQI, floristic quality index]

Geological setting	Habitat type	FQI	Productivity index
Inactive deltaic plain	Swamp forest-herbaceous	>80	>60
	Swamp forest-canopy	>80	>60
	Fresh marsh	>80	>60
	Intermediate marsh	>80	>55
	Brackish marsh	>80	>50
	Saline marsh	>80	>40
Active deltaic plain	Fresh marsh	>70	>55
	Intermediate marsh	>70	>80
Chenier plain	Fresh marsh	>80	>60
	Intermediate marsh	>80	>55
	Brackish marsh	>80	>50
	Saline marsh	>80	>20

Project Trajectory

As more years of data become available, trends in the indices will be compared among project and reference sites (fig. 5). Regression techniques will be used to test for the significant difference in slopes of fitted linear regressions. Each project will be compared to the trends in the reference sites and all other project sites within its habitat and geological setting.

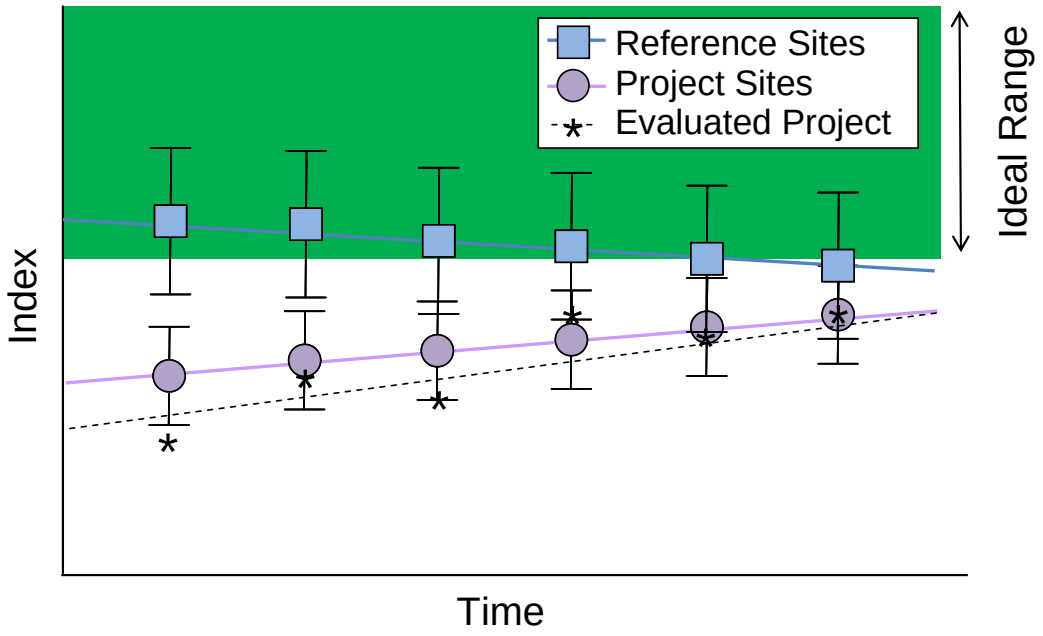

Figure 5. Example of graphing Coastwide Reference Monitoring System (CRMS) information used to evaluate a project trend. Graphs will be generated with data from CRMS stations that have the same marsh types and geological settings as those of the project data.

Example Analyses Using CWPPRA Monitoring Data

Twelve years of vegetation cover and composition data from the East Mud Lake Marsh Management (CS-20) CWPPRA project were utilized to demonstrate the floristic quality (herbaceous) and productivity indices usage across time and between project and reference sites. An FQI was calculated for each vegetation station by using equations 2 and 3. Vegetation station FQI scores were averaged by station type (that is, project and reference). Trends in project and reference station FQI scores were compared graphically (fig. 6). The productivity index (PI) trends for reference and project vegetation station groups are also compared graphically (fig. 7).

The FQI is variable within station type and between years as is shown in figure 6. Within both project and reference sites floristic quality generally decreased after major disturbances (that is, drought in 1997 and Hurricane Rita in 2005) and increased following the disturbance. In most years, both the reference and the project FQI scores were below the ideal range (80, see table 5) for a brackish marsh in the chenier plain. The PI trends were similar to those of the FQI in that productivity decreased after major disturbances in 1997 and 2005 and increased following the disturbances (fig. 7). Both project and reference areas had PI levels below the ideal PI range (table 5).

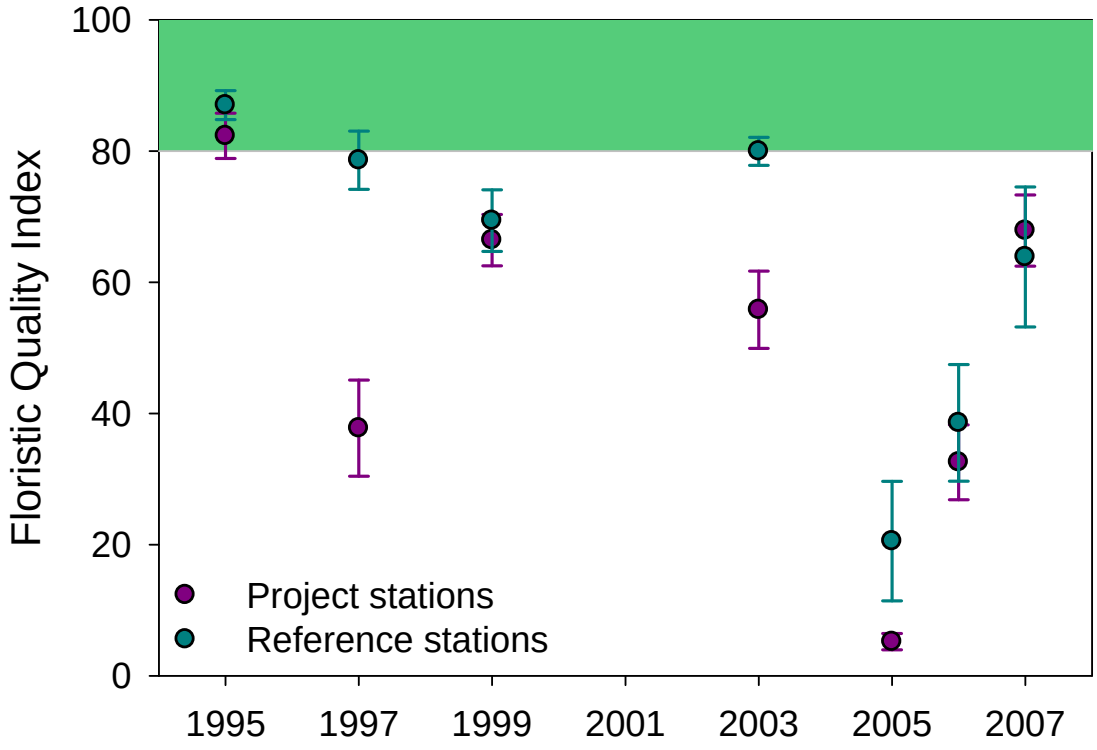

Figure 6. Mean (± SE) floristic quality index scores for CS-20 project and reference stations by year. Green shaded area indicates ideal range for brackish marshes in the chenier plain.

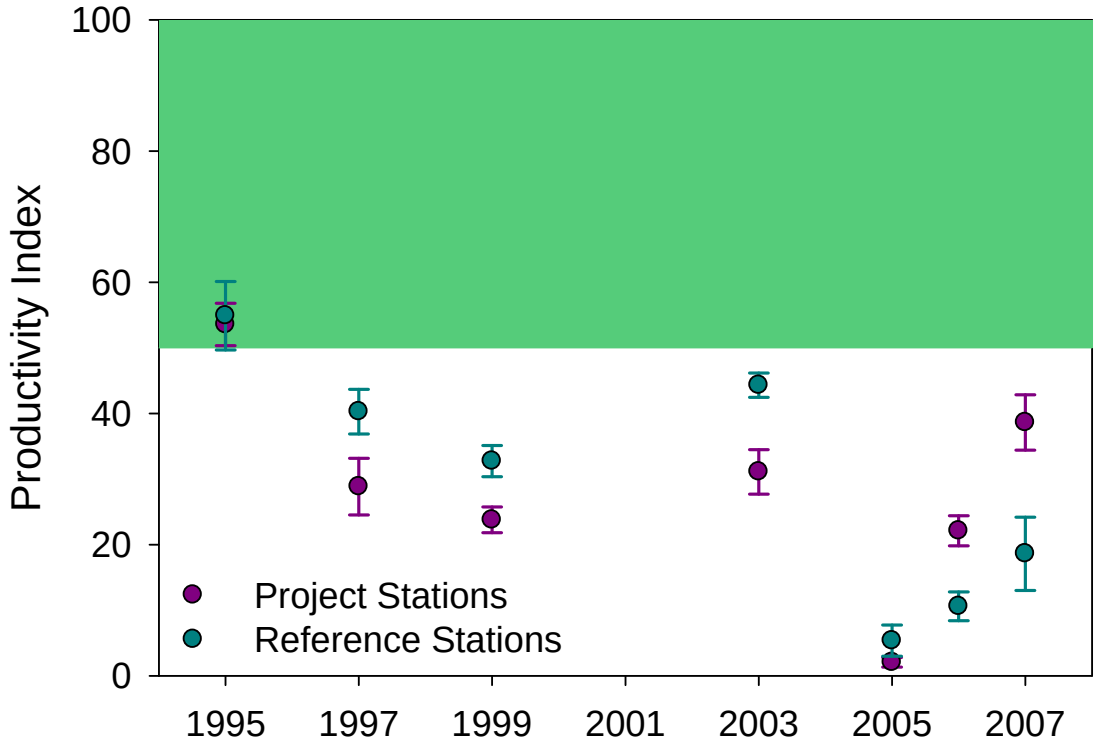

Figure 7. Mean (± SE) productivity index scores for CS-20 project and reference stations by year. Green shaded area indicates ideal range for brackish marshes in the chenier plain.

Evaluation of Program Effectiveness

Vegetation Distribution

Changes in marsh type within project sites will be compared to changes within reference sites across the entire coastal zone of Louisiana (landscape scale). Only projects for which construction has been completed more than 3 years before the CRMS survey year will be included as project sites. The CRMS sites are within the boundaries of coastwide vegetation surveys conducted in 1968 (Chabreck and others, 1968), 1997 (Chabreck and Linscombe, 1997), 2001 (Chabreck and Linscombe, 2001) and 2007 (Sasser and others, 2008); therefore, historical marsh types are available for the sites for those years. An algorithm based on species composition (Sasser and Visser, 2008) will be used to assign a marsh type to each CRMS site for all years where vegetation data is available. To determine marsh type change, the historical marsh type data from the 1968, 1997, 2001, and 2007 surveys will be compared to the marsh type data derived for the CRMS sites by using the algorithm.

If the CWPPRA projects have an effect on vegetation composition in the coastal zone, the analysis will show a statistical difference between the projects and reference sites. An example of the type of program-wide comparison expected is as follows: If X

percent of the intermediate reference sites changed to brackish, did X percent of the project sites show the same change? Chi-square analysis will be used to determine if the amount of change is statistically different. This analysis will be done by using all stations coastwide and by hydrologic basin.

Vegetation Condition

Floristic quality and productivity indices alike have ideal ranges that differ by habitat type. Assessments of vegetation condition at landscape scales need to address these differences. Therefore, for each of the indices, we will use the difference between the site index and ideal range for its habitat type as an indicator of condition. Sites that are within the ideal range will be assigned a condition value of 1. Sites that are below the ideal range will have their condition calculated as follows:

$$Conditi\quad on\quad =\quad 1-\frac{Min_I - Index}{Min_I}, \qquad (6)$$

where MinI is the minimum value of the optimal range for the index and Index is either the FQI or Productivity index score. The condition calculated by using the FQI will be called the "floristic condition." The condition calculated by using the productivity index will be called "productivity condition." A site will be evaluated relative to the ideal range for its habitat and relative to all other project and reference sites within the same habitat type and geological setting. A project site is a site that is within a project constructed at least 3 years prior to the vegetation survey. Descriptive statistics will be calculated for florisitc and productivity condition by site type (project and reference), habitat type, and geological setting to create a boxplot for each combination of site type, habitat type, and geological setting. Site floristic and productivity condition will be plotted with the appropriate boxplot to evaluate the status of the site. Because the ideal ranges are based on the best available data, these ranges may need to be adjusted as new data become available.

The project-scale floristic and productivity conditions will be used to create vegetation condition contour maps of the coast to provide a landscape view of vegetation condition and to identify regions of the coast with different levels of floristic or productivity condition. Regions with poor vegetation condition can then be highlighted so that the cause(s) of poor performance can be determined. With multiple years of data, changes in vegetation condition over time can be shown in relationship to project areas and project types. This update will provide an assessment of projects and identify projects that have improved vegetation condition relative to reference areas as well as projects that need improvement.

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Appendix. Plant Species That Occur in Marshes and Forested Wetlands in Coastal Louisiana

Appendix Table. Plant species that occur in marshes and forested wetlands in coastal Louisiana.

[CC, Cofficient of Conservatism score (0–10) assigned by the coastal Louisiana vegetation expert panel; N, species that are native to the contiguous 48 States of the United States; I, species that are introduced; A, annual; P, perennial; B, biennial, following the U.S. Department of Agriculture's PLANTS Database (USDA, NRCS, 2008); †CC, score when the given species occurs in fresh and intermediate marshes; ‡CC, score when the given species occurs in brackish and saline marshes]

Scientific name	CC	Origin	Duration	Form	Family
Acer L.	6				Aceraceae
Acer negundo L.	6	N	P	Tree	Aceraceae
Acer rubrum L.	7	N	P	Tree	Aceraceae
Acer saccharinum L.	6	N	P	Tree	Aceraceae
Acer saccharum Marsh.	6	N	P	Tree	Aceraceae
Acmella L.C. Rich. ex Pers.	3				Asteraceae
Acmella oppositifolia (Lam.) R.K. Jansen	3	N	P	Herb	Asteraceae
Aeschynomene L.	3				Fabaceae
Aeschynomene americana L.	3	N	P	Subshrub	Fabaceae
Aeschynomene indica L.	3	N	A	Subshrub	Fabaceae
Agalinis Raf.	6				Scrophulariaceae
Agalinis fasciculata (Ell.) Raf.	6	N	A	Herb	Scrophulariaceae
Agalinis harperi Pennell	5				Scrophulariaceae
Agalinis heterophylla (Nutt.) Small ex Britt.	6	N	A	Herb	Scrophulariaceae
Agalinis maritima (Raf.) Raf.	7	N	A	Herb	Scrophulariaceae
Agalinis purpurea (L.) Pennell	6	N	A	Herb	Scrophulariaceae
Agrostis L.	3				Poaceae

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Scientific name	CC	Origin	Duration	Form	Family
Agrostis hyemalis (Walt.) B.S.P.	3	N	P	Graminoid	Poaceae
Alopecurus L.	1				Poaceae
Alopecurus carolinianus Walt.	1	N	A	Graminoid	Poaceae
Alternanthera Forsk.	0				Amaranthaceae
Alternanthera philoxeroides (Mart.) Griseb.	0	I	P	Herb	Amaranthaceae
Amaranthus L.	2				Amaranthaceae
Amaranthus albus L.	0	I	A	Herb	Amaranthaceae
Amaranthus australis (Gray) Sauer	2	N	A	Herb	Amaranthaceae
Amaranthus bigelovii Uline & Bray	2	N	A	Herb	Amaranthaceae
Amaranthus cannabinus (L.) Sauer	2	N	P	Herb	Amaranthaceae
Amaranthus spinosus L.	2	N	A	Herb	Amaranthaceae
Amaranthus tuberculatus (Moq.) Sauer	2	N	A	Herb	Amaranthaceae
Ambrosia L.	2				Asteraceae
Ambrosia artemisiifolia L.	2	N	A	Herb	Asteraceae
Ambrosia psilostachya DC.	2	N	A	Herb	Asteraceae
Ambrosia trifida L.	2	N	A	Herb	Asteraceae
Ammannia L.	4				Lythraceae
Ammannia auriculata Willd.	4	N	A	Herb	Lythraceae
Ammannia coccinea Rottb.	4	N	A	Herb	Lythraceae
Ammannia latifolia L.	4	N	A	Herb	Lythraceae

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Scientific name	CC	Origin	Duration	Form	Family
Ampelopsis Michx.	4				Vitaceae
Ampelopsis arborea (L.) Koehne	5	N	P	Vine	Vitaceae
Ampelopsis cordata Michx.	4	N	P	Vine	Vitaceae
Anagallis L.	2				Primulaceae
Anagallis minima (L.) Krause	2	N	A	Herb	Primulaceae
Andropogon L.	3				Poaceae
Andropogon capillipes Nash	3	N	P	Graminoid	Poaceae
Andropogon gerardii Vitman	3				Poaceae
Andropogon glaucopsis Ell.	3	N	P	Graminoid	Poaceae
Andropogon glomeratus (Walt.) B.S.P.	3	N	P	Graminoid	Poaceae
Andropogon mohrii (Hack.) Hack. ex Vasey	3	N	P	Graminoid	Poaceae
Andropogon virginicus L.	3	N	P	Graminoid	Poaceae
Apios Fabr.	5				Fabaceae
Apios americana Medik.	5	N	P	Vine	Fabaceae
Arisaema Mart.	4				Araceae
Arisaema dracontium (L.) Schott	4	N	P	Herb	Araceae
Arundinaria Michx.	5				Poaceae
Arundinaria gigantea (Walt.) Muhl.	5	N	P	Graminoid	Poaceae
Asclepias L.	7				Asclepiadaceae
Asclepias incarnata L.	7	N	P	Herb	Asclepiadaceae

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Scientific name	CC	Origin	Duration	Form	Family
Asclepias lanceolata Walt.	8	N	P	Herb	Asclepiadaceae
Asclepias longifolia Michx.	7	N	P	Herb	Asclepiadaceae
Asclepias perennis Walt.	7	N	P	Herb	Asclepiadaceae
Atriplex L.	3				Chenopodiaceae
Atriplex cristata Humb. & Bonpl. ex Willd.	3	N	A	Herb	Chenopodiaceae
Avicennia L.	10				Verbenaceae
Avicennia germinans (L.) L.	10	N	P	Shrub	Verbenaceae
Axonopus Beauv.	2				Poaceae
Axonopus fissifolius (Raddi) Kuhlm.	2	N	P	Graminoid	Poaceae
Baccharis L.	5				Asteraceae
Baccharis angustifolia Michx.	5	N	P	Shrub	Asteraceae
Baccharis halimifolia L.	4	N	P	Shrub	Asteraceae
Bacopa Aubl.	5				Scrophulariaceae
Bacopa caroliniana (Walt.) B.L. Robins.	5	N	P	Herb	Scrophulariaceae
Bacopa monnieri (L.) Pennell	5	N	P	Herb	Scrophulariaceae
Bacopa repens (Sw.) Wettst.	4	N	P	Herb	Scrophulariaceae
Bacopa rotundifolia (Michx.) Wettst.	4	N	P	Herb	Scrophulariaceae
Batis P. Br.	5				Bataceae
Batis maritima L.	5	N	P	Subshrub	Bataceae
Berchemia Neck. ex DC.	6				Rhamnaceae

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Scientific name	CC	Origin	Duration	Form	Family
Berchemia scandens (Hill) K. Koch	6	N	P	Vine	Rhamnaceae
Bidens L.	3				Asteraceae
Bidens aristosa (Michx.) Britt.	3				Asteraceae
Bidens laevis (L.) B.S.P.	3	N	A	Herb	Asteraceae
Bignonia L.	5				Bignoniaceae
Bignonia capreolata L.	5	N	P	Vine	Bignoniaceae
Blutaparon Raf.	5				Amaranthaceae
Blutaparon vermiculare (L.) Mears	5	N	P	Herb	Amaranthaceae
Boehmeria cylindrica (L.) Sw.	4	N	P	Herb	Urticaceae
Boehmeria nivea (L.) Gaud.	0	I	P	Herb	Urticaceae
Boltonia L'Hér.	5				Asteraceae
Boltonia asteroides (L.) L'Her.	5	N	P	Herb	Asteraceae
Boltonia diffusa Ell.	5	N	P	Herb	Asteraceae
Borrichia Adans.	7				Asteraceae
Borrichia frutescens (L.) DC.	7	N	P	Subshrub	Asteraceae
Brunnichia Banks ex Gaertn.	4				Polygonaceae
Brunnichia ovata (Walt.) Shinners	4	N	P	Vine	Polygonaceae
Cakile P. Mill.	2				Brassicaceae
Cakile constricta Rodman	7	N	A	Herb	Brassicaceae
Cakile geniculata (B.L. Robins.) Millsp.	6	N	A	Herb	Brassicaceae

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Scientific name	CC	Origin	Duration	Form	Family
Caladium Vent.	0				Araceae
Caladium bicolor (Ait.) Vent.	0	I	P	Herb	Araceae
Calystegia R. Br.	0				Convolvulaceae
Calystegia sepium (L.) R. Br.	0	I	P	Vine	Convolvulaceae
Campsis Lour.	4				Bignoniaceae
Campsis radicans (L.) Seem. ex Bureau	4	N	P	Vine	Bignoniaceae
Cardamine L.	1				Brassicaceae
Cardamine hirsuta L.	0	I	A	Herb	Brassicaceae
Cardamine pensylvanica Muhl. ex Willd.	2	N	A	Herb	Brassicaceae
Carex alata Torr.	3	N	P	Graminoid	Cyperaceae
Carex albolutescens Schwein.	3	N	P	Graminoid	Cyperaceae
Carex cherokeensis Schwein.	3	N	P	Graminoid	Cyperaceae
Carex comosa Boott	6	N	P	Graminoid	Cyperaceae
Carex crus-corvi Shuttlw. ex Kunze	5	N	P	Graminoid	Cyperaceae
Carex frankii Kunth	3	N	P	Graminoid	Cyperaceae
Carex glaucescens Ell.	7	N	P	Graminoid	Cyperaceae
Carex hyalinolepis Steud.	5	N	P	Graminoid	Cyperaceae
Carex longii Mackenzie	6	N	P	Graminoid	Cyperaceae
Carex lupulina Muhl. ex Willd.	5	N	P	Graminoid	Cyperaceae
Carex triangularis Boeckl.	6	N	P	Graminoid	Cyperaceae

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Scientific name	CC	Origin	Duration	Form	Family
Carex tribuloides Wahlenb.	5	N	P	Graminoid	Cyperaceae
Carex vulpinoidea Michx.	5	N	P	Graminoid	Cyperaceae
Carya Nutt.	8				Juglandaceae
Carya aquatica (Michx. f.) Nutt.	8	N	P	Tree	Juglandaceae
Catalpa Scop.	7				Bignoniaceae
Catalpa bignonioides Walt.	7	N	P	Tree	Bignoniaceae
Celtis L.	7				Ulmaceae
Celtis laevigata Willd.	7	N	P	Tree	Ulmaceae
Centella L.	4				Apiaceae
Centella erecta (L. f.) Fern.	4	N	P	Herb	Apiaceae
Cephalanthus L.	6				Rubiaceae
Cephalanthus occidentalis L.	6	N	P	Shrub	Rubiaceae
Chaerophyllum L.	2				Apiaceae
Chaerophyllum tainturieri Hook.	2	N	A	Herb	Apiaceae
Chasmanthium Link	6				Poaceae
Chasmanthium latifolium (Michx.) Yates	6	N	P	Graminoid	Poaceae
Chasmanthium laxum (L.) Yates	6	N	P	Graminoid	Poaceae
Chenopodium L.	0				Chenopodiaceae
Chenopodium album L.	0	I	A	Herb	Chenopodiaceae
Chenopodium ambrosioides L.	0	I	A	Subshrub	Chenopodiaceae

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Scientific name	CC	Origin	Duration	Form	Family
Chloracantha Nesom	7				Asteraceae
Chloracantha spinosa (Benth.) Nesom	7	N	P	Subshrub	Asteraceae
Cicuta L.	5				Apiaceae
Cicuta maculata L.	5	N	B	Herb	Apiaceae
Cinnamomum Schaeffer	0				Lauraceae
Cinnamomum camphora (L.) J. Presl	0	I	P	Tree	Lauraceae
Cirsium P. Mill.	2				Asteraceae
Cirsium horridulum Michx.	2	N	A	Herb	Asteraceae
Cirsium muticum Michx.	2	N	B	Herb	Asteraceae
Cissus L.	5				Vitaceae
Cissus trifoliata (L.) L.	5	N	P	Vine	Vitaceae
Cladium P. Br.	8				Cyperaceae
Cladium mariscus (L.) Pohl	8	N	P	Graminoid	Cyperaceae
Clematis L.	6				Ranunculaceae
Clematis crispa L.	6	N	P	Vine	Ranunculaceae
Clitoria L.	6				Fabaceae
Clitoria mariana L.	6	N	P	Vine	Fabaceae
Colocasia Schott	0				Araceae
Colocasia esculenta (L.) Schott	0	I	P	Herb	Araceae
Commelina caroliniana Walt.	0	I	A	Herb	Commelinaceae

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Scientific name	CC	Origin	Duration	Form	Family
Commelina communis L.	0	I	A	Herb	Commelinaceae
Commelina diffusa Burm. f.	3	N	A	Herb	Commelinaceae
Commelina erecta L.	4	N	P	Herb	Commelinaceae
Commelina virginica L.	5	N	P	Herb	Commelinaceae
Conoclinium DC.	3				Asteraceae
Conoclinium coelestinum (L.) DC.	3	N	P	Herb	Asteraceae
Conyza Less.	1				Asteraceae
Conyza canadensis (L.) Cronq.	1	N	A	Herb	Asteraceae
Cornus L.	6				Cornaceae
Cornus florida L.	6	N	P	Tree	Cornaceae
Cornus foemina P. Mill.	7	N	P	Tree	Cornaceae
Cortaderia Stapf	0				Poaceae
Cortaderia selloana (J.A. & J.H. Schultes) Aschers. & Graebn.	0				Poaceae
Crataegus L.	7				Rosaceae
Crataegus viridis L.	7	N	P	Tree	Rosaceae
Crinum L.	8				Liliaceae
Crinum americanum L.	8	N	P	Herb	Liliaceae
Croton L.	2				Euphorbiaceae
Croton capitatus Michx.	2	N	A	Herb	Euphorbiaceae
Croton glandulosus L.	2	N	A	Subshrub	Euphorbiaceae

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Scientific name	CC	Origin	Duration	Form	Family
Croton monanthogynus Michx.	3	N	A	Herb	Euphorbiaceae
Croton punctatus Jacq.	3	N	P	Subshrub	Euphorbiaceae
Cynanchum L.	6				Asclepiadaceae
Cynanchum angustifolium Pers.	6	N	P	Vine	Asclepiadaceae
Cynanchum laeve (Michx.) Pers.	6	N	P	Vine	Asclepiadaceae
Cynodon L.C. Rich.	0				Poaceae
Cynodon dactylon (L.) Pers.	0	I	P	Graminoid	Poaceae
Cyperus articulatus L.	5	N	P	Graminoid	Cyperaceae
Cyperus compressus L.	2	N	P	Graminoid	Cyperaceae
Cyperus difformis L.	0	I	A	Graminoid	Cyperaceae
Cyperus elegans L.	4	I	A	Graminoid	Cyperaceae
Cyperus erythrorhizos Muhl.	3	N	P	Graminoid	Cyperaceae
Cyperus esculentus L.	0	N	A	Graminoid	Cyperaceae
Cyperus filicinus Vahl	4	N	A	Graminoid	Cyperaceae
Cyperus flavescens L.	2	N	A	Graminoid	Cyperaceae
Cyperus haspan L.	5	N	P	Graminoid	Cyperaceae
Cyperus iria L.	0	N	P	Graminoid	Cyperaceae
Cyperus ochraceus Vahl	4	N	P	Graminoid	Cyperaceae
Cyperus odoratus L.	4	N	A	Graminoid	Cyperaceae
Cyperus oxylepis Nees ex Steud.	4	N	P	Graminoid	Cyperaceae

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Scientific name	CC	Origin	Duration	Form	Family
Cyperus polystachyos Rottb.	4	N	A	Graminoid	Cyperaceae
Cyperus pseudovegetus Steud.	4	N	P	Graminoid	Cyperaceae
Cyperus retrorsus Chapman	6	N	P	Graminoid	Cyperaceae
Cyperus rotundus L.	0	I	P	Graminoid	Cyperaceae
Cyperus strigosus L.	3	N	P	Graminoid	Cyperaceae
Cyperus surinamensis Rottb.	4	N	P	Graminoid	Cyperaceae
Cyperus tetragonus Ell.	3	N	P	Graminoid	Cyperaceae
Cyperus virens Michx.	4	N	P	Graminoid	Cyperaceae
Decodon J.F. Gmel.	6				Lythraceae
Decodon verticillatus (L.) Ell.	6	N	P	Subshrub	Lythraceae
Dichanthelium (A.S. Hitchc. & Chase) Gould	6				Poaceae
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark	4	N	P	Graminoid	Poaceae
Dichanthelium commutatum (J.A. Schultes) Gould	5	N	P	Graminoid	Poaceae
Dichanthelium dichotomum (L.) Gould	6	N	P	Graminoid	Poaceae
Dichanthelium scabriusculum (Ell.) Gould & C.A. Clark	7	N	P	Graminoid	Poaceae
Dichanthelium scoparium (Lam.) Gould	5	N	P	Graminoid	Poaceae
Diodia L.	2				Rubiaceae
Diodia teres Walt.	2	N	A	Herb	Rubiaceae
Diodia virginiana L.	2	N	A	Herb	Rubiaceae
Diospyros L.	7				Ebenaceae

Appendix Table. Plant species that occur in marshes and forested wetlands in coastal Louisiana.

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Scientific name	CC	Origin	Duration	Form	Family
Diospyros virginiana L.	7	N	P	Tree	Ebenaceae
Distichlis spicata (L.) Greene	2†,9‡	N	P	Graminoid	Poaceae
Echinochloa Beauv.	3				Poaceae
Echinochloa colona (L.) Link	0	I	A	Graminoid	Poaceae
Echinochloa crus-galli (L.) Beauv.	0	I	A	Graminoid	Poaceae
Echinochloa muricata (Beauv.) Fern.	3	N	A	Graminoid	Poaceae
Echinochloa polystachya (Kunth) A.S. Hitchc.	5	N	P	Graminoid	Poaceae
Echinochloa walteri (Pursh) Heller	5	N	A	Graminoid	Poaceae
Echinodorus L.C. Rich. ex Engelm.	5				Alismataceae
Echinodorus berteroi (Spreng.) Fassett	5	N	P	Herb	Alismataceae
Echinodorus cordifolius (L.) Griseb.	5	N	P	Herb	Alismataceae
Eclipta L.	3				Asteraceae
Eclipta prostrata (L.) L.	3	N	A	Herb	Asteraceae
Egeria Planch.	0				Hydrocharitaceae
Egeria densa Planch.	0	I	P	Herb	Hydrocharitaceae
Eleocharis acicularis (L.) Roemer & J.A. Schultes	3	N	A	Graminoid	Cyperaceae
Eleocharis albida Torr.	5	N	P	Graminoid	Cyperaceae
Eleocharis baldwinii (Torr.) Chapman	5	N	P	Graminoid	Cyperaceae
Eleocharis cellulosa Torr.	7	N	P	Graminoid	Cyperaceae
Eleocharis elongata Chapman	5	N	P	Graminoid	Cyperaceae

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Scientific name	CC	Origin	Duration	Form	Family
Eleocharis equisetoides (Ell.) Torr.	7	N	P	Graminoid	Cyperaceae
Eleocharis fallax Weatherby	5	N	P	Graminoid	Cyperaceae
Eleocharis flavescens (Poir.) Urban	6	N	P	Graminoid	Cyperaceae
Eleocharis macrostachya Britt.	7	N	P	Graminoid	Cyperaceae
Eleocharis microcarpa Torr.	5	N	A	Graminoid	Cyperaceae
Eleocharis montana (Kunth) Roemer & J.A. Schultes	5	N	P	Graminoid	Cyperaceae
Eleocharis montevidensis Kunth	5	N	P	Graminoid	Cyperaceae
Eleocharis obtusa (Willd.) J.A. Schultes	3	N	A	Graminoid	Cyperaceae
Eleocharis olivacea Torr.	6	N	P	Graminoid	Cyperaceae
Eleocharis palustris (L.) Roemer & J.A. Schultes	5	N	P	Graminoid	Cyperaceae
Eleocharis parvula (Roemer & J.A. Schultes) Link ex Bluff, Nees & Schauer	3	N	A	Graminoid	Cyperaceae
Eleocharis quadrangulata (Michx.) Roemer & J.A. Schultes	7	N	P	Graminoid	Cyperaceae
Eleocharis rostellata (Torr.) Torr.	6	N	P	Graminoid	Cyperaceae
Eleocharis tortilis (Link) J.A. Schultes	4	N	P	Graminoid	Cyperaceae
Eleocharis tuberculosa (Michx.) Roemer & J.A. Schultes	4	N	P	Graminoid	Cyperaceae
Eleocharis vivipara Link	3	N	A	Graminoid	Cyperaceae
Equisetum L.	3				Equisetaceae
Equisetum hyemale L.	3	N	P	Herb	Equisetaceae
Eragrostis hypnoides (Lam.) B.S.P.	5	N	A	Graminoid	Poaceae
Eragrostis japonica (Thunb.) Trin.	0	I	A	Graminoid	Poaceae

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Scientific name	CC	Origin	Duration	Form	Family
Erechtites Raf.	3				Asteraceae
Erechtites hieraciifolia (L.) Raf. ex DC.	3	N	A	Herb	Asteraceae
Eriochloa Kunth	2				Poaceae
Eriochloa contracta A.S. Hitchc.	2	N	A	Graminoid	Poaceae
Eryngium L.	3				Apiaceae
Eryngium prostratum Nutt. ex DC.	3	N	P	Herb	Apiaceae
Eupatorium L.	3				Asteraceae
Eupatorium capillifolium (Lam.) Small	1	N	P	Herb	Asteraceae
Eupatorium compositifolium Walt.	2	N	P	Herb	Asteraceae
Eupatorium perfoliatum L.	4	N	P	Herb	Asteraceae
Eupatorium pilosum Walt.	3	N	P	Herb	Asteraceae
Eupatorium purpureum L.	3	N	P	Herb	Asteraceae
Eupatorium serotinum Michx.	3	N	P	Herb	Asteraceae
Eustoma Salisb. ex G. Don	7				Gentianaceae
Eustoma exaltatum (L.) Salisb. ex G. Don	7	N	A	Herb	Gentianaceae
Euthamia Nutt. ex Cass.	5				Asteraceae
Euthamia leptocephala (Torr. & Gray) Greene	5	N	P	Herb	Asteraceae
Fimbristylis annua (All.) Roemer & J.A. Schultes	3	N	A	Graminoid	Cyperaceae
Fimbristylis caroliniana (Lam.) Fern.	5	N	P	Graminoid	Cyperaceae
Fimbristylis castanea (Michx.) Vahl	6	N	P	Graminoid	Cyperaceae

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Scientific name	CC	Origin	Duration	Form	Family
Fimbristylis dichotoma (L.) Vahl	3	N	A	Graminoid	Cyperaceae
Fimbristylis miliacea (L.) Vahl	0	N	A	Graminoid	Cyperaceae
Fimbristylis tomentosa Vahl	3	N	A	Graminoid	Cyperaceae
Forestiera Poir.	5				Oleaceae
Forestiera acuminata (Michx.) Poir.	5	N	P	Shrub	Oleaceae
Frangula P. Mill.	6				Rhamnaceae
Frangula caroliniana (Walt.) Gray	6	N	P	Tree	Rhamnaceae
Fraxinus L.	7				Oleaceae
Fraxinus caroliniana P. Mill.	7	N	P	Tree	Oleaceae
Fraxinus pennsylvanica Marsh.	7	N	P	Tree	Oleaceae
Fraxinus profunda (Bush) Bush	7	N	P	Tree	Oleaceae
Fuirena Rottb.	4				Cyperaceae
Fuirena breviseta (Coville) Coville	5	N	P	Graminoid	Cyperaceae
Fuirena pumila (Torr.) Spreng.	3	N	A	Graminoid	Cyperaceae
Fuirena squarrosa Michx.	4	N	P	Graminoid	Cyperaceae
Gaillardia Foug.	4				Asteraceae
Gaillardia pulchella Foug.	4	N	A,B,P	Subshrub	Asteraceae
Galium L.	2				Rubiaceae
Galium obtusum Bigelow	2	N	P	Herb	Rubiaceae
Galium tinctorium L.	2	N	P	Herb	Rubiaceae

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Scientific name	CC	Origin	Duration	Form	Family
Galium trifidum L.	2	N	P	Herb	Rubiaceae
Gleditsia L.	6				Fabaceae
Gleditsia aquatica Marsh.	7	N	P	Tree	Fabaceae
Gleditsia triacanthos L.	6	N	P	Tree	Fabaceae
Gratiola L.	4				Scrophulariaceae
Gratiola brevifolia Raf.	5	N	A	Herb	Scrophulariaceae
Gratiola neglecta Torr.	4	N	A	Herb	Scrophulariaceae
Gratiola virginiana L.	4	N	A	Herb	Scrophulariaceae
Habenaria Willd.	5				Orchidaceae
Habenaria repens Nutt.	5	N	P	Herb	Orchidaceae
Helenium L.	2				Asteraceae
Helenium amarum (Raf.) H. Rock	2	N	A	Herb	Asteraceae
Helenium autumnale L.	3	N	P	Herb	Asteraceae
Helianthus L.	6				Asteraceae
Helianthus angustifolius L.	6	N	P	Herb	Asteraceae
Heliotropium L.	3				Boraginaceae
Heliotropium curassavicum L.	4	N	A	Herb	Boraginaceae
Heliotropium procumbens P. Mill.	3	N	A	Herb	Boraginaceae
Heteranthera Ruiz & Pav.	3				Pontederiaceae
Heteranthera dubia (Jacq.) MacM.	3	N	A	Herb	Pontederiaceae

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Scientific name	CC	Origin	Duration	Form	Family
Heteranthera limosa (Sw.) Willd.	3	N	A	Herb	Pontederiaceae
Heteranthera reniformis Ruiz & Pavon	4	N	P	Herb	Pontederiaceae
Hibiscus L.	6				Malvaceae
Hibiscus grandiflorus Michx.	6	N	P	Shrub	Malvaceae
Hibiscus laevis All.	6	N	P	Herb	Malvaceae
Hibiscus lasiocarpos Cav.	7	N	P	Herb	Malvaceae
Hibiscus moscheutos L.	7	N	P	Herb	Malvaceae
Hydrocotyle L.	3				Apiaceae
Hydrocotyle bonariensis Comm. ex Lam.	4	N	P	Herb	Apiaceae
Hydrocotyle ranunculoides L. f.	4	N	P	Herb	Apiaceae
Hydrocotyle umbellata L.	3	N	P	Herb	Apiaceae
Hydrocotyle verticillata Thunb.	3	N	P	Herb	Apiaceae
Hydrolea L.	5				Hydrophyllaceae
Hydrolea ovata Nutt. ex Choisy	5	N	P	Herb	Hydrophyllaceae
Hydrolea uniflora Raf.	5	N	P	Herb	Hydrophyllaceae
Hygrophila R. Br.	5				Acanthaceae
Hygrophila lacustris (Schlecht. & Cham.) Nees	5	N	P	Herb	Acanthaceae
Hymenocallis Salisb.	7				Liliaceae
Hymenocallis caroliniana (L.) Herbert	7	N	P	Herb	Liliaceae
Hymenocallis liriosme (Raf.) Shinners	7	N	P	Herb	Liliaceae

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Scientific name	CC	Origin	Duration	Form	Family
Hypericum crux-andreae (L.) Crantz	6	N	P	Subshrub	Clusiaceae
Hypericum drummondii (Grev. & Hook.) Torr. & Gray	6	N	A	Herb	Clusiaceae
Hypericum fasciculatum Lam.	7	N	P	Shrub	Clusiaceae
Hypericum hypericoides (L.) Crantz	5	N	P	Subshrub	Clusiaceae
Hypericum mutilum L.	4	N	A	Herb	Clusiaceae
Hypericum perforatum L.	0	I	P	Herb	Clusiaceae
Hyptis Jacq.	5				Lamiaceae
Hyptis alata (Raf.) Shinners	5	N	P	Herb	Lamiaceae
Ilex L.	7				Aquifoliaceae
Ilex ambigua (Michx.) Torr.	6	N	P	Shrub	Aquifoliaceae
Ilex cassine L.	7	N	P	Shrub	Aquifoliaceae
Ilex coriacea (Pursh) Chapman	7	N	P	Shrub	Aquifoliaceae
Ilex decidua Walt.	7	N	P	Shrub	Aquifoliaceae
Ilex glabra (L.) Gray	7	N	P	Shrub	Aquifoliaceae
Ilex myrtifolia Walt.	7	N	P	Shrub	Aquifoliaceae
Ilex verticillata (L.) Gray	6	N	P	Shrub	Aquifoliaceae
Ilex vomitoria Ait.	7	N	P	Shrub	Aquifoliaceae
Ipomoea coccinea L.	0	I	A	Vine	Convolvulaceae
Ipomoea imperati (Vahl) Griseb.	7	N	P	Vine	Convolvulaceae
Ipomoea pes-caprae (L.) R. Br.	7	N	P	Vine	Convolvulaceae

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Scientific name	CC	Origin	Duration	Form	Family
Ipomoea sagittata Poir.	8	N	P	Vine	Convolvulaceae
Iresine P. Br.	6				Amaranthaceae
Iresine rhizomatosa Standl.	6	N	P	Herb	Amaranthaceae
Iris fulva Ker-Gawl.	7	N	P	Herb	Iridaceae
Iris giganticaerulea Small	7	N	P	Herb	Iridaceae
Iris hexagona Walt.	8	N	P	Herb	Iridaceae
Iris pseudacorus L.	0	I	P	Herb	Iridaceae
Iris virginica L.	7	N	P	Herb	Iridaceae
Isolepis R. Br.	2				Cyperaceae
Isolepis carinata Hook. & Arn. ex Torr.	2	N	A	Graminoid	Cyperaceae
Itea L.	7				Grossulariaceae
Itea virginica L.	7	N	P	Shrub	Grossulariaceae
Iva L.	3				Asteraceae
Iva angustifolia Nutt. ex DC.	2	N	A	Herb	Asteraceae
Iva annua L.	2	N	A	Shrub	Asteraceae
Iva frutescens L.	4	N	P	Shrub	Asteraceae
Iva imbricata Walt.	4	N	P	Subshrub	Asteraceae
Juncus acuminatus Michx.	5	N	P	Graminoid	Juncaceae
Juncus bufonius L.	3	N	A	Graminoid	Juncaceae
Juncus canadensis J. Gay ex Laharpe	6	N	P	Graminoid	Juncaceae

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Scientific name	CC	Origin	Duration	Form	Family
Juncus coriaceus Mackenzie	5	N	P	Graminoid	Juncaceae
Juncus dichotomus Ell.	5	N	P	Graminoid	Juncaceae
Juncus diffusissimus Buckl.	4	N	P	Graminoid	Juncaceae
Juncus effusus L.	8	N	P	Graminoid	Juncaceae
Juncus interior Wieg.	3	N	P	Graminoid	Juncaceae
Juncus marginatus Rostk.	5	N	P	Graminoid	Juncaceae
Juncus nodatus Coville	5	N	P	Graminoid	Juncaceae
Juncus repens Michx.	5	N	A	Graminoid	Juncaceae
Juncus roemerianus Scheele	9	N	P	Graminoid	Juncaceae
Juncus scirpoides Lam.	5	N	P	Graminoid	Juncaceae
Juncus tenuis Willd.	3	N	P	Graminoid	Juncaceae
Juncus validus Coville	5	N	P	Graminoid	Juncaceae
Justicia L.	5				Acanthaceae
Justicia americana (L.) Vahl	6	N	P	Herb	Acanthaceae
Justicia ovata (Walt.) Lindau	5	N	P	Herb	Acanthaceae
Kosteletzkya K. Presl	7				Malvaceae
Kosteletzkya virginica (L.) K. Presl ex Gray	7	N	P	Herb	Malvaceae
Kyllinga Rottb.	2				Cyperaceae
Kyllinga brevifolia Rottb.	2	N	P	Graminoid	Cyperaceae
Kyllinga pumila Michx.	2	N	A,P	Graminoid	Cyperaceae

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Scientific name	CC	Origin	Duration	Form	Family
Lachnanthes Ell.	7				Haemodoraceae
Lachnanthes caroliana (Lam.) Dandy	7	N	P	Herb	Haemodoraceae
Leersia Sw.	7				Poaceae
Leersia hexandra Sw.	7	N	P	Graminoid	Poaceae
Leersia oryzoides (L.) Sw.	7	N	P	Graminoid	Poaceae
Leersia virginica Willd.	7	N	P	Graminoid	Poaceae
Lepidium L.	2				Brassicaceae
Lepidium virginicum L.	2	N	A	Herb	Brassicaceae
Leptochloa Beauv.	2				Poaceae
Leptochloa fusca (L.) Kunth	2	N	A	Graminoid	Poaceae
Leptochloa panicea (Retz.) Ohwi	2	N	A	Graminoid	Poaceae
Lespedeza Michx.	6				Fabaceae
Lespedeza stuevei Nutt.	6	N	P	Herb	Fabaceae
Leucospora Nutt.	2				Scrophulariaceae
Leucospora multifida (Michx.) Nutt.	2	N	A	Herb	Scrophulariaceae
Lilaeopsis Greene	6				Apiaceae
Lilaeopsis carolinensis Coult. & Rose	6	N	P	Herb	Apiaceae
Lilaeopsis chinensis (L.) Kuntze	6	N	P	Herb	Apiaceae
Limnobium L.C. Rich.	5				Hydrocharitaceae
Limnobium spongia (Bosc) L.C. Rich. ex Steud.	5	N	P	Herb	Hydrocharitaceae

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Scientific name	CC	Origin	Duration	Form	Family
Limnosciadium Mathias & Constance	2				Apiaceae
Limnosciadium pinnatum (DC.) Mathias & Constance	3	N	A	Herb	Apiaceae
Limnosciadium pumilum (Engelm. & Gray) Mathias & Constance	2	N	A	Herb	Apiaceae
Limonium P. Mill.	7				Plumbaginaceae
Limonium carolinianum (Walt.) Britt.	7	N	P	Herb	Plumbaginaceae
Lindernia All.	3				Scrophulariaceae
Lindernia dubia (L.) Pennell	3	N	A	Herb	Scrophulariaceae
Linum L.	3				Linaceae
Linum medium (Planch.) Britt.	3	N	A	Herb	Linaceae
Liquidambar L.	6				Hamamelidaceae
Liquidambar styraciflua L.	6	N	P	Tree	Hamamelidaceae
Lobelia L.	8				Campanulaceae
Lobelia cardinalis L.	8	N	P	Herb	Campanulaceae
Ludwigia L.	4				Onagraceae
Ludwigia alata Ell.	4	N	P	Herb	Onagraceae
Ludwigia decurrens Walt.	4	N	A	Herb	Onagraceae
Ludwigia glandulosa Walt.	4	N	P	Herb	Onagraceae
Ludwigia grandiflora (Michx.) Greuter & Burdet	4	N	P	Herb	Onagraceae
Ludwigia leptocarpa (Nutt.) Hara	4	N	A	Herb	Onagraceae
Ludwigia linearis Walt.	5	N	P	Herb	Onagraceae

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Scientific name	CC	Origin	Duration	Form	Family
Ludwigia microcarpa Michx.	5	N	P	Herb	Onagraceae
Ludwigia octovalvis (Jacq.) Raven	3	N	P	Herb	Onagraceae
Ludwigia palustris (L.) Ell.	4	N	P	Herb	Onagraceae
Ludwigia peploides (Kunth) Raven	4	N	P	Herb	Onagraceae
Ludwigia repens J.R. Forst.	5	N	P	Herb	Onagraceae
Ludwigia sphaerocarpa Ell.	5	N	P	Herb	Onagraceae
Luziola fluitans (Michx.) Terrell & H. Robins.	5	N	P	Graminoid	Poaceae
Luziola peruviana Juss. ex J.F. Gmel.	0	I	P	Graminoid	Poaceae
Lycium L.	6				Solanaceae
Lycium carolinianum Walt.	6	N	P	Shrub	Solanaceae
Lycopus L.	4				Lamiaceae
Lycopus americanus Muhl. ex W. Bart.	4	N	P	Herb	Lamiaceae
Lycopus rubellus Moench	4	N	P	Herb	Lamiaceae
Lycopus virginicus L.	5	N	P	Herb	Lamiaceae
Lygodium Sw.	0				Lygodiaceae
Lygodium japonicum (Thunb. ex Murr.) Sw.	0	I	P	Vine	Lygodiaceae
Lythrum L.	5				Lythraceae
Lythrum lineare L.	5	N	P	Herb	Lythraceae
Magnolia L.	7				Magnoliaceae
Magnolia grandiflora L.	7	N	P	Tree	Magnoliaceae

Appendix Table. Plant species that occur in marshes and forested wetlands in coastal Louisiana.

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Scientific name	CC	Origin	Duration	Form	Family
Magnolia virginiana L.	7	N	P	Tree	Magnoliaceae
Mecardonia Ruiz & Pav.	4				Scrophulariaceae
Mecardonia acuminata (Walt.) Small	4	N	P	Herb	Scrophulariaceae
Melia L.	0				Meliaceae
Melia azedarach L.	0	I	P	Tree	Meliaceae
Melochia L.	0				Sterculiaceae
Melochia corchorifolia L.	0	I	A	Herb	Sterculiaceae
Micranthemum Michx.	4				Scrophulariaceae
Micranthemum umbrosum (J.F. Gmel.) Blake	4	N	A	Herb	Scrophulariaceae
Mikania Willd.	4				Asteraceae
Mikania cordifolia (L. f.) Willd.	4	N	P	Vine	Asteraceae
Mikania scandens (L.) Willd.	3	N	P	Vine	Asteraceae
Mimulus L.	5				Scrophulariaceae
Mimulus alatus Ait.	5	N	P	Herb	Scrophulariaceae
Mitreola L.	5				Loganiaceae
Mitreola petiolata (J.F. Gmel.) Torr. & Gray	5	N	A	Herb	Loganiaceae
Mitreola sessilifolia (J.F. Gmel.) G. Don	5	N	A	Herb	Loganiaceae
Monanthochloe Engelm.	8				Poaceae
Monanthochloe littoralis Engelm.	8	N	P	Graminoid	Poaceae
Morella Lour.	6				Myricaceae

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Scientific name	CC	Origin	Duration	Form	Family
Morella caroliniensis (P. Mill.) Small	6	N	P	Shrub	Myricaceae
Morella cerifera (L.) Small	6	N	P	Shrub	Myricaceae
Nelumbo Adans.	6				Nelumbonaceae
Nelumbo lutea Willd.	6	N	P	Herb	Nelumbonaceae
Nuphar Sm.	6				Nymphaeaceae
Nuphar lutea (L.) Sm.	6	N	P	Herb	Nymphaeaceae
Nymphaea L.	6				Nymphaeaceae
Nymphaea elegans Hook.	6	N	P	Herb	Nymphaeaceae
Nymphaea mexicana Zucc.	6	N	P	Herb	Nymphaeaceae
Nymphaea odorata Ait.	7	N	P	Herb	Nymphaeaceae
Nymphoides Hill	7				Menyanthaceae
Nymphoides aquatica (J.F. Gmel.) Kuntze	7	N	P	Herb	Menyanthaceae
Nymphoides cordata (Ell.) Fern.	7	N	P	Herb	Menyanthaceae
Nyssa L.	8				Cornaceae
Nyssa aquatica L.	9	N	P	Tree	Cornaceae
Nyssa biflora Walt.	8	N	P	Tree	Cornaceae
Nyssa sylvatica Marsh.	7	N	P	Tree	Cornaceae
Oldenlandia L.	3				Rubiaceae
Oldenlandia uniflora L.	3	N	A	Subshrub	Rubiaceae
Opuntia P. Mill.	4				Cactaceae

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Scientific name	CC	Origin	Duration	Form	Family
Opuntia humifusa (Raf.) Raf.	4	N	P	Cactus	Cactaceae
Orontium L.	7				Araceae
Orontium aquaticum L.	7	N	P	Herb	Araceae
Oryza L.	0				Poaceae
Oryza sativa L.	0	I	P	Graminoid	Poaceae
Osmunda L.	7				Osmundaceae
Osmunda cinnamomea L.	7	N	P	Fern	Osmundaceae
Osmunda regalis L.	8	N	P	Fern	Osmundaceae
Ottelia Pers.	0				Hydrocharitaceae
Ottelia alismoides (L.) Pers.	0	I	P	Herb	Hydrocharitaceae
Oxycaryum Nees	3				Cyperaceae
Oxycaryum cubense (Poepp. & Kunth) Lye	3	N	P	Graminoid	Cyperaceae
Packera A. Löve & D. Löve	1				Asteraceae
Packera glabella (Poir) C. Jeffrey	1	N	A	Herb	Asteraceae
Panicum amarum Ell.	7	N	P	Graminoid	Poaceae
Panicum anceps Michx.	5	N	P	Graminoid	Poaceae
Panicum capillare L.	2	N	A	Graminoid	Poaceae
Panicum dichotomiflorum Michx.	3	N	A	Graminoid	Poaceae
Panicum hemitomon J.A. Schultes	10	N	P	Graminoid	Poaceae
Panicum repens L.	3	N	P	Graminoid	Poaceae

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Scientific name	CC	Origin	Duration	Form	Family
Panicum rigidulum Bosc ex Nees	5	N	P	Graminoid	Poaceae
Panicum tenerum Bey. ex Trin.	5	N	P	Graminoid	Poaceae
Panicum verrucosum Muhl.	2	N	A	Graminoid	Poaceae
Panicum virgatum L.	6	N	P	Graminoid	Poaceae
Parthenocissus Planch.	4				Vitaceae
Parthenocissus quinquefolia (L.) Planch.	4	N	P	Vine	Vitaceae
Paspalidium Stapf	6				Poaceae
Paspalidium geminatum (Forsk.) Stapf	6	N	P	Graminoid	Poaceae
Paspalum conjugatum Berg.	4	N	P	Graminoid	Poaceae
Paspalum denticulatum Trin.	4	N	P	Graminoid	Poaceae
Paspalum dissectum (L.) L.	5	N	P	Graminoid	Poaceae
Paspalum distichum L.	6	N	P	Graminoid	Poaceae
Paspalum floridanum Michx.	4	N	P	Graminoid	Poaceae
Paspalum fluitans (Ell.) Kunth	5	N	A	Graminoid	Poaceae
Paspalum hydrophilum Henr.	0	I	P	Graminoid	Poaceae
Paspalum plicatulum Michx.	4	N	P	Graminoid	Poaceae
Paspalum urvillei Steud.	0	I	P	Graminoid	Poaceae
Paspalum vaginatum Sw.	7	N	P	Graminoid	Poaceae
Peltandra Raf.	7				Araceae
Peltandra virginica (L.) Schott	7	N	P	Herb	Araceae

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Scientific name	CC	Origin	Duration	Form	Family
Pennisetum L.C. Rich. ex Pers.	0				Poaceae
Pennisetum glaucum (L.) R. Br.	0	I	A	Graminoid	Poaceae
Pentodon Hochst.	2				Rubiaceae
Pentodon pentandrus (K. Schum.) Vatke	2	N	A	Herb	Rubiaceae
Persea P. Mill.	8				Lauraceae
Persea borbonia (L.) Spreng.	8	N	P	Tree	Lauraceae
Persea palustris (Raf.) Sarg.	8	N	P	Tree	Lauraceae
Phanopyrum (Raf.) Nash	8				Poaceae
Phanopyrum gymnocarpon (Ell.) Nash	8	N	P	Graminoid	Poaceae
Phragmites Adans.	6				Poaceae
Phragmites australis (Cav.) Trin. ex Steud.	6	N	P	Graminoid	Poaceae
Phyla Lour.	3				Verbenaceae
Phyla fruticosa (Mill.) Kennedy	0	I	P	Herb	Verbenaceae
Phyla lanceolata (Michx.) Greene	3	N	P	Herb	Verbenaceae
Phyla nodiflora (L.) Greene	4	N	P	Herb	Verbenaceae
Phytolacca L.	1				Phytolaccaceae
Phytolacca americana L.	1	N	P	Herb	Phytolaccaceae
Pilea Lindl.	5				Urticaceae
Pilea pumila (L.) Gray	5	N	A	Herb	Urticaceae
Pinus L.	6				Pinaceae

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Scientific name	CC	Origin	Duration	Form	Family
Pinus elliottii Engelm.	6	N	P	Tree	Pinaceae
Pinus taeda L.	6	N	P	Tree	Pinaceae
Planera J.F. Gmel.	7				Ulmaceae
Planera aquatica J.F. Gmel.	7	N	P	Tree	Ulmaceae
Platanthera L.C. Rich.	5				Orchidaceae
Platanthera lacera (Michx.) G. Don	5	N	P	Herb	Orchidaceae
Platanus L.	6				Platanaceae
Platanus occidentalis L.	6	N	P	Tree	Platanaceae
Pluchea Cass.	2				Asteraceae
Pluchea camphorata (L.) DC.	2	N	A	Herb	Asteraceae
Pluchea foetida (L.) DC.	2	N	P	Herb	Asteraceae
Pluchea odorata (L.) Cass.	2	N	A	Herb	Asteraceae
Polygala L.	7				Polygalaceae
Polygala incarnata L.	8	N	A	Herb	Polygalaceae
Polygala leptocaulis Torr. & Gray	7	N	A	Herb	Polygalaceae
Polygala mariana P. Mill.	7	N	A	Herb	Polygalaceae
Polygonella Michx.	4				Polygonaceae
Polygonella polygama (Vent.) Engelm. & Gray	4	N	P	Subshrub	Polygonaceae
Polygonum glabrum Willd.	4	N	A	Herb	Polygonaceae
Polygonum hydropiper L.	0	I	A	Herb	Polygonaceae

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Scientific name	CC	Origin	Duration	Form	Family
Polygonum hydropiperoides Michx.	4	N	P	Herb	Polygonaceae
Polygonum lapathifolium L.	4	N	A	Herb	Polygonaceae
Polygonum pensylvanicum L.	3	N	A	Herb	Polygonaceae
Polygonum persicaria L.	0	I	A	Herb	Polygonaceae
Polygonum punctatum Ell.	5	N	A	Herb	Polygonaceae
Polygonum sagittatum L.	4	N	A	Vine	Polygonaceae
Polygonum setaceum Baldw.	4	N	P	Herb	Polygonaceae
Polypogon interruptus Kunth	7	N	P	Graminoid	Poaceae
Polypogon monspeliensis (L.) Desf.	0	I	A	Graminoid	Poaceae
Pontederia L.	7				Pontederiaceae
Pontederia cordata L.	7	N	P	Herb	Pontederiaceae
Populus L.	5				Salicaceae
Populus deltoides Bartr. ex Marsh.	5	N	P	Tree	Salicaceae
Portulaca oleracea L.	0	I	A	Herb	Portulacaceae
Portulaca pilosa L.	5	N	A	Herb	Portulacaceae
Proserpinaca L.	6				Haloragaceae
Proserpinaca palustris L.	6	N	P	Herb	Haloragaceae
Ptilimnium Raf.	4				Apiaceae
Ptilimnium capillaceum (Michx.) Raf.	4	N	A	Herb	Apiaceae
Quercus L.	7				Fagaceae

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Scientific name	CC	Origin	Duration	Form	Family
Quercus falcata Michx.	6	N	P	Tree	Fagaceae
Quercus laurifolia Michx.	7	N	P	Tree	Fagaceae
Quercus lyrata Walt.	8	N	P	Tree	Fagaceae
Quercus nigra L.	7	N	P	Tree	Fagaceae
Quercus phellos L.	8	N	P	Tree	Fagaceae
Quercus texana Buckl.	7	N	P	Tree	Fagaceae
Quercus virginiana P. Mill.	5	N	P	Tree	Fagaceae
Ranunculus L.	1				Ranunculaceae
Ranunculus muricatus L.	0	I	A	Herb	Ranunculaceae
Ranunculus pusillus Poir.	2	N	A	Herb	Ranunculaceae
Ranunculus sardous Crantz	0	I	A	Herb	Ranunculaceae
Ranunculus sceleratus L.	2	N	A	Herb	Ranunculaceae
Ranunculus trilobus Desf.	0	I	A	Herb	Ranunculaceae
Rayjacksonia R.L. Hartman & M.A. Lane	3				Asteraceae
Rayjacksonia phyllocephala (DC.) R.L. Hartman & M.L. Lane	3	N	A	Herb	Asteraceae
Rhexia L.	7				Melastomataceae
Rhexia mariana L.	7	N	P	Herb	Melastomataceae
Rhynchospora Vahl	6				Cyperaceae
Rhynchospora caduca Ell.	7	N	P	Graminoid	Cyperaceae
Rhynchospora capitellata (Michx.) Vahl	5	N	P	Graminoid	Cyperaceae

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Scientific name	CC	Origin	Duration	Form	Family
Rhynchospora cephalantha Gray	5	N	P	Graminoid	Cyperaceae
Rhynchospora chalarocephala Fern. & Gale	6	N	P	Graminoid	Cyperaceae
Rhynchospora colorata (L.) H. Pfeiffer	6	N	P	Graminoid	Cyperaceae
Rhynchospora corniculata (Lam.) Gray	5	N	P	Graminoid	Cyperaceae
Rhynchospora globularis (Chapman) Small	5	N	A	Graminoid	Cyperaceae
Rhynchospora glomerata (L.) Vahl	6	N	P	Graminoid	Cyperaceae
Rhynchospora inexpansa (Michx.) Vahl	6	N	P	Graminoid	Cyperaceae
Rhynchospora macrostachya Torr. ex Gray	7	N	P	Graminoid	Cyperaceae
Rhynchospora microcarpa Baldw. ex Gray	7	N	P	Graminoid	Cyperaceae
Rhynchospora nitens (Vahl) Gray	5	N	A	Graminoid	Cyperaceae
Rorippa Scop.	2				Brassicaceae
Rorippa palustris (L.) Bess.	2	N	A	Herb	Brassicaceae
Rorippa sessiliflora (Nutt.) A.S. Hitchc.	2	N	A	Herb	Brassicaceae
Rosa L.	0				Rosaceae
Rosa bracteata J.C. Wendl.	0	I	P	Vine	Rosaceae
Rotala indica (Willd.) Koehne	0	I	A	Herb	Lythraceae
Rotala ramosior (L.) Koehne	4	N	A	Herb	Lythraceae
Rubus L.	4				Rosaceae
Rubus trivialis Michx.	4	N	P	Subshrub	Rosaceae
Ruellia L.	0				Acanthaceae

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Scientific name	CC	Origin	Duration	Form	Family
Ruellia caerulea Morong	0	I	P	Herb	Acanthaceae
Rumex altissimus Wood	3	N	P	Herb	Polygonaceae
Rumex crispus L.	0	I	P	Herb	Polygonaceae
Rumex verticillatus L.	3	N	P	Herb	Polygonaceae
Sabal Adans.	8				Arecaceae
Sabal minor (Jacq.) Pers.	8	N	P	Shrub	Arecaceae
Sabal palmetto (Walt.) Lodd. ex J.A. & J.H. Schultes	8	N	P	Shrub	Arecaceae
Sabatia Adans.	6				Gentianaceae
Sabatia angularis (L.) Pursh	6	N	A	Herb	Gentianaceae
Sabatia arenicola Greenm.	6	N	A	Herb	Gentianaceae
Sabatia calycina (Lam.) Heller	6	N	P	Herb	Gentianaceae
Sabatia campestris Nutt.	5	N	A	Herb	Gentianaceae
Sabatia stellaris Pursh	6	N	A	Herb	Gentianaceae
Saccharum L.	3				Poaceae
Saccharum giganteum (Walt.) Pers.	3	N	P	Graminoid	Poaceae
Sacciolepis Nash	6				Poaceae
Sacciolepis striata (L.) Nash	6	N	P	Graminoid	Poaceae
Sagittaria australis (J.G. Sm.) Small	5	N	P	Herb	Alismataceae
Sagittaria graminea Michx.	5	N	P	Herb	Alismataceae
Sagittaria guayanensis Kunth	0	I	P	Herb	Alismataceae

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Scientific name	CC	Origin	Duration	Form	Family
Sagittaria lancifolia L.	6	N	P	Herb	Alismataceae
Sagittaria latifolia Willd.	5	N	P	Herb	Alismataceae
Sagittaria papillosa Buch.	5	N	P	Herb	Alismataceae
Sagittaria platyphylla (Engelm.) J.G. Sm.	5	N	P	Herb	Alismataceae
Salicornia L.	6				Chenopodiaceae
Salicornia bigelovii Torr.	5	N	A	Herb	Chenopodiaceae
Salicornia depressa Standl.	7	N	P	Herb	Chenopodiaceae
Salix caroliniana Michx.	5	N	P	Tree	Salicaceae
Salix nigra Marsh.	2	N	P	Tree	Salicaceae
Sambucus L.	2				Caprifoliaceae
Sambucus nigra L.	2	N	P	Shrub	Caprifoliaceae
Samolus L.	6				Primulaceae
Samolus valerandi L.	6	N	P	Herb	Primulaceae
Saururus L.	7				Saururaceae
Saururus cernuus L.	7	N	P	Herb	Saururaceae
Schoenoplectus (Reichenb.) Palla	7				Cyperaceae
Schoenoplectus americanus (Pers.) Volk. ex Schinz & R. Keller	8	N	P	Graminoid	Cyperaceae
Schoenoplectus californicus (C.A. Mey.) Palla	7	N	P	Graminoid	Cyperaceae
Schoenoplectus deltarum (Schuyler) Sojak	8	N	P	Graminoid	Cyperaceae
Schoenoplectus maritimus (L.) Lye	7	N	P	Graminoid	Cyperaceae

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Scientific name	CC	Origin	Duration	Form	Family
Schoenoplectus pungens (Vahl) Palla	7	N	P	Graminoid	Cyperaceae
Schoenoplectus robustus (Pursh) M.T. Strong	7	N	P	Graminoid	Cyperaceae
Schoenoplectus tabernaemontani (K.C. Gmel.) Palla	7	N	P	Graminoid	Cyperaceae
Scirpus L.	6				Cyperaceae
Scirpus cyperinus (L.) Kunth	5	N	P	Graminoid	Cyperaceae
Scirpus lineatus Michx.	6	N	P	Graminoid	Cyperaceae
Scutellaria L.	5				Lamiaceae
Scutellaria lateriflora L.	5	N	P	Herb	Lamiaceae
Scutellaria ovata Hill	5	N	P	Herb	Lamiaceae
Senna P. Mill.	4				Fabaceae
Senna obtusifolia (L.) Irwin & Barneby	4	N	A,P	Herb	Fabaceae
Sesbania Scop.	1				Fabaceae
Sesbania drummondii (Rydb.) Cory	2	N	P	Shrub	Fabaceae
Sesbania herbacea (P. Mill.) McVaugh	2	N	A	Shrub	Fabaceae
Sesbania punicea (Cav.) Benth.	0	I	P	Subshrub	Fabaceae
Sesbania vesicaria (Jacq.) Elliot	2	N	A	Subshrub	Fabaceae
Sesuvium L.	4				Aizoaceae
Sesuvium maritimum (Walt.) B.S.P.	4	N	A	Herb	Aizoaceae
Sesuvium portulacastrum (L.) L.	5	N	P	Herb	Aizoaceae
Setaria faberi Herrm.	0	I	A	Graminoid	Poaceae

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Scientific name	CC	Origin	Duration	Form	Family
Setaria italica (L.) Beauv.	0	I	A	Graminoid	Poaceae
Setaria magna Griseb.	4	N	A	Graminoid	Poaceae
Setaria parviflora (Poir.) Kerguelen	3	N	P	Graminoid	Poaceae
Setaria pumila (Poir.) Roemer & J.A. Schultes	0	I	A	Graminoid	Poaceae
Setaria verticillata (L.) Beauv.	0	I	A	Graminoid	Poaceae
Smilax L.	5				Smilacaceae
Smilax bona-nox L.	5	N	P	Vine	Smilacaceae
Smilax laurifolia L.	5	N	P	Vine	Smilacaceae
Smilax rotundifolia L.	5	N	P	Vine	Smilacaceae
Solanum L.	3				Solanaceae
Solanum ptycanthum Dunal	3	N	A	Herb	Solanaceae
Solidago L.	4				Asteraceae
Solidago fistulosa P. Mill.	4	N	P	Herb	Asteraceae
Solidago sempervirens L.	4	N	P	Herb	Asteraceae
Solidago stricta Ait.	4	N	P	Herb	Asteraceae
Sonchus L.	0				Asteraceae
Sonchus asper (L.) Hill	0	I	A	Herb	Asteraceae
Sonchus oleraceus L.	0	I	A	Herb	Asteraceae
Sorghum Moench	0				Poaceae
Sorghum halepense (L.) Pers.	0	I	P	Graminoid	Poaceae

Appendix Table. Plant species that occur in marshes and forested wetlands in coastal Louisiana.

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Scientific name	CC	Origin	Duration	Form	Family
Sparganium L.	7				Sparganiaceae
Sparganium americanum Nutt.	7	N	P	Graminoid	Sparganiaceae
Spartina alterniflora Loisel.	10	N	P	Graminoid	Poaceae
Spartina cynosuroides (L.) Roth	8	N	P	Graminoid	Poaceae
Spartina patens (Ait.) Muhl.	9	N	P	Graminoid	Poaceae
Spartina pectinata Bosc ex Link	4	N	P	Graminoid	Poaceae
Spartina spartinae (Trin.) Merr. ex A.S. Hitchc.	8	N	P	Graminoid	Poaceae
Spergularia (Pers.) J.& K. Presl	6				Caryophyllaceae
Spergularia salina J.& K. Presl	6	N	A	Herb	Caryophyllaceae
Spermacoce L.	4				Rubiaceae
Spermacoce glabra Michx.	4	N	P	Herb	Rubiaceae
Sphenoclea Gaertn.	0				Sphenocleaceae
Sphenoclea zeylanica Gaertn.	0	I	A	Herb	Sphenocleaceae
Spiranthes L.C. Rich.	8				Orchidaceae
Spiranthes odorata (Nutt.) Lindl.	8	N	P	Herb	Orchidaceae
Sporobolus R. Br.	9				Poaceae
Sporobolus virginicus (L.) Kunth	9	N	P	Graminoid	Poaceae
Stachys L.	4				Lamiaceae
Stachys tenuifolia Willd.	4	N	P	Herb	Lamiaceae
Steinchisma Raf.	4				Poaceae

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Scientific name	CC	Origin	Duration	Form	Family
Steinchisma hians (Ell.) Nash	4	N	P	Graminoid	Poaceae
Strophostyles Ell.	6				Fabaceae
Strophostyles helvola (L.) Elliott	6	N	A	Vine	Fabaceae
Strophostyles umbellata (Muhl. ex Willd.) Britt.	7	N	P	Vine	Fabaceae
Styrax L.	7				Styracaceae
Styrax americanus Lam.	7	N	P	Shrub	Styracaceae
Suaeda Forsk. ex J.F. Gmel.	5				Chenopodiaceae
Suaeda linearis (Ell.) Moq.	5	N	A	Herb	Chenopodiaceae
Symphyotrichum Nees	4				Asteraceae
Symphyotrichum dumosum (L.) Nesom	4	N	P	Herb	Asteraceae
Symphyotrichum elliotii (Torr. & Gray) Nesom	4	N	P	Herb	Asteraceae
Symphyotrichum subulatum (Michx.) Nesom	4	N	A	Herb	Asteraceae
Symphyotrichum tenuifolium (L.) Nesom	5	N	P	Herb	Asteraceae
Symphyotrichum turbinellum (Lindl.) Nesom	4	N	P	Herb	Asteraceae
Tamarix L.	0				Tamaricaceae
Tamarix africana Poir.	0	I	P	Shrub	Tamaricaceae
Tamarix canariensis Willd.	0	I	P	Shrub	Tamaricaceae
Tamarix gallica L.	0	I	P	Shrub	Tamaricaceae
Taxodium L.C. Rich.	10				Cupressaceae
Taxodium distichum (L.) L.C. Rich.	10	N	P	Tree	Cupressaceae

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Scientific name	CC	Origin	Duration	Form	Family
Teucrium L.	5				Lamiaceae
Teucrium canadense L.	5	N	P	Herb	Lamiaceae
Thalia L.	5				Marantaceae
Thalia dealbata Fraser ex Roscoe	5	N	P	Herb	Marantaceae
Thelypteris Schmidel	7				Thelypteridaceae
Thelypteris palustris Schott	7	N	P	Fern	Thelypteridaceae
Toxicodendron P. Mill.	2				Anacardiaceae
Toxicodendron radicans (L.) Kuntze	2	N	P	Vine	Anacardiaceae
Triadenum Raf.	7				Clusiaceae
Triadenum virginicum (L.) Raf.	7	N	P	Herb	Clusiaceae
Triadenum walteri (J.G. Gmel.) Gleason	6	N	P	Herb	Clusiaceae
Triadica Loureiro	0				Euphorbiaceae
Triadica sebifera (L.) Small	0	I	P	Tree	Euphorbiaceae
Triglochin L.	8				Juncaginaceae
Triglochin striata Ruiz & Pav.	8	N	P	Graminoid	Juncaginaceae
Tripsacum L.	5				Poaceae
Tripsacum dactyloides (L.) L.	5	N	P	Graminoid	Poaceae
Typha L.	2				Typhaceae
Typha angustifolia L.	0	I	P	Graminoid	Typhaceae
Typha domingensis Pers.	3	N	P	Graminoid	Typhaceae

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Scientific name	CC	Origin	Duration	Form	Family
Typha latifolia L.	2	N	P	Graminoid	Typhaceae
Ulmus L.	7				Ulmaceae
Ulmus alata Michx.	6	N	P	Tree	Ulmaceae
Ulmus americana L.	8	N	P	Tree	Ulmaceae
Ulmus rubra Muhl.	6	N	P	Tree	Ulmaceae
Uniola L.	9				Poaceae
Uniola paniculata L.	9	N	P	Graminoid	Poaceae
Verbena L.	2				Verbenaceae
Verbena hastata L.	3	N	P	Herb	Verbenaceae
Verbena litoralis Kunth	0	I	P	Herb	Verbenaceae
Verbena scabra Vahl	3	N	A	Herb	Verbenaceae
Verbena urticifolia L.	3	N	P	Herb	Verbenaceae
Veronica L.	2				Scrophulariaceae
Veronica peregrina L.	2	N	A	Herb	Scrophulariaceae
Vicia L.	0				Fabaceae
Vicia lutea L.	0	I	A	Vine	Fabaceae
Vigna Savi	3				Fabaceae
Vigna luteola (Jacq.) Benth.	3	N	P	Vine	Fabaceae
Vitis L.	5				Vitaceae
Vitis rotundifolia Michx.	5	N	P	Vine	Vitaceae

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Scientific name	CC	Origin	Duration	Form	Family
Woodwardia Sm.	7				Blechnaceae
Woodwardia areolata (L.) T. Moore	7	N	P	Fern	Blechnaceae
Woodwardia virginica (L.) Sm.	7	N	P	Fern	Blechnaceae
Xyris L.	7				Xyridaceae
Xyris caroliniana Walt.	6	N	P	Herb	Xyridaceae
Xyris laxifolia Mart.	7	N	P	Graminoid	Xyridaceae
Zanthoxylum L.	7				Rutaceae
Zanthoxylum clava-herculis L.	7	N	P	Tree	Rutaceae
Zizania L.	6				Poaceae
Zizania aquatica L.	6	N	P	Graminoid	Poaceae
Zizaniopsis Doell & Aschers.	5				Poaceae
Zizaniopsis miliacea (Michx.) Doell & Aschers.	5	N	P	Graminoid	Poaceae